# AHRQ Health Information Technology Portfolio's 2009 Annual Report (With Project Summaries)

Agency for Healthcare Research and Quality
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Health IT

# AHRQ Health Information Technology Portfolio's 2009 Annual Report (With Project Summaries)

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# Preface

The Agency for Healthcare Research and Quality (AHRQ), through its Health Information Technology (IT) Portfolio, sponsors a variety of contracts, grants, and cooperative agreements that examine the impact of health IT implementation and use on quality, safety, and other important health care outcomes. This annual report features 121 grant and 59 contract project summaries of AHRQ-managed health projects, as well as a summary of activities in the Health IT Portfolio as of Calendar Year (CY) 2009. This summary does not include the Health IT Portfolio's Interagency Agreements (IAAs) to support projects managed by other Federal agencies or IAAs from other Federal agencies to contract for projects to be conducted by the National Resource Center (NRC) for Health IT.

AHRQ is most grateful to its contractors and grantees for their ongoing provision of timely, informative reports and their participation in this initiative to generate project-specific, calendar-year summaries.

We welcome comments on the utility of the summary of the Health IT Portfolio provided in this report and of the 180 Web-based project summaries. Comments may be sent by mail to the program officials below at: Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD 20850, or by e-mail to Vera.Rosenthal@AHRQ.hhs.gov.

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# Executive Summary

Recent national efforts to improve health care reemphasize the ongoing relevancy of research funded by the Agency for Healthcare Research and Quality (AHRQ) Health Information Technology Portfolio. Through AHRQ-sponsored health information technology (IT) research, advancements are realized and disseminated on how health IT can be used across a variety of health care settings. The projects provide evidence on how health IT can ensure that medical information is available to appropriate individuals, in an understandable and actionable format, where and when it is needed. To support its broad mission of improving the quality of health care for all Americans, the Agency has focused its health IT initiatives on the following three goals:

- Improve health care decisionmaking.
- Support patient-centered care.
- Improve medication management.

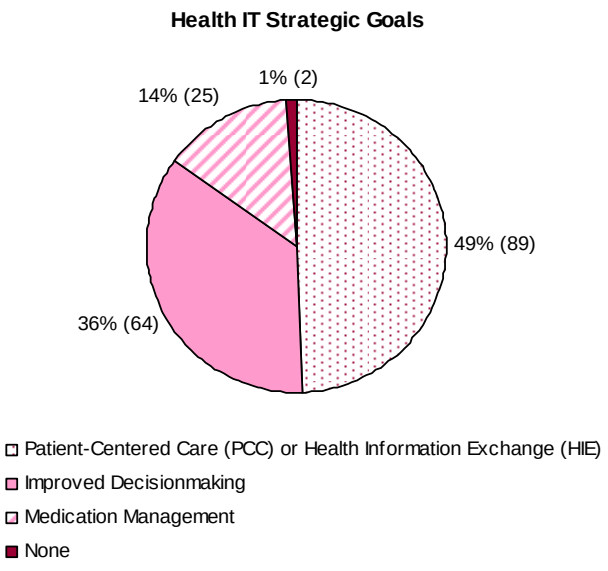
The research projects generate evidence and insight that facilitate successful design, implementation, and use of health IT, and examine the impact of health IT use on changes in quality, safety, and improved health care outcomes. These projects have been conducted in real care delivery settings and identify the practical issues of implementing health IT to:

- Help clinicians provide safe, high quality health care.
- Put the patient at the center of health care.
- Inform the effective implementation of health IT, especially in underserved and under resourced areas.
- Evaluate costs and benefits of health IT.

The AHRQ Health IT Portfolio's 2009 Annual Report includes 121 grant-specific and 59 contract-specific projects, and summarizes activities that took place throughout calendar year (CY) 2009. Each individual project summary provides an overview of the project's longterm objectives, status updates on the specific aims, and updates on completed or ongoing project activities, as well as highlighting strategic and business goals of each project. Each summary also describes some of the challenges experienced by the research team and the solutions used to address those issues, as well as a sampling of disseminated products and outputs from projects, such as tools, publications, and presentations. Preliminary findings are presented when applicable, and a status for overall progress in project milestones and spending on grant-funded projects is also indicated.

### Highlights

The vast majority of the Health IT Portfolio's 180 projects spanned multiple years. Sixty-three projects started during CY 2009; 87 were ongoing from the previous year, while 30 others came to a close. The lifetime funding for these grants and contracts is $122.2 million and $68.4 million, respectively.




Nearly half of the Health IT Portfolio for CY 2009 was assigned the strategic goal of enabling Patient-Centered Care or Health Information Exchange. Improved Decisionmaking was the next most common strategic goal among the projects. Other projects focused on Medication Management as their strategic goal. Two projects (grants supporting conferences) were not assigned a specific Health IT strategic goal.

The geographic reach of the active Health IT-sponsored projects spanned 38 States and the District of Columbia in 2009. The Health IT Portfolio also included a diversified pool of grantee principal investigators (PIs). There were 115 unique PIs responsible for 121 active grants (6 individuals served as PI on 2 health IT grants); 28 PIs had previously received a Federal career award or training grant to enhance their research abilities.

Of the 180 total projects active during the year, 30 projects (19 grants and 11 contracts) ended during CY 2009, including the 8 projects highlighted in the *Success Stories from the AHRQ-Funded Health IT Portfolio (2009)* Report, available at http://healthit.ahrq.gov/SuccessStoriesCY2009. The purpose of this report is to provide illustrative examples of the various types of the AHRQ Health IT Portfolio-funded projects. Collectively, these summaries show the wide range of successful projects supported by the Health IT Portfolio. Furthermore, the projects address important gaps in the research literature and/or health IT implementation, and thereby address the means by which health IT implementation has successfully demonstrated improvements in quality of care and the potential to translate these findings to other health care settings. Below is a description of the projects included in this report.

- **SAFEHealth – Secure Architecture for Exchanging Health Information**: SAFEHealth is a regional health information exchange that securely and immediately transfers patient health information to providers so that patients' health information follows them wherever they go.
- **Use of Electronic Referral System to Improve the Outpatient Primary Care-Specialty Care Interface**: This project developed an eReferral system that allows referring physicians to electronically submit referral requests to adult medical specialty clinics. The system has improved access to specialty care and communication between specialists and referring physicians.
- **Implementation and Evaluation of Standing Orders Using Health Information Technology:** This project demonstrated that empowering staff to carry out electronic standing orders can improve the efficiency and quality of care by facilitating the timely delivery of necessary preventive services to patients.

- **Standardization and Automatic Extraction of Quality Measures in an Ambulatory Electronic Health Record:** This project successfully used pre-existing electronic health record technology to facilitate quality measurement reporting.
- **Personal Health Information Management and Design of Consumer Health IT:** A novel, 2-day workshop to bring together a multi-disciplinary group of experts to address and promote the design of consumer health IT systems based on consumers' personal health information management practices.
- **Consumer Engagement in Developing Electronic Health Information Systems:** A novel project investigating health care consumers' awareness, beliefs, perceptions, and fears of health IT, and the potential role of health care consumers in the design and use of health IT.
- **Use of Dense Display of Data and Information Design Principles in Primary Care Healthcare Information Technology Systems:** This contract was AHRQ's first initiative to guide innovation in electronic health record usability to benefit potential health IT users.
- **Computer-Based Provider Order Entry Implementation in Intensive Care Units:** This project successfully used human factors research to increase the success of a computerized provider order entry system.

This is just a small sampling of the projects funded through the health IT portfolio; collectively, the projects examine the impact of health IT implementation and use on changes in quality, safety, and improved health care outcomes. These individual summaries of each AHRQ health-IT funded project active in 2009 are available in an easy-to-access, Web-based format through AHRQ's National Resource Center (NRC) for Health IT Web site (www.healthit.ahrq.gov). Users can peruse the diverse projects by clicking on the map of the United States and review these project summaries as well as other project news and updates. This year's report also includes an interactive CD, where users can search for specific projects on several attributes including type of health IT, target population, and care setting. These resources should prove useful for health IT implementers, prospective research applicants, and others interested in the challenges and successes of real-world health IT implementation, use, and evaluation.

# I. Purpose

The purpose of this project was to assemble and distribute information on the Health Information Technology (IT) Portfolio as of the end of 2009 at both the portfolio and project level. This report is the next installment of the inaugural Health IT Annual Report, first published for calendar year 2008. Through this exercise, AHRQ sought to understand the state of the Health IT Portfolio, inform the development of similar reporting for subsequent years, and provide the public with easy-to-access, Web-based project summaries for calendar year 2009.

This report summarizes the 180 projects that were directly funded by the AHRQ Health IT Portfolio active in 2009. For the purpose of this report, active is defined as ongoing for any period of time in calendar year 2009.

The Health IT Portfolio is summarized by the broad categories of projects, including: Health IT Portfolio strategic goals, AHRQ business goals, mechanism type (grant or contract), total funding from AHRQ over project period (i.e., AHRQ Lifetime Funding), duration of grants, principal investigator's (PI's) experience as a PI, State funding history, and usage rates of the National Resource Center (NRC) Web site.

The summaries synthesize individual projects' first-hand experience in the implementation, use, and evaluation of health IT to improve health care outcomes. The summaries include highlights of the challenges, mitigating factors, status of specific aims (ongoing, upcoming, and achieved), awardees' pertinent publications and presentations, preliminary findings, and grantees' overall progress in terms of spending pattern and meeting milestones.

Each of the 180 project-specific summaries is currently available through the AHRQ-funded project search tool at the NRC Web site (www.healthit.ahrq.gov). By clicking on the map of the United States, users can search for individual projects on several categories and review their project summary as well as other project-related news and publications. Hyperlinks to these project summaries are also included Section VII.

# II. Background

AHRQ supports a series of interrelated health services research programs that individually and collectively seek to improve the quality, safety, efficiency, and effectiveness of health care for all Americans. In 2009, each of the extramural activities (i.e., grants and contracts) was organized into one of the following six AHRQ portfolios.

- Value
- Health Information Technology
- Comparative Effectiveness
- Prevention/Care Management
- Patient Safety
- Innovations/Emerging Issues

Health IT "allows comprehensive management of medical information and its secure exchange between health care consumers and providers. Broad use of health IT has the potential to improve health care quality, prevent medical errors, increase the efficiency of care provision and reduce unnecessary health care costs, increase administrative efficiencies, decrease paperwork, expand access to affordable care, and improve population health."[1] Health IT applications can use a variety of platforms, such as desktop computer applications, cellular phones, personal digital assistants (PDAs), and touch-screen kiosks. Examples of health IT applications include electronic health records/electronic medical records (EHRs/EMRs), personal health records (PHRs), telemedicine, clinical alerts and reminders, computerized provider order entry (CPOE), computerized clinical decision support (CDS) systems, consumer health informatics applications, and electronic exchange of health information. Health IT is a tool that must be appropriately designed, implemented, and used if it is to be effective.

## A. Project Classification

In 2009, each of the Health IT Portfolio-funded grants and contracts was categorized into one of three strategic goals, and one of three AHRQ business goals.

### *Health IT Strategic Goals*

- **Medication Management**: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.
- **Patient-Centered Care (PCC) or Health Information Exchange (HIE)**: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

[1] U.S. Department of Health & Human Services. http://healthit.hhs.gov/portal/server.pt

- **Improved Decisionmaking:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

### *AHRQ Business Goals*

- **Knowledge Creation**
  - Collecting data on and producing measures of the quality, safety, effectiveness, and efficiency of American health care and health care systems.
  - Fostering the development of knowledge about improving health care, health care systems, and capacity (e.g., training, placement).
- **Synthesis and Dissemination**
  - Creating tools and synthesis of evidence including knowledge, measure, and data.
  - Disseminating information to multiple stakeholders to improve the system.
- **Implementation and Use**
  - Partnering with stakeholders to implement proven strategies for health care improvement, including empowering Americans to be proactive patients.

## B. Mechanisms

There are a variety of mechanisms for funding projects that further the goals of the Health IT Portfolio. Each award mechanism specifies the content, format, and timeline for deliverables, including periodic reporting requirements for completion of milestones and budget updates. Grants, cooperative agreements, contracts, and interagency agreements are four of the common mechanisms that AHRQ applies to carry out a wide variety of directed health services research and administrative activities. Further description of each is provided below.

### *Grant*

Grants provide money, property, or other direct assistance to allow eligible entities to carry out an approved project or activity in support of a public purpose that does not directly benefit the Government. A grant is used whenever the Operating Division (OPDIV) anticipates no substantial programmatic involvement with the recipient during performance of the financially assisted activities. [2]

### *Cooperative Agreement*

Cooperative agreements are used when there will be substantial Federal programmatic involvement. Substantial involvement means that OPDIV program staff will collaborate or

[2] Page B-6 of the HHS Grants Policy Statement (http://www.hhs.gov/grantsnet/docs/HHSGPS_107.doc)

participate in project or program activities as specified in the Notice of Grant Award. The difference between grants and cooperative agreements is the degree of Federal programmatic involvement rather than the type of administrative requirements imposed.

*For the purpose of this report, the term 'grant' is used to include both grants and cooperative agreements.*[3]

### *Contract*

A contract is an agreement, initiated by the Government, to acquire an identifiable product or service under specified terms. Contracts may be awarded by AHRQ pursuant to the Federal Acquisition Regulation (FAR).

### *Interagency Agreement*

Interagency Agreements (IAAs) are used to provide to, purchase from, or exchange goods or services with another Federal agency.

## C. Health IT Portfolio

AHRQ's Health IT Portfolio continues to be an active and committed force in the Nation's 10-year effort to bring health care into the 21st century and improve the quality of care provided for all Americans by advancing the use of information technology. Through this research portfolio, AHRQ and its partners identify challenges to health IT adoption and use, solutions and best practices for making health IT work, and tools that will help hospitals and clinicians successfully incorporate new information technology. In addition, the Health IT Portfolio develops and disseminates evidence and evidence-based tools to inform policy and practice on how health IT can improve the quality of health care in the United States.

The Health IT Portfolio is both an organizing construct for research and a designation for a collaborative team of AHRQ staff mainly located in AHRQ's Center for Primary Care, Prevention, and Clinical Partnerships. P. Jon White, M.D., Director of the Health IT Portfolio, works with a core team of 10 full-time employees. However, there are a number of staff across AHRQ who serve as program officials and support the Portfolio's activities, including staff in the Office of Communications and Knowledge Transfer (OCKT); the Office of Performance, Accountability, Resources, and Technology; and the Office of Extramural Research, Education, and Priority Populations, as well as the numerous contracts that support the NRC.

In 2009, members of the health IT team applied their skills and dedication to the Health IT Portfolio in various ways, including: served as program officials on health IT-sponsored grants and contracts, managed the portfolio, set strategic and business goals for the portfolio, conducted intramural research, developed reports and published peer-reviewed manuscripts, reviewed grant applications submitted through grant funding opportunity

[3] Page B-4 of the HHS Grants Policy Statement (http://www.hhs.gov/grantsnet/docs/HHSGPS_107.doc)

announcements (FOAs), issued a series of requests for task orders, published the inaugural Summary of AHRQ Health Information Technology Portfolio-Funded Projects as of 2008, developed and updated in-depth project-specific profiles on the NRC Web site, and participated in and presented at numerous interagency and public meetings.

AHRQ's NRC for Health IT supports the Agency's mission of developing and disseminating evidence and evidence-based tools on how health IT can improve health care quality, safety, and efficiency. AHRQ initially established the NRC for Health IT in 2004 as a way to communicate and deliver technical assistance to its grantees. Since then, AHRQ has made the NRC available to the public as a resource for research findings, best practices, lessons learned, and funding opportunities with health IT researchers, implementers, and policymakers.

In 2009, there were 121 grants and 59 contracts active during the year (see Table 1). Collectively, AHRQ's lifetime funding for these projects was approximately $191 million. Of the grants and contracts that were active in calendar year 2008, 19 grants and 11 contracts ended in 2009. Sixty-nine grants and 18 contracts were ongoing into 2010, and an additional 33 grants and 30 contracts started in 2009.

**Table 1: Counts and Lifetime AHRQ Funding for Health IT Portfolio-Sponsored Grants and Contracts Active as of 2009**

| Mechanism | Count | Lifetime AHRQ Funding[4] |
|---|---|---|
| Grants[5] | 121 | $122.2 |
| AHRQ Project-Specific Contracts[6] | 59 | $68.4 |
| **Total** | **180** | **$190.6** |

### *Grants: Funding Opportunity Announcements*

Proposals for grants and cooperative agreements are submitted in response to AHRQ's issuance of an FOA. One-time FOAs are known as Request for Applications (RFAs) and recurring FOAs are known as Program Announcements (PAs). An RFA is a one-time funding opportunity issued to solicit specific research projects quickly. A PA allows applications to be submitted over multiple years at one of three submission cycles in a given year.[7] (See standard due dates at http://grants1.nih.gov/grants/funding/submissionschedule.htm.)

[4] In millions of dollars.
[5] Not included are projects sponsored by other AHRQ portfolios, e.g., Comparative Effectiveness, Innovations and Emerging Issues, Prevention/Care Management, Patient Safety, and Value, which may feature health IT components.
[6] Includes six Health Information Exchange State and Regional Demonstration (SRD) projects, two clinical decision support (CDS) contracts, and 51 other individual contracts.
[7] Original new and competing renewal applications that were submitted prior to January 25, 2010, will be permitted two amendments (A1 and A2). For these "grandfathered" applications, AHRQ expects that any A2 will be submitted no later than January 7, 2011, and AHRQ will not accept A2 applications after that date.

Table 2 (Page 20) outlines the history of the Health IT Portfolio's funding. There have been three major funding waves: Transforming Health Care Quality through Information Technology RFAs, Ambulatory Safety and Quality RFAs, and most recently, Health IT-Oriented Program Announcements. All of the grants in the first two categories had been awarded through now-closed, one-time RFAs. The funding types are described below.

**1. Transforming Health Care Quality through Information Technology (THQIT) RFAs.** The THQIT projects support different aspects of organizational and community-wide health IT implementation-related activities, elucidate various stakeholders' perspectives, and/or demonstrate the value of health IT implementation and use, particularly in rural hospitals and community-based health care settings. AHRQ's Health IT Portfolio's THQIT initiative includes grants funded through the following four RFAs:

- The THQIT planning grants (HS-04-010) were designed to support the planning phase and development of health IT infrastructure for communities interested in preparing for effective exchange of health information across multiple community health care organizations. All 39 THQIT planning grants were completed in 2004 and 2005.
- The initial THQIT implementation grants (HS-04-011) were intended to assess the extent to which health IT implementation contributes to measurable and sustainable improvements in patient safety, cost, and overall quality of care. Only one of these grants was still active—and was completed—in 2009.
- The second set of THQIT implementation grants (HS-05-013), referred to here as 'post-planning implementation grants', had the same objectives as the initial THQIT implementation grants. The awarded institutions had the benefit of receiving and completing a planning grant prior to an implementation grant. Twelve of these grants were active during 2009, and all were completed by the end of the year.
- The THQIT value grants (HS-04-012) sought to generate insight on health IT's value— including clinical, safety, quality, financial, organizational, effectiveness, efficiency, and other direct or indirect benefits—when health IT is used in the delivery of health care. According to the FOA, these value assessments were to be from various stakeholders' perspectives, including patients, providers, purchasers, payers, policymakers, or other important stakeholders and decisionmakers. In 2009, four of these grants were active and completed.

In total, 118 THQIT grants were funded by AHRQ. As indicated in Table 2, 17 of those grants were still active in 2009, comprising 14 percent (17/121) of the active grants across all funding initiatives in that year. However, at the end of 2009, all THQIT grants were closed.

**2. Ambulatory Safety and Quality RFAs.** In 2007 and 2008, the Health IT Portfolio issued a series of RFAs (HS-07-007, HS-07-006, HS-07-002, and HS-08-002), that was

known as the Ambulatory Safety and Quality (ASQ) initiative and supported grants to improve the safety and quality of ambulatory health care in the United States.

- The purpose of the **Enabling Patient-Centered Care (PCC) Through Health IT RFA** (HS-07-007) was to support grants that investigate novel methods or evaluate existing strategies for using health IT to create or enhance patient-centered models of care in the ambulatory setting. Applicants were expected to demonstrate how patient-centered care can improve health outcomes, patient safety, and patients' reported experience with care. Applicants were encouraged to consider projects that focused on: shared decisionmaking, patient-clinical communication, PHRs, integration of patient information across transitions in care, or patient self-management of chronic conditions. Funding was set aside for three areas of research: primary care Practice-Based Research Networks (PBRNs), projects that serve vulnerable populations, and medication management. Regardless of set-aside research focus, all of these grants were assigned PCC or HIE as their Health IT Portfolio strategic goal because of the dominant theme of the RFA to enable PCC. All 16 of these grants were active through the end of 2009.
- The purpose of **Improving Quality Through Clinician Use of Health IT (IQHIT) RFA** (HS-07-006) was to support grants that investigate novel methods or evaluate existing strategies for clinician use of health IT in ambulatory settings to improve outcomes through more effective CDS, medication management, or care delivery. Applicants were encouraged to demonstrate the ability of EHRs and medication management systems to effectively move evidence-based clinical information to providers and participants in HIE. Research areas with set-aside funding were primary care PBRNs, projects that serve vulnerable populations, and medication management. Health IT Portfolio strategic goals were selected based on the primary objective of a given grant. All 24 of these grants were active through the end of 2009.
- The purpose of the **Enabling Quality Measurement (EQM) Through Health IT RFA** (HS-07-002) was to support grants that develop safety and quality measures in ambulatory care settings, automate quality measurement, demonstrate the ability of electronic data systems (such as EHRs or claims data merged with EHR data), to expand potential safety and quality measures, and demonstrate improved ability to export data for reporting performance on measures and improvement. All 17 of these grants were active in 2009; two grants ended during that year (one with a 3-month no-cost extension), and the remaining 15 were awarded 1-year no-cost extensions.
- The purpose of the **Improving Management of Individuals with Complex Healthcare Needs through Health IT** (also known as management of complex patients or MCP) **RFA** (HS-08-002) was to support the development of health IT that assists clinicians, practices, systems, and patients and families in improving the quality and safety of care delivery for individuals with complex health care needs (e.g., multiple chronic diseases) in ambulatory care settings, particularly in high-risk care transitions. The long-term goal of this effort is to ensure that

patients receive appropriate care and management for prevention and treatment of priority conditions. All 12 of these grants were active through the end of 2009.

**3. Health IT-Oriented FOAs.** In September 2008, AHRQ issued its continuum of three PAs (HS-08-268; HS-08-269; HS-08-270) to research how health IT can be used to improve health care quality in a progressively more complex fashion. Grants funded through these FOAs allow AHRQ to support the development and diversification of research infrastructures and individuals engaged in solving the important remaining challenges in health IT implementation, use, and evaluation as it relates to improving the health of all Americans.

Applications responsive to these FOAs focused on implementation of health IT in one or more of the following: ambulatory setting(s), transitions in care between ambulatory settings, or transitions in care between ambulatory and nonambulatory settings. For the purpose of these FOAs, ambulatory care settings include: health care clinician offices; outpatient clinics; outpatient mental health centers; outpatient substance abuse centers; urgent care centers; ambulatory surgery centers; community-based, school, or occupational health centers; safety-net clinics; pharmacies; homes; independent living centers; and long-term residential care facilities. These FOAs are open for a 3-year period. In September 2009, the first of these types of grants were begun. Potential applicants should consult the current version of the FOA for guidance on content and application requirements. The following are general overviews about each of these FOAs.

- **Small Research Grants to Improve Healthcare Quality through Health IT (R03) FOA** (PAR-08-268) support different types of small research studies, including: 1) small pilot and feasibility or self-contained health IT research projects, 2) secondary data analysis of health IT research, and 3) economic (prospective or retrospective) analyses of health IT implementation. A total of three of these projects were awarded in 2009. Highlights of each type of health IT R03 study are:
  - *Health IT Small Pilot and Feasibility and Self-contained Research Projects* may be either preliminary or preparatory work that informs future health IT implementation.
  - *Health IT Secondary Data Analysis* investigates additional research questions that are related to, but distinct from, the specific aims of the original data collection.
  - *Health IT Prospective or Retrospective Economic Analyses* feature an evaluation of financial and non-financial costs and benefits of a companion health IT implementation project.
- **Exploratory and Developmental Grant to Improve Health Care Quality through Health IT (R21) FOA** (PAR-08-269) supports health IT exploratory and developmental research projects. These R21 grants support the conduct of short-term preparatory, pilot, or feasibility studies that are needed to inform future health IT implementation and may include but are not limited to the conduct of a health IT research demonstration grant. The R21 grants are intended to be more

comprehensive and broader in scope than the small, self-contained health IT research projects supported by the health IT R03 FOA. During 2009, a total of six projects were awarded.

- **Utilizing Health IT to Improve Health Care Quality Grant (R18) FOA** (PAR-08-270) supports demonstration research grants that study health IT implementation and use to improve the quality, safety, effectiveness, and efficiency of health care in ambulatory settings and transitions between care settings. AHRQ awarded 12 of these R18 grants in 2009.

Researchers interested in AHRQ funding opportunities should periodically check the AHRQ Web site for updates: http://www.ahrq.gov/fund/ as well as the most recent information on the peer review process, funding criteria, and application forms: http://grants.nih.gov/grants/guide/notice-files/NOT-HS-10-002.html.

**4. Other Health IT-Funded Grants.** The Health IT portfolio funds grants with a health IT focus, which are solicited through other FOAs including:

- **Career and Dissertation Awards.** In addition, the Health IT Portfolio issued a Special Emphasis Notice (SEN) (NOT-HS-08-014), articulating its commitment to enhancing the careers of health IT-focused researchers by funding K-awards and research dissertation grants (R-36). These grants support the career development of clinical and research doctorates who focus their research on one of three priority health IT research areas. There were nine active career and dissertation awards (three R36, five K08, and one K01) in 2009.

- **Conference Support Awards.** AHRQ continues to support conferences through its Grant Programs to support both small (PA-09-070 Small Grant Program for Conference Support [R13]) and large (PAR-09-257 Grant Program for Large Conference Support [R13] and [U13]) conferences to help further its mission to improve the quality, safety, efficiency, and effectiveness of health care for all Americans. In 2009, there was one active R13 grant funded under the Health IT Portfolio in 2008 for a large conference, and two R13 small conferences that were funded in 2009.

- **AHRQ Health Services Research (R01) Purpose.** In March 2007, AHRQ issued an agency-wide FOA (PAR-09-231) for ongoing extramural grants for research, demonstration, dissemination, and evaluation projects to support improvements in health outcomes, strengthen quality measurement and improvement, and identify strategies to improve access. In 2009, there was one active R01 grant under the Health IT Portfolio, funded in 2009.

- **Centers for Education and Research on Therapeutics (CERTs) (U18).** AHRQ was given responsibility for administering the CERTs demonstration program authorized by Congress as part of the Food and Drug Administration Modernization Act of 1997 (Public Law 105-115). AHRQ awarded grants to

support the first four centers in September 1999, and the full CERTs program was established as part of the Healthcare Research and Quality Act of 1999 (Public Law 106-129). CERTs conduct research and provide education to advance the optimal use of drugs, medical devices, and biological products; increase awareness of the benefits and risks of therapeutics; and improve quality while cutting the costs of care. CERTs consist of 14 research centers and a coordinating center. In 2009, there was one active CERT program, funded under the Health IT Portfolio, awarded in 2007.

## Table 2: AHRQ-Sponsored Health IT Funding Opportunity Announcements and Special Emphasis Notices, Published 2004-2009

| Publication Number | Title and Hyperlink | Year Awarded | Number of Grants Active as of 2009 | New Grant Proposals May be Submitted |
|---|---|---|---|---|
| RFA-HS-04-010 | Transforming Healthcare Quality Through Information Technology (THQIT)—Planning Grants | 2004 | None[8] | No |
| RFA-HS-04-011 | Transforming Healthcare Quality Through Information Technology (THQIT)—Implementation Grants | 2004 | 1 | No |
| RFA-HS-04-012 | Demonstrating the Value of Health Information Technology | 2004 | 4 | No |
| RFA-HS-05-013 | Limited Competition for AHRQ Transforming Healthcare Quality Through Information Technology (THQIT)—Implementation Grants | 2005 | 12 | No |
| RFA-HS-07-004 | Centers for Education and Research on Therapeutics (CERTs) (U18) | 2007 | 1 | No |
| RFA-HS-07-007 | Ambulatory Safety and Quality: Enabling Patient-Centered Care Through Health IT (R18) | 2007 | 16 | No |
| RFA-HS-07-006 | Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health IT (R18) | 2007 | 24 | No |
| RFA-HS-07-002 | Ambulatory Safety and Quality Program: Enabling Quality Measurement Through Health IT (R18) | 2007 | 17 | No |
| RFA-HS-08-002 | Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs Through Health IT (R18) | 2008 | 12 | No |
| PAR-09-257 | AHRQ Grant Program for Large Conference Support (R13) and (U13) | 2008 | 1 | No |
| PA-09-070 | AHRQ Health Services Research (R01) | 2009 | 1 | No |
| PA-09-231 | Small Grant Program for Conference Support (R13) | 2009 | 2 | No |
| PAR-HS-08-268 | Small Research Grant to Improve Health Care Quality Through Health Information Technology (IT) (R03) | 2009 | 3 | Yes[9] |
| PAR-HS-08-269 | Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (IT) (R21) | 2009 | 6 | Yes |
| PAR-HS-08-270 | Utilizing Health Information Technology (IT) to Improve Health Care Quality (R18) | 2009 | 12 | Yes |
| NOT-HS-08-014 | Special Emphasis Notice: Career Development (K01, K02, K08) and Dissertation (R36) Grants Focused on Health Information Technology (IT) | 2009 | 9 | Yes |

[8] The 39 THQIT planning grants finished in 2004 and 2005.
[9] The three active Health IT FOAs and Special Emphasis Notice have an expiration date of November 17, 2011. AHRQ will consider their renewal as appropriate.

### *Contracts*

The Health IT Portfolio uses various contract mechanisms to solicit requests for proposals (RFPs), including one-time RFPs and request for task orders (RFTOs) when a master contract has been issued. Master Contracts are a special type of RFP that are issued to a group of well-qualified contractors who are then eligible to compete for a subsequent series of Master Contract-issued RFTOs. The full text of closed AHRQ RFPs issued since 2000 are available at http://www.ahrq.gov/fund/contrarch.htm. RFTOs are provided to Master Contract awardees for a given program, such as the Primary Care PBRN.

The following section describes the AHRQ-funded contracts, starting with the contracts that support the activities of the National Resource Center for Health IT.

**1. National Resource Center (NRC) for Health IT Contracts.**

AHRQ initially established the NRC for Health IT in 2004 as a means of delivering technical assistance to its grantees and disseminating their findings. Since then, AHRQ has expanded the breadth of resources it disseminated for purposes of sharing research findings, best practices, lessons learned, and funding opportunities with health IT researchers, implementers, and policymakers. The NRC plays a pivotal role in supporting AHRQ's management of the Health IT Portfolio in various capacities, including: generating and disseminating synthesized reference documents, such as lessons learned and project success stories; conducting a series of national Web conferences; and organizing and posting numerous resources on the NRC Web site. More than 10,000 documents, presentations, articles, and tools are freely available on the NRC Web site. From 2004 through September 2009, the NRC was primarily supported through a single multi-year contract.

In anticipation of the continued growth of the NRC and the conclusion of the initial 5-year NRC contract, in 2008 AHRQ announced its intent to issue a new series of Master Contracts stratified across four domains to support the next 5-year phase of the NRC. This RFP, the Health IT Portfolio-issued AHRQ NRC for Health IT (Solicitation No. AHRQ-2009-10003) was published in January 2009 and is available at: http://www.ahrq.gov/fund/contarchive/rfp0910003.htm. Thirty-two master contractors were selected to support the diverse needs of the NRC across the following four domains, as listed in Table 3.

## Table 3: National Resource Center Domains and Master Contractors

| | Domain 1 - Support for Health IT Program Management, Guidance, Assessment, and Planning | Domain 2 - Health IT Technical Assistance, Content Development, and Program-Related Projects and Studies | Domain 3 - Health IT Dissemination, Communication, and Marketing | Domain 4 - Health IT Portal Infrastructure Management and Web Site Design and Usability Support |
|---|---|---|---|---|
| | ▪ http://healthit.ahrq.gov/domain1 | ▪ http://healthit.ahrq.gov/domain2 | http://healthit.ahrq.gov/domain3 | ▪ http://healthit.ahrq.gov/domain4 |
| **Contractors** | ▪ Booz Allen Hamilton<br>▪ Computer Sciences Corporation<br>▪ National Opinion Research Center<br>▪ RTI International | ▪ Abt Associates<br>▪ Believe Health LLC<br>▪ Booz Allen Hamilton<br>▪ Fox Systems, LLC<br>▪ ICOR Partners, LLC<br>▪ John Snow, Inc.<br>▪ Mathematica<br>▪ National Opinion Research Center<br>▪ RTI International<br>▪ Thomson Reuters<br>▪ Trustees of Indiana University<br>▪ Westat | ▪ AIR<br>▪ The Lewin Group<br>▪ Millennium<br>▪ National Opinion Research Center<br>▪ RTI International | ▪ Amdex<br>▪ Booz Allen Hamilton<br>▪ Data Consulting Group<br>▪ Data Federal<br>▪ Function1<br>▪ IBM<br>▪ IFMC<br>▪ National Opinion Research Center<br>▪ Project Performance Corporation<br>▪ RTI International<br>▪ FEI |

For Fiscal Year 2009, the AHRQ Health IT program awarded an initial set of 19 tasks including:

- Developing requirements and plans for program management and governance of the new NRC.
- Synthesizing findings from the Program's $139 million in grants to small and rural health care organizations as well as $50 million to establish State and regional demonstrations of health information exchange.
- Establishing Federal resources for the Patient Centered Medical Home (PCMH)

For more detail on these initial set of tasks, please see Table 4.

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|---|---|---|---|---|
| | ▪ http://healthit.ahrq.gov/domain1 | ▪ http://healthit.ahrq.gov/domain2 | http://healthit.ahrq.gov/domain3 | ▪ http://healthit.ahrq.gov/domain4 |
| **Contractors** | ▪ Booz Allen Hamilton<br>▪ Computer Sciences Corporation<br>▪ National Opinion Research Center<br>▪ RTI International | ▪ Abt Associates<br>▪ Believe Health LLC<br>▪ Booz Allen Hamilton<br>▪ Fox Systems, LLC<br>▪ ICOR Partners, LLC<br>▪ John Snow, Inc.<br>▪ Mathematica<br>▪ National Opinion Research Center<br>▪ RTI International<br>▪ Thomson Reuters<br>▪ Trustees of Indiana University<br>▪ Westat | ▪ AIR<br>▪ The Lewin Group<br>▪ Millennium<br>▪ National Opinion Research Center<br>▪ RTI International | ▪ Amdex<br>▪ Booz Allen Hamilton<br>▪ Data Consulting Group<br>▪ Data Federal<br>▪ Function1<br>▪ IBM<br>▪ IFMC<br>▪ National Opinion Research Center<br>▪ Project Performance Corporation<br>▪ RTI International<br>▪ FEI |

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For more detail on these initial set of tasks, please see Table 4.

## Table 4: National Resource Center Task Orders by Domain, 2009

| | Domain 1 Tasks Orders (Contractor) | Domain 2 Tasks Orders (Contractor) | Domain 3 Tasks Orders (Contractor) | Domain 4 Tasks Orders (Contractor) |
|---|---|---|---|---|
| **Task Orders Awarded in CY 2009** | ▪ AHRQ Health IT Program Strategic Planning, Functional Requirements, and Operations Plan (BAH) | ▪ Web-Based National Teleconferences to Conduct Interactive Presentations on Health Information Technology Implementation and Use (NORC)<br>▪ Support for AHRQ's Clinical Decision Support Demonstration Projects (Westat)<br>▪ Health IT Project Monitoring and Reporting (JSI)<br>▪ Hardened Rules for Clinical Decision Support (Thomson Reuters )*<br>▪ Establishing Federal Resources to Support the Patient-Centered Medical Home Concept (Mathematica)*<br>▪ Health IT Grantee/Contractor Meeting (Abt Associates, Inc.)<br>▪ Technical Assistance to Support Progress and On-time Completion of Health IT Grants (BAH)<br>▪ Support for AHRQ's State and Regional Demonstrations in Health IT (RTI)<br>▪ Synthesis Reports for Grants and Cooperative Agreements for Transforming Healthcare Quality through Information Technology (Mathematica)* | ▪ AHRQ Health IT Partnership Strategy Development (RTI),<br>▪ AHRQ Health IT Marketing Communications Strategy Development (RTI)<br>▪ AHRQ Health IT Translation and Dissemination (RTI, NORC) | ▪ NRC Health IT Website Content Operations Support (PPC, F1)<br>▪ NRC Health IT Portal Infrastructure and Database Support (F1)<br>▪ NRC Health IT Portal Security and Documentation Support (PPC)<br>▪ NRC Health IT Website Portal Development Support (PPC, F1, IBM, BAH, AMDEX, NORC)<br>▪ NRC Health IT Independent Verification and Validation of Web site and Portal (DCG)<br>▪ NRC Health IT PCMH Resource Center Public and Private Web Portal (BAH) |

* Only those NRC contracts for projects that are considered 'knowledge generating' are included in the results section and have developed project summaries. The remainder of the NRC contracts are considered administrative or operational.

**2. Health IT Contracts**. In addition to the NRC, AHRQ funds a variety of knowledge-generating contracts through other mechanisms. The number of Health IT Portfolio contracts, by mechanism and the year they began are shown below.

## Table 5: AHRQ-Sponsored Health IT Contracts

| Number of Contracts Active as of 2009 | Title | Years Awarded |
|---|---|---|
| **One-Time Requests for Proposals** | | |
| 6 | State and Regional Demonstrations in Health Information Technology | 2004 and 2005 |
| 2 | Clinical Decision Support Services | 2007 |
| **Master Contracts Through Which Active Health IT Portfolio Task Orders (TO) Were Issued:** | | |
| 4 | Program Evaluation and Analysis Task Order Contract (PEATOC) | 2008 and 2009 |
| 1 | Department of Health and Human Services Program Support Center (PSC) | 2007 |
| 11 | Primary Care Practice-Based Research Networks (PBRNs) | 2007, 2008, and 2009 |
| 4 | Evidence-Based Practice Care Centers | 2008 and 2009 |
| 12 | Accelerating Change and Transformation in Organizations and Networks (ACTION) | 2007, 2008, and 2009 |
| 4 | Blanket Purchasing Agreement (BPA) for Support Services | 2008 and 2009 |
| 3 | National Resource Centers Task Orders for "knowledge-generating" contracts | 2009 |
| 10 | Other Task Orders | 2007, 2008, and 2009 |
| 2 | Interagency Agreements (see below) | 2006 and 2009 |

### *Interagency Agreements*

In 2009, the Health IT Portfolio funded two projects that were managed by other Federal agencies. Through an Interagency Agreement (IAA) with the National Institutes of Health (NIH) and the National Library of Medicine, the Health IT Portfolio provided $133,000 to an NLM-sponsored grant for the development of CDS guidelines. The second IAA was the Asthma Measurement Development with National Heart, Lung, and Blood Institute for $50,000.

This report summarizes Health IT Portfolio-sponsored projects managed by AHRQ. It does not include the Health IT Portfolio's IAA to support projects managed by other Federal agencies or IAAs from other Federal agencies to contract for projects to be conducted by the NRC.

# III. Methods

### *Development of Project Summaries*

John Snow, Inc. (JSI) and AHRQ staff developed multi-step content development and review processes for drafting project summaries of 121 grants and 59 contracts. Content for the summaries included data abstracted from multiple data sources, such as grant applications, contractor proposals, final reports, grantee quarterly reports from the AHRQ Research Reporting System (ARRS), and funding history documents provided by AHRQ. Information recorded in discussions with grantees and contractors during JSI's quarterly calls for its NRC Domain 2 Health IT Project Monitoring and Reporting contract also contributed to the content of the project summaries.

A template of the project summary was generated and pre-populated with data for each grantee and contractor project. New project summaries were created for projects that were funded in 2009; summaries for projects funded prior to 2009 were updated. JSI conducted followup calls with PIs and project directors (PDs) to collect missing information and/or to clarify and confirm information, and then submitted drafts of the summaries to the PIs and PDs for final review and sign-off.

To ensure consistency, JSI followed a standard operating procedure that outlined the steps of content development as well as the steps of the review process. For an overview of JSI's approach to developing these summaries, please see **Appendix A**.

Most of these project summaries are snapshots of ongoing multi-year research projects. They neither preempt nor replace the peer-reviewed publications of findings that were generated after conclusion and analyses of projects. Rather, these project summaries articulate the challenges, milestones, and outputs from an array of ongoing and concluded-in-2009 Health IT Portfolio-sponsored initiatives in an unprecedented and more immediate fashion. AHRQ intends that the summaries be informative references for implementers of health IT, prospective research applicants, and others interested in the challenges and successes of health IT implementation and use.

# IV. Results and Discussion

Through these 180 projects, AHRQ is supporting the development and dissemination of evidence on how health IT can be used to improve the quality, safety, efficiency, and effectiveness of care in a variety of health care settings. In this section, the distribution of grants and contracts active in 2009 by Health IT Portfolio strategic goals, AHRQ business goals, and AHRQ lifetime funding are presented. Given the differences in reporting and tracking requirements between grants and contracts, there are additional characteristics of grants that are systematically tracked across grants. Therefore, this section provides additional information about grantee characteristics, including grantees' self-reported performance in terms of spending and overall status of grantee-specified milestones, and the PI's history with Federal grant funding.

## A. Health IT Portfolio Active Projects (Grants and Contracts)

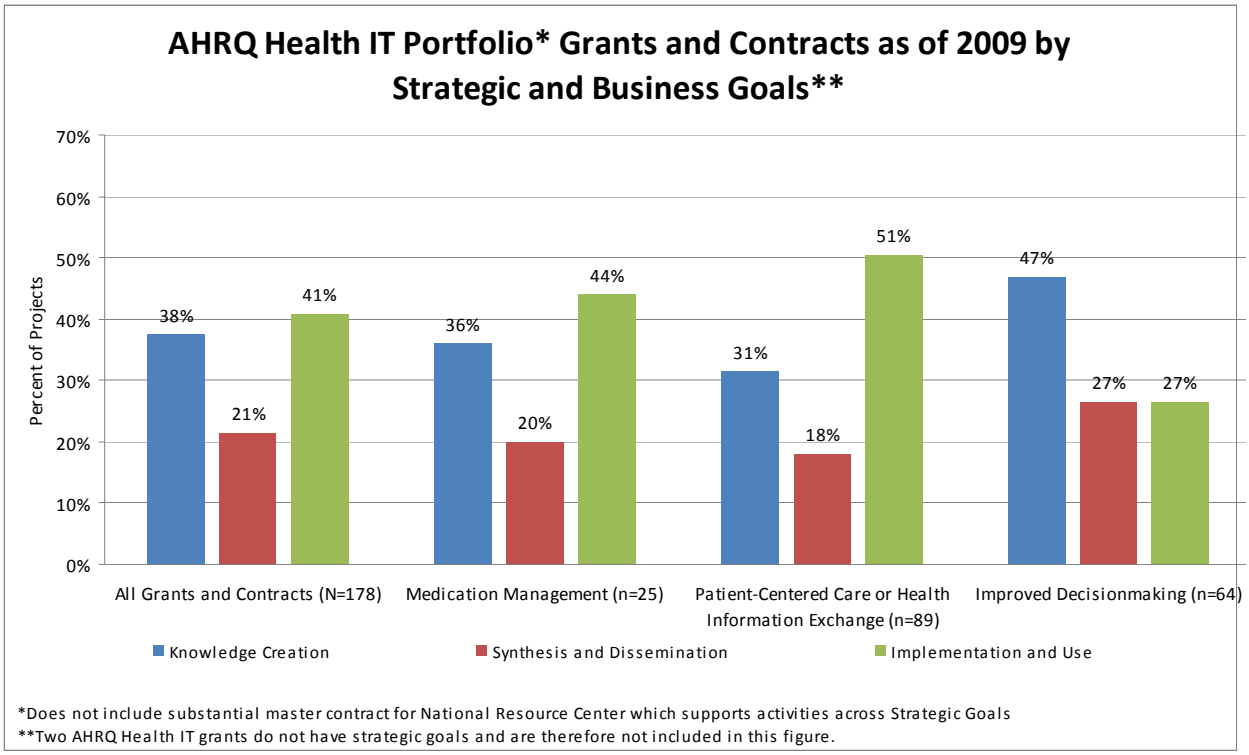
### *By Strategic and Business Goals*[10]

Eighty-nine projects (32 contracts and 57 grants), or 49 percent of all Health IT Portfolio-sponsored projects as of 2009, were assigned the strategic goal of enabling patient-centered care or health information exchange (PCC or HIE). Sixty-four projects (23 contracts and 41 grants), or 36 percent of the Portfolio's projects, had improved decisionmaking as their strategic goal. Twenty-five projects (4 contracts and 21 grants), or 14 percent, focused on medication management as their strategic goal.

The distribution of business goals differs by type of mechanism (contract or grant). Of the 119 grants, 59 (50 percent) focused on implementation and use of health IT. Forty-nine grants (41 percent) focused on knowledge creation. Eleven grants, or 9 percent, focused on synthesis and dissemination. Among the 59 contracts, 27 (46 percent) focused on synthesis and dissemination. Eighteen contracts (30 percent) focused on knowledge creation, and 14 contracts (24 percent) focused on implementation and use of health IT.

[10] Two projects (grants) were not assigned a specific Health IT strategic goal.

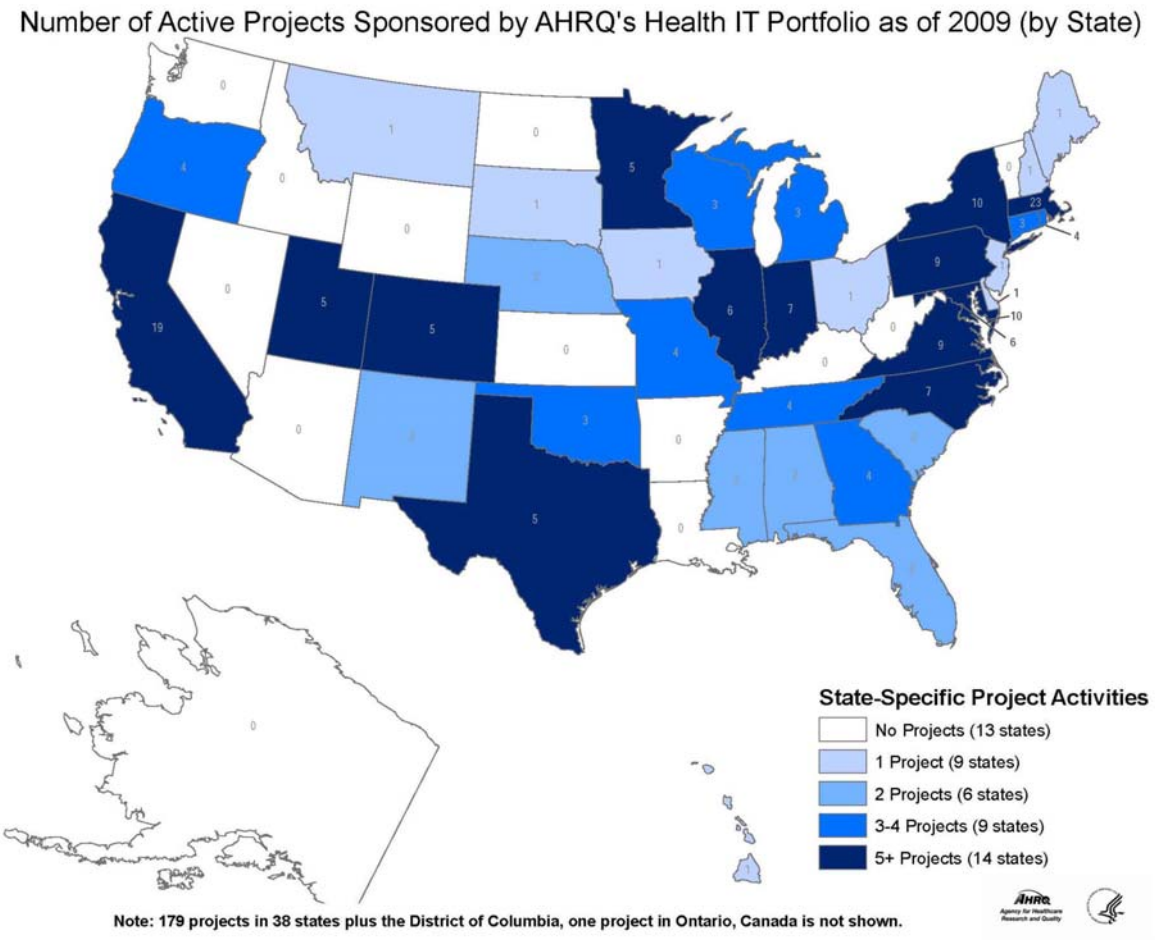
## Figure 1: AHRQ-Sponsored Health IT Grants and Contracts as of 2009, by Strategic and Business Goals




### *Geographic Distribution of Active Projects*

In 2009, the active recipient project institutions spanned 38 States and the District of Columbia (see Figure 2). One project was awarded to an institution in Ontario, Canada. Massachusetts, with 23, had the highest number of active health IT projects. California, with 19, had the next-highest level of active health IT projects, followed by New York and Maryland, which had 9 each. Indiana, Virginia, Tennessee, North Carolina, and Pennsylvania are also examples of States with longstanding AHRQ-funded health IT research programs.

**Figure 2: Number of Active Projects Sponsored by AHRQ's Health IT Portfolio as of 2009 (by State)**




# B. Grants

### *Term of Grants*

Each FOA or PA specifies the maximum project period for a grant. All of the Health IT Portfolio-sponsored grants active in 2009 were multi-year grants except two R03 grants (PAR-HS-08-268) and three Health Services Research Dissertation (R36) grants, which were 1-year awards.

Grants that were issued under expanded authority[11] are able to request, 1 month before their initial project period end date, a no-cost extension[12] of up to 12 months beyond the grant project

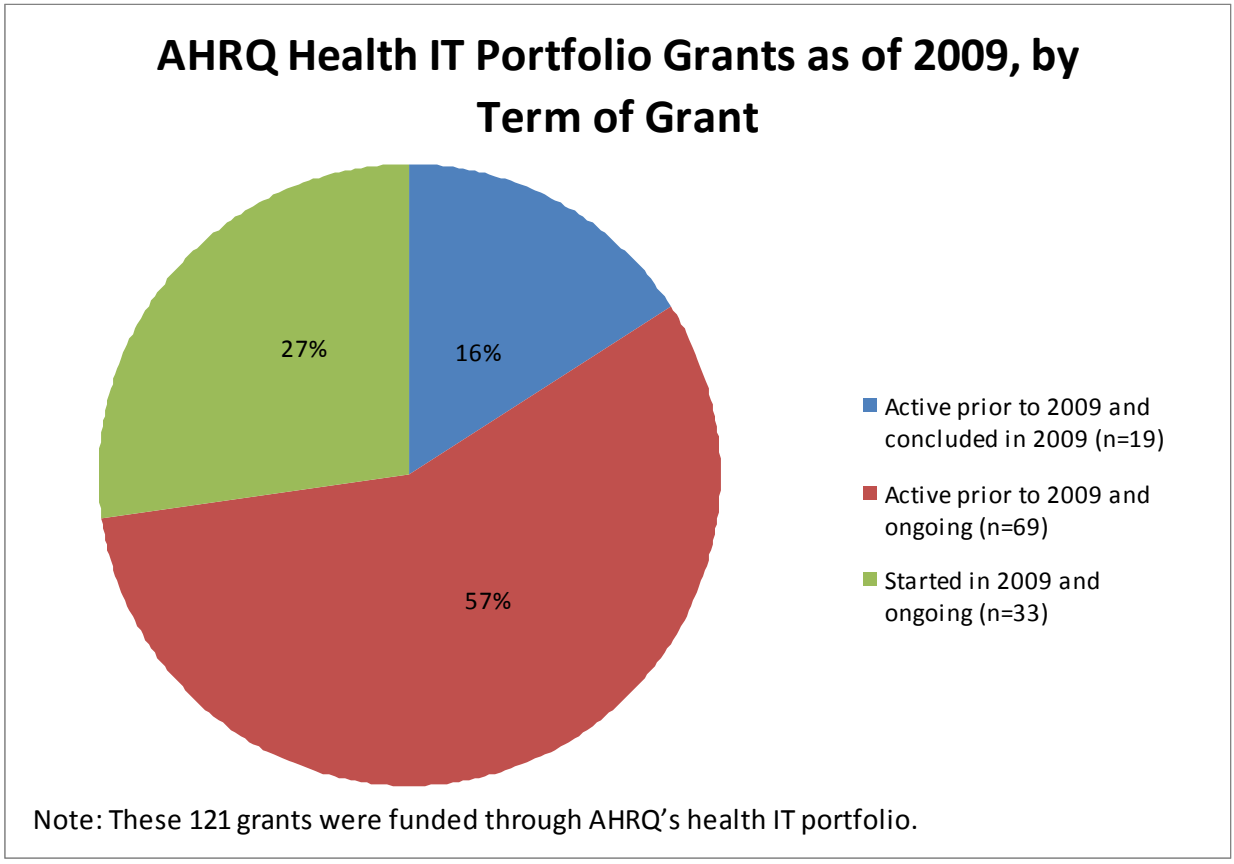
[11] Operating authorities provided to grantees that waive the requirement for agency prior approval for specified actions.

[12] An extension of the period of performance beyond the expiration date to allow the principal investigator to finish a project, with no additional costs provided.

period without prior approval by AHRQ, as long as there were no changes in scope. Grants (including cooperative agreements) that were not issued under expanded authority may request no-cost extensions of up to 12 months. Among the 17 THQIT grants active in 2009, all were functioning under a no-cost extension and ended during 2009. As of the end of 2009, 16 of the 17 EQM grants (HS-07-002) had requested and were approved for a no-cost extension; all of these were for 1 year, with the exception of one project that received a 3-month no-cost extension and ended in late 2009. The Health IT Portfolio will continue to monitor the duration of and extent to which no-cost extensions are used among health IT grantees.

Figure 3 shows the disposition of grants in terms of whether they concluded in 2009, started in 2009, or were begun prior to 2009 and continued through 2010. As demonstrated by this figure, there was an increase in the number of active Health IT Portfolio research grants at the end of 2009, with 33 new grants beginning and only 19 ending. The number of new grants is related to the release of the new Health IT Portfolio PAs in 2008.

**Figure 3: Health IT Grants as of 2009, by Term of Grant**




Note: These 121 grants were funded through AHRQ's health IT portfolio.

### *Grants: Lifetime AHRQ Funding by Term of Grant and Strategic Goals*

Lifetime AHRQ funding refers to the total support (direct plus indirect costs) that AHRQ obligates to a grant during the project period, as long as the grantee's performance indicates continuation of the grant.

Among the 119 grants assigned a strategic goal and active in 2009, 57 had the goal of enabling PCC or HIE and $61.5 million lifetime AHRQ funding (see Table 6). The 21 medication management grants were comparably funded, with $22.4 million, and the 41 improved decisionmaking grants had $38.1 million lifetime AHRQ funding. It is not surprising that 48 percent were assigned the most-common strategic goal of PCC or HIE, since two FOAs (HS-08-002 and HS-07-007) funded projects that support health IT implementation and use for patients with complex medical needs and to support patient-centered care. Sixty-eight percent, or 13 of the 19 grants that were active prior to 2009 and concluded in 2009, had PCC or HIE as their strategic goal. Forty-seven percent (32 of the 68 grants active prior to 2009 and ongoing) had a PCC or HIE strategic goal, and 38 percent (12 of the 32 grants that started in 2009 and are ongoing) had a PCC or HIE strategic goal.

The grants that ended in 2009 included: 1 grant with a strategic goal of Medication Management and $1.5 million lifetime AHRQ funding, 5 grants with a strategic goal of Improved Decisionmaking and $6.3 million lifetime AHRQ funding, and 13 grants with a strategic goal of PCC or HIE and $18.4 million lifetime AHRQ funding (see Table 6).

## Table 6: Counts and Lifetime AHRQ Funding for Active Health IT Grants as of 2009, by Term of Grant and Strategic Goals*

| | Medication Management | | Patient-Centered Care or Health Information Exchange | | Improved Decisionmaking | | Total | |
|---|---|---|---|---|---|---|---|---|
| **Grant Term** | Number | AHRQ Funding** | Number | AHRQ Funding** | Number | AHRQ Funding** | Number | **Total AHRQ Funding** (%)** |
| Active prior to 2009; concluded in 2009 | 1 | $1.5 | 13 | $18.4 | 5 | $6.3 | 19 (16%) | **$26.1 (21%)** |
| Active prior to 2009; ongoing | 15 | $18.1 | 32 | $36.4 | 21 | $19.8 | 68 (57%) | **$74.2 (61%)** |
| Started in 2009; ongoing | 5 | $2.9 | 12 | $6.7 | 15 | $12.0 | 32 (27%) | **$21.6 (18%)** |
| **Total** | **21 (18%)** | **$22.4 (18%)** | **57 (48%)** | **$61.5 (50%)** | **41 (34%)** | **$38.1 (31%)** | **119 (100%)** | **$122.0 (100%)** |

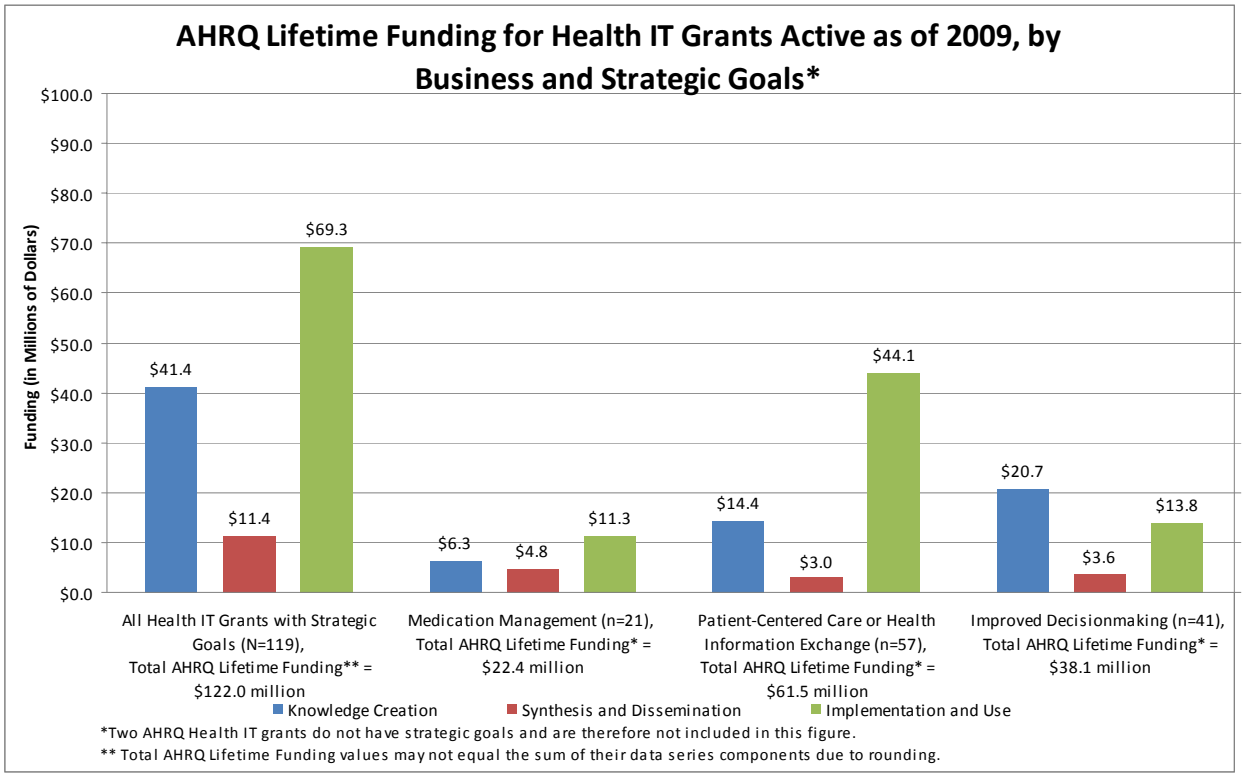
**The two AHRQ Health IT grants without strategic goals are not included in this table.*
***In millions of dollars. Total AHRQ funding values may not equal the sum of their data series components due to rounding.*

The distribution of AHRQ lifetime funding by business and strategic goals is shown in Figure 4. Grants that focused on implementation and use of health IT dominate the portfolio in terms of number of grants (50 percent, or 59 out of 119 grants) and percentage of AHRQ lifetime funding (57 percent, or $69.3/$122.0 million).

Grants that have a business goal of knowledge creation constitute 41 percent (49 grants) and 34 percent ($41.4/$122.0 million), respectively, of the AHRQ lifetime funding for grants. Knowledge creation is a growing focus of the Health IT Portfolio, as reflected in the purpose and scope of the health IT PAs that were published in 2008.

While only 9 percent (11/119) of grants have the business goal of dissemination and synthesis, this number does not indicate an undervaluing of dissemination or synthesis activities. On the contrary, dissemination of results is a requirement specified in each FOA and notice of grant award. Each grantee is encouraged to update the NRC on at least a quarterly basis to share with them the status of the grant, to post materials on the NRC Web site, to notify AHRQ's OCKT when and where manuscripts are to be published, and to participate in the annual AHRQ-sponsored grantee meeting. However, these requisite dissemination requirements would likely be secondary to the business goals assigned to many of the grants.

**Figure 4: AHRQ Lifetime Funding for Health IT Grants as of 2009, by Business and Strategic Goals**



### *Grantees' Most Recent Self-Reported Project and Spending Status*

In an effort to understand grantees' experience and performance in reaching their specific project milestones, AHRQ Health IT Portfolio grantees report their project progress and challenges to ARRS on a quarterly basis. Included in quarterly reports are self-reported categorical variables for grantees to indicate the extent to which they are on track in reaching overall milestones and spending plans. Since these self-characterizations are reported quarterly, fluctuation may occur from quarter to quarter for a given project. AHRQ also recognizes that, through the course of the grant process, unexpected delays (e.g., loss of key personnel, additional time to ensure the institutional review board's [IRB's] approval of plans for protection of human subjects, delays in software development, installation, or interfacing with pre-existing software) may temporarily affect research milestones and spending plans. AHRQ is mindful of the importance of early identification and remediation of such challenges, especially in health IT implementation research projects.

AHRQ-sponsored health IT grantees' self-reported overall goal status[13] for calendar year 2009 (see Figure 5) were:

- 14 percent (15/107) reported progress is completely on track
- 58 percent (62/107) reported progress is mostly on track
- 22 percent (24/107) reported progress is on track in some respects but not others
- 0 percent (0/107) reported progress in meeting many milestones is stalled
- 0 percent (0/107) reported progress across the project is stalled
- 6 percent (6/107) did not report[14]

In general, these grantees report a high level of attaining grant-specified milestones, and during quarterly calls with JSI, no grantee reported problems that might lead to project failure. All grantees had identified alternative solutions or expected to request a no-cost extension to complete the project.

AHRQ-sponsored health IT grantees' self-reported status regarding spending for calendar year 2009 (see Figure 6)[15] were:

- 13 percent (14/107) were significantly underspent, more than 20 percent
- 33 percent (35/107) were somewhat underspent, approximately 5 to 20 percent
- 49 percent (52/107) were spending roughly on target
- 0 percent (0/107) were somewhat overspent, approximately 5 to 20 percent
- 0 percent (0/107) were significantly overspent, more than 20 percent
- 6 percent (6/107) did not report[16]

Nearly half (46 percent) of grantees reportedly underspent budgeted AHRQ funds in their most recent (2009) quarterly report. Of the 21 grants that were funded in the last quarter of 2009, (September through December), 52 percent (11/21) reportedly underspent their allotted budget. Several of these grantees said that underspending was a result of delays in implementation of the

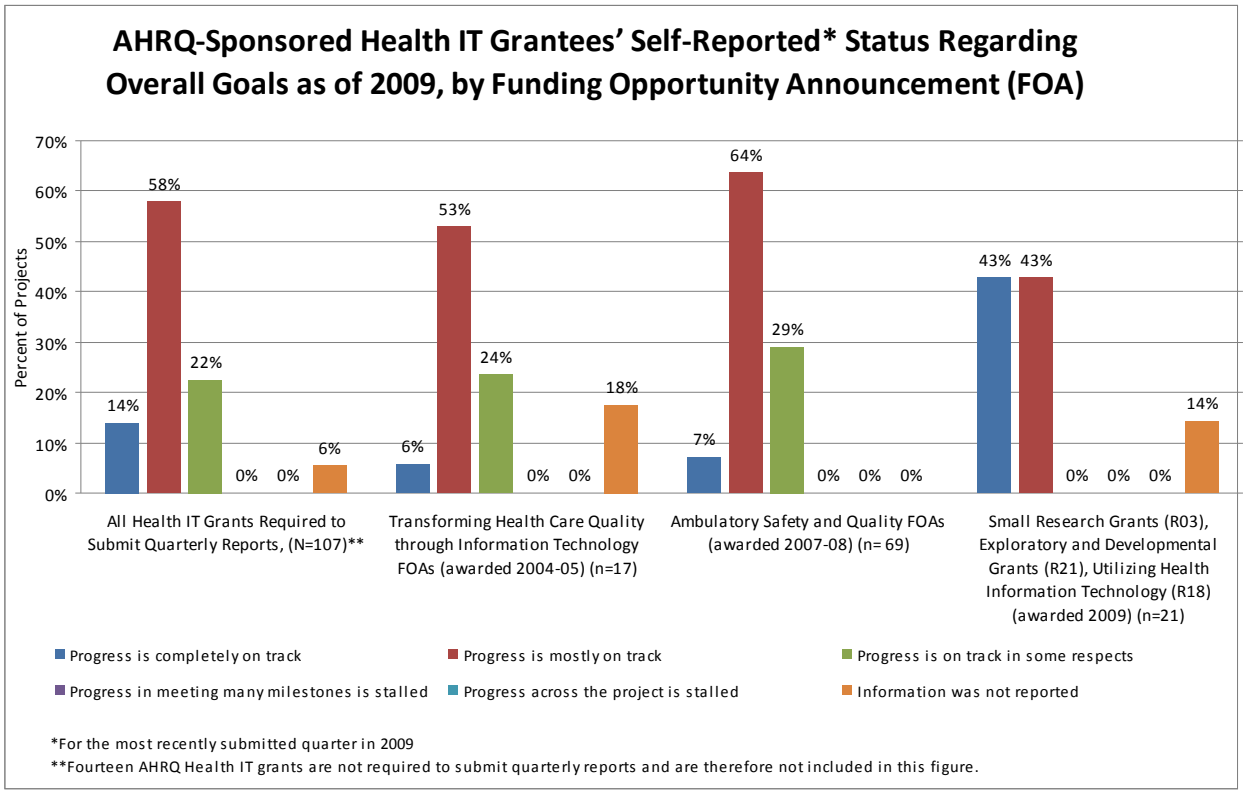
[13] Training (K-awards and research dissertation grants [R-36]) and other Health IT grants (e.g., conference support grants) do not report progress on a quarterly basis and are therefore not included in these totals.
[14] Three of these grants started in late 2009 and had not yet been prompted to submit a progress report.
[15] Numbers may not add up due to rounding.
[16] Three of these grants started in late 2009 and had not yet been prompted to submit a progress report.

project (e.g., hiring staff, awaiting IRB approval). Notably, grantees appear to be sound fiscal managers of their grant funding as evidenced by the lack of reports of significant overspending.

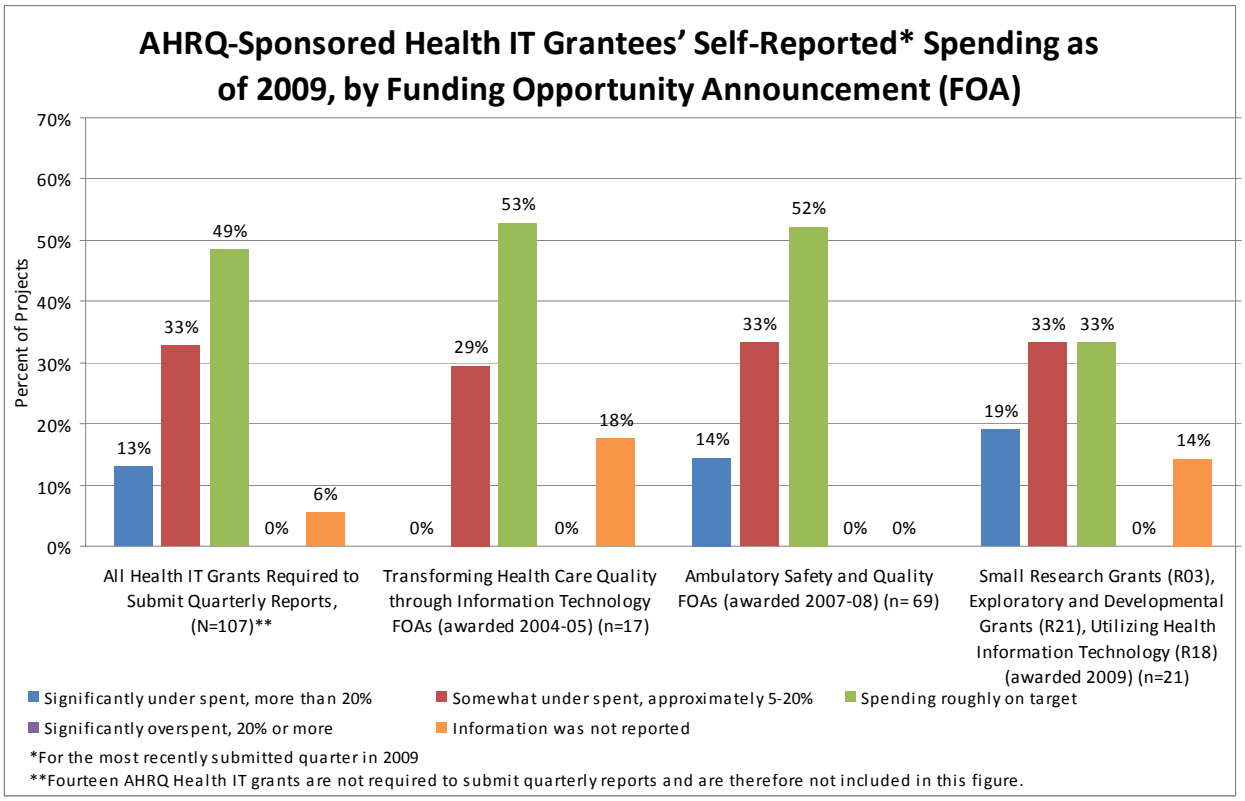
Reporting these spending levels through ARRS is, in part, voluntary. However, grantees are required to report budgeting and spending patterns in the requisite Public Health Service Form 2590 if they wish to receive approval for continuation of funding for each multi-year grant, such as these.

AHRQ is monitoring the milestone progress and spending patterns of grantees both within and across funding mechanisms in order to understand factors that influence project process and spending (see Figure 5).

**Figure 5: AHRQ-Sponsored Health IT Grantees' Self-Reported* Status Regarding Overall Goals as of 2009, by Funding Opportunity Announcement**



## Figure 6: AHRQ-Sponsored Health IT Grantees' Self-Reported* Spending as of 2009, by Funding Opportunity Announcement




### *Principal Investigators*

Grants and cooperative agreements are awarded to an institution and not to a PI. Yet, the PI is the individual who the recipient grantee organization designates responsible for the scientific, technical, and programmatic aspects and day-to-day management of the project. Among the 121 health IT grants active in 2009, there were 115 distinct PIs. Six of these PIs had two AHRQ-sponsored health IT grants active in 2009.

AHRQ gathered information about PI grantee award histories based on data from the Information for Management Planning, Analysis, and Coordination (IMPAC) II database. This grantee award database is maintained by NIH and is used by agencies within the Department of Health and Human Services. Among the 115 unique PIs in 2009 who had an active health IT-sponsored grant, 28 (24 percent) were prior recipients of a career award (K-award) or training grant (T-32) to enhance their research abilities. Among these 28 PIs, 13 had received 1 or more K-awards, 13 had received a T-32 training grant, and 2 PIs had received both a K-award and a T-32 training grant.

## Table 7: The Distribution of First-Time Grant Principal Investigators, by Funding Opportunity Announcement[17]

| Percentage of First-Time PIs | Transforming Healthcare Quality Through Health IT (THQIT) FOAs |
|---|---|
| 33% (4/12) | RFA-HS-05-013 Limited Competition for AHRQ THQIT Implementation |
| 100% (1/1) | RFA-HS-04-011 THQIT Implementation |
| 0% (0/4) | RFA-HS-04-012 Demonstrating the Value of Health Information Technology |
| **Percentage of First-Time PIs** | **Ambulatory Safety and Quality (ASQ) FOAs** |
| 44% (7/16) | RFA-HS-07-007 ASQ Enabling Patient-Centered Care through Health IT |
| 25% (6/24) | RFA-HS-07-006 ASQ Improving Quality through Clinician Use of Health IT |
| 24% (4/17) | RFA-HS-07-002 ASQ Enabling Quality Measure through Health IT |
| 8% (1/12) | RFA-HS-08-002 ASQ Improving Management of Individuals with Complex Healthcare Needs through Health IT |
| **Percentage of First-Time PIs** | **Health IT-Oriented PAs** |
| 33% (1/3) | PAR-HS-08-268 Small Research Grant to Improve Health Care Quality through Health IT (R03) |
| 8% (1/12) | PAR-HS-08-270 Utilizing Health IT to Improve Health Care Quality (R18) |
| 33% (2/6) | PAR-HS-08-269 Exploratory and Developmental Grant to Improve Health Care Quality through Health IT (R21) |
| **Percentage of First-Time PIs** | **Training and Career** |
| 22% (2/9) | NOT-HS-08-014 Special Emphasis Notice: AHRQ Announces Interest in Career Development (K01, K02, K08) focused on Health IT |
| 100% (3/3) | PAR-HS-06-118 AHRQ Grants for Health Services Research Dissertation (R36) |
| **Percentage of First-Time PIs** | **Conference Support and Other FOAs** |
| 50% (1/2) | PA-HS-06-074 Small Grant Program for Conference Support (R13) |
| 0% (0/1) | RFA-HS-07-004 Centers for Education and Research on Therapeutics (CERTs) (U18) |
| 100% (1/1) | PA-HS-06-378 AHRQ Grant Program for Large Conference Support (R13) and (U13) |
| 0% (0/1) | PA-HS-07-243 AHRQ Health Services Research (R01) |

[17] The Department of Health and Human Services (DHHS) IMPAC II database tracks research funding for several grant programs among various DHHS, including AHRQ, the 27 institutes at the National Institutes of Health, Health Resources and Services Administration, National Institute for Occupational Safety and Health, etc.

It is not surprising that the rates of first-time grantees were high (29 percent) across the THQIT grantees. The THQIT FOAs were designed for community health centers, rural hospitals, other health care settings, and community representatives concerned with health IT implementation but who may not have a history of conducting traditional health services research and evaluation. Therefore, the Health IT team anticipated that there would be some THQIT PIs who did not have prior grantee experience but could gather an experienced interdisciplinary research team.

The percentage of first-time grantees across the ASQ FOAs was varied. Only one of the 12 PIs (8 percent) for grants to the Improving Management of Individuals with Complex Healthcare Needs through Health IT (HS-08-002) was a first-time PI, while 24, 25, and 44 percent of the remaining three ASQ FOAs were first time PIs.

Two of the six PIs (33 percent) who had Exploratory and Developmental Grant to Improve Heath Care Quality through Health Information Technology (R21) (PAR-HS-08-269) grants were new PIs. Only one (8 percent) of the 12 PIs who had Utilizing Health Information Technology to Improve Health Care Quality (R18) (PAR-HS-08-270) grants was new. One of the three (33 percent) PIs who had a Small Research Grant to Improve Health Care Quality through Health Information Technology (R03) (HS-08-268) grants was a new PI.

## C. Contracts

In 2009, the Health IT Portfolio had 59 active contracts with a cumulative AHRQ lifetime support of $68.4 million. These contracts enabled individual projects to address a defined, pre-determined need. All contracts were assigned one of three Health IT Portfolio strategic goals and one of three AHRQ business goals.

Initial project duration is specified in each contract. Some contracts have, at AHRQ's discretion, a provision to support additional option years. The start dates and duration of the 59 project-specific contracts active in 2009 vary.

- Five 5-year contracts for State and Regional Demonstration (SRD) Projects in Health Information Technology began in 2004. Three are scheduled to conclude in 2010, and two are scheduled to conclude in 2011.
- One 5-year contract for SRD Projects began in 2005 and is scheduled to conclude in 2011.
- One project began in 2007 and is scheduled to end in 2010.
- Of the 10 contracts begun in 2007, 9 ended in 2009, and 1 is scheduled to end in 2010.
- Of the 12 contracts begun in 2008, 4 ended in 2009, and 8 are scheduled to end in 2010.
- Of the 30 contracts begun in 2009, 1 concluded in 2009, 17 are scheduled to conclude in 2010, and 12 are scheduled to conclude in 2011.

As illustrated in Table 8, more contracts (n=32) and contract funding ($44.2 million) are associated with the Health IT Portfolio strategic goal of PCC or HIE than the other two strategic goal categories combined (n=27 and $24.2 million). Together, the six SRDs for HIE have an AHRQ lifetime budget of $31.1 million; each of the SRDs has the strategic goal of PCC or HIE. There were 23 contracts with a Health IT Portfolio strategic aim of Improved Decisionmaking,

and a total of $22.0 million funding. Health IT Portfolio support for Medication Management is lower than other categories, at $2.2 million for 4 contracts.

For business goals, the majority of contracts had a business goal of Synthesis and Dissemination (n=27, 46 percent), followed by Knowledge Creation (n=18, 30 percent) and Implementation and Use (n=14, 24 percent).

Both of the 2-year projects for the Clinical Decision Support (CDS) Initiative (funded at $6.2 million and $6.3 million) had an AHRQ business goal of Knowledge Creation. Excluding the larger contracts for SRD and CDS, AHRQ lifetime funding ranged from $50,000 to $3 million for the remaining 51 contracts.

**Table 8: Counts and Lifetime AHRQ Funding for Health IT Contracts as of 2009, by Health IT Portfolio Strategic Goal and AHRQ Business Goal**

| | Medication Management | | Patient-Centered Care or Health Information Exchange | | Improved Decisionmaking | | Total | |
|---|---|---|---|---|---|---|---|---|
| **AHRQ Business Goal** | Number (%) | AHRQ Funding* (%) | Number (%) | AHRQ Funding* (%) | Number (%) | AHRQ Funding* (%) | **Number (%)** | **Total AHRQ Funding* (%)** |
| Implementation and Use | 1 | $1.0 | 8 | $32.6 | 5 | $4.6 | **14 (24%)** | **$38.2 (56%)** |
| Knowledge Creation | 2 | $0.8 | 11 | $3.9 | 5 | $13.6 | **18 (30%)** | **$18.3 (27%)** |
| Synthesis and Dissemination | 1 | $0.4 | 13 | $7.7 | 13 | $3.8 | **27 (46%)** | **$11.9 (17%)** |
| **Total** | **4 (7%)** | **$2.2 (3%)** | **32 (54%)** | **$44.2 (65%)** | **23 (39%)** | **$22.0 (32%)** | **59 (100%)** | **$68.4 (100%)** |

**In millions of dollars*

# V. Dissemination

A hallmark of AHRQ's Health IT Portfolio is its commitment to prompt and easy-to-use dissemination of information generated through its program, related partners, and other Federal programs. In order to capture the breadth of synthesis and dissemination activities of the Health IT Portfolio, the presentations and outreach activities pursued by Health IT Portfolio members, activities led by staff of AHRQ's OCKT, and numerous NRC-sponsored activities and Web-based postings must be noted.

There are four complementary means for the AHRQ-led dissemination of health IT information.

- Presentation by members of the Health IT Portfolio
- AHRQ's Office of Communications and Knowledge Transfer
- The NRC Web site
- AHRQ's Annual Conference

### Presentations by Members of the Health IT Portfolio

Numerous presentations were made to various health IT stakeholder groups and venues, including: Healthcare Information and Management Systems Society (HIMSS); American Medical Informatics Association Conferences; and cosponsored meetings with other Federal agencies including CMS, NIH, the Department of Health and Human Services Office of the National Coordinator (ONC) for Health IT, and HRSA.

### AHRQ's Office of Communications and Knowledge Transfer (OCKT)

AHRQ's OCKT staff plays a critical role in the synthesis and dissemination of findings from the Agency's health IT research. In addition to preparing and disseminating content-specific multi-media newscasts and press releases, OCKT staff update various points-of-contact lists to ensure successful dissemination of materials as they are generated. For example, in CY 2008, OCKT launched a new health IT e-mail list using a sophisticated e-mail subscription system. By end of CY 2009, nearly 28,000 subscribers joined the health IT e-mail list.

**To sign-up to receive AHRQ Health IT News and Information**

- Go to AHRQ's homepage: www.ahrq.gov
- Select "E-mail Updates" located next to the red envelope on the upper right hand corner
- Enter your e-mail address
- Select "Health IT" under the "Quality & Patient Safety" heading

Highlights from OCKT's media and marketing outreach efforts during CY 2009 are listed below.

- **Marketing outreach:** OCKT conducted marketing outreach to key associations, Federal entities, advocacy groups, policy groups, and other stakeholders to promote relevant findings to health IT industry. OCKT also parlayed announcements made by the Office of the National Coordinator for Health Information Technology, including relevant news

surrounding the Health Information Technology for Economic and Clinical Health (HITECH) Act. OCKT issued 35 brief e-mail announcements on important health IT findings and activities to these key audiences.

- **Media interviews and coverage:** OCKT conducted more than 15 media interviews with mainstream and trade publications including
  - *AMIA E-News iHealthBeat*
  - *Federal News Radio 1500 AM*
  - *CongressDaily*
  - *The Health Care Blog*
  - *Doctor's Digest*
  - *CMA Today*
  - *Technology Review magazine*

- **Manuscripts and reports:** OCKT prepared approximately 14 health IT-oriented manuscripts in various formats, including the Emerging Lessons and Health IT Implementation Stories, which are available on the NRC website at http://healthit.ahrq.gov/portal/server.pt/community/ahrq-funded_projects/.

- **Journal commentaries and articles:** OCKT helped promote a special AHRQ-funded issue of Pediatrics. The January 2009 issue featured 14 articles on the effect that health IT has on the quality of health care for children. Below are links to abstracts of selected articles.
  - It is Time! Accelerating the Use of Child Health Information Systems to Improve Child Health by Fairbrother G, and Simpson LA. Select to access the abstract.
  - Alliance for Pediatric Quality: Creating a Community of Practice to Improve Health Care for America's Children by Miles PV, Miller M, Payne DM, Perelman R, Saffer M, and Zimmerman E. Select to access the abstract.
  - Linking Children's Health Information Systems: Clinical Care, Public Health, Emergency Medical Systems, and Schools by Hinman AR, and Davidson AJ. Select to access the abstract.
  - The Public Role in Promoting Child Health Information Technology by Conway PH, White PJ, and Clancy C. Select to access the abstract.

- **Meeting exhibits**: OCKT participated in nine national conferences and meetings that were relevant to the health IT community and promoted AHRQ's products and resources from its health IT portfolio to participants at each event.

- **E-Newsletters and Research Activities:** Approximately 49 articles and summaries on AHRQ's health IT programmatic and research activities were featured in three Agency electronic and print newsletters: AHRQ's periodic *Electronic Newsletter*, AHRQ's monthly *Patient Safety and Health Information Technology E-Newsletter*, and AHRQ's monthly *Research Activities*.

- **Podcasts:** AHRQ's Healthcare411 (see: http://www.healthcare411.org/) is a news series that features consumer-oriented audio podcasts about health care quality, safety,

efficiency, and health IT. Sixty-second radiocasts now air weekly on almost 300 radio stations nationwide, and a 10-minute newscast produced by AHRQ on a bi-weekly basis is distributed to more than 500 professional organizations. OCKT issued five health IT newscasts, available at the following links:

- Clinical Decision Support and Improving Patient Outcomes
- Clinical Decision Support White Papers
- Making Hospital Discharges Safer for Seniors
- Personal Health Records
- E-prescribing - A Cost Saving Alternative to Paper Prescriptions

## National Resource Center for Health IT Web Site

***NRC Web Site Content***

The NRC Web site (www.healthit.ahrq.gov) is a central means for the dissemination of findings from AHRQ's health IT projects. Additionally, it is a platform to support outreach and delivery of information from AHRQ and to share expertise across the multidisciplinary fields that are engaged in critical aspects of health IT implementation.

Most notably, the NRC Web site is a gateway and historical repository of AHRQ's Health IT Portfolio. It is a comprehensive repository for various resources, detailed below. The vast majority of material posted on the NRC Web site is generated by Health IT Portfolio-sponsored grantees or contractors. As of 2009, information on the NRC Web site was continuously updated and organized by categories of information types, which include but are not limited to:

- **Events:** Past and upcoming events related to health IT are listed with links to resources, such as meeting agendas and presentations. The list includes activities sponsored by AHRQ, such as Web-based National Web Teleconferences featuring interactive presentations by experts in a particular field of health IT, and other important health IT activities such as those sponsored by the ONC. The list of upcoming events is proactively assembled and includes important professional meetings up to 1 year in advance.

- **AHRQ-Funded Projects:** By clicking on the map of the United States, the user interface allows user to identify groups of health IT-funded projects by health care setting, type of health IT technology, target population, PI, State of organization conducting the research, and community type.

- **Health IT Tools:** AHRQ and its community of contractors and grantees have developed tools to help health care organizations plan for, implement, and evaluate health IT. These tools describe and recommend strategies for addressing some of the common challenges organizations encounter when working with health IT systems. The tools are freely available but should be properly cited when referenced on the Web or in print. Tools include: Rural Health IT Adoption Toolkit, Health IT Literacy Guide, and the Health IT Bibliography.

- **Knowledge Library:** The Knowledge Library contains both evidenced-based and theoretical content gathered by health IT experts. The content is organized into two

categories. The Core Collection contains high-quality information that AHRQ NRC experts find central to the health IT discipline. Partner Contributions include content provided by professional societies and nonprofit organizations that have experience in health IT.

- **Funding Opportunities:** This Web site lists all of AHRQ's open FOAs for health IT and provides links to other Federal grant programs such as NIH, the Department of Defense, the National Science Foundation, the Centers for Disease Control and Prevention, and the White House Official Grant Catalog, as well as foundation funding Web sites for the Robert Wood Johnson Foundation, California Healthcare Foundation, and the Commonwealth Fund.

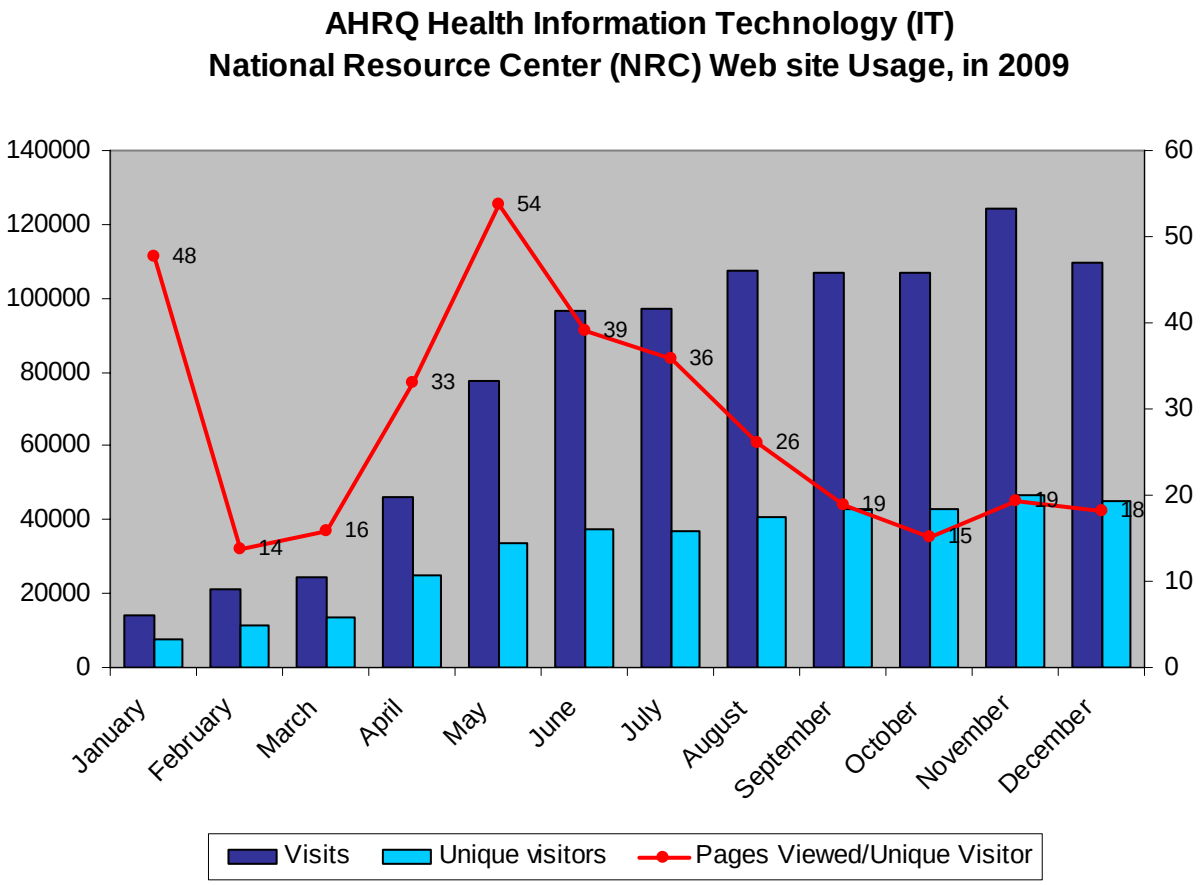
### *Key Performance Indicators*

In 2009, the NRC monitored key performance indicators of visits to and information sought from the NRC Web site, including unique visitors, visits, and pages viewed per unique visitor by month. The NRC uses the AWStats Web usage reporting tool, which defines a unique visitor as someone who has made at least one hit on one page of the host's Web site during a month. If the user makes several visits during a month, it is counted only once. Most of these hits are tracked using the Internet protocol (IP) of devices participating in a computer network. However, many users surf the Web using proxy servers (e.g., AOL, Comcast), and these proxies use banks of servers to hit the same page to speed surfing. AWStats has a method for resolving proxy usage and avoids over-reporting of unique visitors.

Figure 7 shows the monthly values for number of visits, unique visitors, and average page views per unique visitor. The monthly key performance indicators for visits to the NRC Web site were:

- The mean number of visitors per month in 2009 was 77,747. The lowest number (14,333) of visitors was in January, after which the number increased every month until a high of 124,499 in November, which tapered off at 109,488 in December. The mean number of visitors during the year has increased considerably since 2008, when the average number was 16,034.
- The number of unique visitors per month follows a similar pattern, with an average of 32,022, steadily increasing every month. The lowest number of unique visitors was in January (7,690), to a high in November of 46,406, tapered off in December (45,204). The average number of unique visitors is considerably higher than in 2008, when the average was 8,671.
- The mean average number of page views per unique visitors in 2009 was 28. The lowest number of mean number of page views (14) per unique visitor was in February, and the highest number of page views (54) per unique visitor was in May.

**Figure 7: AHRQ Health IT NRC Web Site Usage, in 2009**




It is not surprising that the lowest values for two of the key NRC Web usage indicators—mean number of visitors per month and mean number of unique visitors per month— were in December 2009, as many people take vacations in December due to school closings and religious holidays.

The increased use of the NRC Web site is, most likely, partly due to the increased funding available through the three health IT focused FOAs (HS-08-268, HS-08-269, HS-08-270) and the master contracts and task orders to support the NRC. It is also likely that the increased use is due to the increased interest in health IT and visitors recognizing the Web site as a resource for information. However, there are no definitive answers regarding relative increases observed among key usage indicators over time.

### *AHRQ Annual Conference, 2009*

To help advance its goal of improving health care for all Americans, AHRQ held its third annual conference from September 13 to 16, 2009, in Bethesda, MD. This conference, entitled "*Promoting Quality...Partnering for Change,*" was designed to showcase the Agency's best research and provide examples of how that research is being implemented at all levels in health

care delivery. During the free 4-day meeting, there were more than 100 interactive in-person sessions, multiple poster sessions, and several support booths at the m*AHRQ*et Place Café.

The conference featured presentations in six major tracks:

- Health Care Infrastructure
- Organization of How Services are Delivered
- Health Care Quality and Safety
- Improving Americans' Health Status
- Provider Performance and Payment Reform
- Increasing Patient and Consumer Involvement in Their Care

**Sessions on Health IT.** Eleven of the sessions were dedicated to discourse and dissemination about Health IT Portfolio-funded projects. These sessions addressed a variety of health IT topics (see Table 9). Approximately two dozen Health IT Portfolio-sponsored projects were represented. The PowerPoint presentations for these health IT sessions and other portfolios presentations from this meeting are available at http://www.ahrq.gov/about/annualconf09/#contents.

## Table 9: Health IT Portfolio-Sponsored Sessions at AHRQ's Annual Meeting, September 2009

| Sessions on Health IT |
|---|
| **Monday, September 14, 2009** |
| Experience in Improving Health Care Decision-Making With Health IT: Impacts on Quality and Safety |
| The Role of Health IT in Measuring and Reducing Disparities |
| Personal Health Records: What Are They Good For? A Panel Discussion |
| First Do No Harm: Ensuring the Safe and Effective Use of Health IT: A Panel Discussion |
| **Tuesday, September 15, 2009** |
| Getting to Meaningful Use of Health IT: Experiences in Redesigning Workflow in the Ambulatory Setting |
| Are We Making Progress? Measuring the Adoption, Meaningful Use, and Impacts of Health IT |
| Moving Beyond Institution-Based Service Delivery: Medical Homes and Health 2.0 |
| Building the Health IT Infrastructure: How Do We Get There? A Panel Discussion |
| Seeing the Forest for the Trees: Are Electronic Health Records Enough for Population Health? A Panel Discussion |
| **Wednesday, September 16, 2009** |
| Experiences in Patient-Centered Care: Improving Coordination and Communication Among Patients and Providers |
| Connecting Communities: Lessons From Six State Health Information Exchange Demonstrations |

**Health IT Grantee and Contractor Meetings.** In order for AHRQ to facilitate grantee and contractor collaboration, networking sessions were carefully planned. There was a session for the 16 PCC grantees (HS-07-007), and two additional sessions for all grantees in combination. Similarly, there was one networking session for NRC and two sessions to meet with AHRQ Health IT staff to share ideas about how to improve and evolve the AHRQ Health IT Program. Finally, there were two health IT vendor roundtables, dedicated to networking with others using particular vendor systems.

**m*AHRQ*et Place Café.** The health IT booth at the m*AHRQ*et Place Café was staffed by health IT staff from the NRC, who provided 2 full days of demonstrations on how to use and search the NRC Web site (www.healthit.ahrq.gov); answered questions; and distributed Health IT Portfolio folders containing AHRQ publications, which provided overview and summary materials for various health IT-sponsored programs.

# VI. Conclusion

In 2009, the Health IT Portfolio provided funding to numerous organizations and individuals through various mechanisms. Organizations in 38 States and the District of Columbia had active Health IT-sponsored projects, and there were 115 unique grant PIs among the 121 grants active. At the close of CY 2009, the Health IT Portfolio's 6th year, the Portfolio entered a phase of supporting projects that evaluate factors associated with successful implementation and utilization of health IT in order to improve the quality, safety, effectiveness, and efficiency of health care.

CY 2009 was a notable year for the grants funded through the THQIT initiatives. Of the total 118 grants funded under these initiatives in 2004 and 2005, 17 remained active and ended in 2009, bringing the funding for that inaugural program to a close. Through its THQIT-funded grants, AHRQ proactively focused on health IT implementation among rural hospitals and community-based health care settings, many of which had little or no prior experience in preparing for and implementing health IT systems. During the first few years of these grants (2005-2006), the NRC provided grantees with myriad opportunities for one-on-one and group technical assistance on various topics, including: governance; start-up and grant writing; research design and evaluation; health IT procurement, connectivity, privacy, security, and standards; and synthesizing, disseminating, and publishing findings. Both first-time and experienced grantees engaged in these activities and displayed a commitment toward honing new skills and building integrated communities that support health IT implementation and use.

AHRQ will continue to disseminate lessons learned from these grants. An NRC Task Order award to Mathematica Policy Research, Inc. in 2009 is helping the Health IT Portfolio to synthesize and evaluate the THQIT initiative in terms of the barriers, facilitators, and incentives for the timely completion of those grants, and the extent to which various types of health IT systems implemented through these grants have been sustained or modified, as well as other factors.

During the year, the first ASQ grants came to a close. Two grants from this initiative, which focused on health IT use impacting outcomes in ambulatory care settings, emergency departments, and transitions in care, closed, while the remaining ASQ projects that were scheduled to close in 2009 received a 1-year no-cost extension. These projects and other ASQ projects, originally funded through 2010 and 2011, remain active.

In total, 30 projects ended in CY 2009: 19 grants and 11 contracts. However, there were beginnings as well as endings: Thirty-three grants and 30 contracts were started.

Three new grant PAs and a Special Emphasis Notice (NOT-HS-08-014) were issued in 2008 to support research that examines how health IT can be used to improve health care quality in a progressively more complex fashion and to support career development, respectively. In September 2009, 21 new grants were awarded, including 3 regarding the use of health IT to improve health care outcomes through small research grants (HS-08-268 [R-03]), 6 exploratory

and developmental grants (HS-08-269 [R-21]), and 12 research and demonstration grants (HS-008-270 [R18]). In addition, there were 6 career development (K-awards) and 3 dissertation grants (R-36) awarded in 2009 (NOT-HS-08-014). These PAs are open through November 2011. Finally, there were two R13 small conferences (PA-09-070) and one R01 grant (PAR-09-231) funded in 2009.

The majority of the Health IT Portfolio's active grants in 2009 (69/121 or 57 percent) were funded through one of the four RFAs of the ASQ initiative. As of the end of 2009, 55 of the 69 ASQ grants entered their third year and continued to report challenges and triumphs, as discussed in their individual project summaries.

- Fifteen of the 17 Enabling Quality Measurement Through Health IT (HS-07-002) grants requested and received an additional 1-year no cost extension on top of their scheduled 2-year project funding periods. One EQM grant received a 3-month no-cost extension, closing at the end of 2009. An additional EQM grant completed the grant during the allotted 2-year funding period.
- Each of the 16 grants funded by Enabling Patient-Centered Care Through Health IT (HS-07-007) concluded their first 27 months of their scheduled 3-year project funding periods.
- Each of the 24 Improving Quality Through Clinician Use of Health IT (HS-07-006) grants concluded their first 27 months of their scheduled 3-year project funding periods.
- Each of the 12 Improving Management of Individuals with Complex Healthcare Needs Through Health IT grants concluded the first 15 months of their 3-year project funding periods.

Among the Health IT Portfolio contracts active in 2009, eight contracts across two program areas accounted for 63.9 percent of the Health IT Portfolio's contract funding.

- Six 5-year contracts to support a State and Regional Demonstration Project for Health Information Exchange began in 2004 and 2005. Their AHRQ lifetime funding is $31.1 million.
- Two CDS Services contracts begun in 2008 currently have AHRQ lifetime funding of $12.5 million and additional option years.

The remaining 51 contracts had AHRQ lifetime funding ranging from $50,000 to $3 million and typically had 2-year project periods. Individually and collectively, these projects serve to generate and disseminate much-needed insight.

On average, 32,022 unique visitors went to the NRC Web site (www.healthit.ahrq.gov) each month to access a variety of content or participate in the series of NRC-administered National Web Teleconferences. This average number of unique visitors is considerably higher than in 2008, when it was 8,671. AHRQ's OCKT was actively engaged in synthesis and dissemination of Health IT Portfolio including health IT-oriented manuscripts in various formats, including the Emerging Lessons and Health IT Implementation Stories. In addition, OCKT helped promote the special AHRQ-Funded issue of Pediatrics (January 2009), which featured 14 articles on health IT's impact on the quality of health care for children.

Early in 2010, AHRQ's Health IT Portfolio set forth a plan to aggregate extant information to allow NRC staff, with assistance from AHRQ staff, to develop comprehensive project summaries. This project has provided the Health IT Portfolio with a better understanding of the potential power of concise, informative project reporting to provide contextual explanations of triumphs and travails of health IT implementation and use. AHRQ will continue to explore these project summaries in order to identify technical assistance guidance. It is anticipated that the benefits of this informed guidance feedback loop will eventually outweigh the inconvenience of reporting for grantees.

AHRQ intends for the summaries to be informative references for implementers of health IT, prospective research applicants, and others interested in the challenges and successes of health IT implementation and use in terms of research and practical application. Would-be grantees are encouraged to carefully peruse project-specific summaries in their fields of interest to learn more about characteristics of successful research projects and PIs' abilities to adjust and persevere through the real-world challenges and setbacks encountered in health IT implementation, use, and evaluation. The project summaries are available on the NRC Web site in an easy-to-access, Web-based format. Users can click on the map of the United States and search for projects, review their project summary, and view other project related news and publications. This year's report also includes an interactive CD, where users can search for specific projects on several attributes including type of health IT, target population, and care setting.

Large and diversified groups of stakeholders are committed to successful health IT implementation in order to achieve measurable and sustained improvement in the quality and safety of health care. AHRQ encourages readers to explore the NRC Web site (www.healthit.ahrq.gov) and sign up for the AHRQ Health IT Portfolio Listserve to receive updates on research findings and funding opportunities.

# VII. Project Summaries

## Table 10: Grant-Specific Summaries (ASQ)

| Enabling Patient-Centered Care Through Health IT (PCC) | | | | |
|---|---|---|---|---|
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| No | Adams, William, MD | Conversational Information Technology (IT) for Better, Safer Pediatric Primary Care | HS07-007 | Page 54 |
| No | Bove, Alfred, MD | Using a Telemedicine System to Promote Patient Care Among Underserved Individuals | HS07-007 | Page 56 |
| No | Burns, Edith, MD | Enhancing self-management of T2DM with an Automated Reminder and Feedback System | HS07-007 | Page 58 |
| No | Chrischilles, Elizabeth, PhD | Personal Health Records and Elder Medication Use Quality | HS07-007 | Page 60 |
| No | Chueh, Henry, MD | Ambulatory Care Compact to Organize Risk and Decisionmaking | HS07-007 | Page 62 |
| No | Hahn, Elizabeth, MA | Implementing a Low-Literacy, Multimedia IT System to Enhance Patient-Centered Cancer Care | HS07-007 | Page 65 |
| No | Jack, Brian, MD | Virtual Patient Advocate to Reduce Ambulatory Adverse Drug Events | HS07-007 | Page 68 |
| No | Krist, Alexander, MD | An Interactive Preventive Health Record (IPHR) to Promote Patient-Centered Care | HS07-007 | Page 71 |
| No | Lapane, Kate, PhD | Tailored DVD to Improve Medication Management for Low Literate Elderly Patients | HS07-007 | Page 74 |
| No | Mold, James, MD | Impact of a Wellness Portal on the Delivery of Patient-Centered Prospective Care | HS07-007 | Page 77 |
| No | Samore, Matthew, MD | Patient-Centered Informatics System to Enhance Health Care in Rural Communities | HS07-007 | Page 79 |
| No | Schillinger, Dean, MD | Harnessing Health Information Technology for Self-Management Support and Medication Activation in a Medicaid Health Plan | HS07-007 | Page 82 |
| No | Stepnowsky, Carl, PhD | Enabling Sleep Apnea Patient-Centered Care via an Internet Intervention | HS07-007 | Page 85 |
| No | Tang, Paul, MD | Patient-Centered Online Disease Management Using a Personal Health Record System | HS07-007 | Page 87 |
| No | Wagner, Peggy J., PhD | Using An Electronic Personal Health Record To Empower Patient With Hypertension | HS07-007 | Page 90 |
| No | Wolf, Michael, PhD | Using IT for Patient-Centered Communication and Decisionmaking about Medications | HS07-007 | Page 92 |

| Improving Quality Through Clinician Use of Health IT (IQHIT) | | | | |
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| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| No | Baker, David, MD | Using Precision Performance Measurement to Conduct Focused Quality Improvement | HS07-006 | Page 94 |
| No | Carrow, Grant, PhD | Enabling Electronic Prescribing and Enhanced Management of Controlled Medications | HS07-006 | Page 97 |
| No | Fischer, Michael, MD | Impact of Office-Based E-Prescribing on Prescribing Processes and Outcomes | HS07-006 | Page 100 |
| No | Forrest, Christopher, MD | Improving Otitis Media Care with EHR-based Clinical Decision Support and Feedback | HS07-006 | Page 103 |
| No | Fox, Karen, PhD | The Bettering Lives Utilizing Electronic Systems Project: Improving Diabetes Outcomes in Mississippi with Health Information Technology | HS07-006 | Page 105 |
| No | Fricton, James, DDS, MS | eHealth Records to Improve Dental Care for Patients with Chronic Illnesses | HS07-006 | Page 108 |
| No | Gardner, William, PhD | Pharmaceutical Safety Tracking (PhaST): Managing Medications for Patient Safety | HS07-006 | Page 111 |
| No | Gorman, Paul, MD | RxSafe: Shared Medication Management and Decision Support for Rural Clinicians | HS07-006 | Page 113 |
| No | Gurwitz, Jerry, MD | Improving Post-Hospital Medication Management of Older Adults with Health Information Technology | HS07-006 | Page 115 |
| No | Johnson, Kevin B., MD, MS | Safety Through Enhanced e-Prescribing Tools: Developing Web Services for Safe Pediatric Dosing | HS07-006 | Page 117 |
| No | Kaushal, Rainu, MD | Electronic Prescribing and Electronic Transmission of Discharge Medication Lists | HS07-006 | Page 120 |
| No | Kopal, Helene, MPA, MPH | Evaluation of a Computerized Clinical Decision Support System and EHR-linked Registry to Improve Management of Hypertension | HS07-006 | Page 123 |
| No | Lapane, Kate, PhD | Optimizing Medication History Value in Clinical Encounters with Elderly Patients | HS07-006 | Page 125 |
| No | Lobach, David, MD, PhD, MS | Improving Quality through Decision Support for Evidence-Based Pharmacotherapy | HS07-006 | Page 128 |
| No | Mehr, David, MD, MS | Using Health Information Technology to Improve Ambulatory Chronic Disease Care | HS07-006 | Page 131 |
| No | Nebeker, Jonathan, MD | Veterans Administration Integrated Medication Manager | HS07-006 | Page 134 |
| No | Ornstein, Steven, MD | Medication Safety in Primary Care Practice - Translating Research into Practice | HS07-006 | Page 136 |
| No | Pohl, Joanne, PhD | A Partnership for Clinician Electronic Health Record (EHR) Use and Quality of Care | HS07-006 | Page 138 |

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|---|---|---|---|---|
| No | Schwarz, Eleanor, MD | Harnessing Health Information Technology to Prevent Medication-Induced Birth Defects | HS07-006 | Page 141 |
| No | Sequist, Thomas D., MD, MPH | Can Risk Score Alerts Improve Office Care for Chest Pain? | HS07-006 | Page 144 |
| No | Simon, Steven, MD, MPH | Improving Laboratory Monitoring in Community Practices: A Randomized Trial | HS07-006 | Page 147 |
| No | Singh, Gurdev, PhD, MSc | A Systems Engineering Approach: Improving Medication Safety | HS07-006 | Page 150 |
| No | Trivedi, Madhukar, MD | Using Information Technology to Provide Measurement Based Care for Chronic Illness | HS07-006 | Page 153 |
| No | Veline, James, MS, MA | Electronic Prescribing and Decision Support to Improve Rural Primary Care Quality | HS07-006 | Page 156 |

**Improving Management of Individuals With Complex Healthcare Needs Through Health IT (MCP)**

| Completed in 2009 | Principal Investigator | Project Title | Funding Opportunity Announcement | Summary |
|---|---|---|---|---|
| No | Baker, Wende, MEd | Chronic Mental Health: Improving Outcomes Through Ambulatory Care Coordination | HS08-002 | Page 159 |
| No | Ciemins, Elizabeth, PhD | Evaluation of Effectiveness of a Health Information Technology-Based Care Transition Information Transfer System | HS08-002 | Page 161 |
| No | Dorr, David, MD, MS | Enhancing Complex Care Through an Integrated Care Coordination Information System | HS08-002 | Page 163 |
| No | Druss, Benjamin, MD, MPH | An Electronic Personal Health Record for Mental Health Consumers | HS08-002 | Page 165 |
| No | Feldman, Penny, PhD | Improving Medication Management Practices and Care Transitions through Technology | HS08-002 | Page 167 |
| No | Field, Terry, DSc | Using Health Information Technology to Improve Transitions of Complex Elderly Patients from Skilled Nursing Facilities to Home | HS08-002 | Page 169 |
| No | Friedman, Robert, MD | A Longitudinal Telephone and Multiple Disease Management System to Improve Ambulatory Care | HS08-002 | Page 171 |
| No | Kahn, James O., MD | Randomized Controlled Trial Embedded in an Electronic Health Record | HS08-002 | Page 174 |
| No | Lobach, David F., MD, PhD, MS | Improving Care Transitions for Complex Patients through Decision Support | HS08-002 | Page 176 |
| No | Mertens, Ann, PhD | Improving Pediatric Cancer Survivorship Care through SurvivorLink | HS08-002 | Page 179 |
| No | Ritchie, Christine, MD, MSPH | E-Coaching: Interactive Voice Response-Enhanced Care Transition Support for Complex Patients | HS08-002 | Page 181 |

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|---|---|---|---|---|
| No | Singh, Hardeep, MD, MPH | Using Electronic Data to Improve Care of Patients with Known or Suspected Cancer | HS08-002 | Page 183 |
| **Enabling Quality Measurement Through Health IT (EQM)** | | | | |
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| No | Bailey, Thomas, MD | Surveillance for Adverse Drug Events in Ambulatory Pediatrics | HS07-002 | Page 185 |
| No | Berner, Eta, EdD | Closing the Feedback Loop to Improve Diagnostic Quality | HS07-002 | Page 187 |
| No | Davidson, Arthur, MD | Colorado Associated Community Health Information Exchange (CACHIE) | HS07-002 | Page 189 |
| No | Hazlehurst, Brian, MD | Automating Assessment of Asthma Care Quality | HS07-002 | Page 191 |
| No | Kaushal, Rainu, MD | Developing and Using Valid Clinical Quality Metrics for Health Information Technology with HIE | HS07-002 | Page 194 |
| Yes | Kmetik, Karen, PhD | Cardio-Hit Phase II | HS07-002 | Page 196 |
| No | Lazarus, Ross, MBBS, MPH, MMed | Electronic Support for Public Health - Vaccine Adverse Event Reporting System | HS07-002 | Page 199 |
| No | Lehmann, Christoph, MD | Medication Monitoring for Vulnerable Populations via Information Technology | HS07-002 | Page 202 |
| No | Logan, Judith, MD | Improving Quality In Cancer Screening: The Excellence Report For Colonoscopy | HS07-002 | Page 204 |
| Yes | McColm, Denni, MBA | Standardization and Automatic Extraction of Quality Measures in an Ambulatory Electronic Medical Record | HS07-002 | Page 206 |
| No | Schneider, Eric, MD | Massachusetts Quality E-Measure Validation Study | HS07-002 | Page 209 |
| No | Selby, Joe, MD | Feedback of Treatment Intensification Data to Reduce Cardiovascular Disease Risk | HS07-002 | Page 211 |
| No | Thomas, Eric, MD | Using Electronic Records to Detect and Learn from Ambulatory Diagnostic Errors | HS07-002 | Page 213 |
| No | Turchin, Alexander, MD | Monitoring Intensification of Treatment for Hyperglycemia and Hyperlipidemia | HS07-002 | Page 215 |
| No | Williams, Andrew, PhD | Using IT to Improve the Quality of Cardiovascular Disease Prevention and Management | HS07-002 | Page 217 |
| No | Weiner, Mark, MD | Crossing the Quality Assessment Chasm: Aligning Measured and True Quality of Care | HS07-002 | Page 220 |
| No | Wu, Winfred, MD | Bringing Measurement to the Point of Care | HS07-002 | Page 222 |

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| **Project Title:** | Conversational Information Technology for Better, Safer Pediatric Primary Care |
| **Principal Investigator:** | Adams, William, M.D. |
| **Organization:** | Boston Medical Center |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017248 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,159,609 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Medically Underserved, Pediatric*

**Summary:** This project seeks to develop and evaluate an automated telephony system as part of prevention services delivered in an urban pediatric practice. The system gathers personal health data and counsels parents before scheduled visits, integrates the data with the physician's electronic health record (EHR), and offers personalized followup assessment and counseling after visits. The internally developed interactive voice response (IVR) telephony system interfaces with the providers' EHR, GE Centricity Physician Office. The telephony system, called the Personal Health Partner (PHP), uses fully automated, interactive conversations (including synthetic speech and speech recognition) to gather health data and counsel parents before scheduled pediatric primary care visits. Parent-entered data are shared with the child's primary care provider (PCP) via the EHR, where data are reviewed and clinician decision support is provided. The system is being evaluated via a three-armed, randomized, controlled trial (PHP only, PHP assessment with counseling, or usual care groups) to determine the marginal effect of the PHP intervention on: comprehensive preventive and medication management assessments during PCP visits; preventive and medication management counseling; healthier parental behaviors; and increased parental activation.

**Specific Aims**

- Develop an automated telephony system that uses fully automated conversations to perform pre-visit pediatric primary care assessments, offer parental counseling (including appropriate medication use), and support clinician decisionmaking by incorporating the PHP child assessments into their EHR at the point-of-care. **(Achieved)**
- Conduct a randomized clinical trial to determine: 1) whether PHP assessment alone (no counseling) with EHR data exchange leads to higher quality preventive care and medication management and 2) whether the addition of PHP counseling to PHP child assessments (before and after visits) is associated with increased quality and healthier parental behaviors. **(Ongoing)**

**2009 Activities:** This year the grant team completed development of the forms for data exchange between the PHP telephony system and the EHR. The system is now fully operational. As part of this process the grant team established the data exchange workflow, finalized the application that manages

potential and actual study participants, and finalized the application that extracts appointment data, demographics, and medication lists from the EHR system for input into the IVR system.

The hospital's clinical data warehouse has been delivering appointment and medication data into the team's SQL Server database. Families are using it successfully and providers are able to access this information in the EHR. Providers can review the data provided by patients and determine whether to accept the information to prepopulate the visit documentation.

The grant team also finalized the functions in the PHP Manager (a PowerBuilder application) to print recruitment letters, appointment labels, and mailing labels. To promote recruitment into the trial, the team began mailing out letters and brochures to a group of "pilot users" (patients of Dr. Adams) in April and May. By the end of May, testing was completed and full implementation of the study protocol (letter printing, mailing, full implementation of the PHP Patient-centered system, data exchange between the PHP system and the EHR, and completion of followup surveys) began.

Toward the end of the year, the team expanded the recruitment strategy to include an outbound reminder call from a member of the research staff 4 to 5 days after mailing the recruitment brochure.

**Preliminary Impact and Findings:** No key findings have yet been reported. However, the team has received positive informal feedback from users and sees potential for this effort to improve efficiency and quality of care for urban families if utilized on a broader scale.

**Selected Outputs**

Sample scripts for smoking counseling and assessment modules and the postvisit followup call.

Personal Health Partner recruitment brochure.

Postvisit Medication Reconciliation Table.

PHP counseling/activation messages spreadsheet.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Project aims and milestones have been achieved, but the team remains approximately 3 months behind the original project schedule. Using no-cost extension funds, the team plans to carry forward sufficient resources to continue the study into an additional year and fully expects to achieve all study aims.

**Milestones:** Progress on track in some respects, but not others.

**Budget:** Significantly underspent, more than 20 percent.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Using a Telemedicine System to Promote Patient Care Among Underserved Individuals |
| **Principal Investigator:** | Bove, Alfred, M.D. |
| **Organization:** | Temple University Clinical Research Center |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017202 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,198,371 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*, Hypertension, Inner City*, Medically Underserved, Racial or Ethnic Minorities*: African American

**Summary:** Hypertension affects more than 65 million people in the United States, with African Americans disproportionately affected. Untreated hypertension is associated with an increased risk for myocardial infarction, sudden death, stroke, and renal failure. Despite the importance of controlling hypertension and available therapy, the clinical application of well-established guidelines has been disappointing. Inadequate blood pressure control remains all too common.

In order to advance care for chronic conditions such as hypertension, the patient-provider relationship needs be a partnership. Patient empowerment must be increased through education, self-management, collaborative goal setting, and treatment planning. Patient-centered care (PCC) has been implemented for acute ambulatory settings. However, chronic disease management and prevention present unique challenges for PCC since the patient is followed by episodic office visits. Chronic disease care requires innovative strategies to support the constructs of PCC in an efficient and cost-effective manner. Telemedicine has the capacity to empower the patient and strengthen the patient-provider relationship, and support a chronic care model of PCC in a realistic and sustainable manner.

The goal of the project is to develop a patient-centered tool for managing hypertension within a primary care practice. The project builds upon a pre-existing, internally developed telemedicine system that patients access via the Internet. The system provides patient education on hypertension and serves as a tool for self-management, shared decisionmaking, and treatment planning. A cellular telephone interactive system accommodates subjects who do not have Internet access. The system was also enhanced by incorporating hypertension treatment guideline education modules; self-reporting modules on items such as blood pressure, weight, exercise, diet, and smoking; and automated reminders and feedback. The project team observes patients' responses to care measures aimed at lowering their blood pressure to normal, as defined by standards of the Joint National Committee (JNC-VII). The education module incorporated into the system requires a response by the patient before he/she is able to enter his/her data. Patients complete one of seven lessons per login, after which they receive an automated reminder of the guidelines. An automatic report created from the database is sent to both the primary care physician and the patient on a monthly basis. The report describes, in both text and graphics, the patient's blood pressure over that month, the medications the patient was on, and whether the patient is at his/her goal blood pressure; it recommends a physician visit to those that are not within goal. The primary endpoint of the randomized, controlled trial is to identify the proportion of subjects who achieve goal

blood pressure. Secondary endpoints include the rate of self-monitoring, steps per day, weight, cardiovascular disease knowledge, number of patients at medication guidelines, and satisfaction with the practice.

**Specific Aims**

- Enhance the current telemedicine system by incorporating guideline-based algorithms for hypertension treatment as well as automated reminders and feedback for both patients and health care providers. **(Achieved)**
- Determine the percentage of patients meeting guidelines for anti-hypertensive medication therapy. **(Ongoing)**
- Empower inner-city African American patients to take a more active role in their health care through self-monitoring, education, reinforcement, and feedback through telemedicine. **(Ongoing)**
- Measure telemedicine utilization. **(Ongoing)**
- Examine the impact of the telemedicine system on medical knowledge, self-efficacy, and the quality of doctor-patient interaction as compared to controls. **(Ongoing)**
- Compare blood pressure outcomes between control and telemedicine groups after 6 months of telemedicine risk management. **(Ongoing)**

**2009 Activities:** By the end of the calendar year, project staff had screened 489 subjects and enrolled 184 (38 percent) into the study, half of whom were randomized into the telemedicine arm. Eighty-one subjects have completed the study, and 18 have chosen to continue using the system following completion of their 6-month study period. In order to enhance recruitment efforts, the project collaborated with Christiana Health Systems to increase the number of participants and reach the targeted goal of 252 enrolled patients.

**Preliminary Impact and Findings:** According to the current baseline data, the demographics of the sample are typical of the patient population and indicate the need for improved cardiovascular risk management. The data to date indicate that the patients are aware of their health status, are satisfied with their physicians, and are on anti-hypertensive medication.

**Selected Outputs**

Bove, A. Internet-based Telemedicine for Cardiovascular Disease Management. Presentation at the Annual Conference of the Agency for Healthcare Research and Quality, 2008 September 8; Bethesda, MD. (PowerPoint File; Web Version).

Information page used by the research team that enables the study coordinator to view patient responses and respond as needed.

Internet-based reporting form for physicians and patients.

Internet-based tool used for patient interaction.

**Grantee's Self-Reported Quarterly Status (as of December 2009):** Patients continue to be enrolled, with ongoing data collection and analysis. Overall the project is making good progress. It is anticipated that the project will request a no-cost extension.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

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| **Project Title:** | Enhancing Self-Management of Type 2 Diabetes With an Automated Reminder and Feedback System |
| **Principal Investigator:** | Burns, Edith, M.D. |
| **Organization:** | Medical College of Wisconsin Affiliated Hospitals |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017276 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,166,243 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Chronic Care*, Diabetes, Elderly*, Medically Underserved, Veterans

**Summary:** This project tests whether an automated self-management monitor (ASMM) that reminds patients to self-monitor their blood glucose (SMBG), prompts them to take medications, and provides education on how lifestyle choices affect blood sugar has an effect on diabetics' glycemic control and self-management behaviors. The ASMM developed by the project is composed of a simple personal computer-glucometer interface unit with specialized software. The software receives data downloaded through the glucometer interface; interprets the measures; matches them with individualized profiles for glycemic monitoring and control; and provides appropriate, individualized audio feedback.

To demonstrate the effectiveness of the intervention, the project team is recruiting adults from community health centers and the Veteran's Health Administration to participate in a randomized, controlled trial. Participants must have poorly controlled diabetes, defined as those with hemoglobin A1c (HbA1c) levels greater than eight percent. Once participants are recruited, the project team contacts the provider to request the patient's glucose checking schedule and glycemic targets. A research team member visits the participant's home to collect baseline data and provide the glucometer and supplies necessary to perform SMBG. At a second home visit 3 months later, a member of the research team provides the participant with a standard set of educational materials, administers survey tools, determines any self-reported change in medication regimen, and downloads glucometer data. Patients are randomized into an Intervention Group (IG) or a Usual Care (UC) group. For IG participants, the researcher also installs the ASMM with the pre-programmed information, trains the participants to use the system, and reviews the reminders the system provides. Additional home visits are conducted by the research team at 9 and 15 months after enrollment. The primary effective outcome measure is change in HbA1c, with secondary measures of self-management behaviors such as SMBG frequency, nutritional content, physical activity, medication adherence, and patient use of diabetes education options.

**Specific Aims**

- Demonstrate that use of the ASMM improves glycemic control in inadequately controlled people with Type 2 Diabetes. **(Ongoing)**
- Demonstrate that this effect is sustained over longer term followup. **(Ongoing)**
- Identify self-management practices that improve in people using the ASMM. **(Ongoing)**

**2009 Activities:** Data collection is underway. As of December 15, 2009, the grantee had collected baseline data on 227 participants. Three-month data have been collected on 200 participants and all have been randomized to either the UC control group (n= 99) or to the IG (n= 101). Nine-month data have been collected on 151 participants (74 UC, 79 IG), and 15-month data on 66 participants (33 UC, 33 IG).

All baseline data have now been entered, and the team is conducting descriptive analyses of baseline data. Once all the 9-month visits have been completed, the research team will explore secondary outcomes such as diet and medication, and moderating factors related to which participants are doing better and why.

**Preliminary Impact and Findings:** Randomization was successful with no significant differences in demographic variables or baseline HbA1c levels between the UC and IG. Preliminary analyses of dietary data show no significant relationships between broad dietary components and HbA1c (total carbohydrates, total calories, total protein, total fiber, calories from fat). However participants with initial HbA1c levels lower than 14 appear to have somewhat different diet composition than those with baseline HbA1c higher than 14 (lower total carbohydrates and total fiber and more calories from fat).

**Selected Outputs**

Burns E. Use of a computerized reminder and feedback system to improve self-management of type 2 diabetes and improve resilience in older adults. Gerontological Society of America (GSA) Annual Conference; 2008 Nov 21-25; National Harbor, MD.

Burns E. Enhancing Self-Management of T2DM with In-Home Technology. Paper session presented at: Promoting Quality…Partnering for Change. AHRQ Annual Conference; 2008 Sep 7-10; Bethesda, MD.

Barber L. Improving Self-Management of T2DM. Annual Research Opportunity for Academic Development in Science (ROADS) presentation, Medical College of Wisconsin; 2008 August 8; Milwaukee, WI.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** All aims and milestones are on track and data collection is in process. Baseline data have been collected and entered, and preliminary analyses have begun. Nearly all participants have now received a 3-month visit and have been randomized.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Personal Health Records and Elder Medication Use Quality |
| **Principal Investigator:** | Chrischilles, Elizabeth, Ph.D. |
| **Organization:** | University of Iowa |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017034 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,199,999 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the exchange of electronic health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Elderly*, Medicare

**Summary:** Use of medications by older adults living in the community is far from optimal. Medication errors, including overuse, underuse, and misuse, are common. The Medicare Modernization Act (MMA) of 2003 required health plans to provide medication therapy management (MTM) services to optimize therapeutic outcomes among high-risk patients with multiple chronic conditions taking multiple medications. Because the MMA did not dictate how health plans should deliver MTM, various delivery methods exist. Regardless of delivery method, a model of patient-centered MTM requires that the patient play a pivotal role in self-monitoring, self-evaluation, goal setting, and medication taking. The features of a patient controlled personal health record (PHR) system parallel and are thought to enhance these critical behaviors. By enhancing patient MTM behaviors, the use of PHRs may result in enhanced patient-provider communication, care continuity, better prescribing, and medication adherence.

The project is evaluating the ability of a PHR to support and improve elderly patients' medication adherence, use, and management. The team is testing the hypothesis that a successfully maintained PHR provides reinforcement to build self-efficacy for MTM, that an up-to-date PHR increases patient knowledge about medications, and that PHR-gained information allows patients to shift their beliefs about medication from concern to understanding.

Phase I of the project consisted of a series of patient, caregiver, and provider focus groups to identify patient and physician medication management practices, barriers to PHR use, and physician office workflow issues. Through a careful evaluation of the feedback received during these sessions, the project team identified patients' and providers' wants and needs with respect to the varied functionalities of these products and will develop a formal measure of the patients' role in maintaining their health. The project team also conducted an environmental scan of commercially available PHR products to identify existing core PHR functions available to elderly patients. The project team selected the best commercially available PHR based on the products that met the criteria of the identified core functions, as well as on usability as evaluated by experts on older-adult computer interaction.

Phases II and III are hands-on trials of patients' interaction with a PHR product. The team will test the PHR by measuring elderly patients' interaction with the technology and their resulting self-activation with respect to medication management. Based on Phase I feedback, the project team will incorporate patient and provider suggestions into the product. Phase II is a usability study of the PHR via a human-computer interaction (HCI) laboratory assessment of elderly adults to identify challenges patients face when using the PHR and support needed to facilitate usage. Phase III is a randomized controlled trial of older adults'

usage of the PHR . The team will compare those using the PHR with those randomized to no PHR across outcomes such as patient-reported MTM behaviors, patient beliefs about their medications, medication adherence, patient-physician communication, and other technology utilization measures. Core activities to be analyzed as behavior-based measures of patient participation include: keeping an active medication list; recording the purpose of each medication; reporting side effects to providers; and asking questions about medications.

**Specific Aims**

- Develop measures of patient MTM behaviors and patient self-efficacy for MTM. **(Ongoing)**
- Compare the patient-reported MTM behaviors, medication adherence, patient- and physician-centric medication quality indicators, patient self-efficacy for MTM, and patient beliefs about medication among patients randomized to a current, representative PHR system versus patients randomized to usual care. **(Upcoming)**
- Investigate the usability of PHR system in an HCI interaction laboratory compared with alternative prototypes developed through participatory design with older adults of varying ability levels. Associate PHR performance with measures of cognitive, motor, and perceptual ability. **(Ongoing)**

**2009 Activities:** The project team developed protocols and recruited and conducted focus groups with older adults, their caregivers, family physicians, and medical office staff. These qualitative data provided the information necessary to develop and refine behavior-based MTM measures for the trial.

A series of PHR prototype participatory design sessions were completed with a group of eight older (age 65 plus) adults at a local retirement community to delineate basic content and features of a PHR for use by older adults. Thirteen sessions were held over several weeks. The team delineated broad configurations for the PHR development, and met frequently to develop content, layout, and function specifications. Finally, the PHR system was tested in focus groups of older adults and in a usability laboratory setting.

**Preliminary Impact and Findings:** Finding from focus groups with family physicians suggested that providers predominantly view PHRs as a backup source of medical information secondary to the patient's medical record as opposed to a tool for patients. While providers believe PHRs have the potential to decrease errors and increase efficiency, they are concerned about how to integrate PHRs into patient appointments that are already too short.

**Selected Outputs**

AHRQ 2008 Annual Conference presentation: Personal Health Records for Medication Use: Views from Elders and Their Physicians. Slide Presentation from the AHRQ 2008 Annual Conference. Agency for Healthcare Research and Quality, Rockville, MD.

Available at: http://www.ahrq.gov/about/annualmtg08/090908slides/Chrischilles.htm

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project has implemented the intervention and is in the process of collecting and analyzing data as well as developing manuscripts.

**Milestones:** Progress is mostly on track.

**Budget:** Significantly underspent, more than 20 percent.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Ambulatory Care Compact to Organize Risk and Decisionmaking |
| **Principal Investigator:** | Chueh, Henry, M.D. |
| **Organization:** | Massachusetts General Hospital |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017190 |
| **Project Period:** | 9/07 – 08/10 |
| **AHRQ Funding Amount:** | $923,783 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults

**Summary:** Primary care in our current health system is fragmented, inefficient, and frequently unsafe. Efforts to improve quality of care, focusing on a relatively narrow set of quality measures, and increasing emphasis on care guidelines have transformed the practice of medicine in ways that are both good and bad for patients and clinicians. Standardized care algorithms attempt to promote uniform compliance with evidence-based care but are underutilized. This may be due to their inability to accommodate individual patient and clinician preferences and values. With greater access to health information via the Internet and other media, patients are increasingly involved in the medical decisionmaking process. At the same time, advances in health information technology (IT) have ushered in electronic health records (EHRs) and increased capacity to identify and track patient populations within a health system. These advances will facilitate the design of new models of primary care delivery that employ system-level health IT tools to promote patient and clinician partnerships.

This project's objectives are to design, develop, implement, and evaluate a comprehensive, practical, and innovative model of care delivery to support the process of shared decisionmaking. The system, titled Ambulatory Care Compact to Organize Risk and Decisionmaking (ACCORD), will allow patients to collaborate with clinicians to establish, monitor, and track shared clinical care plans. ACCORD will interface with the Massachusetts General Primary Care Practice-Based Research Network's preexisting, internally developed Computer Stored Ambulatory Record EHR system.

The project team is developing ACCORD to help providers and patients manage followup activities determined at primary care visits. The team selected the following domains to maintain through ACCORD: preventive health screenings, abnormal findings followup, and medication monitoring. ACCORD will enable patient-specific care plan development to diminish miscommunication between providers and patients by presenting care plans as explicit compacts and by providing explanatory information about the risks of not adhering to the plans. The project team is working to ensure that both patients and providers are comfortable proposing the compacts.

The project activities are organized into three steps. Step one is to design, build, and test the system to develop a usable method of compact authoring and tracking. Step two will test the tool to determine if providers and patients are comfortable creating explicit agreements and if the tool is effective in this capacity. Step three is to conduct one or more randomized controlled trials (RCTs) in a primary care practice and an institution-wide cohort in another primary care practice to examine system adoption and

process measures. The RCTs will examine differences in outcomes, such as preventive screening test completion, chronic disease management, patient engagement, patient knowledge, patient-provider communication, patient and clinician satisfaction, and various system-utilization metrics.

**Specific Aims**

- Design a model for patient-centered primary care that facilitates patient-clinician partnerships that results in documented followup care plans that can be tracked reliably to reduce the risk of care plans being lost to followup in busy primary care networks. **(Achieved)**
- Develop a health IT architecture and software (i.e., ACCORD) to support the developed patient-centered care-delivery model. **(Ongoing)**
- Implement and evaluate ACCORD in an RCT within the Massachusetts General Primary Care Practice-Based Research Network. **(Upcoming)**

**2009 Activities:** Work on the ACCORD template library focused on distilling a usable and consistently presented set of templates for the October 2009 focus groups. Physician authors continued to find it difficult to formulate ACCORD templates, but the project identified the main issue as entrenched methods of thinking about clinical management rather than any technical reasons. The team has identified an emerging framework for evaluating a topic for ACCORD and creating its template. First, the nature of the topic demands some patient classification. Second, evidence must be available to take an empirical approach for creating patient classification. Finally, classifications that patients can potentially understand and that providers can distinguish between must be derived. Most guidelines are flow based and temporal and are often tailored to reduce the different potential actions to be taken. The ramifications of this go well beyond ACCORD. From a cost-effectiveness point of view, taking action without clear justification and understanding of patient preference may accelerate health care costs. With this in mind, the project's focus has become tuning the ACCORD model of synthesizing the decisionmaking as a combination of evidence, patient preference, state, and most importantly, understanding the meaning behind the actions planned.

The first round of focus groups was completed, and a paper detailing thematic selection and its application to ACCORD design was drafted. Submission of a manuscript will be delayed until the project can incorporate results from the second round of focus groups, which took place in October. Six volunteer primary care provider-patient pairs were recruited to use a live version of ACCORD in hypothetical and real scenarios suggested by their own experiences and issues. At each session, teams were given an orientation to the system and the purpose of the sessions. Each participant was handed a sheet with a customized selection of scenarios to consider in different situations. Each was also given a personal schedule for rotating through different rooms (which represented either patient homes or provider offices). Each participant had an opportunity to consider use of ACCORD in the pre-visit, visit, or post-visit contexts. After three rotations, the teams came together to discuss the experience in a facilitated focus group. Data are being analyzed. Two reports have been created for use in immediate decisionmaking about system and study design and as preparation for future planned publications.

**Preliminary Impact and Findings:** The focus groups produced the following preliminary findings:

- Both patients and physicians were able to comprehend the purpose of ACCORD fairly readily.
- Patients are more likely than physicians to see value in spending time with the system, but not all physicians and patients see enough value to use the system.
- Even physicians who are highly engaged in the system demand that it be tightly integrated with the EHR's clinical workflow functionality.
- A key workflow integration challenge is differentiating an ACCORD—an explicit agreement about a treatment plan for a clinical issue—from closely-related constructs like to-do lists and discussion threads pertaining to clinical issue treatment planning.

- Advanced preparation for a scheduled visit will likely be the most common use for ACCORD.
- Patients and physicians were able to use the primary functions of ACCORD with little training or explanation but had difficulty accessing more advanced features.
- Physicians and patients had divergent views of how restrictive ACCORD will be.

**Selected Outputs**

Chueh HC. Designing for ACCORD with Patients. AHRQ 2008 Annual Conference presentation; 2008 Sept 8; Bethesda, MD. Available at: PowerPoint® File; Web Version.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is making significant progress, and the principal investigator anticipates completion by the end of the grant period.

**Milestones:** Progress is on track in some respects, but not others.

**Budget:** Spending is roughly on target.

| | |
|---|---|
| **Project Title:** | Implementing a Low-Literacy, Multimedia Information Technology System to Enhance Patient-Centered Cancer Care |
| **Principal Investigator:** | Hahn, Elizabeth, M.A. |
| **Organization:** | Northwestern University |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017300 |
| **Project Period:** | 09/07 – 09/10 |
| **AHRQ Funding Amount:** | $1,198,839 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Cancer, Low Literacy, Low SES/Low Income*, Medically Underserved, Safety Net

**Summary:** Cancer-related information, if delivered in a user-friendly way, can reach special populations with limited literacy skills. The research team hypothesizes that promoting patient understanding of disease and treatment through innovative information delivery methods will in turn promote better communication, treatment adherence and outcomes including patient satisfaction with health care, patient-provider communication, cancer-related knowledge, patients' self-efficacy, treatment adherence, and health-related quality of life (HRQL).

This project modifies a widely-used talking touchscreen multimedia information and assessment system for patients being treated for breast and colorectal cancer to be more accessible for patients with low literacy skills. The CancerHelp® Talking Touchscreen (TT), developed by the CancerHelp Institute and investigators on this grant, is available at any time during clinic hours via a kiosk at the site. The software provides patient education on diagnoses, treatment, support, side effects, prevention, and screening. It contains easy access to cancer information from National Cancer Institute sources, user statistics, and customizable features. The research team will adapt the CancerHelp TT software so that it is more user-friendly for patients across the spectrum of literacy skills. Strategies will be implemented to enhance the ease of understanding the material and navigating through the program. For example, the amount of text on each screen will be shortened; patients will have the option to choose between text-based and audio presentation of education materials, communication tools, and assessment questions; and videos will be developed for certain modules.

Using the CancerHelp TT kiosk, patients are able to print information and generate a visit-specific checklist of their top priorities to discuss with their providers. During regular visits to cancer care centers for treatment, participants will interact with the adapted CancerHelp TT available at any time during clinic hours via a kiosk at the site. At the conclusion of their in-clinic cancer treatments, participants in the intervention arm will also receive a posttreatment cancer survivorship care plan (modeled on templates from the Institute of Medicine) summarizing the cancer treatments they have received and provides appropriate aftercare recommendations, including detailed contact information for future appointments. Participants' cancer treatment clinicians review the care plan with them and instruct them

to provide a copy to their primary care physicians. This survivorship care planning is designed to minimize the interruptions in care that can occur when patients complete their cancer treatments.

The intervention will be evaluated through a randomized trial of 200 patients with breast or colorectal cancer conducted at three ambulatory cancer care centers. Patients in both the intervention group and control group will use the talking touchscreen to complete surveys on knowledge, satisfaction, HRQL, and other study measures up to 3 times during treatment and once afterwards. Both groups will receive diagnosis- and treatment-specific brochures; however, only patients randomized to the intervention arm will have access to the software adapted for this intervention.

**Specific Aims**

- Test whether a low-literacy-friendly multimedia information and assessment information technology system used in daily clinical practice improves patient outcomes during treatment in 200 recently diagnosed breast and colorectal cancer patients based on the primary endpoints: satisfaction with health care communication, knowledge of cancer and treatment, self-efficacy, adherence to recommended treatment, and HRQL. **(Ongoing)**
- Evaluate the relationships between patient characteristics, resources, needs, health behaviors, and health outcomes using the Behavioral Model for Vulnerable Populations. **(Upcoming)**
- Test whether use of the multimedia information technology (IT) system improves adherence to recommended posttreatment surveillance care and HRQL during the early posttreatment surveillance period (3 months after treatment). **(Upcoming)**

**2009 Activities:** Much of the programming for the study has now been completed, and the software is ready to be implemented. Study staff worked with programming and informatics staff for testing and editing the programmed items, and the research team has reviewed DVDs of the program's modules. The quality assessment of the trial software for the intervention portion of the study was completed. The software went through minor updates and system enhancement based on feedback from patients, including allowing users to skip a set of instructional slides orienting them to the educational software if they choose to do so.

Pretesting was completed with four patients at each of the three clinical sites. The purpose of the pretest was to obtain qualitative feedback on the patient education software. Patients were enthusiastic about the technology and the content. Patients found the touchscreen easy to use. They enjoyed the audio, dictionary, and print features, and they were very satisfied with the usefulness of the educational content. Thirteen patients were enrolled in field testing that was completed toward the end of 2009. Patient feedback was largely positive and was used to improve the software.

Some educational content has been finalized, including script development and videotaping for the communication module. Several modules, including Chemotherapy and You, Radiation Therapy and You, Eating Hints, and Understanding Cancer Pain were programmed by CancerHelp staff, and they were tested and proofread by study staff.

A resource directory was also completed, and patients in the intervention arm will be able to print out this information from the kiosk. The list includes contact information about support services in four categories: support, information, and counseling services; medication and co-pay assistance; food and legal assistance; and advocacy.

**Preliminary Impact and Findings:** Thirteen patients were enrolled in field testing that was completed toward the end of 2009. Patient feedback was largely positive, and feedback was used to improve the software. Patient randomization for the study has started, and the trial will begin in early 2010.

**Selected Outputs**

Garcia, SF, Muench C, Miller, E, Kattezham R, Hahn EA. Cancer Care Communication (C3): A novel low literacy, multimedia information technology system for patient-centered care. Poster session presented at AHRQ Annual Meeting; 2008 September 7–10: Bethesda, MD.

Hahn EA. Cancer Care Communication (C3): Enhancing patient-centered cancer care for vulnerable populations through the use of a low-literacy, multimedia IT system. Presented at AHRQ Annual Meeting; 2008 September 7–10: Bethesda, MD.

Garcia S F, Muench C, Miller E, Kattezham K, Hahn, E. Cancer Care Communication (C3): Implementing a low literacy, multimedia information technology system to enhance patient-centered cancer care. Presented at the American Academy on Communication in Healthcare Research and Teaching Forum, Madison, WI, October 2008.

Miller E, Muench CM, Hahn EA, Garcia SF. Steps for setting up outcomes research for cancer patient education. Presented at the Joint Annual Meeting of the American Association for Cancer Education (AACE), Cancer Patient Education Network (CPEN), and European Association for Cancer Education (EACE); Clearwater, FL, October 2008.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The research team is somewhat underspent because they are behind on their timeline. Much of the programming for the study has now been completed, and the software is ready to be implemented. Some educational content has been finalized, and a resource directory has been completed.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Virtual Patient Advocate to Reduce Ambulatory Adverse Drug Events |
| **Principal Investigator:** | Jack, Brian, M.D. |
| **Organization:** | Boston Medical Center |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017196 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,180,772 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults

**Summary:** The transition time between hospitalization and the first ambulatory visit is one of high risk for medical errors. The overarching objective of this project is to expand the use of an animated conversational agent to assist patients during the transition from hospital to ambulatory setting. In prior studies, the project team developed a paper-based tool called the After Hospital Care Plan (AHCP) to deliver the Re-Engineered Hospital Discharge, a set of recommended activities to be performed upon a patient's discharge from the hospital. Subsequently, the team developed the Virtual Patient Advocate (VPA), a computerized, animated character that emulates the face-to-face conversational behavior of an empathic provider, to deliver the AHCP tool.

This project delivers, via Web portal, the VPA intervention to patients at the point of hospital discharge to their first post hospitalization visit with their primary care physician. The VPA offers health education as well as monitoring and advice on self care and medication use and assesses the patient's understanding and adherence. To program the system, the team is modifying the content, logic, layout, and database of the intervention tools (workstation, AHCP, and training manual) to meet the needs of the ambulatory environment. It is also developing links between the VPA system, Boston Medical Center's Certified Commission for Health Information Technology-certified GE Centricity electronic medical record (EMR), and the ambulatory provider's information technology (IT) systems, and conducting a series of qualitative evaluations with potential users and clinicians. Once the beta version is sufficiently prepared, the team will pretest the system with potential users and clinicians, make modifications pursuant to findings from the pretest, and conduct a randomized controlled trial (RCT) with subjects who are at high risk of adverse drug events. The system has now been completed debugged and tested with hospitalized patients. The RCT which is a test of concept trial will begin in August of 2010. In addition to the programming of the VPA, the enrollment forms, the data forms for data collected at the time that the nurses respond to "alerts" generated by the system have been designed. The outcome data will be collected after the first postdischarge appointment with the responsible clinician.

The participants in the randomized trial will be instructed to: 1) check in with the VPA via computer following discharge from the hospital and on a regular basis before the first post hospital visit; 2) bring to the first postdischarge visit the result of the online interactions (a list of items to discuss with the clinician); and 3) meet with the VPA after the ambulatory visit for instructions on any medication regimen changes made during the office visit. The team will evaluate the intervention by comparing

process outcomes (i.e., enrollment, adherence and attrition, fidelity, therapeutic alliance, and patient activation) and clinical outcomes (i.e., patient and provider satisfaction, patient knowledge of self-care and medications, adverse events, and pharmacist interventions) of those using the VPA to outcomes for a group of similar participants. Concurrently, the team is pursuing dissemination of the VPA by introducing the system to other interested health care organizations. The RCT of this system will be completed by September 30, 2012.

**Specific Aims**

- Program the VPA, a computer-based, interactive, animated character, to offer patients with limited health literacy/health education advice on self-care and medication use during the transition from hospital to ambulatory care. **(Achieved)**
- Design and implement an ambulatory care plan using the VPA to educate the patient and respond to questions. **(Achieved)**
- Evaluate the intervention in the ambulatory setting. **(Ongoing)**
- Build a robust dissemination program that will introduce this system into a health care system that is a member of a national test bed. **(Ongoing)**

**2009 Activities:** The intervention was launched after significant development, testing, and refining of the VPA system. To further inform development of the computer interaction, patient sessions with a clinical pharmacist after hospital discharge were recorded. These sessions imitated what will be accomplished during the postdischarge Web interactions: a review of discharge medications (i.e., adherence, education, and side effects), discussion of followup appointments, and other medical issues.

Methods for identifying adverse drug events were evaluated through extensive script reviews and role playing. The review process also allowed scripts to be edited for tone. A timeline for patient interactions was set by the script-writing team to guide transitions from each content piece and to ease the programming process. In addition, mock-up screen images for the intervention were sent for programming.

The study team continued testing the workstation and identifying areas that need improvement or additions. A program was written so that a variety of clinicians and patients could review the interaction and via a "debugging" system they could make recommendations about how the system should be modified. Additionally, testing was done for how the VPA portal information flows from the patient to the clinical team and back to the patient and a codification system was designed on how to categorize these "alerts" and how to consistently respond to them. Additional diagnosis scripts, diagnosis pages, medications, medication scripts, primary care providers, and pharmacies have been added to the existing selections. Integration of the workstation with the Boston Medical Center EMR was completed. The research group is also in discussion with a large health IT program that could potentially integrate the postdischarge system into a larger Web-based EMR system that will be available to a large number of patients.

**Preliminary Impact and Findings:** No impacts or findings have yet been reported.

**Selected Outputs**

The Ambulatory Visit Training Manual: Used to train the clinicians in the ambulatory setting.

Jack, B. Testing the Re-Engineered Discharge. Presentation at the Annual Conference of the Agency for Healthcare Research and Quality, 2008 September 7-10; Bethesda, MD.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is entering the proof-of-concept phase and is developing manuscripts for publication submission.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

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|---|---|
| **Project Title:** | An Interactive Preventive Health Record to Promote Patient-Centered Care |
| **Principal Investigator:** | Krist, Alexander, M.D. |
| **Organization:** | Virginia Commonwealth University |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017046 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,198,677 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults

**Summary:** While there is clear evidence supporting the health benefits of preventive care, Americans receive only 50 percent of indicated preventive services. A number of patient, clinician, and health care system barriers contribute to this gap in the delivery of quality preventive care.

This project's objectives are to design, develop, implement, and evaluate whether an interactive preventive health record (IPHR) linked to an electronic medical record (EMR) will increase recommended screening tests, immunizations, and counseling. MyPreventiveCare provides tailored recommendations, links to educational resources and decision aids, and patient and clinician reminders. By linking patients to their clinicians' EMRs and supplementing that information with user responses to questions on demographics, past receipt of preventive services, and other behavioral risk factors, MyPreventiveCare can share knowledge and promote the free flow of information between clinicians and patients. MyPreventiveCare gives the patient a link to preventive elements of his/her EMR, a health risk assessment, an individualized list of recommended preventive services based on risk stratification, education resources, and reminders. Reminders include messages encouraging healthy behaviors and/or recommended services, alerts informing patients when they become eligible for retesting or new services, and requests encouraging patients to update their profiles. MyPreventiveCare provides the clinician with a summary of the patient's risk factor information, which can be used to update the clinician's EMR.

The study takes place in eight primary care practices in the Virginia Ambulatory Care Outcomes Research Network. All of the practices use a common EMR, the Certified Commission for Health Information Technology-certified Allscripts Touchworks® EMR. A randomly selected sample of 5,500 of the practices' 228,000 patients, stratified by age and sex, receive a request from their clinicians to use MyPreventiveCare or receive "usual" preventive care. Through this randomized, controlled trial, the project team is examining the effects of MyPreventiveCare on clinical preventive services, shared decisionmaking, and patient-physician communication. This involves the analysis of data in the EMR, utilization data from MyPreventiveCare, and data collected from patient and provider surveys.

**Specific Aims**

- Evaluate whether an invitation from a patient's primary care clinician to use MyPreventiveCare results in use of the system. **(Ongoing)**

- Evaluate whether an invitation from a patient's primary care clinician to use MyPreventiveCare results in increased delivery of age- and gender-appropriate clinical preventive services. **(Ongoing)**
- Evaluate whether an invitation from a patient's primary care clinician to use MyPreventiveCare results in increased shared decisionmaking for preventive services. **(Ongoing)**
- Evaluate whether an invitation from a patient's primary care clinician to use MyPreventiveCare results in improved clinician-patient communication about preventive needs. **(Ongoing)**

**2009 Activities:** Post-intervention EMR data was extracted and cleaned. Datasets have been combined to get a more robust and accurate picture of the effects of the system on the delivery of preventive services. A protocol to deal with data discrepancies was developed, and the pre-post change in delivery of preventive care for average-risk adults using patient survey responses and EMR data was analyzed. The team is in the process of calculating the change in the delivery of preventive services for high-risk adults (e.g., pneumonia vaccines for adults under age 65 who have pulmonary or cardiovascular disease) and the change in the delivery of chronic care that MyPreventiveCare addresses (e.g., cholesterol control, blood pressure control, diabetes control). Included in the analysis is an understanding of the impact of MyPreventiveCare on doctor-patient communication and on shared decisionmaking using the Consumer Assessment of Healthcare Providers and Systems patient survey. The type of data included from the EMR was expanded in order to better identify high-risk patients who may need additional preventive services. These refined protocols are consistent with the prevention recommendations that MyPreventiveCare promotes to patients.

Predefined MyPreventiveCare users received a final invitation letter to join the program in 2009. The study team worked with a communication firm and graphic artist to modify the recruitment materials for the third and final mailing.

Sixteen patients were recruited for three sets of focus group interviews. Eight physicians were similarly recruited to understand their usage of MyPreventiveCare. In addition, an invitation was sent and subsequent focus groups were held with IPHR non-users in order to explore why some patients elected not to use the system.

The study team presented at several meetings and conferences and is in the process of writing their 1-year outcome results.

**Preliminary Impact and Findings:** Within 6 weeks of being mailed the invitation, 292 patients (11 percent) had established an account and used MyPreventiveCare. Users were more often male and older compared to non-users. Although 76 percent of users had attended a wellness or chronic care visit within the past year, only three percent were up-to-date with risk factors under control for all 18 preventive services. Among MyPreventiveCare users, 49 percent and 56 percent were due for screening tests and vaccinations, respectively; 91 percent and 55 percent needed counseling for unhealthy behaviors and preventive medications, respectively; and 35 percent had inadequate control of chronic conditions. Alerts to clinicians issued by MyPreventiveCare led practices to update 59 percent of patients' records and to contact patients to schedule a wellness visit (80 patients), chronic care visit (49 patients), or an appointment for a specific preventive service (56 patients).

In a preliminary analysis, combining information from patient survey responses and the EMR, patients mailed an invitation to use MyPreventiveCare were 1.5 percent more up to date on the overall delivery of preventive services 4 months post implementation of the system compared to pre-system implementation ($p=0.016$), while the control group did not have a similar increase. This increase was significantly diluted by the fact that only a fifth of intervention patients used MyPreventiveCare (i.e. were exposed to the system). Restricting the analysis to MyPreventiveCare users only, users had more than a five percent

increase in the overall delivery of preventive services ($p<0.001$), with increases of more than 10 percent for some services (colon cancer screening, breast cancer screening, and cervical cancer screening).

**Selected Outputs**

MyPreventiveCare is available at http://www.mypreventivecare.net, http://www.mypreventivecare.com, or http://www.mypreventivecare.org.

**Grantee's Self-Reported Quarterly Status (as of December 2009):** The project made significant progress and in 2010 will continue to collect post-intervention data and conduct analysis. A no-cost extension may be requested to allow additional time to focus on dissemination activities.

**Milestones:** Progress is completely on track.

**Budget:** Spending roughly on target.

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|---|---|
| **Project Title:** | Tailored DVD to Improve Medication Management for Low Literate Elderly Patients |
| **Principal Investigator:** | Lapane, Kate, Ph.D. |
| **Organization:** | Virginia Commonwealth University |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017281 |
| **Project Period:** | 09/07 – 09/10 |
| **AHRQ Funding Amount:** | $1,199,014 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of medication information to improve medication management.

**Business Goal:** Implementation and Use

**Target Population:** Elderly*, Low Literacy

**Summary:** Medication decisions are the most common type of decision that physicians make, yet the evidence shows that discussions between patients and providers regarding medications remain infrequent during medical encounters in primary care settings. Medication management issues among older patients include high incidence of preventable adverse drug events and difficulty taking medications as prescribed. The availability of access to electronic medication history at the point of prescribing via electronic prescribing applications may assist physicians in understanding more fully the medication management issues that older patients experience. Comprehensive and accurate electronic medication history provides the opportunity to create tailored interventions based on the particular medication issues a patient may be experiencing.

Dr. Lapane's research team hypothesizes that electronic medication history can be harnessed to develop tailored patient education DVDs and print materials for low-literate audiences. The purpose of these materials is to empower geriatric patients and their caregivers to participate in treatment decisions and negotiate acceptable medication regimens that are more amenable to follow-through. This project focuses on developing and testing interventions that seek to improve medication adherence and use by patients through health information technology, improved shared decisionmaking, and patient-clinician communication, as well as self-management of chronic conditions. The team will develop paper-based and tailored DVD content for low-literate patients, illustrating the principles of medication adherence and provide guidance on medication use so that they can better adhere to complex drug regimens.

The study is a mixed methods formative evaluation to ensure a representative variety of data are analyzed and used for the development of the final product. Data sources include: focus groups with patients, providers, and caregivers; electronic prescription data and other sources of data such as the National Health and Nutrition Examination Survey, and other publicly available databases; and telephone surveys with a cross-section of the population. Once developed, materials will be confirmed with additional focus groups, and the DVDs and print materials will be pretested in a live environment. Once the materials have been finalized, the research team will engage four practices in a pilot study of the intervention. The study will follow 25 patients within each practice, collecting and analyzing information such as demographics, social support, medication profiles, medication management issues, stage of readiness to change, self-efficacy, self-reported adherence, and adherence measures based on electronic medication history, as well

as a series of clinical process measures. The intervention will include surveys of both patients and providers, as well as audio taping of the clinical encounter.

**Specific Aims**

- Develop algorithms to identify potential medication management issues based on community pharmacy-generated electronic medication history of elderly people in census areas with high concentrations of minorities and poor people. **(Achieved)**
- Develop tailored print materials based on electronic medication history to assist geriatric patients in adhering to complex medication regimens. **(Upcoming)**
- Develop tailored instructional videos which focus on improving the geriatric patient's role in patient-provider communication regarding medication issues and adherence to medication regimens. **(Ongoing)**
- Pretest these interventions with versions in English and Spanish as part of a feasibility study within physician offices likely to service low-literate geriatric patients. **(Upcoming)**

**2009 Activities:** Additional focus groups were conducted at community centers, and data from 2008 and 2009 focus groups were analyzed using qualitative analysis software. These data were revisited throughout the process of content development for the DVDs and has proven particularly valuable for development of patient scenarios. A survey was implemented to confirm focus group findings and to improve insight into understanding of areas to emphasize in the various segments.

DVD content development and filming are complete. During the past year the research team has focused on script writing, editing and translating, and on preparing for and producing video segments. Scripts were reviewed by both English and Spanish-speaking community members. Segments are in English and Spanish, and topics include general tips (six segments), Warfarin, insomnia, depression, heart failure, and diabetes. Video editing is nearly complete for the English segments and in the early stages for the Spanish segments.

Confirmatory focus groups were conducted in English at low-income community centers. The response was extremely positive and participants provided helpful suggestions related to video length, look and feel of the videos, and how the content should be disseminated to users (i.e. all at once or in multiple mailings). Spanish-language focus groups will be conducted once the Spanish video editing has been completed.

Analysis of medication history is on track. Data acquisition and analysis are complete, and the team is now focused on development of the specific algorithms that will trigger segments of the DVD. They expect to begin testing the algorithms in early 2010.

A second survey is now being finalized for the evaluation portion of the final phase of the project, and planning efforts are focused on the development of an evaluation strategy that encompasses all of the different segments and topics.

**Preliminary Impact and Findings:** Confirmatory English-language focus groups showed very positive reception of the video content and provided valuable suggestions related to video length, look and feel of the videos, and how the content should be disseminated to users.

**Selected Outputs**

Lapane K. Use of Mixed-Method Designs to Inform Patient-Centered Tools to Improve Medication Management. Paper session presented at: Promoting Quality…Partnering for Change. AHRQ Annual Conference; 2008 Sep 7-10; Bethesda, MD.

Audio Clips from focus groups to be used as educational tools.

Codebooks for analysis of patient and caregiver focus groups.

Recruitment fliers for patient and caregiver focus groups (English and Spanish).

Scripts for patient and caregiver focus groups (English and Spanish).

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**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is mostly on track, however, the team has had to spend more time than anticipated working on translation, recording, and editing of the Spanish language videos. The team is on track with developing specific algorithms that will trigger segments of the DVD and preparing for the evaluation portion of the final phase of the project. Spending will be on track once final video production costs have been expended.

**Milestones:** Progress is on track in some respects but not in others.

**Budget:** Significantly underspent, more than 20 percent.

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**AHRQ Priority Population*

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| **Project Title:** | Impact of a Wellness Portal on the Delivery of Patient-Centered Prospective Care |
| **Principal Investigator:** | Mold, James, M.D. |
| **Organization:** | University of Oklahoma Health Sciences Center |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care (PCC) through Health Information Technology |
| **Grant Number:** | R18 HS 017188 |
| **Project Period:** | 10/07 – 08/10 |
| **AHRQ Funding Amount:** | $902,411 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Pediatric*

**Summary:** As the number of recommended preventive services continues to increase, clinicians struggle to maintain a balance between immediate patient concerns and the time required to address prevention. If effective and timely clinical decision support is not integrated into a comprehensive care delivery approach (e.g. the Chronic Care Model), and patient-centered tailoring of recommendations is not incorporated, primary care clinicians' performance in this area will not improve from the current suboptimal levels—40 to 60 percent rates of delivery of well-accepted preventive services. Optimal delivery of primary, secondary, and tertiary preventive services will increasingly require sophisticated information processing and much greater patient involvement.

This project develops and tests an Internet-based patient-centered Wellness Portal to allow patient access to the Preventive Services Reminder System (PSRS), a pre-existing, internally-developed clinical tool for improving the delivery of patient-centered preventive services. Practices within the Oklahoma Physicians Resource/Research Network (OKPRN) use the PSRS. The PSRS contains a patient registry, preventive service reminders according to evidence-based guidelines, an electronic chart-auditing and patient recall tool for clinical decision support, patient education materials, and a 3-year prospective wellness plan. The project team members have enhanced functionality of the PSRS by allowing patient access via the Wellness Portal, which patients can access through their home computer or provider office kiosks. The Wellness Portal allows patients to securely input personal information on their health behaviors and wellness status in order to personalize their wellness plan through the risk assessment algorithm, securely contact their provider and schedule visits, transfer their wellness record to other providers using the Continuity of Care Record interface, and review educational materials.

The Wellness Portal project enrolled guardians of children (6 years old and younger) and adult patients (50 years or older) at four clinician practices within a primary care practice-based research network in Oklahoma. The research team is concluding a 12-month randomized controlled trial with four intervention and four control OKPRN practices to elucidate whether the Wellness Portal improves the delivery of appropriate preventive services at the right time, increases patient experience with patient-centered care, enhances patient activation, and improves delivery of preventive services controlled for the level of utilization, patient demographics, and health status.

**Specific Aims**

- Develop, field test, and refine an Internet-based patient Wellness Portal linked to PSRS to facilitate patient-centered, preventive care in primary care practices. **(Achieved)**
- Determine the impact of the Wellness Portal on the process of patient-centered preventive care by examining the behavior and experiences of both patients and providers and the degree to which recommended services are individualized. **(Ongoing)**
- Develop model Wellness Portal practices and disseminate the Wellness Portal technology and knowledge derived from Aims 1 and 2 findings. **(Upcoming)**

**2009 Activities:** Activities during 2009 focused on conducting the randomized, controlled trial; collecting data; ensuring data integrity; and cultivating practice and patient engagement. The project continued to improve and refine the implementation methodology in each of the intervention practices. Patient enrollment was completed with 89 percent of the enrollees having used the Wellness Portal. This was achieved through two mail-outs, biweekly e-mails, and telephone reminders. The practice enhancement assistants remained active in patient recruitment.

The project described and tested the intervention using Plan-Do-Study-Act cycles. The process began with the development of flow charts describing each step the practice implemented to ensure that patients had access to their Wellness Portal preventive services recommendations at the time of the visit. Updates to Wellness Portal participants regarding tips and health updates were provided monthly. The Wellness Portal incorporates audiovisual navigation help and user tutorials on each page in the form of context-sensitive, on-demand, embedded videos.

Baseline data collection included paper and electronic chart audits for preventive services coverage, patient surveys to gauge the level of satisfaction with care and patient activation, and clinician surveys to examine the process of preventive care delivery in the practice. Post-intervention data collected included all of the above, plus patient focus groups and clinician interviews in intervention practices to determine the impact of the Portal on patient care. The appropriateness and timeliness of preventive services have also been examined by comparing electronic care recommendations from the PSRS risk engine before and after the Portal intervention, based on chart review data. As the project continues with data collection, it is looking for new ways to engage practices and improve patient participation. Financial incentives to patients and practices, along with training videos, are among the efforts the project has undertaken to ensure ongoing participation.

**Preliminary Impact and Findings:** The team has completed the analyses of the field trial of the Wellness Portal. Results indicate a high degree of patient and provider satisfaction with the tool's usability, effectiveness, and value. Additional findings will be presented in forthcoming manuscripts.

**Selected Outputs**

The team has completed development of the beta-test version of the Wellness Portal.

**Grantee's Self-Reported Quarterly Status (as of December 2009):** The project has made significant progress, and it is anticipated that the project will be completed on time. The major focus for the remainder of the project will be data analysis and manuscript development.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Patient-Centered Informatics System to Enhance Health Care in Rural Communities |
| **Project Investigator:** | Samore, Matthew, M.D. |
| **Organization:** | University of Utah |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017308 |
| **Project Period:** | 09/07 – 09/10 |
| **AHRQ Funding Amount:** | $1,199,999 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Rural Health*, Chronic Care*, Diabetes, Heart Disease, Chronic Obstructive Pulmonary Disease, Hypertension

**Summary:** This is a demonstration project to evaluate whether integrating the functions of an electronic medical record (EMR), personal health record (PHR), and communication system leads to more patient-centered care in rural communities in the Intermountain West. This system, the Unified Health Resource (UHR), provides disease information and decision support tools for patient self-management of acute and chronic diseases, supports the reconciliation of medication lists, and enables exchange of information between clinicians and patients through a series of structured, bidirectional communication channels.

The EMR and PHR function independently of each other. The UHR software developer, CaduRx, designed an interface that allows each side to view and import changes to reflect the updates made by the other party. Patients may view items such as physician notes, diagnoses, and diagnostic test results imported into their PHR. Physicians who are granted access by the patient are able to view and import the patient's information from the PHR into their EMR which may include new prescriptions, symptoms, or diseases. In addition, there are several types of structured e-visits patients can use to communicate with clinics and clinicians. Patients may request medication refills online as well as input results of home monitoring tests into their PHR, such as blood sugar levels and blood pressure measurements. Through extensive usability testing, the project team has ensured that the vocabulary used in the PHR is understandable to the patients, clinically significant to the providers, linkable to International Classification of Diseases, Clinical Modification codes, and able to be coded for clinics' record keeping and billing purposes.

To assess the effect of the UHR on patient-centered care, the team will conduct a prospective cohort study among selected adult patients within one of the two rural clinics that use the UHR or two comparable clinics that recently implemented another EMR system. Participants will be recruited so that the final cohort is made up of 25 percent with no diagnosis of a chronic disease and 75 percent with one or more of the following chronic illnesses: diabetes mellitus, hypertension, chronic heart disease, or chronic obstructive pulmonary disease. Measures of patient activation, involvement in decisionmaking, self-management behaviors, medication management, and preventive practices will be obtained at baseline and serially during followup. The team will also analyze data abstracted from the UHR, and conduct a manual review of the patients' medical records to compare the provider assessment of patient disease

management to patient report of their own self-management. A formative evaluation of the UHR will also be conducted to assess and improve usability, usefulness, and adoption. During Year 3, the research team will launch a community-wide education campaign to enhance adoption of the UHR by increasing awareness of PHRs and the utility of asynchronous communication with clinicians.

**Specific Aims**

- Recruit two rural primary care clinics that use UHR and two primary care clinics that use an alternative, non-UHR EMR system to participate in a 3-year research demonstration project. **(Achieved)**
- Apply formative evaluation methods to assess and improve usability, usefulness, and adoption of the UHR personal health system by patients. **(Ongoing)**
- Enroll patients from the four participating rural clinics into a prospective cohort study to assess the impact of the UHR personal health system on patient-centered care. **(Ongoing)**
- Examine patterns of use of the UHR personal health system. **(Ongoing)**
- Increase awareness, confidence, and skills to use PHRs and Internet health resources among rural community residents, leveraging local libraries and health departments. **(Upcoming)**

**2009 Activities:** The UHR has been implemented in the clinics that will be using it, and the research team continues to evaluate the level of adoption of the UHR in the study clinics to identify and respond to the needs of each clinic. This includes monthly clinic visits as well as training to support integration of the EMR into clinic workflow and helping clinics understand the benefits of the PHR which has been more challenging because it is a relatively new concept to them. These efforts to promote integration and educate providers will put the clinics in a better position to promote the UHR among their patients and increase the satisfaction/adoption among those patients who use the UHR. The team will also be in communication with the non-UHR clinics in order to assess and address their needs with respect to further integrating their own EMR into their workflow. Usability testing was conducted and completed, and findings were used to make improvements to the UHR and the ongoing usability testing strategies. Improvements to the UHR have been tracked, so the team is aware of when each issue is addressed.

Data collection is ongoing. The patient survey has taken longer than expected but is very close to completion. The team needed to send many more mailers than had been expected to recruit participants from all the clinics in the project due to refusals on the phone and wrong or disconnected telephone numbers. A minimal/nonuser survey is currently being developed and will require 30 completed surveys from each of the clinics using the UHR (60 surveys total). The team expects similar recruitment challenges, but the number of surveys is much smaller. It is expected that this survey will be complete by the spring of 2010. The team continues to work on determining what constitutes an effective or ideal pattern of use for the PHR and EMR as well as an inefficient pattern of use. This will be helpful in identifying factors that lead to adoption of the tool. They have defined their key questions with regard to use of the PHR and have requested and received corresponding data from the developer. They have also determined their baseline for the number of patients who use the PHR in order to evaluate the effect of promotion activities to get patients to sign up for and use the PHR. The team is also in the process of determining the number of patients who are using the PHR in study clinics and what features they are using (e.g. health history, medications, health trackers).

The team has finalized plans for community-wide outreach involving local health departments and public libraries and has solidified plans for health education classes that will include information on using the PHR in each of the clinics using the UHR. The team also plans to provide similar information to the clinics. This will help them in their efforts to educate their patients about their health and medical conditions. The focus with the clinics will be on promoting the "Resources" section of the PHR which contains links to many Web sites that provide accurate and reliable information on health topics.

**Preliminary Impact and Findings:** Through recruitment of patients from the participating clinics for the usability testing, the team has discovered, anecdotally, that patients are very interested in the idea of a PHR linked with their health care provider and to their clinic records. The challenge will be to make sure patients are aware of how the tool is integrated with the clinic and understand how to use it successfully. Clinic staff, including providers, will need to be well informed about the UHR and understand its utility and potential to produce increased office efficiency and improved patient outcomes. An important factor influencing patient success will be the providers' use and encouragement of patient use. Patients who are chronically ill but have low levels of computer literacy may benefit from more structured training as learned through beta testing and patient pilot testing. The clinic staff might be ideal teachers for their patients, and working with them could complement the dissemination aim.

**Selected Outputs**

Priority matrix for software developed based on beta tester's feedback.

Script and protocol for formative usability testing, based on beta testing of the UHR.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Progress is mostly on track. The research team continues to evaluate the level of adoption of the UHR in the study clinics to identify and respond to the needs of each clinic with respect to adoption. Data collection is ongoing, and the patient survey is very close to completion. The team has finalized plans for community-wide outreach involving local health departments and public libraries and has solidified plans for health education classes that will include information on using the PHR in each of the clinics using the UHR.

**Milestones:** Progress is mostly on track

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Harnessing Health Information Technology for Self-Management Support and Medication Activation in a Medicaid Health Plan |
| **Principal Investigator:** | Schillinger, Dean, M.D. |
| **Organization:** | University of California, San Francisco |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017261 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,130,769 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Diabetes, Elderly*, Low Literacy, Low SES/Low Income*, Medicaid, Medically Underserved, Medicare, Racial or Ethnic Minorities*: Asian Cantonese-speaking and Hispanic/Latino, Safety Net, Uninsured

**Summary:** The Self-Management Automated Real Time Telephone Support (SMART-Steps) Program enhances an automated telephone self-management (ATSM) support system to provide ethnically diverse, publicly insured patients that have diabetes with surveillance and education and to prioritize additional telephone care management through questions on patient behavior. This work builds on a previously funded Agency for Healthcare Research and Quality (AHRQ) project by promoting dissemination of these results, as well as modifications for improved outcomes and adaptation for sustained implementation. Through a randomized, controlled trial, the project team is examining the effects of interacting with the SMART-Steps Program on members of the San Francisco Health Plan (SFHP), a Medicaid plan. Upon enrollment into the study, patients will be randomized to the ATSM-only group (SMART-Steps ONLY), the ATSM-plus group (SMART-Steps PLUS), or the usual care waitlist comparison group (subsequently to receive ATSM-only or ATSM-plus services). In the SMART-Steps Program ONLY model, patients will respond to a rotating set of questions on self-care, psychosocial aspects of care, and receipt of preventive services. Patients with an answer that is "out of range" on an item receive an immediate automated health education message. Patients with an answer "significantly out of range" receive the automated message plus a followup person-to-person call from an SFHP care manager. In addition to those services, the SMART-Steps PLUS model has supplementary phone communications from the ATSM care manager to the patient triggered by data derived from pharmacy claims and a diabetes registry. These calls further activate patients with respect to medication adherence and/or intensification based on clinical criteria developed by a clinical advisory board.

To measure how patient-centered the care is, the team is conducting patient surveys to analyze outcomes such as perspectives on the structure of their care and the interpersonal processes of care. To analyze patient safety, the team is exploring characteristics of adverse events: triggers, frequencies, their nature, preventability and/or ability to be ameliorated, and clinician awareness. To analyze effects of the intervention on relevant metabolic and clinical process and outcome measures, the team is using electronically available clinical and administrative data.

**Specific Aims**

- Measure the effects of a Medicaid health plan-directed ATSM on patient-centered outcomes among ethnically diverse health plan enrollees with diabetes. **(Upcoming)**
- Explore whether combining ATSM with an additional patient-directed health information technology innovation—a medication activation communication strategy triggered by pharmacy claims data—yields differential effects on patient-centered outcomes compared to ATSM alone. **(Upcoming)**
- Quantify and characterize patient safety events triggered and/or identified through active surveillance among ATSM participants. **(Upcoming)**
- Measure differences in the frequency and nature of patient safety events among participants receiving ATSM-only versus ATSM-plus medication activation. **(Upcoming)**
- Explore the effects of ATSM interventions on Healthcare Effectiveness Data and Information Set (HEDIS)-relevant metabolic and clinical process and outcome measures when compared to usual care. **(Upcoming)**
- Explore whether ATSM-plus medication activation is superior to ATSM-only with respect to HEDIS-relevant metabolic and clinical process and outcome measures. **(Upcoming)**

**2009 Activities:** As participant enrollment by the SFHP continues, Dr. Schillinger is on track to meet project goals for the coming year of enrolling 200 SFHP members with diabetes into the SMART-Steps Program, and obtaining informed consent to perform detailed, baseline telephone interviews in three languages (English, Spanish, and Cantonese) with at least 150 of these SFHP members as part of the University of California, San Francisco (UCSF) evaluation of patient-centered outcomes. These data are being entered into a UCSF computer assisted telephone interview instrument, so as to enable real-time reporting of SFHP and UCSF recruitment efforts and enable preliminary cross-sectional interim analyses.

As a result of substantial pre-enrollment efforts, SMART Steps has had a tremendous enrollment success rate. The total number of participants enrolled in SMART Steps as of December 1, 2009 is 261. This includes 147 Cantonese, 74 English, and 40 Spanish speaking enrollees. Of these, 252 have agreed to partake in the UCSF evaluation: 140 Cantonese, 75 English, and 35 Spanish speaking participants. Of these, 197 baseline interviews (78 percent) have been completed. These include 124 Cantonese, 47 English, and 26 Spanish speaking enrollees. A total of 17 followup interviews have been completed (6.7 percent). These interviews are now being conducted using the computer-assisted telephone interview.

The grantee is working closely with SFHP outreach and care management staff in a consultative and supportive role to: perform quality assurance monitoring of care manager efforts; facilitate communication between SFHP staff and community provider sites; ensure accurate interpretation of daily and weekly data reports; and to promote secure monthly data exchange between the Community Health Network diabetes registry and the SFHP staff, allowing SFHP to identify potentially eligible SFHP members. The grantee is also monitoring SFHP's efforts to use the database to monitor fidelity to 1) the randomization and wait-listing procedures intrinsic to the quasi-experimental design as well as 2) the care management protocols in both intervention arms of SMART-Steps.

Dr. Schillinger's team plans to perform detailed analyses of the claims-based data collected by SFHP to enable development of consistent methods to accurately characterize measures related to monthly refill nonadherence. This will enable future analysis of the effects of the SMART-Steps PLUS medication intensification arm relative to SMART-Steps ONLY arm. The team also plans to perform real-time assessments of potential and actual adverse events identified through the surveillance function of the SMART-Steps program, again to enable the future analysis of the effects of the SMART-Steps PLUS medication intensification arm relative to SMART-Steps ONLY arm on patient safety. They will also

begin a pilot process related to root cause analysis work that will be undertaken with a subset of SMART-Steps patients and primary care physicians.

The team has now initiated data analysis to determine best measures for fidelity assessment.

**Preliminary Impact and Findings:** No findings to date. Findings related to specific aims will be analyzed in the final year of the grant.

**Selected Outputs**

Handley MA, Shumway M, Schillinger D. Cost-effectiveness of automated telephone self-management support with nurse care management among patients with diabetes. Ann Fam Med 2008 Nov-Dec;6(6):512-8.

Ratanawongsa N. Using Health IT to Triangulate the Contributions of Patient Preferences, Non-Adherence and Need For Treatment Intensification in the Achievement of Diabetes Goals in a Vulnerable Population. Poster session presented at AHRQ Annual Meeting; 2009 September 14-16: Washington DC.

Sarkar U. Applying Automated Telephone Technology to Safety Surveillance. Paper session presented at Third National Leadership Summit on Eliminating Racial and Ethnic Disparities in Health. Office of Minority Health, U.S. Department of Health and Human Services; 2009 February 25-27: National Harbor, MD.

Sarkar U, Handley MA, Gupta R, et al. Use of an interactive, telephone-based self-management support program to identify adverse events among ambulatory diabetes patients. J Gen Intern Med 2008 Apr;23(4):459-65.

Schillinger D, Hammer H, Wang F, et al. Seeing in 3-D: examining the reach of diabetes self-management support strategies in a public health care system. Health Educ Behav 2008 Oct;35(5):664-82.

Schillinger D, Handley M, Wang F, et al. Effects of self-management support on structure, process, and outcomes among vulnerable patients with diabetes: a three-arm practical clinical trial. Diabetes Care 2009 Apr;32(4):559-66.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** SMART Steps has had a very successful enrollment so far, and the grantee is on track to meet project goals for the coming year. The grantee will be on track in terms of spending, pending approval of a planned no-cost extension application. Dr. Schillinger is working in consultation with AHRQ on plans for completion of the project.

**Milestones:** Progress is mostly on track.

**Budget:** Significantly underspent, more than 20 percent.

**AHRQ Priority Population*

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| **Project Title:** | Enabling Sleep Apnea Patient-Centered Care via an Internet Intervention |
| **Principal Investigator:** | Stepnowsky, Carl, Ph.D. |
| **Organization:** | Veterans Medical Research Foundation |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017246 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,155,062 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Sleep Apnea

**Summary:** Poor treatment adherence with continuous positive airway pressure (CPAP) therapy is well-documented. This project develops and evaluates an integrated remote monitoring device and Internet-based portal for patients with obstructive sleep apnea (OSA) syndrome who are prescribed CPAP treatment. This project evaluates the intervention's effect on patients' experience of care, CPAP adherence, and OSA outcomes.

OSA is a common sleep apnea caused by obstruction of the airway and is treated with a CPAP flow generator, which is a machine that blows air at a physician-prescribed pressure into a facemask or nasal pillow. The team is using the ResMed developed Restraxx Data Center (RDC), a Web site that obtains data from the CPAP flow generator via a wireless monitoring module that affixes directly to the CPAP unit. The objectively measured adherence data from the RDC will be transmitted to both patient and provider and used as the central outcome measure to evaluate the intervention. The provider portal contains information including: 1) adherence, 2) amount of air leaking, and 3) number of apneas/hypopneas per hour. With this information, the provider can continuously monitor the patient's progress and make ongoing decisions about how to support the patient and/or alter his/her treatment plan.

The team organizes the data provided by the RDC into user-friendly pieces of information provided to the patient through the Internet Positive Airway Pressure (i-PAP) patient portal. In addition, to monitor the automatically-generated indicators, the portal contains tailored measures that the patients can observe and allows the patient to add self-defined measures. The i-PAP patient portal contains a learning center with information on sleep apnea and the CPAP device; charts that provide objectively measured adherence and efficacy data, and self-tracked changes in weight, sleepiness, physical activity, and other user-defined factors over time; self-assessment materials, including research surveys and a journal for self-documentation; a message board with a support network for CPAP users; and links to external sources of additional information on sleep apnea.

The project is conducting a randomized controlled clinical trial to evaluate the effects of the interactive portion of the CPAP treatment. Both the usual care group and the i-PAP patients will be provided with CPAP devices and education materials on OSA. The trial will evaluate the effect of having the Internet-based portal to facilitate the flow of information and communication between providers and patients in addition to the CPAP device. The team will evaluate whether the i-PAP intervention has an effect on OSA-related outcomes, CPAP adherence, patient-centeredness of care, patient assessment of and

satisfaction with care, and patient activation. In addition, the team will evaluate the possible mechanisms that account for those impacts using indicators such as use of the Web site and frequencies/nature of clinical contacts.

**Specific Aims**

- Examine the effect of the i-PAP intervention compared to usual care on the patient's experience of the quality of patient-centered, collaborative care. **(Ongoing)**
- Examine the effect of the i-PAP Internet intervention compared to usual care on the level of CPAP adherence. **(Ongoing)**
- Examine the effect of i-PAP compared to usual care on obstructive sleep apnea outcomes. **(Ongoing)**
- Perform a basic cost analysis of the i-PAP intervention compared to usual care, applying a micro-cost methodology of measuring the quantity of inputs used in the production of care and the unit cost of each. **(Ongoing)**

**2009 Activities:** The development of the user interface, determination of the navigation process through the i-PAP, and development of the i-PAP portal functionalities supporting the online assessment were completed. The Web site has been functioning throughout the period and has moved from a text-based to a more user-friendly Web site, the Web portal's layout was simplified, and the CPAP troubleshooting process was automated.

The study team monitored various factors that affect recruitment and enrollment and established contingency plans. The resulting recruitment of patients was steady and on track. Analysis of data for compliance with the Web-based assessment began.

**Preliminary Impact and Findings:** Preliminary findings from the team's review of sleep apnea and CPAP Web sites identified more than 90 Web sites and coded 49 of them for descriptive and evaluative variables. The project team is reviewing the information for type of interactivity. Preliminary findings suggest that less than 5 Web sites had any interactive content, and only one had graphical interactive content. Preliminary findings regarding compliance indicate that even patients who are engaged in the clinical aspect of the project are not as compliant with the Web-based assessment as would have been expected. The study team is expecting to implement strategies to improve 25 percent attrition rates.

**Selected Outputs**

Bonjean M, Stepnowsky C, Dang-Vu TT, et al. Sleep medicine and sleep disorders. In: Carlstedt R, editor. Handbook of integrative clinical psychology, psychiatry, and behavioral medicine: perspectives, practices and research. New York: Springer Publishing; 2010. Chapter 6.

Stepnowsky C, Bonjean M. An ehealth approach to the management of chronic sleep disorders. In: Carlstedt R, editor. Handbook of integrative clinical psychology, psychiatry, and behavioral medicine: perspectives, practices and research. New York: Springer Publishing; 2010. Chapter 28.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The study team is considering a no-cost extension because of delays in previous years.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

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| **Project Title:** | Patient-Centered Online Disease Management Using a Personal Health Record System |
| **Principal Investigator:** | Tang, Paul, M.D. |
| **Organization:** | Palo Alto Medical Foundation |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care (PCC) through Health Information Technology |
| **Grant Number:** | R18 HS 017179 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,158,401 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*, Diabetes

**Summary:** Patient-centered care is an ideal for American health care in the 21st century. Diabetes is a major, growing, and costly chronic disease in the United States. Yet implementation of recommended diabetes care is suboptimal and inconsistent for a sizable proportion of affected Americans. In an effort to reduce these treatment and adherence gaps in diabetes care, this study is evaluating a Customized, Continuous Care Management (CCCM) program that actively supports a partnership between the patient and his/her multidisciplinary care management (CM) team via an online disease management (ODM) system. The ODM system will be integrated with a comprehensive electronic health record (EHR) system that includes a personal health record and secure patient-clinician messaging capabilities. The CCCM program, based upon effective, evidence-based CM strategies, creates an ODM system that is fully integrated with a leading, commercially-available EHR product. This program will provide a blueprint for instituting CCCM for many different chronic conditions in a range of ambulatory care settings.

The CM team includes a nurse diabetes care coordinator, a clinical pharmacist, a nutritionist, and the patient's physician(s). The ODM system is integrated with Epic Systems' EpicCare, a comprehensive, Certification Commission for Health Information Technology-certified EHR system. Patients of the Palo Alto Medical Foundation (PAMF) have access to an integrated personal health record (PHR), PAMFOnline, which is a customized version of Epic Systems' MyChart PHR. PAMFOnline provides patients with: a health summary from their EHR (diagnoses, medications, allergies, laboratory test results with physician annotations, immunizations, and a health maintenance schedule); physician-endorsed information resources about health topics; the ability to request a prescription renewal or appointment; a list of pending appointments and laboratory orders; and private notes, which patients enter themselves and are not visible to the clinical staff. In addition, patients can communicate electronically with their health care team.

The Engaging and Motivating Patients Online With Enhanced Resources—for Diabetes study applies ODM tools to support patients with type 2 diabetes. Using a specially-designed wireless adaptor that attaches to their glucometer, patients can wirelessly upload their glucometer readings to their PHR from anywhere. Once logged on to PAMFOnline, they can view the information graphically and correlate their glucose trends with other information about their health behavior (e.g., diet, exercise, medication use). Working from a shared action plan developed specifically for each individual, the patient works with the

CM team, primarily via online communication, to adjust medications or make further lifestyle changes. Custom-tailored "nuggets" of patient education and advice are "dispensed" to a patient based on his/her specific clinical situation (e.g., responding to uploaded glucose readings, nutrition logs, test results, or patient questions). These "nuggets" can be personalized text, videos, graphs, or hyperlinks on topics such as hypoglycemia, controlling food portions, and exercise. The project team also provides a diabetes summary report that consolidates all of a patient's relevant diabetes information into a single report. Importantly, the report correlates the patient's specific action plan with their risk of major complications (e.g., stroke, kidney failure, heart attack, blindness) from diabetes.

The project team is evaluating the ODM program for diabetes as compared to usual medical care in a two-arm, randomized, controlled trial (RCT) at PAMF. For inclusion in the trial, patients must have inadequately-controlled type 2 diabetes, defined as hemoglobin A1c (HbA1c) greater than 7.5 percent, and be without severe complications. The primary hypothesis under evaluation is that patients in the intervention arm will have lower HbA1c at 12 months post-randomization than those receiving usual medical care. Secondary hypotheses are that, compared with usual medical care, the intervention will be associated with: improved self-management practices (e.g., medication adherence, home monitoring of glucose and blood pressure, healthy diet, and regular exercise); improved biologic measurements such as blood pressure and lipids; better processes of care (e.g., frequency of monitoring tests); lower cardiovascular risk; enhanced patient experience and satisfaction with care; and improved patient psychosocial well-being. These measures will be assessed in both groups by laboratory testing, EHR data extraction, and an online questionnaire at baseline, 6 months, and 12 months post-randomization.

**Specific Aims**

- Refine the Personalized Health Care Program platform with a particular focus on enhancing the customization capability of the ODM system and ensuring a seamless incorporation of ODM into the workflow of clinicians on the CM team and with the self-management process of patients. **(Achieved)**
- Evaluate the ODM program for diabetes relative to usual medical care, in a two-arm RCT. **(Ongoing)**
- Disseminate results of the RCT in the scientific literature, and deploy the PHCP program in PAMF and other ambulatory care settings for use with diabetes and other chronic conditions. **(Upcoming)**

**2009 Activities:** The project team implemented a revised recruitment process to compensate for the low number of eligible patients due to better-than-expected control of diabetes. The project team significantly improved recruitment rates and timely completion of online surveys. This increased efficiency and yield of the team's efforts had resulted in the project reaching its recruitment goal. The project team also saw increases in patient completion of the 6-month followup questionnaire as well as interaction with the research assistant.

**Preliminary Impact and Findings:** Beta tests showed that patients valued their relationship with the nurse diabetes care coordinator and the comprehensive patient-specific risk information in the diabetes summary report, and found online messaging a convenient, efficient alternative to phone calls. Patients commented that manual entry of glucometer and health behavior data provided valuable insights about changes in glucose readings in relation to their dietary intake and physical activity. Following the initial learning period, they valued the efficiency gained through wireless uploading of glucose readings, which made it easier for them to sustain measuring and uploading readings on a regular basis.

**Selected Outputs:**

The project does not have any reported outputs to date.

**Grantee's Self-Reported Quarterly Status (as of December 2009):** The project has resolved recruitment issues and is making progress on data collection. They anticipate requesting a no-cost extension to complete the work based upon a revised schedule.

**Milestones:** Progress is mostly on track.

**Budget:** Spending roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Using an Electronic Personal Health Record to Empower Patients with Hypertension |
| **Principal Investigator:** | Wagner, Peggy J., Ph.D. |
| **Organization:** | Medical College of Georgia |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017234 |
| **Project Period:** | 09/07 – 08/11, Including No Cost Extension |
| **AHRQ Funding Amount:** | $1,181,369 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*, Hypertension

**Summary:** Patient- and family-centered care (PFCC) represents a new paradigm for health care delivery, where patients and their families take an active role in health care management and decisionmaking. Evidence shows that PFCC improves outcomes, including reduction of medication errors, increased compliance, and better disease management. Implementation of patient-centered care in the ambulatory setting remains elusive for most U.S. clinical practices. An electronic personal health record (ePHR) helps overcome barriers to adoption of PFCC by maximizing patient-clinical collaboration, self-management, and related health outcomes.

The project examines the feasibility, acceptability, and impact of an ePHR for patients with hypertension. The project is using the Cerner Health ePHR, under the Medical College of Georgia (MCG), My HealthLink. To foster personal wellness and chronic condition management, My HealthLink allows consumers to log entries into their ePHR, track progress against their customized care plan, complete health assessments, securely communicate with their provider, access health education content, and check for interactions between medications.

The project team incorporated the experiences, perspectives, and insights of patients and their families in the design of the ePHR. The team enrolled patients from the MCG Medical Center and conducted two iterative pilot beta tests to evaluate the modified ePHR. Each beta-test session had participants use the ePHR for 2 weeks. Subsequently, the project team conducted acceptability interviews and identifying themes from the feedback received. Throughout this process, the project team has worked with Cerner to modify the ePHR. Once the modifications suggested by the beta-test participants are fully incorporated, the project team will conduct a clustered, randomized, controlled trial to compare a group using My HealthLink with those receiving usual care. The team will evaluate the effectiveness of My HealthLink through questionnaires and biological measurements, including: patient activation and perception of care; biological markers, specifically blood pressure, body mass index, and lipid levels; collaborative patient-physician communication; congruence of medication treatment with guidelines; and frequency-of-use of medical services. The team will also evaluate, via surveys and in-depth interviews, physician and staff perceptions of the ePHR and toward patient- and family-centered practices.

**Specific Aims**

- Improve the application of PFCC elements in an existing ePHR system. **(Achieved)**
- Implement and test the effectiveness of the revised ePHR (My HealthLink) with patients who are being treated for hypertension by a team of physicians, mid-level practitioners, nurse clinicians, and support staff in two ambulatory settings. **(Ongoing)**
- Monitor the shift in provider and support staff awareness and incorporation of PFCC concepts as a result of the implementation of the ePHR. **(Ongoing)**

**2009 Activities:** Four additional physicians were recruited from Family Medicine and randomly assigned (three to the intervention group; one to the control group). Two issues of a study newsletter were developed and distributed. The newsletters highlighted physician participation in the study, provided tips and preliminary results to gain interest, and encourage participation by enrolled physicians.

In response to a slower-than-expected subject enrollment and a subsequent review of statistical power and sample size, the total anticipated sample for the study was reduced from 720 to 460 patients. This 36 percent reduction in sample size produces a 12 percent reduction in the standardized effect size. A total of 356 patients were enrolled during this period. By the end of 2009, a total of 450 subjects were enrolled in the study, with 246 subjects enrolled in the control group (86 males, 160 females) and 204 subjects enrolled in the intervention group (50 males, 154 females).

Subject followup began between December 29, 2008, and January 5, 2009, in each participating clinic. There were 340, 274, and 181 subjects who returned for their second, third, and fourth followup, respectively. Attrition during this period remained low.

A no-cost extension was requested and granted, extending the project end date to August 2011.

**Preliminary Impact and Findings:** No impacts or findings have yet been reported.

**Selected Outputs**

Institutional PFCC survey: measures perceptions of patient- and family-centered care.

Internet Accessibility Questionnaire: measures computer experience, access, and Internet usage.

ePHR Tri-Fold: a tutorial highlighting the portions of the ePHR expected to have the highest utilization rate.

ePHR User Manual: an owner's guide to My HealthLink, including screen shots and detailed instructions.

Sodomka, P. Design of Patient-Centered Care Health IT: Patient Advisor Involvement in ePHR Design and Outcomes Research. Presentation at the Annual Conference of the Agency for Healthcare Research and Quality, 2008 September 7-10; Bethesda, MD.: (PowerPoint® File; Web Version).

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project has requested a no-cost extension and is revising its workplan and timeline to reflect their milestones as on track.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Somewhat underspent, approximately 5 to 20%.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Using Information Technology for Patient-Centered Communication and Decisionmaking about Medications |
| **Principal Investigator:** | Wolf, Michael, Ph.D. |
| **Organization:** | Northwestern University |
| **Mechanism:** | RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC) |
| **Grant Number:** | R18 HS 017220 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,199,997 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of transitions across care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults

**Summary:** Medication errors are a major source of patient injury, hospitalization, and death. Medication management in primary care is extremely complicated, given the continually expanding array of available therapies, fragmentation of care, proliferation of information sources, and numerous obstacles experienced by patients (e.g., cost). This study integrates interventions that target patients, providers, and the overall practice system in an effort to improve the medication management process.

The overarching objective of this multicomponent intervention is to develop a protocol to reconcile medications through the phases of the patient-provider clinical encounter. The project provides patient education materials and medication lists automatically extracted from the Certification Commission for Health Information Technology-certified Epic Systems' electronic medical record (EMR), EpicCare. Patients receive the materials as they check into the multispecialty primary care center for their physician visit. Patients then review the medication information contained within the system, indicating if there are any discrepancies or if they have any related questions or concerns. The nurse reviews patient-provided information and places the output into the rooming sheet for the physician. The system encourages physicians to engage in shared decisionmaking by including prompts for eliciting questions and concerns as well as tailoring treatment plans to match patients' needs and abilities. The physician will then clarify any issues with the patient, update the patient's medication list in the EMR, and if prescribing a new medication, the system will automatically generate a plain-language medication information sheet for the patient. The information sheet is automatically generated through project-developed "dot phrases" (system macros that automatically fill in descriptive text prompted by key words) in the EMR, an enhancement to the existing functionality of the Epic EMR.

The clustered, controlled clinical trial will be randomized at the "pod" level, as the clinic is organized into four areas (pods) with separate nursing staff and physicians. Through the postvisit interviews and data extracted from the EMR, the project will measure outcomes such as postvisit discrepancies in the medication list and the patient's functional understanding of their medication regimen, questions on adherence and safety, as well as a series of process measures to assure that the intervention is translatable to other organizations.

**Specific Aims**

- Develop and test a multimedia program (which has been since revised to an educational print piece) to help patients understand the importance of both giving and receiving accurate information about medications (previsit patient intervention). **(Ongoing)**
- Use the EMR to encourage patient-centered medication management and extend the EMR medication management capability by training nurses to engage in a patient-centered review of current medications immediately before a patient sees the doctor. Leverage the EMR by developing a template that physicians can easily access and display on-screen to engage in a patient-centered discussion about new medications under consideration. **(Ongoing)**
- Work with the practice-based research network to disseminate and track the use of effective interventions, and create pathways for facilitating National distribution to other practices. **(Upcoming)**

**2009 Activities:** Two patient focus groups were held to gain insight into both the medication information sheets and the content of patient printed materials. Physicians participating in the pilot tests were trained for their role in the intervention. Similarly, nurses were trained on their role of reviewing patients' medication lists and relaying information to the physicians for the study intervention. Pilot tests were run and the study team met with clinical teams to obtain feedback on the pilot test and suggestions on the print materials created for the intervention.

Through working group meetings that included physicians and nurses from the clinical practice, the study team concluded that the best way to engage patients is to have a copy of the medication list printed out from the EMR as the patients check in and to have them read over and edit the list while waiting for their appointment. The team tested a version of this printed medication list during the first pilot test and made modifications based on the feedback from patients, physicians, and nurses. The finalized version has instructions for the patients to cross out any medications they are not taking, check off whether the instructions are listed correctly, and provides a place to list concerns the patient may have about the medication that they want to discuss with the doctor. Nurses review medication lists with the patients and clarify any problems the patient may have, and leave the lists for the physician. The physician uses the medication list to review the patient's medications and can update the EMR easily. This protocol was tested and no problems were found in the process. Data collection for the baseline data was completed by interviewing 200 participants. The data was analyzed and a preliminary report was given to members of the research team.

**Preliminary Impact and Findings:** The baseline data collection was completed and the data have been analyzed. Preliminary findings showed that 50 percent of participants indicated a medication discrepancy where at least one medication on their medication list was one that the patient was not actually taking. Another 50 percent indicated that they were taking a medication on the printout in a manner differently than it was listed. Thirty-five percent of patients indicated they were taking an over-the-counter or prescribed medication that was not listed. Of the medication taken but not listed, 5 percent was prescribed medication.

**Selected Outputs**

The team has developed prototype print materials to support patients' ability to engage in a medication review and reconcile medications at the time of the encounter.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December, 2009):** The project is in the data collection and analysis phase.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is somewhat underspent, 5 to 20 percent.

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| **Project Title:** | Using Precision Performance Measurement to Conduct Focused Quality Improvement |
| **Principal Investigator:** | Baker, David, M.D. |
| **Organization:** | Northwestern University |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017163 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,199,415 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*, Diabetes, Health Disease, Hypertension

**Summary:** Measures that depend on data collected for administrative purposes inevitably have inaccuracies at the individual patient level. Patients may fail a quality measure because they were incorrectly considered to be eligible or because they truly met the measure but appropriate data were not captured. As a result of these limitations, quality benchmarks are typically far less than 100 percent. The gap between the benchmark and 100 percent is attributed to unidentified exceptions, patient preferences, or measurement error. Thus, the true failure rate for recommended tests or therapies remains obscured. While these kinds of measurements permit valid comparisons—e.g., across health plans—imprecise measurement methods can never be the foundation for a health care system that delivers near 100 percent high-quality care for chronic disease care and prevention. Quality measurement needs to be embedded within electronic health record (EHR) systems and become dynamic, accurate, and detailed to support the highest level of care possible for all patients.

This project creates systems that allow clinicians to capture reasons for not providing care as part of point-of-care clinical decision support reminder systems, improve data quality, and seamlessly link data to practice-level quality improvement programs and point-of-care interventions. The project uses previously developed quality measurement programs that examine EHR data to measure quality of care for coronary artery disease, heart failure, diabetes, hypertension, and preventive services. This study began at a large academic internal medicine practice and is now being implemented in four community practices that use the same Certification Commission for Health Information Technology-certified EHR, Epic (version Spring 2007).

Exception codes are being introduced into the EHR for 18 National quality measures. Data are extracted from the EHR every month to assess changes in the primary outcome: the proportion of eligible patients who do not satisfy a measure and do not have any exclusion criteria documented. The statistical significance of changes will be assessed with time series analysis. In addition, physicians will be repeatedly surveyed on their attitudes toward the interventions described in the aims listed below. Outcomes of the quality improvement activities will be monitored along with the costs of the intervention. This study will produce computerized tools and educational materials that can be provided to more than 1,000 sites that use the Epic ambulatory product.

**Specific Aims**

- Integrate simple, standard ways for clinicians to document patient reasons or medical reasons for why quality measures are not met and assess the use of these exception codes, the impact of exception reporting on measured levels of quality, and the impact of using these codes on physician satisfaction and self-reported efficiency. **(Ongoing)**
- Use the exception codes (patient reasons and medical reasons) that clinicians enter to target three forms of quality improvement, including: 1) peer review of all medical reasons for not adhering to guidelines followed by academic detailing if a clinician enters an unjustified reason for not following guidelines; 2) counseling for patients whose physician enters an exclusion code stating that the patient cannot afford a needed medication to determine ways of overcoming barriers; and 3) educational outreach to all patients who refuse recommended interventions (e.g., colorectal cancer screening), including mailing of plain-language health education materials or DVDs. **(Ongoing)**
- Provide clinicians with highly accurate information on patients' quality deficits immediately prior to their visit as part of routine workflow and assess whether this intervention increases provision of recommended therapies/tests and documentation of exclusion codes. **(Ongoing)**

**2009 Activities:** Analysis of the exception reporting and outreach from the first year of the project was completed. A paper describing the medical exception review and feedback has been drafted and submitted for publication. Implementation at the second site presented challenges, which slowed study progress. At the site administration's request, a set of alerts for diabetes and for asthma was added. Challenges with the programming of the quality measures and the feedback tools for providers persisted during this time but have now been met and the intervention is under way.

**Preliminary Impact and Findings:** For the first aim, the primary outcome of ten measures improved more rapidly the year after implementation than during the prior year ($p<0.001$ for 8 measures, $p<0.05$ for 2). For four other measures, quality improved, but the rate of improvement did not differ significantly from the year prior to the intervention. One measure improved at a significantly slower rate and the performance of mammography declined due to new barriers to access at the study site. Improvements resulted from increases in patients receiving the service, documentation of exceptions, or a combination of both. By the end of the first year, for five drug prescribing measures, over half of physicians achieved 100 percent performance.

For the second aim, through 2008, 6.5 percent of the quality reviews identified an issue requiring feedback from an investigator to a clinician, who then entered a medical exception. In patient outreach, the majority of patients do not want to talk about their refusal. Of all patients, 13.5 percent eventually completed a test or medication they originally declined.

**Selected Outputs**

The project team presented live demonstrations or summaries of the project tools to the Northwestern Medical Faculty Foundation (NMFF) Board of Directors, the NMFF Information Technology Leadership Committee, and the Evanston Northwestern Healthcare Department of Family Medicine Faculty Meeting.

Baker D. Use of information technology for precision performance measurement and focused quality improvement. Presentation at the Annual Conference of the Agency for Healthcare Research and Quality, 2008 September 8; Bethesda, MD.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Challenges to implementation at the second clinical site delayed study progress. Because of these challenges, the study

team expects to request a no-cost extension to allow adequate time for analysis and preparation of manuscripts.

**Milestones:** Progress is mostly on track.

**Budget:** Project is somewhat underspent, approximately 5 to 20 percent.

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**AHRQ Priority Population.*

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| **Project Title:** | Enabling Electronic Prescribing and Enhanced Management of Controlled Medications |
| **Principal Investigator:** | Carrow, Grant, Ph.D. |
| **Organization:** | Massachusetts State Department of Public Health |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017157 |
| **Project Period:** | 09/07 – 09/10 |
| **AHRQ Funding Amount:** | $1,199,794 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Implementation and Use

**Target Population:** Adults

**Summary:** The goal of this project is to foster the safe and productive adoption of electronic prescribing (e-prescribing) of federally controlled substances. The project examines the adoption and diffusion of e-prescribing to improve medication management by ambulatory care clinicians at the point of care. It is also contributing to discussions about expansion of e-prescribing to cover federally controlled substances (e.g., narcotics, stimulants, sedatives), particularly for patients with chronic medical conditions who are being treated with such substances, and the potential for e-prescribing to reduce the risks of prescription fraud and drug diversion. The aims of the project are being acheived through the design, implementation, and evaluation of a safe, secure, and efficient system for electronic transmission of controlled substances prescriptions. As a result, these efforts are helping to inform the U.S. Drug Enforcement Administration (DEA) as it implements the recently promulgated Interim Final Rule (75 FR 16236) governing the electronic prescribing of controlled substances.

The project team is partnering with health information technology solutions providers, DrFirst, Inc., and Emdeon eRx Network to design, implement, and field test a system for e-prescribing controlled substances in a contained ambulatory care environment. Concurrently, the project is developing and testing an interface between e-prescribing system data and Massachusetts Prescription Monitoring Program (PMP) data to monitor nonmedical use and abuse of federally controlled medications, while supporting enhanced patient-clinician communication, medication access, and safety of patients with chronic medical conditions.

**Specific Aims**

- Develop, implement, and verify a system of safe and secure electronic transmission of prescriptions for federally controlled substances in an ambulatory care setting. **(Ongoing)**
- Develop and test the interfacing of this e-prescribing system with the Massachusetts PMP to monitor prescription fraud and nonmedical use of controlled medications, while supporting enhanced patient-clinician communication, medication access, and safety of patients with chronic medical conditions. **(Ongoing)**

- Conduct systems process and outcomes evaluations of the improvements to patient care, risk reduction, patient and clinician benefits, patient safety, and information privacy and confidentiality that are expected as a result of this system. **(Ongoing)**
- Develop and implement a plan for dissemination of findings. **(Ongoing)**

**2009 Activities:** The major focus of the project during 2009 was to establish the technical requirements for end-to-end transmission of electronic prescriptions for controlled substances (EPCS). This involved both technical testing and security assessment. Other activities included provider and pharmacy recruitment, orientation, and training; a baseline survey of prescribing providers focusing on their use of e-prescribing and perceptions of EPCS; and work with MassHealth, the Massachusetts Medicaid program, to ensure reimbursement to participating pharmacies for electronically transmitted controlled substance prescriptions.

The first controlled-substance e-prescription was successfully transmitted from a Berkshire Health Systems provider to a local pharmacy in a pilot test on September 14, 2009. Additional providers and pharmacies were activated in November 2009. At that time, an error occurred when an electronic transmission of one renewal for a controlled substance was transmitted without the use of the required Cryptokey (hard token). This triggered the project team's EPCS Critical Incident Examination and Response Process. EPCS transmissions were suspended until the cause of the event was identified and corrected. Transmissions resumed on January 21, 2010.

The project's principal investigator and project manager met with the DEA to discuss the effect that new regulations (to be released in 2010) might have on the project. It was decided that the project team will be granted a period of time after the regulations are released to bring the project into compliance.

**Preliminary Impact and Findings:** Between January and May 2009, the project team conducted a survey of prescribing providers to provide a baseline for assessing the impact of EPCS and to discover implementation issues. Of the 246 prescribers who responded (a 64 percent response rate), 43 percent of respondents currently use e-prescribing for non-controlled substances. Controlled substances comprised 25 percent of the prescriptions. The functions of e-prescribing software most often used were to review prescribing history, respond to drug interaction alerts, and make automated refills. In general, the results indicated that while EPCS can improve the quality and efficiency of care by decreasing errors, concern about the burden associated with safety features, including the use and sole possession of a hard token, may slow adoption.

Surveys about potential third party payer reimbursement issues were conducted among major medical carriers, Medicare, Medicaid, and major Pharmacy Benefit Managers. It was determined that third party payers will reimburse pharmacy claims for controlled substances that are electronically prescribed. The insurance industry appears to be ready for EPCS, and reimbursement for covered claims will not be a barrier to implementation.

An initial assessment of the prescription information transmitted to the Massachusetts PMP by the pharmacy information systems revealed that a unique prescription identifier number will be needed to accurately reconcile prescription information received from the pharmacies' and the providers' software. As a consequence, the Massachusetts Department of Public Health (MDPH) worked with the American Society for Automation in Pharmacy (ASAP) to determine if a unique prescription identifier number could be added to the standard. While there is currently no means of transmitting this unique number from the pharmacies (as it is not in the ASAP standard), an interim solution utilizing a spare field was identified for purposes of the project. Discussions between MDPH and ASAP resulted in ASAP's inclusion of a field in its January 1, 2010 release of Version 4.10 Standards Update to accommodate a Transaction Control Number that will be common to e-prescribing application software products in the future.

**Selected Outputs**

Agency for Healthcare Research and Quality National Teleconference on Medication Management Enabling e-Prescribing of Controlled Substances, August 27, 2009, Grant Carrow, PhD.

National Medical Report (PBS), Taped a segment about Innovations in Health Information Technology, September 9, 2009, Richard Sage, Vice President, Clinical Services, eRx Network, an Emdeon company.

AHRQ National Conference, Poster Presentation Enabling e-Prescribing of Controlled Substances, Bethesda, MD, September 13-16, 2009, Cindy Thomas, PhD, Grant Carrow, PhD, Stephen Kelleher, MHA, FACHE, and Peter Kaufman, MD.

Health Information and Management Systems Society (HIMSS) e-Prescribing Work Group Teleconference Update on the Enabling e-Prescribing of Controlled Substances Project, November 10, 2009, Michael Blackman, MD, Chief Medical Information Officer, Berkshire Health Systems, Inc.

National Council for Prescription Drug Programs (NCPDP), NCPDP Script Work Group Meeting, New Orleans, LA, November 11, 2009, Richard Sage, Vice President for Clinical Services, eRx Network, an Emdeon company.

White Paper: EPCS Critical Incident Examination and Response Process—Describes an orderly process of action to be taken in managing any unexpected event, regardless of severity.

White Paper: Pre-deployment Risk Analysis and System Design Review—A security review of the DrFirst and eRx Network IT systems design conducted by the Global Sage Group (GSG), the IT Security Evaluator, using as a benchmark the fraud scenarios in Section VII of the 9/18/2008 Memorandum of Agreement between the DEA and MDPH.

Assessment Tool: A list of 224 evaluative criteria developed by GSG that could be applied in the assessment of controlled substance components of electronic prescribing systems. The criteria are based on the Federal Information Security Management Act Acceptable Risk Safeguards and National Institute of Standards and Technology Special Publication 800-53.

Pharmacy Issues Log: A tool to collect qualitative information on pharmacy issues that arise with the use of manual prescriptions of controlled substances.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** A 6-month restriction on Year 2 funds was lifted in April 2009. While significant progress was made on technical work, additional work is required to bring the project back on track.

**Milestones:** Project is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

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| **Project Title:** | Impact of Office-Based E-Prescribing on Prescribing Processes and Outcomes |
| **Principal Investigator:** | Fischer, Michael, M.D. |
| **Organization:** | Brigham and Women's Hospital |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017151 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,199,007 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Synthesis and Dissemination

**Target Population:** General

**Summary:** Suboptimal prescribing practices in current systems of care delivery in outpatient settings can result in errors and excessive costs. Electronic prescribing (e-prescribing) is a technology that allows prescribers to write prescriptions electronically. The Medicare Modernization Act set goals for the uptake of e-prescribing across the country and private coalitions have stepped forward to encourage the adoption of e-prescribing through the use of financial incentives. For this to occur, effective e-prescribing systems must have utility for prescribers and must be integrated into the workflow of routine medical practice. For e-prescribing to improve quality and safety, it must have valid and usable decision support capabilities and be available at point of care.

The primary aim of this study is to evaluate the implementation of an e-prescribing system in ambulatory settings. ZixCorp's PocketScript system is currently used in a large number of practices in Massachusetts, New Jersey, Pennsylvania, New York, North Carolina, California, and Louisiana, providing a large study population with diverse practice types (e.g., pediatric, adult primary care, family practice, and specialty offices), locations (urban, suburban, and rural), and sizes (from single-physician practices to groups of more than 20 providers). This study will evaluate the full spectrum of e-prescribing. The project has an active partnership with the developers of the office-based e-prescribing system and with multiple insurance companies and public programs that will provide claims data.

The project is being conducted in three phases. The first phase uses data from the e-prescribing system to evaluate physician responses to decision support interventions and alerts. In the second phase, the project brings experts on information technology and experienced survey researchers together to develop a qualitative study demonstrating the impact of e-prescribing on prescribing processes and outpatient workflow, including a large-scale survey to develop a detailed understanding of how e-prescribing can be integrated into medical practice. The third phase of the project will draw on decades of experience studying large medical databases to evaluate prescribing decisions and clinical outcomes when e-prescribing is initiated. The project will link the e-prescriptions issued to patients with the pharmacy claims for those patients and will generate a comprehensive dataset to evaluate the true clinical impact of e-prescribing.

Although public interest in e-prescribing is growing and recent proposals seek to provide all physicians with e-prescribing systems, data on how e-prescribing systems are used and what impact they actually have on prescribing processes and outcomes are still quite limited. The findings of this research will provide important lessons for clinicians, researchers, insurers, policymakers, patients, and all who are interested in improving the use of prescription drugs.

**Specific Aims**

- Measure physician use of two safety-related e-prescribing functions: safety alerts and dispensed drug history. **(Ongoing)**
- Measure the effect of e-prescribing on processes of prescribing for physicians to assess characteristics of successful and productive adoption. **(Ongoing)**
- Extend and expand ongoing research to assess whether the adoption of e-prescribing is associated with improved clinical outcomes for patients. **(Upcoming)**

**2009 Activities:** Significant qualitative and quantitative data collection was completed, analyzed, and drafted into reports. Data collection included interviews with physician practices that have abandoned e-prescribing, focus groups with practices to understand e-prescribing impact on workflow and impact on prescribing accuracy, and a large-sample survey of end-users to assess acceptability and usability of e-prescribing including attitudes and satisfaction. Case studies about the effect of e-prescribing on office workflow were developed. By the end of the calendar year, data-use agreements were complete, and databases that enabled the study team to link the e-prescriptions issued to patients with the pharmacy claims for those patients in order to generate a comprehensive dataset to evaluate the true clinical impact of e-prescribing were obtained.

**Preliminary Impact and Findings:** Focus group participants identified a range of issues associated with the current use of e-prescribing in their practices, including benefits derived/perceived, challenges in using the technology, and workflow issues caused by the technology. Positive responses toward e-prescribing focused on efficiency, a reduction in medical errors, patient satisfaction, and ease of use. Negative responses focused on technological problems, medical errors, trust of technology, the learning curve for using the software, and surveillance and liability issues.

There were different reactions and changes to the e-prescription workflow based on which functions were completed by physicians versus office staff. Physicians entered prescriptions while seeing patients or immediately thereafter, whereas the office staff usually handled refills. By splitting the tasks, significant workflow efficiency was gained. It was also noted that in some instances, office staff signed on as the physician in order to handle the prescriptions.

In regard to e-prescription evolution/adoption, the focus groups found that the attitude of the doctors played a major role in the perceived usefulness of the technology. Some practices that adopted the technology have found that they cannot live without it now. On the other hand, several users do not yet have complete knowledge of the functionality of the application (e.g., what the colors on the screen represent).

Survey results showed that physicians have generally positive attitudes regarding e-prescribing and the impact of e-prescribing on the efficiency and safety of prescribing. Physicians using e-prescribing systems that are integrated into comprehensive electronic health records use more e-prescribing functionalities on a more regular basis than physicians who use stand-alone e-prescribing systems. On the other hand, the cost of stand-alone e-prescribing systems is considerably lower, which is attractive for many physicians and practices.

**Selected Outputs**

Agarwal R, Angst CM, DesRoches CM, Fischer MA. Technological viewpoints (frames) about electronic prescribing in physician practices. J Am Med Inform Assoc. 2010 Jul-Aug;17(4):425-31.

Fischer MA, Vogeli C, Stedman MR, et al. Uptake of electronic prescribing in community-based practices. J Gen Intern Med 2008;23(4):358-63.

Fischer MA. E-prescribing in Community-Based Practices: Successes and Barriers. AHRQ 2008 Annual Conference presentation; 2008 Sept 8: Agency for Healthcare Research and Quality: Rockville, MD; Available at: http://www.ahrq.gov/about/annualmtg08/090808slides/Fischer.htm

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Two key elements of the project, obtaining data use agreements and data, were accomplished. It is anticipated this will enable significant progress to be made during 2010.

**Milestones:** Progress is on track in some respects, but not others.

**Budget:** Spending is roughly on target.

| | |
|---|---|
| **Project Title:** | Improving Otitis Media Care with Electronic Health Record-Based Clinical Decision Support and Feedback |
| **Principal Investigator:** | Forrest, Christopher, M.D. |
| **Organization:** | Children's Hospital of Philadelphia |
| **Mechanism:** | RFA: HS07-006: Ambulatory and Safety Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017042 |
| **Project Period:** | 09/07 – 02/11 |
| **AHRQ Funding Amount:** | $877,011 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Pediatric*, Otitis Media

**Summary:** Several problems in the treatment of otitis media (OM) in children can be addressed through health information technology (IT). This project addresses physicians' lack of awareness of national guidelines on judicious use of antibiotics and the overuse of antibiotics in OM treatment. The goal is to develop, test, and disseminate a health IT intervention that improves the quality of OM care while reducing the amount of resources used in its treatment.

The intervention uses the Children's Hospital of Philadelphia's (CHOP's) electronic health record (EHR) to integrate care over time and to supply physicians with the knowledge they need at the point-of-care. The full intervention comprises of: 1) a method for linking all services a patient receives from any physician into clinically logical clusters called episodes-of-care, 2) clinical decision support (CDS) for medications and referrals to specialists based on the best available scientific evidence, 3) feedback on past performance of OM care provided by physicians, and 4) physician training on use of tools. The study randomly allocates 28 primary care practices into groups for usual care, full intervention without feedback, and full intervention with feedback.

The project is being conducted in the CHOP Pediatric Research Consortium, which includes all primary care practices in the CHOP network. It utilizes the Epic ambulatory electronic medical record system, EpicCare 2007, a Certification Commission for Health Information Technology-certified ambulatory EHR tool that affords immediate, secure electronic access to clinical information, and communication at the point-of-care. Because OM is a common condition in children, the widespread adoption of the intervention from this project has the potential to affect the lives of millions of children.

**Specific Aims**

- Develop and pilot test the OM health IT intervention. **(Achieved)**
- Examine overall effect of health IT intervention and the independent contribution of physician feedback on quality (primary outcomes). **(Ongoing)**
- Assess the effects of the intervention on the secondary outcomes of resource use and clinician adoption of the technology. **(Ongoing)**
- Upon project completion, the study team will work with members of their advisory board, including the American Board of Pediatrics, National Committee for Quality Assurance, and the

Child Health Corporation of America to disseminate the work to child health professionals nationally. **(Upcoming)**

**2009 Activities:** The pilot test of the OM health IT intervention was completed, and the full intervention with implementation of the CDS in all clinical sites randomized for CDS began. The central component of the CDS tool is the "episode grouper," which summarizes prior care and presents a coherent overview, including recommendations for therapy and links to educational resources. Initial feedback on the episode grouper was that it was well received by physicians.

Feedback reports to physicians serve a dual purpose of performance feedback and encouraging physician use of the CDS tool. With the hope of increasing adoption of CDS, the project team provides feedback reports directly to physicians through the in person site visits. This provides the study team the opportunity to discuss the feedback reports with physicians. The original approach to feedback was giving it through a report in the EHR, however the study team found that discussion of the report and setting aside a time explicitly to review the report was helpful. The feedback report includes prescription information such as the proportion of patients with acute otitis media (AOM) who were prescribed narrow spectrum antibiotics when indicated. Also included in the feedback is the performance of the providers with the highest (top 10 percent) adherence to guidelines, to demonstrate an achievable benchmark to providers with lower guideline adherence. The first quality indicator developed was the measurement of appropriate first-line antibiotic prescriptions. Feedback was analyzed at the physician, practice, and network levels and given to both intervention and control sites.

**Preliminary Impact and Findings:** Measuring the impact of the CDS on quality of care is the primary outcome of the project. The project team began to analyze data on the differences in prescribing behavior between the control sites and sites with the CDS tool before and after the intervention. The quality data presented at the end of the intervention will be two composite indicators—one for AOM, and one for otitis media with effusion (OME).

Many lessons have been learned on how to give feedback to providers. Physicians expect scientific evidence, so data returned in feedback must be solid and defensible if it is to create behavior change. High-data quality is imperative and the team has been working on improving data in the feedback reports. Usage of the CDS tool was low (approximately 20 percent), which is being addressed through the incorporation of feedback solicited from care providers.

Initial analysis of data to demonstrate the impact of the CDS on quality is positive. Analysis of pre-intervention quality data found that pre-intervention amoxicillin was appropriately prescribed 73 percent of the time at the network level. Preliminary intervention site analysis indicates that use of the CDS increases the appropriate prescription level by 10 percent.

**Selected Outputs**

A feedback report for physicians was created providing data on quality indicators.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Addressing lower than desired usage of the CDS through feedback reports and development of additional quality indicators of AOM and OME care are the central current activities.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | The Bettering Lives Utilizing Electronic Systems Project: Improving Diabetes Outcomes in Mississippi with Health Information Technology |
| **Principal Investigator:** | Fox, Karen, Ph.D. |
| **Organization:** | Delta Health Alliance, Inc. |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017233 |
| **Project Period:** | 09/07 – 09/10 |
| **AHRQ Funding Amount:** | $1,163,573 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*, Diabetes

**Summary:** The prevalence and incidence of diabetes in the U.S. are reaching epidemic proportions, and this is especially true in Mississippi. The Delta Health Alliance (DHA), which has sponsored the Delta Diabetes Project (DDP) over the past several years, initiated the Bettering Lives Utilizing Electronic Systems (BLUES) Project in September 2007 to determine whether utilization of health information technology (IT) in diabetes management would enhance delivery of health care and improve health outcomes of patients. The project is two thirds of the way through the grant period. The project demonstrates the effects of using well-designed, comprehensive health IT in diabetes management practices at several ambulatory clinics in Mississippi. The study looks at cost-effectiveness, the impact on clinical outcomes, medication management, and timeliness of care.

The BLUES project uses research and measurement module of the Allscripts Electronic Health Record (EHR). This module enables users to easily query patient records to review key clinical performance indicators. The EHR application is certified by the Certification Commission for Health Information Technology for: functionality, the ability to create and manage electronic patient records and automate workflow in a physician's office; interoperability, the ability to receive and send electronic data to other entities such as laboratories; and security, the ability to keep patient information safe. The EHR system combines patient demographics, clinical outcomes, reported laboratory values, and prescription fill history from different databases across patient "dimensions," thereby centralizing and standardizing data analysis and reporting methodologies. An important capability of the EHR for this project is the system's ability to integrate and maximize the effectiveness of third-party technologies that aid diabetic care.

Four diabetes management clinics that employ the same model of diabetes care are participating in this study; two in an urban setting and two in a rural setting. One of the sites in each setting utilizes the health IT system. The timeline for this project coincides with independent plans to implement EHRs at these sites, which provides an invaluable opportunity to compare similar practices of health care providers and the health outcomes of their patients with and without use of a comprehensive health IT system.

Various data analysis methods will be used to measure the progress toward attaining the project aims. These include:

- Clinician use of the various components of the EHR will be modeled as a continuous measure (percent or proportion) rather than a strict yes/no binary measure, and a mixed model analysis of covariance will be used to analyze the measure, controlling for fixed (clinic, time) and random (patient) effects.
- Individual generalized estimating equations analyses will be used to model changes over time in the proportion of patients that access various components of the Patients Interactive Module.
- A multivariate model will be built to investigate and measure changes from baseline to end-of-study.

**Specific Aims**

- Implement an EHR system in two existing diabetes management clinics, focusing on integration of the EHR into clinician workflows. **(Ongoing)**
- Evaluate the impact of the EHR system on clinical processes of care and patient outcomes. **(Ongoing)**
- Produce and distribute a generalizable, replicable model of care for implementing an integrated health IT system for diabetes management care throughout the United States. **(Ongoing)**

**2009 Activities:** The DHA continued its legal, administrative, and technical work implementing an EHR system that is integrated into clinicians' workflow at clinics in Jackson and Greenville, Mississippi. Efforts continued to develop interface protocols for message and information transfer. The DHA BLUES Project staff gathered baseline data prior to implementation, as well as comparison data from the Jackson Medical Mall and the Gorton Clinic Assistant Professor at the University of Mississippi Medical Center (UMMC) School of Health Related Professions, Dr. Lisa Morton, a data collection and health information management expert, joined the BLUES Project staff in 2009 as a co-investigator.

The project had to deal with several disruptions in 2009. The Delta Regional Medical Center (DRMC), which was to serve as the rural test site, went "live" with EHR in June 2008 but closed in 2009 and is no longer part of the study. The BLUES team and its external analysts looked for a suitable replacement—a clinic in the same locale and with similar client demographics. The replacement was the Greenville Clinic, a multi-specialty clinic that follows medical/clinical workflow procedures more similar to its urban counterparts, has similar demographics to DRMC, and served as a referral place for some of DRMC's patients. The closure of UMMC Pavilion Diabetes Clinic (the urban EHR intervention site) led to its replacement in the research model with UMMC, Family Practice Clinic. Among the control sites, the Jackson Medical Mall Diabetes Clinic (Jackson, Hinds County; urban) closed on June 30, 2009. The closure did not negatively impact BLUES research, as the data had already been gathered. Most patients from this clinic were referred to the Jackson Medical Mall Internal Medicine Clinic, located downstairs from the former diabetes clinic, which is now serving as the urban control site. The rural control site was changed from the NWRMD Diabetes Clinic (Clarksdale, Caohoma County), to the Gorton Clinic (Belzoni, Humphreys County) due to the reduction of DDP program sites within Northwest Mississippi Regional Medical Center.

In accordance with the project plan, chart evaluations have been completed and DHA received an acceptable audit with no conditions or recommendations noted. Consumer Assessment of Healthcare Providers and Systems (CAHPS) surveys were administered to patients at the Jackson Medical Mall, UMMC, and the Gorton clinic. The project team continues to monitor project activities and gather the necessary process and outcome measures for evaluation purposes. A Web-based portal was created for capturing and reporting CAHPS data online. Initial data from the CAHPS survey were sent to external evaluators at the University of Illinois at Chicago for preliminary review. Survey results are expected in 2010.

A quality assurance (QA) check on BLUES files and CAHPS data found accuracy rates between 80 and 100 percent. The QA efforts will continue on a regular basis. Researchers continue to enter patient satisfaction surveys via a secure Web portal. Staff members are working collaboratively to ensure continuous data collection. Project staff convened meetings with all grant partners throughout 2009 to ascertain project outcomes and to determine their ability to measure project outcomes. Staff also consulted with evaluation team members and statisticians to resolve any data issues.

**Preliminary Impact and Findings:** When administering the CAHPS Survey, the BLUES team encountered both resistance and enthusiasm. Seven patients refused to participate; one disliked the survey and the use of technology because "they couldn't find my records"; one stated that the survey was confusing because it did not ask questions about the use of computers; and two patients were excited to participate and stated that they were glad that someone was asking these questions.

**Selected Outputs**

Morton L, Whitt A, Fitch C, et al. EHR Evaluation: Incorporating Grant Research into the Undergraduate Clinical Experience. Presentation at 2009 Faculty Development Institute and Assembly on Education Symposium for the American Health Information Management Association; 2009 July 25-29; Las Vegas, NV.

Fox, K. The BLUES Project. Presentation at the Annual Conference of the Agency for Healthcare Research and Quality, 2008 September 8; Bethesda, MD. (PowerPoint File; Web Version).

The project has developed data collection tools for baseline data for the BLUES Project, as well as measures of impact and outcomes measures.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project timeline has recovered from an initial delay at the project start. Budget spending is expected to be on track in 2010, due to increased project activities and the procurement of hardware and software to aid in the BLUES implementation and research.

Milestones: Project is mostly on track.

Budget: Significantly underspent, by approximately more than 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | eHealth Records to Improve Dental Care for Patients with Chronic Illnesses |
| **Principal Investigator:** | Fricton, James, D.D.S., M.S. |
| **Organization:** | HealthPartners Research Foundation |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017270 |
| **Project Period:** | 09/07 – 09/10 |
| **AHRQ Funding Amount:** | $996,737 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

Target Population: Chronic Care*, Chronic Obstructive Pulmonary Disease, Congestive Heart Failure, Diabetes, Condition Specific: Xerostomia

**Summary:** The project is a group-randomized clinical trial with 47 dentists in 17 clinics on the use of simple reminders in an integrated electronic health record. The primary goal is to evaluate the effectiveness of an integrated electronic health record system that includes an electronic medical record (EMR), electronic dental record (EDR), and a personal health record (PHR) at improving the quality and safety of dental care for patients with chronic illnesses. The EMR used in this project is EPIC Hyperspace Spring 2007, developed by Epic Systems Corporation and certified by the Commission for Health Information Technology (CCHIT). The EDR, developed by General Systems Design Group, Inc., is not CCHIT certified, as a certification process for EDRs does not exist. The tethered PHR is EPIC MyChart® and is used in combination with HealthPartners' Web-based patient portal.

The study compares two interventions against a usual care control. The interventions are designed to address how, and to whom, special dental care needs are communicated. The interventions are: 1) a patient reminder delivered primarily via a PHR e-mail or, if e-mail is not available, over the phone by the dental clinic staff and/or postal mail (Group A); or 2) a point-of-care reminder to the dentist within an EDR (Group B). The patients in the sample population have special dental care needs as a result of four chronic conditions: diabetes mellitus, congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), and xerostomia (dry mouth) caused by medications or related conditions.

An EDR integrated with an EMR and PHR provides a unique opportunity to improve the dental care of patients with chronic conditions by alerting patients to their special care requirements and alerting dentists at the point of care. Furthermore, the integration of an EMR, PHR, and EDR into an integrated electronic health record system improves health information exchange, communication, and cost effectiveness of care, particularly for patients with chronic illnesses. This project demonstrates how leveraging an integrated electronic health record system can improve patient outcomes, increase awareness, and improve clinical decisionmaking by identifying problems needing remediation and providing immediate evidence-based recommendations.

**Specific Aims**

- Determine the effectiveness of integrated EHR-based interventions toward changing dentist and patient behavior. Data collection is complete and analysis is in process. **(Ongoing)**
- Determine the impact of an integrated EHR-based intervention upon the use of emergency and/or restorative dental care. Data collection is complete and analysis is in process. **(Ongoing)**
- Produce and distribute a generalizable, replicable model of evidence-based care recommendations for implementing an integrated health information technology system for diabetes and other chronic illness management within dental care practices throughout the United States. **(Ongoing)**

**2009 Activities:** The investigators met the goals set in the project timetable for 2009. Data on enrollment, sample size, utilization of the reminder system, and impact of the clinical guidelines on care have been collected and are currently being analyzed. The target subject population of 3,960 subjects was surpassed, with a recruitment total of more than 4,800 subjects.

Over the past year, considerable time was spent defining clinical guidelines for managing dental patients with chronic medical conditions and making specific recommendations for each patient. The system has been implemented, tested, and is currently being hosted by HealthPartners Department of Information and Technology. This phase of the project included identifying the server, making sure that all out-of-network access to the server was disabled, and installing the programs necessary to provide the foundation for the application. There was also testing on the new platform, virus scans, and service-level agreements executed to document the responsibility in supporting the application.

Participating clinics were randomized for the study. Dentists and staff reviewed the clinical recommendations and decision support tools, provided feedback on the initial beta testing of the system, and began utilizing the clinical guidelines. Based on participant feedback, the EDR software was modified to include an easily recognizable MedAlert icon that blinks and a MedAlert Link that brings the dental provider to either specific personalized recommendations or to the general recommendation. HealthPartners' PHR has been implemented, and patients are gradually increasing their utilization of the PHR. Patients without e-mail access who are in the patient alert arm of the study (Group A) have been receiving PHR alerts via USPS mail.

**Preliminary Impact and Findings:** More than 4,800 patients participated in the two experimental arms of the study, surpassing the expected sample size. An initial period of baseline utilization was analyzed to determine how participating dental providers use the Web site that provides clinical guidelines. Analysis of data as of the end of December 2009 suggests trends that may reflect the long-term significance of using health information technology to encourage use of evidence based guidelines. After implementing the alert system, the monthly rate at which the Web-based clinical guidelines were accessed by dental providers increased by 80 percent. Both the EDR and PHR groups accessed guidelines more frequently than the control group. When the types of alerts are compared, the EDR showed a significantly greater impact than PHR alerts on Web site access, suggesting that EDR is the best strategy. Furthermore, the use of reminder alerts demonstrated a generalizable effect by increasing the use of the guideline Web sites for patients not identified by the EMRs. Xerostomia and diabetes were the top conditions where Web-based guidelines were reviewed by dental providers, perhaps because of their increased prevalence and direct relevance to dental care changes.

Preliminary conclusions:

- Reminders in the EDR directly targeting dental providers are more effective at encouraging the use of care guidelines than reminders that target the patients.
- Both types of reminder alerts have a generalizable effect of increasing the rate at which providers reference care guidelines for all patients compared to usual care.

- To date, the value of providing an easily accessible record of relevant patient health information and subsequent care guidelines at the point-of-care has been demonstrated.

**Selected Outputs**

Training Protocol for Dental Providers: developed for use of the new system.

Web-based Clinical Guidelines: include recommendations for dentists to follow when patients have a chronic illness including COPD, CHF, xerostomia, or diabetes. The Web-based Clinical Guidelines are able to present personalized recommendations for the patients in the EDR and PHR arms of the study.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is completely on track with its milestones.

**Milestones:** Progress is completely on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Pharmaceutical Safety Tracking: Managing Medications for Patient Safety |
| **Principal Investigator:** | Gardner, William, Ph.D. |
| **Organization:** | Children's Research Institute |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017258 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,156,142 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Implementation and Use

**Target Population:** Medicaid, Pediatric*

**Summary:** Pharmaceutical Safety Tracking (PhaST) is a health information system that assists clinicians' management of medications in ambulatory settings. PhaST seeks to protect outpatients taking drugs that have recognized side effect risks even when those drugs are correctly prescribed. It is an automated system for monitoring medication adherence, side effects, and patient symptoms, using research-based assessment procedures administered via interactive voice response (IVR) telephony.

When a patient reports a problem with a medication on an IVR call, PhaST alerts a psychiatric social worker trained to triage the problem, counsel the patient or family, and when necessary, contact the patient's prescribing clinician or the hospital emergency services. The goal of PhaST is not to replace clinician visits with telephone calls, but to improve safety and remediate access problems by augmenting communication channels already available to families. PhaST communicates data about patients to clinicians using email. Because the full electronic health record system has not yet been fully implemented for the behavioral health clinics, which are the primary source of patient referrals, and because PhaST serves patients across systems with independent health record systems, PhaST does not directly store information in an electronic health record system. Instead, copies of the emailed PhaST reports are filed in paper charts.

The target medications for this project are pediatric antidepressants. To compare the use of PhaST to usual care, the project is conducting a randomized trial in a large, urban, specialty mental health system that serves a primarily Medicaid population. The project seeks to enroll youths who are receiving new prescriptions for antidepressants to assess them for adverse events at baseline and 1-, 2-, and 3- month milestones. The initial expectation was that patients would be enrolled based on antidepressant prescriptions registered by a computerized order information system. However, this recruitment procedure was changed in response to concerns raised by the Institutional Review Board (IRB), and currently patients are recruited based on physician referral. A total of 200 to 250 patients are anticipated to be recruited by the project end. The project will compare chart-documented adverse events to adverse events that have been determined by an examiner who is blind to the patient's randomization. It is predicted that there will be higher agreement between chart-documented adverse events and examiner-determined adverse events when PhaST is used. The project is also comparing PhaST to usual care on

measures of patient and provider satisfaction, patient outcomes, and measures of the quality of medication management, such as rates of patient medication non-adherence.

**Specific Aims**

- Determine whether PhaST is superior to usual care on measures of system process. **(Ongoing)**
- Determine whether PhaST is superior to usual care on measures of patient and provider outcomes. **(Ongoing)**

**2009 Activities:** The project focused on patient recruitment (by speaking to psychiatric staff and distributing promotional materials) and data collection efforts. Recruitment was slowed because of an IRB-mandated change in methodology that relies on providers' recommendations rather than active recruitment. To decrease the chance for interpretation discrepancies, a change was made in how the assessment of suicidal ideation is conducted. Rather than asking, "Have you had serious thoughts about taking your life?," the qualifier 'serious' was removed because some young people were reporting that while they may have thought about it, it was not necessarily a 'serious' thought.

Other accomplishments included the development of a manual for PhaST triage nurses, which is being continuously updated based on experience with the system. The PhaST system is currently providing electronic reports to providers. An upgrade to the system was 95 percent complete, and the production version of PhaST Software is expected to be implemented in 2010. Once the software development is complete, the team anticipates that information technology costs to the project will significantly decrease.

**Preliminary Impact and Findings:** There are no findings to report at this time. Initial recruitment was slower than originally planned. However, once patients are enrolled, retention is high. Although the overall sample size may be smaller than anticipated and some questions may be harder to answer, this is not anticipated to have a significant negative impact on the analysis. Anecdotally, despite lower-than-expected physician adoption of the software, physicians that do try the software provide very positive feedback. The system has also been very reliable, with virtually no downtime.

**Selected Outputs**

The PhaST project. American Academy of Pediatrics Second National Ambulatory Primary Care Patient Safety and Health Information Technology Conference; 2008 Oct 1-3; Washington, DC.

Interview Manual for the PhaST triage nurses.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is generally progressing on track, despite some delays due to changes in recruitment procedures required by the IRB.

**Milestones:** Progress is on track in some respects.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | RxSafe: Shared Medication Management and Decision Support for Rural Clinicians |
| **Principal Investigator:** | Gorman, Paul, M.D. |
| **Organization:** | Oregon Health & Science University |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017102 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,200,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*

**Summary:** It is widely recognized that information technology (IT) can improve medical care and patient safety, but questions remain about how best to achieve this goal. This project seeks to provide important information about how to integrate decision support into clinical practices to improve the quality and safety of medication management for people with chronic illnesses. This project investigates the feasibility and impact of novel approaches to clinical decision support in multidisciplinary ambulatory care, emphasizing high-risk transitions of care. The project has developed technology to support shared medication management for persons with chronic conditions. This health IT will be used to facilitate clinician decisionmaking and improve outcomes for patients and providers in the management of chronic conditions.

The project aims to show improvements in medication management by 1) providing the means to effectively share medication information, 2) making any corrections or improvements made by one team member to the regimen visible to all team members, and 3) providing clinicians using the system with access to evidence-based information at the time and place it is needed.

This project is a continuation of a successful collaboration between community-based nurses and physicians providing ambulatory services in an Oregon coastal community, a multidisciplinary team of university-based investigators with expertise in medicine, nursing, medical informatics, and computer science, and the Oregon Rural Practice-based Research Network, which provides the infrastructure, coordination, and support. Clinical settings for the project are independent clinic practices in two coastal communities, local home health services, and transitions in care into and out of the single community hospital and its emergency room. The patient focus is on community-dwelling persons with chronic conditions on multiple medications. The choice of these specific innovations is informed by experience with development and early deployment of RxSafe, a system that consolidates medication lists of patients in long-term care to integrate information for providers involved in prescribing, dispensing, administering, or monitoring medications.

**Specific Aims**

- Enhance clinician cognitive performance in medication management tasks by exploiting the underlying semantics of medication lists to improve the organization and presentation of medication list information. **(Ongoing)**
- Implement medication list management tools that are integrated into clinician-specific and task-specific workflows to support medication reconciliation at high-risk transitions as well as in ongoing ambulatory care. **(Ongoing)**
- Increase the effectiveness of medication management activities of clinicians in multiple roles by improving their coordination and communication using shared medication management tools. **(Ongoing)**
- Employ evolving standards and architectures to link external, machine-actionable, evidence-based clinical information in context-appropriate and user-appropriate ways to support shared medication management by clinicians practicing in ambulatory settings. **(Ongoing)**

**2009 Activities:** Work pertaining to the first aim has been temporarily suspended because it is dependent upon completion of activities for the last aim. Work related to the second and third aims involved observing clinicians performing medication management tasks to create task models that form the basis for technology interventions. With the technical specifications defined, the project is now moving toward prototype development. Work pertaining to the last aim included the examination of the Food and Drug Administration-structured product labels as a source of Web-based decision support and building mock-ups of Web services that would employ this and other resources. Under development is an interaction model (using Web 2.0), which facilitates the ability of multiple independent agents to contribute and enhance medication lists. Technical specifications have been defined, including individual technical components and a central component for integrating those services. A prototype has been developed and will be tested in 2010.

**Preliminary Impact and Findings:** The project team found that nurses, pharmacists, and physicians used different categorization schemes when thinking about medications. Physicians form sophisticated initial mental models of the patient when performing a simple medication reconciliation task, and these models reinforce cognitive performance. Pharmacists and nurses performing medication management tasks identify and correct discrepancies in the medication regimens of their patients in a more complex fashion than what is commonly defined and performed as "medication reconciliation" and embedded in other tasks relating to the total care of the patient. Finally, no publicly available standard for classifying medications is in use, and this is a major barrier to effective multidisciplinary distributed decision support.

**Selected Outputs**

None available

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** As discussed above, the project has made significant progress with regard to some aims, while one has been temporarily suspended. A no-cost extension may be requested.

**Milestones:** Progress is mostly on track.

**Budget:** Significantly underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Improving Post-Hospital Medication Management of Older Adults with Health Information Technology |
| **Principal Investigator:** | Gurwitz, Jerry, M.D. |
| **Organization:** | University of Massachusetts Medical School at Worcester |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017203 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,199,952 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Implementation and Use

**Target Population:** Elderly*

**Summary:** The project focuses on developing and evaluating the value of an enhanced health information technology (IT)-based medication reconciliation system interfaced with an ambulatory electronic medical record (EMR). The project utilizes the EpicCare Ambulatory EMR, which is certified by the Certification Commission for Health Information Technology. The project employs a randomized, controlled trial design to test a health IT-based transitional care intervention with enhanced medication reconciliation and therapeutic monitoring alerts to improve the quality and safety of patient monitoring and medication management. The project focuses specifically on the transition from inpatient to ambulatory settings for older adults who have multiple comorbid conditions and are prescribed high-risk medications. This research allows for the examination of an integrated health IT intervention on the quality of followup, outpatient clinician workflow, occurrence of adverse drug events (ADEs), and health care utilization, to gain insight into the effective use of clinical alerts and coordinated delivery of actionable information to outpatient clinicians in the management of ambulatory elderly patients subsequent to hospital discharge.

The project's health IT intervention begins with medication reconciliation at the time of hospital discharge. Complex information management and coordination of data sharing across multiple settings often hamper clinician workflow in the post-hospitalization setting. The intervention addresses these special challenges. Specifically, the intervention automates key steps in the transition of care from the hospital to home, including: 1) expediting and facilitating discharge followup appointment scheduling (including monitoring for no-shows), 2) sharing enhanced medication reconciliation lists that highlight key therapeutic changes, and 3) generating patient-specific therapeutic monitoring recommendations for high-risk medications in the post-hospitalization period. Randomization of the health IT discharge communication will occur at the time of hospital discharge.

**Specific Aims**

- Evaluate the impact of automated scheduling alerts on the rate of followup to an outpatient provider within 14 days of hospital discharge. **(Ongoing)**
- Evaluate the impact of automated monitoring alerts on the prevalence of appropriate monitoring for selected high-risk medications at 30 days from the time of hospital discharge. **(Ongoing)**

- Evaluate the impact of a health IT-based transitional care intervention on the incidence of ADEs within 45 days of hospital discharge. **(Ongoing)**
- Evaluate the impact of a health IT-based transitional care intervention on the rate of hospital readmissions and emergency department visits within 30 days of discharge. (Ongoing)
- Assess (by level of comorbidity, number of medications, and use of specific high-risk medications) whether a health IT-based transitional care intervention is more effective in subgroups of patients. **(Upcoming)**
- Determine costs directly related to the development and installation of the health IT-based transitional care intervention. **(Ongoing)**

**2009 Activities:** Significant progress in the development of therapeutic monitoring guidelines/standards was made. The project team has completed the clinical pharmacist reviews, the Delphi process, expert review, and has reached consensus on the guidelines. Additionally, they have held two clinical review sessions with members of the study team as well as members external to the study team within the clinical organization to solicit buy-in for the monitoring guidelines. The clinical content of the guidelines is complete, in blueprint format, and has been provided to the Epic programmers.

The project team has generated and finalized the ADE signal report, ADE event identification, and ADE event classification forms. Collaborating pharmacists and physicians have reviewed these forms to maximize usability and are planning automation of adverse drug event signal identification within the Epic EMR system. Researchers have completed training the pharmacists on how to navigate the EMR system for conducting the ADE review. Baseline data has been collected and analyzed in order to determine the extent of pharmacist review needed. Data on return on investment is being collected on an ongoing basis.

**Preliminary Impact and Findings:** The project does not have any findings at this time.

**Selected Outputs**

The project does not have any outputs at this time.

**Grantee's Self-Reported Quarterly Status (as of December 2009):** Because of delays in Epic programming, the project will be requesting a no-cost extension. It is anticipated that programming will be completed in early 2010, and activities during 2010 and 2011 will position the project team to complete all project tasks and deliverables.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Safety Through Enhanced e-PreScribing Tools (STEPStools): Developing Web Services for Safe Pediatric Dosing |
| **Principal Investigator:** | Johnson, Kevin, M.D., M.S. |
| **Organization:** | Vanderbilt University |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health IT (IQHIT) |
| **Grant Number:** | R18 HS 017216 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,157,753 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Pediatric*

**Summary:** The Safety Through Enhanced e-PreScribing Tools (STEPStools) project assesses the impact on quality and safety of a generally available knowledgebase for pediatric medication management. STEPStools is constructing, pilot testing, and evaluating available tools that provide medication-specific knowledge about dose rounding and extemporaneous formulations necessary in small children. The project also evaluates the effectiveness of using a service-oriented architecture to distribute knowledge, which is an emerging method for knowledge management and dissemination.

If successful, the project will contribute actionable knowledge to the e-prescribing community. The project is committed to releasing this database as a toolkit, initially as a dataset available publicly through the Agency for Healthcare Research and Quality and ultimately through the National Library of Medicine and RxNorm. The project will inform the vendor community and general public about the utility of Web services as a tool for knowledge dissemination, as proposed in such places as the clinical decision support roadmap. In addition, the American Academy of Pediatrics (AAP) has committed to adding to this knowledgebase, enabling its availability to e-prescribing developers for many years.

**Specific Aims**

- Convene a panel of AAP and American Medical Informatics Association experts to construct a knowledgebase of actionable data to guide e-prescribing systems in the appropriate rounding of calculated doses and selection of extemporaneous medication formulations. **(Achieved)**
- Use established service-oriented architecture models to construct Web services and a Web-based client to allow remote access and browsing of the knowledgebase. **(Achieved)**
- Evaluate the usability and content validity of these Web services through a series of pediatric prescribing use cases, site visits to pilot users, and an examination of the error rate of prescriptions generated with and without the use of these Web services. **(Ongoing)**

**2009 Activities:** The validation of the rounding knowledgebase, which provides age-specific dosages for commonly prescribed medications, continued through 2009. The team created rounding recommendations and presented these recommendations to the AAP. There are approximately 20 remaining medications for

which rounding consensus has not yet been reached. In 2010, these remaining medications will be discussed, consensus developed, and the rounding knowledgebase will be completed.

In 2009, the project team started sharing the compound knowledgebase with vendor partners. In the process, the team identified issues related to vocabulary harmonization using RxNorm, the drug nomenclature for standardizing the representation of clinical drugs. The research team is working with vendors to tailor the database and integrate its contents into the e-prescribing workflow. Two groups, Office Practicum and Vanderbilt, are contributing to the implementation of the research.

In order to test the knowledge and rounding algorithm, the team decided to add an additional testing phase of the knowledge database. The evaluation was not part of the initial proposal, but became important as the research team realized the challenges associated with selecting a formulation and ideal dose for each patient request. The knowledge and rounding algorithm will be tested with a large dataset of thousands of completed prescriptions and the variability between the rounding algorithm recommendation and the approach used by the pediatrician will be quantified. Analysis of these differences should provide additional information that can be used to improve the algorithm.

As of the end of 2009, the project team has finalized the study design and methods that will be used in an environmental scan of two pediatric sites that currently have e-prescribing systems. The two goals of this study are to 1) assess the current e-prescribing system environment (i.e., establish a pre-STEPSTools baseline condition) and 2) determine any potential barriers to perform a full, comprehensive evaluation of the STEPSTools system after it is fully implemented. Dr. Johnson and his team plan to conduct non-participatory direct observations of prescribers and prescribing agents (appropriately authorized non-providers who generate prescriptions on the provider's behalf) and peripheral observations of medical support staff. They will also conduct on-site semi-structured interviews with prescribers and prescribing agents, as well as pharmacists who serve the pediatric population. Interviews will follow a guide which will include questions such as "For a new prescription that requires rounding a dose, what steps do you take to generate the prescription?" and "When you generate an electronic prescription, what specific circumstances require a compounded formulation?" Results from this study will be analyzed and compared to data collected during the post-implementation summative evaluation to assess changes in users' impressions of their e-prescribing practice as a result of the implementation of STEPSTools, if any.

**Preliminary Impact and Findings:** The project continues to build the knowledgebase of pediatric compounds and rounding knowledge. As part of dissemination, the project has worked to include findings in the AAP newsletter. The project team has also increased its understanding of how to link knowledgebases. RxNorm, the drug nomenclature for standardizing the representation of clinical drugs, is used as a link between the rounding knowledgebase and the vendor-supplied knowledgebase. The RxNorm creates unique identifiers for the medication name (i.e., Amoxicillin), the routed form of the medication (Amoxocillin Oral), and the dispensable form of medication (Amoxicillin 400 mg/5mL Oral Suspension). Although the unique identifiers were expected to link with other knowledgebases, a number of unanticipated barriers have arisen and will be outlined in a planned manuscript. A second finding using RxNorm is that inactive ingredients in compounds are not typically included in RxNorm and are not coded in many vendor systems. As a result, inactive ingredients will not be included in the knowledgebase.

## Selected Outputs

Helmke, JS, Johnson, KB, Weinberg ST, et al. Development of a Knowledge Base for Pediatric Medication Dose e-Rounding. Platform presentation presented at: American Academy of Pediatrics National Conference and Exhibition, 2009 October 17-20; Washington DC.

Drs. Weinberg and Johnson hosted a meeting of e-prescribing vendors at an American Academy of Pediatrics in Fall 2009.

Constructed a knowledgebase of medications that are commonly compounded (available with password).

Project-specific Web site available at: www.mc.vanderbilt.edu/STEPSTools

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Current grant team focus is planning for the evaluation of the knowledgebase through testing in pilot sites. Two sites were identified, and a third site is now being selected. After receiving internal review board approval at the two initial sites, the team began environmental assessments.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Electronic Prescribing and Electronic Transmission of Discharge Medication Lists |
| **Principal Investigator:** | Kaushal, Rainu, M.D. |
| **Organization:** | Joan and Sanford I. Weill Medical College of Cornell University |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017029 |
| **Project Period:** | 09/07 – 03/11 |
| **AHRQ Funding Amount:** | $1,187,674 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Implementation and Use

**Target Population:** Adults

**Summary:** This project consists of three studies assessing the impact of health information technology (IT) on patient safety in the ambulatory setting. The first study is a multi-center before-and-after study measuring the effects on medication errors of switching from one electronic prescribing (e-prescribing) system to another, in this case from a home-grown to a vendor-based system. The second study is a qualitative study of physicians using one-on-one-interviews and direct observation to understand variations in human-computer interactions with this new e-prescribing system and how user patterns or system features may influence medication errors. The third study is a randomized, controlled trial evaluating the effect of electronically transmitting discharge medication lists from the hospital to the ambulatory setting using: 1) medication discrepancies at the first ambulatory visit following discharge and 2) adverse drug events (ADEs) 30 days post-discharge as outcome measures.

These studies are important because they have the potential to substantially add to knowledge of ambulatory medication safety as it relates to both the value of vendor-based electronic prescribing systems for medication management in the ambulatory setting and the impact of health information exchanges on patient safety at a critical time of transition. In addition, by including a qualitative component on human-computer interactions, this project has the potential to yield critical insights into why certain health IT interventions work (or do not) and how future interventions should be designed to better align themselves with physicians' workflow. The studies also have implications for the many institutions and practices that are transitioning from one electronic health record (EHR) to another. If rates of errors vary greatly between commercial systems, there are potential policy implications for more stringent certification criteria of e-prescribing to ensure medication safety.

**Specific Aims**

- Measure the effects on medication errors of transitioning from one e-prescribing system to another in the ambulatory setting. **(Ongoing)**
- Measure the effects on human-computer interactions of transitioning from one e-prescribing system to another in the ambulatory setting. **(Ongoing)**

- Evaluate the impact on medication discrepancies of electronic transmission of medication lists at discharge from the hospital to the ambulatory setting at the first ambulatory visit following discharge. **(Ongoing)**
- Evaluate the impact on ADEs 30 days post-discharge of electronic transmission of medication lists at discharge from the hospital to the ambulatory setting. **(Ongoing)**

**2009 Activities:** As detailed above, this grant includes three studies. The first and second studies were intended for implementation at two sites; however, at this time it is unlikely the research will be implemented at one of the sites because a planned EHR implementation at that site was delayed by 2 years. Dr. Kaushal is discussing alternative strategies with the Agency for Healthcare Research and Quality (AHRQ) staff toward completion of the grant. Proposed strategies include additional exploration of changes in provider perceptions, changes over time in use of the e-prescribing system, and additional analysis to investigate how providers who had been using a locally developed system learned to use the commercial system and whether this change reduced data errors.

The first study, measuring the effects on medication errors and data collection of transitioning from one electronic prescribing system to another, is nearly complete at the one participating site. Data collection was completed for all three time periods (baseline, 3 months post-implementation, and 1 year post-implementation). Data cleaning and analysis are also complete, and a manuscript is being prepared for submission to a journal.

The second study, a qualitative study measuring the effects on human-computer interaction of this same transition, is also near completion at one of the sites. Data collection and analysis are complete for 15 providers. All transcripts and field observations were coded by teams of two people using qualitative analysis software and were then reviewed by the larger research team. A manuscript has been completed and is under review at a journal.

The third study evaluates the impact on medication discrepancies and adverse drug events of electronic transmission of medication lists at discharge. Investigators, including the chief medical information officer and the medical director of information services for Weill Cornell Physician Organization, developed an application to electronically transmit discharge information, including medication lists, from the inpatient setting to the outpatient setting. This tool has now been implemented at New York-Presbyterian Hospital. Dr. Kaushal's team, in collaboration with Dr. Jeffrey Schnipper from Brigham and Women's Hospital and Harvard Medical School, also developed data collection tools to identify and characterize medication discrepancies, including a patient background form that obtains demographic and health status information from patients in the hospital and a patient medication survey that collects medication data and adverse drug events at approximately 30 days post-discharge. Both the form and the survey have been approved by the institutional review board. The team further developed a medication error and adverse drug event tool. An experienced research nurse will use the tool to identify medication errors in the data and/or adverse drug events experienced by the patient. All medication errors will be reviewed by two experienced physicians who will use this tool to rate the severity of the medication errors and adverse drug events. Data collection is on track and is expected to be completed in the spring of 2010. Data cleaning, analysis, and manuscript preparation will follow.

**Preliminary Impact and Findings:** Key findings are not yet available because analysis is still in progress for studies one and two, and data are still being collected for study three.

**Selected Outputs**

No outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** All aims are on track or have been achieved for the three studies at one of the two planned study sites. Data analysis is in progress for studies one and two, and data collection is on track for the third study; however, it is unlikely the research will be implemented at a second site because a planned EHR implementation at that site was delayed by 2 years. Dr. Kaushal is discussing alternative strategies of completing the grant with AHRQ staff.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

| | |
|---|---|
| **Project Title:** | Evaluation of a Computerized Clinical Decision Support System and Electronic Health Record-Linked Registry to Improve Management of Hypertension in Community-Based Health Centers |
| **Principal Investigator:** | Kopal, Helene, M.P.A., M.P.H. |
| **Organization:** | Primary Care Development Corporation |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017167 |
| **Project Period:** | 09/07 – 09/10 |
| **AHRQ Funding Amount:** | $1,132,569 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Hypertension, Low SES/Low Income*, Racial or Ethnic Minorities*: Latino

**Summary:** This project was initiated in September 2007 and addresses the need for empirical outcome data on effective information technology strategies for improving control of hypertension among low-income immigrant populations. Partners Primary Care Development Corporation, Open Door Family Medical Center (a not-for-profit organization that operates four primary care sites serving low-income, primarily Latino immigrants), New York University College of Dentistry and School of Medicine, and the Columbia University Mailman School of Public Health, are analyzing the effects of a multi-component, technology-driven quality improvement intervention on hypertension control. This multi-disciplinary collaborative effort provides a unique opportunity to target an underserved, hard-to-reach immigrant population.

The project hypothesized that clinical decision support (CDS) and electronic registry-linked performance feedback will be more effective at improving hypertension control than a standard-care electronic health record (EHR) in community health clinics (CHCs) that serve low-income, primarily Latino patients. On a monthly basis, the project extracts data from the eClinicalWorks Electronic Health Record, which is Certification Commission for Health Information Technology-certified, and estimates the effect of the intervention using AutoRegressive Integrated Moving Average modeling. The large number of minority and low-income patients served by Open Door CHCs and the existing practice-based research infrastructure provided by Primary Care Development Corporation and Open Door offers a unique opportunity to investigate the efficacy of these interventions.

**Specific Aims**

- Test the hypothesis that an office-based EHR with decision support and registry-linked provider performance feedback will be more effective in improving hypertension control than a standard EHR alone. **(Ongoing)**
- Assess the implementation process and delineate factors that influence adoption of the EHR-supported quality improvement intervention. **(Ongoing)**

**2009 Activities:** The study intervention for the project was fully implemented as of June 30, 2009, and included creating functional and technical specifications and programming the intervention in the EHR. The latter part of 2009 was spent interviewing key informants and assessing user acceptance of EHR functionality. Training sessions were conducted for providers, patient advocates, and nurses on the CDS application within the EHR. Provider feedback reports are being delivered to project staff. Post-intervention surveys have been created to measure provider attitudes on the CDS tools and use of guidelines. This post-intervention process measurement was originally scheduled for 2009 but was slightly delayed due to the Institutional Review Board renewal process and will begin in early 2010 instead. The delay has no impact on the overall project or the integrity of the project timeline.

**Preliminary Impact and Findings:** Based on approximately 6 months of data following the implementation of the CDS intervention, it appears that blood pressure control among hypertensives has improved by approximately 43 percent. The data to support this preliminary finding was generated via a feedback functionality embedded in the EHR and has not yet been validated by the study analysis. The feedback functionality is a management tool for clinic staff and leadership to provide guidance to staff and their patients with hypertension. Nevertheless, the findings showed a positive trend in the last 6 months of 2009.

**Selected Outputs**

Kopal H. Evaluation of a Clinical Decision Support System and Electronic Medical Record Based Registry to Improve Management of Hypertension in a Community Health Center. Presentation at the Annual Conference of the Agency for Healthcare Research and Quality, 2008 September 8; Bethesda, MD.

Baseline Clinician Interview Script.

Health Care Provider Survey.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is on track with its milestones. As previously reported, the project team anticipates extending the project by six months due to a compulsory EHR upgrade at the study site in November 2008. This delay does not affect the goals, milestones, scope, or other major component of the timeline.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Optimizing Medication History Value in Clinical Encounters with Elderly Patients |
| **Principal Investigator:** | Lapane, Kate, Ph.D. |
| **Organization:** | Virginia Commonwealth University |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017150 |
| **Project Period:** | 09/07 – 09/10 |
| **AHRQ Funding Amount:** | $1,199,989 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Implementation and Use

**Target Population:** Elderly*

**Summary:** Electronic prescribing (e-prescribing) with medication history at the point of prescribing may assist physicians in more fully understanding adherence issues with older patients, thus promoting partnership with patients, empowering them to participate in treatment decisions, and negotiating acceptable medication regimens that are more amenable to patient follow-through. Information regarding medication history provided by community pharmacy chain organizations in real-time, as well as the potential for communication from the pharmacy when a prescription has not been filled is currently available in some e-prescribing systems in selected geographic locations.

Stemming from Dr. Lapane's previous research, this project explores the hypothesis that in order to optimize improvements in quality of medication management during clinician office visits, clinicians need additional professional development focused on improving their use of the medication history in the clinical encounter. The research team also hypothesizes that additional clinical information systems must be used in conjunction with the flow of detailed medication history via e-prescribing to help guide and structure the clinician's approach to medication management in ambulatory settings.

The project aims to test information technology (IT) by leveraging the flow of community pharmacy-based medication history at the point of prescribing, coupled with professional development to enhance patient-provider communication. The project is interested in improving medication management among elderly people seeking care in ambulatory care settings. Specifically, the intervention strives to:

- Aid in the evaluation and prioritization of medication management issues (e.g., polypharmacy, nonadherence issues, and potentially inappropriate medications) at the point of prescribing.
- Facilitate the incorporation of information regarding medication issues into the clinical encounter.
- Foster clinician-geriatric patient/caregiver communication regarding potential medication management issues.
- Promote the optimal integration of medication history data at the point of prescribing.
- Assist clinicians in evaluating and monitoring complex medication regimens to help identify, resolve, and prevent medication-related problems.
- Facilitate informed, shared decisionmaking and monitoring for medication-related problems.

To test this intervention, the project will conduct a large-scale randomized trial, recruiting 18 physician practices that use DrFirst, an e-prescribing application and network to transmit prescriptions to pharmacies. One-third of practices will receive the innovative modality for delivery of the standard of care by leveraging medication history information (triggering); one-third will receive the triggering and a curriculum to teach clinicians how to optimize communication skills with elderly people and their caregivers in the presence of health IT in the clinical encounter (training); and one-third will receive the existing modality for delivery of standard of care. The evaluation of the project relies on extensive process tracking, existing data sources of medication history, and primary data collection of provider information.

**Specific Aims**

- Develop geriatric-specific algorithms to identify potential issues with medication management (e.g., polypharmacy, potentially inappropriate medication use, duplicative therapy, and nonadherence) using community pharmacy-generated medication history. **(Achieved)**
- Develop structured, problem-oriented frameworks for organizing medication history information during visits (triggering) for common issues identified by the algorithms developed in Aim 1. **(Achieved)**
- Develop and pretest modules to teach clinicians how to improve geriatric patient-provider communication relating to medication management with the use of technology (training). **(Achieved)**
- Test the impact of these interventions on clinician behavior using a randomized controlled trial with three arms: 1) no intervention, 2) delivery of triggering intervention, and 3) delivery of triggering and training interventions. **(Ongoing)**
- Develop "tool-kit" resources and developed intervention products for use by nonphysician providers in other ambulatory settings (e.g., pharmacists in community pharmacy settings). **(Ongoing)**

**2009 Activities:** The research team worked with the e-prescribing software developer, DrFirst, to develop the specific triggers and to review additional issues as needed. This process was informed by the analysis of secondary data to confirm what had been learned from earlier systematic reviews. The development aspect and vetting process with DrFirst is now complete.

Clinician focus groups were completed with 10 physicians. Clinicians were asked about training content and approach as well as who should be trained, the value of continuing medical education (CME) credit, the value of software triggers and associated concerns, as well as the process for consenting and surveying their patients. The physicians did not think they would be able to commit to 4 hours of in-house training but suggested that the training modules be linked to the e-prescribing software if they had questions on the medication and adherence triggers. The CME credit offered for completing the modules was of interest only if they needed to complete credits at that time. The physicians thought that the software triggers would be helpful, as long as they could trust the adherence information. Most physicians had a nurse or aide complete the medication reconciliation with patients and thought that their employees would benefit from the training if they could use the compensation from the grant to pay for the training during their overtime hours. They also preferred to have an electronic tablet with the informed consent and survey information on it left at their office, so they could give it to patients to complete, rather than have a research assistant from the grant team recruit patients in the waiting room. Findings were used to inform planning for training and recruitment and to modify the protocol for the evaluation component of the study.

The physician training modules have been finalized and integrated onto the Web site, and CMEs were approved following institutional review board (IRB) approval. As part of this process some modifications were made to ensure that slides would load more quickly, were easy to read, and to organize and track ongoing changes to the Web site. Development of the Web-based system has gone very well, and the

research team is now considering opportunities for diffusion of the intervention after the study has been completed; however, poor Internet performance with streaming video was identified as a challenge in some cases, so DVDs were mailed to minimize participant frustration and provide an alternative.

In order to code the physician patient interaction, physicians will audiotape a small number of clinical encounters at baseline and followup. Focus group participants agreed that completing an audio recording of two patient visits was not an imposition. The research team is now working with the developers of the Medicode System to develop systems for coding patient-physician communication.

Everything is in place for data collection to begin, and the research team has started to recruit physician practices; however, the timing of recruitment is not on track due to previous delays with IRB approval when Dr. Lapane and the grant moved to Virginia Commonwealth University from Brown University and because practices were overwhelmed with H1N1 preparedness concerns.

**Preliminary** Impact and Findings: There are no findings to report to date.

**Selected Outputs**

Geriatric Med Safety. Virginia Commonwealth University, Memorial Hospital of Rhode Island, University of Rhode Island College of Pharmacy, and DrFirst. Available at: http://geriatricmedsafety.org/. This physician training Web site provides more options for intervention delivery and will allow for easier diffusion of the intervention.

Lapane K. Findings from Focus Groups of Geriatric Patients Regarding Medication Issues. Paper session presented at AHRQ Annual Conference; 2008 September 7-10: Bethesda, MD.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is underspent primarily because a substantial portion of the budget is tied to participant recruitment, as well as coding of clinical encounters. Spending will be on target following enrollment phase.

**Milestones:** Progress is on track in some respects but not in others.

**Budget:** Significantly underspent, more than 20 percent.

**AHRQ Priority Population*

| | |
|---|---|
| **Project Title:** | Improving Quality through Decision Support for Evidence-Based Pharmacotherapy |
| **Principal Investigator:** | Lobach, David, M.D., Ph.D., M.S. |
| **Organization:** | Duke University |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017072 |
| **Project Period:** | 09/07 – 08/11, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,198,429 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Implementation and Use

**Target Population:** Chronic Care*, Medicaid

**Summary:** This project seeks to develop a decision support system for medication management to promote increased adherence to evidence-based pharmacotherapeutic guidelines both through traditional clinic-based models of care and through new care models including population health management and cross-disciplinary teams. The system is based on an emerging standard for decision support and uses routinely available claims and scheduling data in order to serve as a replicable model for broader use of decision support for medication management. The decision support system used in this project, known as the System for Evidence-Based Advice through Simultaneous Transaction with an Intelligent Agent across a Network (SEBASTIAN), is the basis for an international Health Level 7 standard for clinical decision support using a service-oriented architecture. Increased availability and use of decision support tools for medication management can be expected to reduce medication errors, improve health care quality at an acceptable cost, and augment disease management for patients and populations.

This project builds upon a regional health information exchange (HIE) network created to connect providers serving 43,000 Medicaid beneficiaries across traditional institutional boundaries from both rural and urban settings in a 6-county region in the Northern Piedmont of North Carolina. This network includes 28 private primary care clinics, 3 Federally qualified health centers, 4 rural health clinics, 3 urgent care facilities, 11 Government agencies, 5 hospitals, and 2 cross-disciplinary care management teams. Rules for evidence-based pharmacotherapy for priority areas identified by the Institute of Medicine have been encoded in a standards-based decision support tool that has been in use within the HIE network for 3 years to promote population health management. These rules are designed to function using routinely available claims and scheduling data in order to make the proposed approach more generalized, portable, and scalable. The primary study hypothesis is that adherence to evidence-based pharmacotherapy will be highest among patients who receive medication management information sent both to their clinic-based practitioners and to their care managers. The expected effect on safety and quality from this project will be improved adherence to evidence-based pharmacotherapy guidelines. This project involves a three-arm randomized, controlled clinical trial (RCT) within an HIE network known as Community-Oriented Approach to Coordinated Healthcare, or COACH, to evaluate the impact of the medication management interventions. To enhance the data in the HIE, new data importation programs are being developed for practices using different health information technology vendor-based practice management applications for patient scheduling and encounter billing activities.

**Specific Aims**

- Expand the functionality of an existing decision support system in use within a regional HIE network for Medicaid beneficiaries to incorporate evidence-based (EB) pharmacotherapy and to promote medication adherence**. (Achieved)**
- Implement and evaluate the impact of two complementary interventions for medication management on adherence to EB pharmacotherapy among Medicaid beneficiaries in ambulatory care settings through a three-arm RCT. **(Ongoing)**
- Compare resource utilization and assess the economic attractiveness (cost-savings or cost effectiveness) of the interventions to promote medication adherence and EB pharmacotherapy. **(Upcoming)**
- Disseminate information regarding the development and impact of the interventions through Web teleconferences, professional meetings, educational lectures, and peer-reviewed journals. **(Ongoing)**

**2009 Activities:** Of the 14 sites that initially agreed to participate in the research study, 1 practice with 2 sites declined to provide access to their scheduling data; however, an additional Duke practice agreed to participate, bringing the final count to 13 participating primary care sites. Data importation of scheduling data from these 13 participating sites was completed during 2009, and the clinic-specific import programs continue to function appropriately, although continued maintenance effort is necessary to support daily data importation. One practice reported plans to transition to a new electronic medical record system in first quarter 2010, so a new data feed and additional importation programming effort will be required.

In the first half of 2009, the project team focused on the final preparations for releasing the medication management intervention, which included: finalizing the pharmacotherapy rules encoded in the SEBASTIAN decision support system, testing the software components for generating point-of-care reports and notices for care managers, testing the procedures to select and randomize the cohort of patients who will be included in the study, testing the patient registry component, and initiating chart audits of 1,400 asthma patients to accurately identify only persistent asthma patients for analysis of adherence to asthma medications within the study population. The steps required to complete the production of reports included finalizing the infrastructure for generating and distributing the reports, implementing a system for recording feedback from providers about these patients, and final system testing. System testing began in July. During the second month of system testing, live production data were used to generate the new medication management reports, and each report was reviewed and validated by software engineers and project coordination staff.

In early August, the final medication management patient population sample (2,918) was identified and randomized from the August Carolina Access enrollment file. The roll-out of the medication management reports was conducted in four phases beginning in late August and was completed in early October. The medication management reports generated for three pilot sites were closely monitored during the first month, including reproducing the medication adherence calculations manually for validation. Development of automated e-mail messages to notify care managers about patients with significant medication non-adherence and no primary care appointments in the prior 6 months was completed in late October; however, implementation of these daily e-mail alerts was postponed, as the software configuration was linked to another project that was delayed until early December. The three-armed medication management RCT was fully initiated on December 7, 2009, at the 13 participating practices.

**Preliminary Impact and Findings:** Evaluation outcomes will not be available until the RCT is complete; however, early feedback from providers has been favorable.

**Selected Outputs**

Lobach D. Use of Clinical Decision Support and the Impact of Clinical Decision Support on Workflow: Use of Clinical Decision Support in Clinical Practice. Co-presented an AHRQ Webinar; October 2008. Available at: Adobe PDF File.

Kawamoto K, Allen LaPointe NM, Silvey GA, et al. Development and Evaluation of an Improved Methodology for Assessing Adherence to Evidence-Based Drug Therapy Guidelines Using Claims Data. AMIA Annual Symp Proc. 2007;394-398.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** At the end of 2009, progress was on track, but due to unforeseen personnel issues and the technical complexity of the work, the project is behind on the original timeline with the RCT about 11 months delayed; however, the RCT was initated in December 2009, and there are no further delays or difficulties anticipated. In order to complete the data collection and analysis, the project team intends to request a no-cost extension.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Using Health Information Technology to Improve Ambulatory Chronic Disease Care |
| **Principal Investigator:** | Mehr, David, M.D., M.S. |
| **Organization:** | University of Missouri–Columbia |
| **Mechanism:** | RFA: HS07-006: Ambulatory and Safety Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017035 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,192,603 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*, Elderly*

**Summary:** Fragmented chronic disease care requires new systems to manage information between providers and enhance communication with patients. To improve patient care quality and safety outcomes, the Family Medicine and General Internal Medicine practices at the University of Missouri–Columbia (MU) are conducting a phased implementation of selected ambulatory care health information technology (IT) systems and functions. This research demonstration project proposes a formative (in-process evaluation aimed at improvement) and summative (final overall) evaluation of health IT innovations designed to foster improved chronic disease care in the ambulatory primary care practices at MU. These innovations result directly from a collaboration of MU clinicians from the Department of Family and Community Medicine with MU's medical record vendor, the Cerner Corporation, which is certified by the Certification Commission for Health Information Technology.

Specific strategies in this health IT project include providing physicians with comparative performance reports in one of three formats, providing patients with access to a Web-based, interactive software system, secure messaging, in-home reconciliation of all medications to Cerner IQ Health Cycle 11 release, and using in-home "smart" diagnostic devices to send patient data directly to the care team.

The project proposes a multi-method evaluation of health IT innovations designed to enhance the quality of primary care for chronic diseases, including qualitative interviews, surveys, and analysis of outcome data in the evaluation. The innovations are being implemented differently in various practices and with different associated care systems. This variation in care processes provides an extraordinary opportunity to evaluate factors that influence whether health IT innovations will aid in performance-based quality improvement, assist with care coordination, and facilitate patient self-management.

**Specific Aims**

- Evaluate the change in patient care processes and outcomes following introduction of health IT-generated clinician quality performance reports with comparison across practices and different peer comparisons. **(Ongoing)**
- Evaluate the effectiveness and changes associated with an interactive Web-based patient interface software system (IQ Health), including in-home medication reconciliation. **(Ongoing)**

- Evaluate the use of in-home "smart" diagnostic devices (e.g., blood pressure cuffs, glucometers) connecting patients with their care teams. **(Ongoing)**
- Disseminate information regarding the development and impact of the interventions through Web teleconferences, professional meetings, educational lectures, and peer review journals. **(Ongoing)**

**2009 Activities:** Performance reports for physicians were completed and made available in February 2009. The reports provide summary information—including blood pressure, laboratory data, and medications for an individual patient—demonstrating whether quality indicators have been achieved for that patient. In addition, providers can compare their data to other providers' data in a variety of ways. To start, some providers were randomized to receive these reports by e-mail as "push reports," while others accessed them online via "pull reports." A data dump of pertinent clinical data from the electronic record allows tracking, whether this new functionality is associated with altered clinical outcomes, or whether it interacts with the performance reports. The impact of access to these reports on performance indicators, such as systolic blood pressure < 140/90, will be evaluated in early 2010.

The development of summary screens is also part of the Cerner-MU collaboration. The summary screens allow the clinician to view multiple elements of a patient record, such as laboratory values and medications for a diabetic patient, in a single screen. A survey was distributed to clinicians to evaluate the usability of the summary screens and the results were presented in September 2009 at the Agency for Healthcare Research and Quality's (AHRQ's) Annual Conference.

The evaluation of IQ Health was initiated. Several flaws in the system were identified in the rollout process and as a result, the software was only implemented on a small scale. Despite these flaws, surveys were distributed to patients and providers who used IQ Health. This qualitative information will be valuable for informing development of improved patient interface software.

Enrollment in the use of in-home "smart" diagnostic devices has continued but has been slowed by technical difficulties such as incompatibility between patients' diagnostic equipment and computers during software releases, and the shift toward upgrading telephone lines to digital cable. These challenges have also limited the eligibility of some potential participants.

**Preliminary Impact and Findings:** The project team presented results on the use of the single summary screens for summarizing diabetes care at the September 2009 AHRQ meeting. The evaluation of the summary screens determined that providers were able to retrieve information more quickly, with fewer mouse clicks and improved accuracy. Qualitatively, the providers embraced the new tool and discussed how rapid access to information is critical. If identifying data is too time consuming, providers may give up, ask the patient to recall information, and if necessary, repeat exams. Initial data on the summary screen indicates that this tool accelerates information retrieval.

**Selected Outputs**

Mehr D, Kochendorfer K. Improving Chronic Disease Care with the use of Automated Real-time Performance Reports. Presentation presented at the Conference on Practice Improvement: Constructing the Medical Home. 2009 November 6; Kansas City, MO.

Koopman RJ, Mehr DR, Kochendorfer K, et al. Immediate and One-Year Evaluation of Single Screen Summarizing Key Data for Diabetes Care in an Electronic Health Record. Poster at the Annual Conference of the Agency for Healthcare Research and Quality, 2009 September 13-16; Washington DC.

Wakefield, D. Secure Patient-Provider Communication System Implementation: Questions to Consider. Presentation presented at the Caring for the Frail Elderly Conference, 2009, August 22; Columbia MO.

IQHealth Benchmarking Survey.

Provider Experience and Perception Survey.

Provider Information Needs and Uses Survey.

Provider Needs and Use Survey: Getting Information out of PowerChart.

Provider Survey for IQ Health.

Summary Screen Interview Protocol.

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**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project team is currently focused on improving the recruitment of patients for evaluation of the use of "smart devices" for blood glucose and blood pressure monitoring.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

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**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Veterans Administration Integrated Medication Manager |
| **Principal Investigator:** | Nebeker, Jonathan, MD |
| **Organization:** | Western Institute for Biomedical Research |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017186 |
| **Project Period:** | 09/07 – 03/11, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $594,582 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Implementation and Use

**Target Population:** Adults and Veterans

**Summary:** Computerized clinical decision support research is often focused on the improvement of technology, but more research is needed in understanding what contributes to successful use of the systems resulting in improved patient outcomes. The Veterans Administration (VA) has implemented clinical decision support, which has supported clinicians in reaching quality goals. However, in 2006, 25 percent of hypertensive patients did not reach the performance standards. To improve on current systems, and support providers in reaching quality goals for more hypertensive patients, this project funds the development and evaluation of a new health information technology application called the Integrated Medication Manager (IMM). The IMM facilitates clinicians' decision-making by helping them consider relevant data when planning patient care. In a departure from the traditional medical record, a major feature of this system is the explicit linking of patient problems, therapies, and goals. This project will compare IMM to a standard electronic health record (EHR), thereby generating new knowledge about medication management.

The design of the IMM is through analysis of the cognitive processing of information by providers, and through better understanding of how and what information is shared between a clinical team of providers. In the first phase of the project, observation of different members of the clinical team provided the information needed to redesign the IMM software. Physicians, mid-level providers, and pharmacists were followed during clinical visits, and between patients asked to "think aloud" and describe their thought processes as they worked through decision-making for a patient using the EHR. The findings of the observations were shared with the development team to guide them as they refined the IMM software.

The second phase of the project is evaluation of the IMM software through the use of test cases in simulation studies. The simulation studies will provide further insight into how providers integrate information, and will further support evaluation of the IMM.

**Specific Aims**

- Identify cognitive components of providers' therapeutic decision-making in the field. **(Achieved)**
- Refine and evaluate the IMM using simulation studies. **(Ongoing)**

**2009 Activities:** In June 2009, members of the study team began weekly meetings with the VA software developers and terminologists who are designing and building the IMM software. However, development

was slowed due to the loss of the support of the VA development team, which will extend the project timeline. Despite setbacks in collaboration with the VA, the research team continued their development of the IMM software throughout the year, and the software is near completion. In 2010, the team will continue to provide support and feedback related to the scientific and clinical aspects of the IMM interface to further refine and complete the software.

In preparation for the simulation studies of the IMM software, the project team began identifying a set of real patients, from which data will be simulated and used to create the EHR test cases. Institutional Review Board and research and development approvals were granted, and data requests were submitted and approved.

**Preliminary Impact and Findings:** The project team has analyzed the result from their cognitive components analysis and is eager to share the results of this analysis and its impact on human factors analysis. Initial results were presented 18 months into the project (presentation below).

**Selected Outputs**

Nebeker J. Human Factors in Prescription Medication Management. Presentation at the Annual Conference of the Agency for Healthcare Research and Quality, 2008 September 8; Bethesda, MD. (PowerPoint File; Web Version).

Nebeker J. Information Integration to Support Medication Management. Presentation at the Annual Conference of the Agency for Healthcare Research and Quality, 2008 September 8; Bethesda, MD. (PowerPoint File; Web Version).

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project team is focused on building test cases using real patient data to prepare for simulation studies to start in early 2010.

**Milestones:** Progress is on track in some respects.

**Budget:** Spending is roughly on target.

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|---|---|
| **Project Title:** | Medication Safety in Primary Care Practice—Translating Research into Practice |
| **Principal Investigator:** | Ornstein, Steven, M.D. |
| **Organization:** | Medical University of South Carolina |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017037 |
| **Project Period:** | 09/07 – 09/10 |
| **AHRQ Funding Amount:** | $1,183,549 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Implementation and Use

**Target Population:** General

**Summary:** The Practice Partner Research Network (PPRNet), a practice-based research network among primary health care providers in 38 states who use a common electronic medical record (EMR), has developed the Practice Partner Research Network—Translating Research into Practice (PPRNet-TRIP), a quality improvement model that translates research into primary care practice. This project is conducting a demonstration project among 20 PPRNet practices. The project has developed a set of medication safety measures relevant for primary care, which have been incorporated into the quarterly practice performance reports that are sent participating practices.

The 2-year intervention includes the development and dissemination of performance reports, network meetings, and practice site visits, to help practices systematize their use of the medication safety clinical decision support features in their EMR system, McKesson Practice Partner (Version 9, Seattle, WA), which is certified by the Certification Commission on Health Information Technology. The intervention features warnings for drug allergies, drug/drug and drug/disease interactions, incorrect dosages, and drug ineffectiveness, and prompts for therapeutic monitoring to prevent adverse drug events. After 2 years, the impact of the intervention on the incidence of medication errors will be assessed. A mixed method process evaluation will also be conducted to assess the project. The findings will then be disseminated to other PPRNet practices and distributed more broadly through presentations and publications. The final performance report will be prepared in the tenth month of Year 3 of the project, and these data will serve as the final point for assessment of the project's effectiveness. Analyses and manuscript preparation will be done during the final 3 months of the project, and a wrap-up network meeting will be held to disseminate study results.

**Specific Aims**

- Develop a set of PPRNet medication safety indicators based on literature and refined to reflect cumulative expertise of members. **(Achieved)**
- Incorporate PPRNet medication safety indicators in quarterly practice reports distributed to 20 participating practices. **(Achieved)**
- Assess the impact of the PPRNet-TRIP quality improvement (QI) model on medication safety indicators in participating practices. **(Ongoing)**

**2009 Activities:** Minor modifications to the PPRNet medication safety indicators that were developed in 2008 continued to be made, based on practice input. For example, blood pressure and serum creatinine were added to the report of hypertensive patients on non-steroidal anti-inflammatory agents, as requested by several practices. Site visits to all 20 participating sites were completed to assess the impact of the PPRNet-TRIP QI model on medication safety indicators. All made improvement plans, largely centered around developing better systems for assuring the completeness of medication lists, using reports to identify patients needing specific followup and using EMR medication safety tools more systematically. Five participating practices have also received a second site visit, which revealed that sites continue to make minor adjustments in their improvement plans based on their experiences during the first year of the intervention. Notable is the increased emphasis for using the Practice Partner Health Maintenance functions as standing orders for medication monitoring. The project team continued to prepare and distribute quarterly reports.

A network meeting was held September 11, 2009, in Charleston, SC. As an initial step in dissemination of project findings, a total of 80 PPRNet clinician and staff attended the general session on the Medication Safety (MS)-TRIP project. Six of the 20 MS-TRIP practices highlighted their improvement approaches during best practice presentations. Representatives from 18 practices participated in small group workshops and met as practice liaison groups to plan medication safety improvement activities.

**Preliminary Impact and Findings:** Practice adherence with the MS-TRIP indicator set over the first 12 months of the intervention (as of July 1, 2009) was analyzed for the following indicator categories: avoiding potential drug/drug interactions, avoiding potentially inappropriate dosing, avoiding potential drug/disease interactions, avoiding potentially inappropriate therapy, and monitoring/preventing potential adverse drug events. Statistically significant improvements were found for each of the indicator categories, with the exception of avoiding drug/drug interactions. Individual indicators with the greatest improvement included: H2 blocker dosing in renal impairment, allopurinol dosing in renal impairment, digoxin dosing in elderly patients with congestive heart failure, avoidance of antibiotics in upper respiratory infections, avoidance of anticholinergics in patients with dementia, and use of folic acid in patients on methotrexate. Adherence with serum creatinine and potassium monitoring over 6 months for elderly patients or patients with estimated creatinine clearance of <50 ml/min on angiotensin converting enzyme inhibitors or angiotensin receptor blockers with potassium-sparing diuretics decreased over time. Practice-specific trends in adherence will be the focus of performance reviews in upcoming site visits.

**Selected Outputs**

Wessell A, Litvin C, Jenkins R, et al. Medication prescribing and monitoring errors in primary care: a report from the practice partner research network. Qual Saf Health Care. Forthcoming 2010.

Wessel A, Nemeth L, Jenkins R, Ornstein S. Improving medication practice plans to improve medication safety in primary care: The PPRNet-TRIP Project. 2009 North American Primary Care Research Group Meeting; 2009 Nov 14-18; Montreal, Quebec, Canada.

Ornstein S. Improving medication safety in primary care practice: preliminary report from the practice partner research network (PPRNet). Poster session presented at the 2009 National AHRQ Meeting; 2009 Sept 14; Bethesda, MD.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is on time on all tasks.

**Milestones:** Progress is completely on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

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| **Project Title:** | A Partnership for Clinician Electronic Health Record (EHR) Use and Quality of Care |
| **Principal Investigator:** | Pohl, Joanne, Ph.D. |
| **Organization:** | Michigan Public Health Institute |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017191 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,184,765 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Chronic Care*, Medically Underserved

**Summary:** Despite the emphasis on health information technology (IT) in ambulatory care, current use of electronic health records (EHRs) in ambulatory settings remains lower than 25 percent. If complete implementation of EHR is considered—including features and functionality of e-prescribing and clinical decision support (CDS)—the rate of adoption and use is closer to 9 percent. After a health center makes a monetary investment in EHR, there remain significant barriers to full and effective use of the system, including redesigning workflow to incorporate use of the EHR before, during, and after a patient visit. It is especially important for CDS systems that these barriers be overcome. If information is not available at the point of care and decisionmaking, IT cannot impact quality and outcomes of care. It is important to identify and disseminate strategies to overcome barriers to full EHR use and strengthen the link between technology adoption and improved quality of patient care.

The Institute for Nursing Centers and the Alliance of Chicago Community Health Services' (Alliance) project studies the effectiveness of a partnership that shares resources and utilizes a data-driven approach to promote full clinician use of an EHR. This project is being conducted in three nurse-managed health centers and three community health centers in order to improve the quality of care in areas of preventive care, chronic disease management, and medication management for vulnerable populations. These partners have a record of highly productive research, successful EHR implementation, commitment to data-supported high quality health care for vulnerable populations, and a history of building and maintaining strong collaborations.

The goals of this project address one of the key problems in leveraging health IT to support high-quality patient care: the fact that, despite the potential, CDS is often not used effectively or consistently by clinicians, even when an EHR is available. The research design of this project incorporates quantitative and qualitative methods as well as individual and center-level analyses. The critical link between full use of EHR functionality (including CDS features) and clinical performance and quality outcomes will be examined with rigorous quantitative methodology. The product is the integrated General Electric (GE) Centricity Practice Management EHR System and is Certification Commission for Health Information Technology-certified as meeting requirements related to functionality, security, reliability, and interoperability—with substantial customization of CDS in templates developed by the Alliance. The quality indicators that have been selected are those that the Institute of Medicine has identified as priority areas for improvement and are areas where significant disparities across racial, ethnic, and income groups

exist. Qualitative methodology will add to the field's understanding of health center leadership and change management required for successful use of EHR.

**Specific Aims**

- Study the effectiveness of a partnership that shares resources and uses a data-driven approach to promote full use of an EHR by clinicians in settings that serve vulnerable populations, in order to improve the quality of care in the areas of preventive care, chronic disease management, and medication management. **(Ongoing)**
- Test the links between clinician use of an EHR and quality of preventive care, chronic disease management, and medication safety. **(Ongoing)**
- Examine organizational processes in the implementation and full use of an EHR in relationship to care delivery and outcomes. **(Ongoing)**

**2009 Activities:** The project continues to support and maintain EHR use by monitoring help desk calls and system use measures. No significant problems have been reported, and routine/ongoing post go-live training and support continue. Data collection and evaluation tool development was completed and the following tools have already been implemented: end-user satisfaction tool, patient satisfaction survey, query of EHR usage, queries of productivity, clinician satisfaction surveys, implementation interviews, and the followup implementation of the Physician Practice Patient Safety Assessment. Data collection and analysis are continuing at participating sites. Qualitative data collection through interviews with site staff was completed. Analysis of data collected during this period is the primary focus of the study at this time. Queries for clinical performance and outcome measures, medication safety measures, EHR usage, and productivity have been initiated. It is anticipated that analysis and manuscript development will continue throughout the remainder of the project.

**Preliminary Impact and Findings:** The project is collecting data with immediate relevance for the current efforts to support EHR adoption across the country. The project is measuring utilization of advanced functionality of the EHR by measuring utilization of clinical decision support (CDS) templates for chronic disease and preventive care, as well as measuring response to medication interaction alerts. Data show varying usage of CDS over time and by provider; current efforts focus on understanding the causes of such variation. Preliminary findings also show that higher utilization of the CDS does not have a straightforward association with improved quality of care for the patient. In addition the partnership model of supported EHR implementation and advanced use of EHR, closely resembles the charge of the Health IT Regional Extension Program of hands on support for meaningful use. With qualitative and financial data, the project is documenting the nature and extent of partner support – and how this addresses barriers to implementation and use of EHR at the health centers.

**Selected Outputs**

Zheng K, McGrath D, Hamilton A, et al. Assessing organizational readiness for adopting electronic health record system: a case study in ambulatory practices. Journal of Decision Systems, 2009;18(1):117--40.

Pohl, J. Nurse Managed Health Centers: Safety Net Settings and EHRs. HIMSS Regional Technology Conference; 2009 Nov 2; Grand Rapids, MI.

Tanner, C.; Zheng, K.; Hamilton, A.; McGrath, D.; Pohl, J. A Partnership Model to Facilitate EHRS Adoption and Improvement of Quality of Care in Safety Net Providers. AMIA Spring Conference; 2009 May 28; Orlando, FL.

Pohl, J.M.; Tanner, C.; Zheng, K.; Hamilton, A.; McGrath, D.; Harris, J.; Onifade, T. EHR: Evaluate for Success. AHRQ 2008 Annual Conference; 2008 Sept 7; Bethesda, MD.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Progress was slower than expected with the multisite nature, getting approval from institutional review boards, and organizational buy-in creating barriers to smooth implementation. A one year extension has been granted.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Harnessing Health Information Technology to Prevent Medication-Induced Birth Defects |
| **Principal Investigator:** | Schwarz, Eleanor, M.D. |
| **Organization:** | University of Pittsburgh at Pittsburgh |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017093 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,199,370 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Women*

**Summary:** Each year, 150,000 infants – 1 to 3 percent of all births in the United States – are born with some form of physical or mental birth defect. The Institute of Medicine has identified prevention of birth defects as one of six priorities for the Nation's health. It is estimated that each year, 12 million women in the United States use medications that might increase the risk of birth defects if used during pregnancy.

Studies show that the concurrent use of contraception with such medications can prevent associated birth defects. Unfortunately, when prescribing potentially teratogenic medications, clinicians rarely counsel women about contraception, and approximately 6 percent of pregnancies are exposed to medications that may increase the risk of birth defects.

As various health information technologies (ITs) have improved the safety of medication management in some health care settings, this project proposed to develop and rigorously evaluate ways that health IT may help doctors counsel women about preventing birth defects that could be caused by the use of certain medications. The project began by conducting a series of focus groups with clinicians and patients seen in academic and community-based practices in order to find out what information would be most useful to primary care clinicians and their patients.

Data from the focus group discussions was used to refine the two distinct health IT application interventions: 1) multi-faceted clinical decision support (CDS), and 2) the networked tablet computer's electronic collection of machine-actionable information about women's risk of pregnancy. The impact of each of these interventions is being evaluated using factorial design, randomized controlled trials. In the first trial, multi-faceted CDS (intervention) is being compared to streamlined clinical alerts (control). The second trial evaluates whether collecting machine-actionable information about women's risk of pregnancy using a networked tablet computer (intervention) is superior to the way clinicians usually collect this information (control).

Over the course of a year, data from the following sources was collected to inform the study: 1) data abstracted from the electronic medical record (EMR) when study clinicians prescribed teratogenic medications; 2) phone interviews conducted with women prescribed medications by participating clinicians; and 3) participating clinicians surveyed about their satisfaction with the CDS they receive. These data are being used to confirm the hypotheses that clinicians in the intervention groups will: 1)

prescribe fewer teratogenic medications; 2) be more likely to prescribe contraception when prescribing a teratogenic medication; 3) have more patients report satisfaction with the counseling they received; and 4) report more satisfaction with the CDS they received. All of the practice sites use the EpicCare (Summer 2007) EMR system, a Certification Commission for Health Information Technology-certified product developed by University of Pittsburgh Medical Center (UPMC) in collaboration with the Epic Systems Corporation.

This evaluation will provide much-needed information on how health IT can best be harnessed to prevent medication-induced birth defects nationwide. The health IT intervention shown to be most effective will be disseminated within the UPMC, which supports three million outpatient visits each year.

**Specific Aims**

- Develop and implement two CDS systems designed to alert ambulatory clinicians to the risk of medication-induced birth defects. **(Achieved)**
- Evaluate the effect of two CDS systems designed to alert ambulatory clinicians to the risk of medication-induced birth defects. **(Ongoing)**

**2009 Activities:** In 2008, the survey to evaluate clinician perspectives on CDS systems designed to alert ambulatory clinicians to the risk of medication-induced birth defects was initiated. During 2009, the survey assessment was expanded beyond UPMC clinicians to include non-UPMC clinicians (Central Pennsylvania, Rhode Island, and Oregon). In addition, the study implemented a post-intervention survey with UPMC clinicians.

Enrollment activities were a significant focus for the research team during 2009. The team obtained consent from over 4,800 women receiving services at the four UPMC primary care clinics. Fifty-three percent of these women completed surveys about the counseling they received from their primary care physicians (PCPs). The CDS system was activated during visits with over 270 of the women who completed surveys. By June, a preliminary analysis of patient survey data and EMR data was completed, with further analysis conducted in September.

The "FAST" tablet system (live since October 2008) and the "Welcome" tablet system (live since November 2008) are both being used as electronic patient intake systems to assess women's pregnancy intentions and use of contraception. In 2009, additional sites were added for both tablet systems. Requests to abstract the data collected have been filed and will be reviewed by the study staff in subsequent study periods.

As part of dissemination activities, the list used for outpatient alerts was modified and implemented for inpatient alerts. Further adaptation is required.

**Preliminary Impact and Findings:** Themes that emerged from focus groups with women of reproductive age include: 1) a desire to receive information about medication side effects from physicians at the time of prescription; 2) a feeling that pregnancy-related risks (related to medication use or poor maternal health) should be routinely discussed; 3) that women depend on their physicians for information about pregnancy risks because they feel other sources may not be reliable; 4) that women can rarely alert their physicians to the possibility of pregnancy because not all plan their pregnancies; and 5) that if a clinician thinks a woman should not get pregnant while using a medication, the clinician needs to help the woman avoid pregnancy by providing an effective form of birth control.

The major themes that emerged from focus groups with primary care clinicians include:

- Desire for accurate information about teratogenic risks that is available in “real time”;
- Difficulty identifying concise sources of teratogenic information on the Internet;
- Concern that hard-copy references may not be up-to-date;

- Desire for references that provide clinically relevant information about teratogenic risks (such as absolute risks instead of relative risks);
- Belief that clinical decision support with computerized order entry would help them alert women to the possibility of teratogenic risks;
- Concern that few medications have been adequately studied during pregnancy;
- Worry that information about teratogenic risks may lead some women to decide not to use needed medications;
- Concern that raising the possibility of unintended pregnancy may offend some women;
- Perception that few women present requesting preconception counseling; and
- Perception that limited clinical time requires prioritizing acute and billable issues, the latter of which preconception counseling is not.

Between December 2008 and August 2009, 1,559 women (56 percent of those consenting) completed surveys about the counseling they received from their PCP. CDS was activated during visits with 233 women who completed surveys.

Most women with PCPs that received an alert still received a prescription. Women with PCPs that received alerts were more likely than women with PCPs that did not receive an alert to report that a doctor told them to avoid use of a medication during pregnancy; however, only a minority of women who received potentially teratogenic medications reported receiving counseling about risk of medication-induced birth defects, or counseling to avoid pregnancy. Women with PCPs that received multi-faceted CDS were less likely to seek more information about their medications. Sources most often consulted by women who sought further information about their medications included pharmacists, the Internet, and package inserts.

**Selected Outputs**

Santucci AK, Gold MA, Akers AY, et al. Women's perspectives on counseling about risks for medication-induced birth defects. Birth Defects Res A Clin Mol Teratol 2010 Jan;88(1):64-9.

Schwarz EB, Santucci A, Borrero S, et al. Perspectives of primary care clinicians on teratogenic risk counseling. Birth Defects Res A Clin Mol Teratol 2009 Oct;85(10):858-63.

Abstract presented at the Society of Family Planning Annual Meeting, Reproductive Health 2008; 2008 Sept 17-20; Washington, DC.

**Grantee's Self-Reported Quarterly Status (as of December 2009):** The project is progressing well overall despite issues with data collection and data integrity. Because of the data issues, the grantee will most likely request a no-cost extension to allow for additional data collection, cleaning, and analysis.

**Milestones:** Progress is mostly on track.

**Budget:** Spending roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Can Risk Score Alerts Improve Office Care for Chest Pain? |
| **Principal Investigator:** | Sequist, Thomas, M.D., M.P.H. |
| **Organization:** | Brigham and Women's Hospital |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017075 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $687,539 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults

**Summary:** Assessment of chest pain in ambulatory patients is challenging; high-risk patients may go undetected, while low-risk patients may be subjected to unnecessary evaluations. This randomized, controlled study implements and evaluates an intervention to improve the treatment of primary care patients with acute chest pain in a large, integrated health care delivery system. The study uses electronic alerts to risk stratify outpatients with chest pain and presents this information to primary care providers (PCPs) in an electronic medical record (EMR). The intervention takes place within Harvard Vanguard Medical Associates (HVMA), a multispecialty integrated group practice with 140 PCPs caring for approximately 300,000 patients at 14 centers in eastern Massachusetts. HVMA has a long history of using advanced EMRs and other forms of health information technology to improve ambulatory patient safety and quality. Since 1999, HVMA has integrated the Epic EMR system, a Certification Commission for Health Information Technology-certified product, into all aspects of ambulatory care within the organization, including point-of-care services, such as electronic order entry and reminders, and centralized functions, such as patient scheduling.

This study has important implications for optimizing the treatment of outpatients with chest pain symptoms through the innovative use of electronic decision support, while documenting the cost implications of such a strategy. This work will also provide a model for how ambulatory practices across the country can use EMRs to present real-time patient risk information to clinicians with the goal of improving patient safety and quality, which has important implications for both acute and chronic care.

**Specific Aims**

- Identify predictors—including race and sex—of risk-appropriate evaluation and treatment of patients presenting to primary care offices with acute chest pain. **(Achieved)**
- Determine whether rates of appropriate evaluation and treatment of patients with acute chest pain can be improved through the use of point-of-care electronic risk alerts that provide individual patient cardiac risk profiles and tailored evaluation and treatment recommendations to primary care clinicians. **(Ongoing)**
- Perform a cost analysis for the provision of electronic decision support for patients with acute chest pain. **(Ongoing)**

**2009 Activities:** This trial required enrollment based on complaint rather than diagnosis. As a result, a key component for the successful delivery of the intervention was the training of medical assistants to accurately identify patients presenting with chest pain to primary care physicians, and enter a coded "chief complaint" of chest pain into the electronic record. This code is used as the electronic trigger for the delivery of the decision support tool. In 2008, more than 150 medical assistants across all of the health care centers were trained in a course that focused on the identification of patients with chest pain and use of the electronic chief complaint codes within the EMR. In 2009, project staff conducted regular site visits during the 18-month intervention period to refresh the medical assistant training. This training required persistence and regular feedback, both in-person and via email.

The core of this intervention involves the delivery of electronic decision support to clinicians within the context of evaluating patients with chest pain presenting to the office. The decision support is provided in the form of an electronic alert ("pop up") within the EMR system. The project contracted with Epic Systems to build this decision support tool for this project. This involved creation of specifications regarding calculation of cardiac risk scores (Framingham Risk Score), as well as the design of the interface with the electronic record. A prototype of this tool was completed and tested by study staff in a test environment within Epic. The project has subsequently migrated the electronic tool into the active clinical production environment within Epic and completed testing. In 2009, this “cardiac risk calculator” was incorporated into Epic’s new standard software package for broader use beyond this project.

The evaluation of the impact of the intervention is under way—for high-risk patients through chart review for performance on EKG and administration of aspirin, and for low-risk patients through avoidance of exercise stress testing. The first charts became available for review in January 2009 and continued throughout the year. About 5,000 charts were reviewed. The data are abstracted through the EMR through both manual and automated chart review and are stored in an Access database. The automated reporting mechanisms include the Framingham Risk Score data at the time of the office visit. This was programmed into the EMR to facilitate date collection.

The project has begun work toward the third aim of the project, performing a cost analysis of the provision of electronic decision support for patients with chest pain. The team began estimating the costs of the intervention through collaboration and meetings with the project economist. Cost estimates are being developed for individual components of the intervention including the creation of data reports, chart reviews, electronic decision support, and treatment/evaluation costs.

**Preliminary Impact and Findings:** Initial qualitative findings from the project include learning how to better describe clinical care for patients in primary care with chest pain. This requires understanding the prevalence of conditions, the resources used, common mistakes, and patient demographics. The training of medical assistants yielded great improvements in coding accuracy. They achieved a 70-percent rate of correct identification of patient complaints of chest pain when it is the single patient complaint, and a 50-percent rate of correct identification when the patient has multiple complaints.

**Selected Outputs**

Electronic Decision Support Tool: The tool uses routinely available data fields within the EHR (patient age, gender, blood pressure, cholesterol, and smoking status) to calculate the Framingham Risk Score.

**Grantee’s Most Recent Self-Reported Quarterly Status (as of December 2009):** The project intervention went live on October 27, 2008, and continued through January 2010, a total of 18 consecutive months, a few months longer than initially planned. With this extension the team is now on track to enroll the appropriate number of both high-risk and low-risk patients with chest pain. Project interventions will be completed in January 2010. Results of the complete intervention will be analyzed in 2010. A significant focus is now the measurement of the cost of implementation of clinical decision support.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

| | |
|---|---|
| **Project Title:** | Improving Laboratory Monitoring in Community Practices: A Randomized Trial |
| **Principal Investigator:** | Simon, Steven, M.D., M.P.H. |
| **Organization:** | Harvard Pilgrim Health Care, Inc. |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017201 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $990,640 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Adults

**Summary:** Medication errors and preventable adverse drug events (ADEs) occur commonly among patients in the ambulatory setting and constitute an important target for patient safety and quality improvement. Laboratory monitoring to ensure the safety and effectiveness of drug therapy and the timely management of abnormal results of laboratory testing have been increasingly recognized as important areas for improving patient safety in ambulatory care. Promising interventions have been developed for practices affiliated with hospitals and integrated delivery systems but, to date, efforts have not adequately reached physicians practicing solo or in small community practices.

The overall aim of the project is the development of clinical decision support (CDS), i.e., point-of-care alerts), in a widely used, commercially available electronic health record (EHR), eClinicalWorks, which is a Certification Commission for Health Information Technology (CCHIT)-certified EHR, that addresses the barriers to and facilitators of laboratory monitoring and that would be adaptable to other CCHIT-certified EHRs. The 3-year study tests the effectiveness of computerized CDS and a results management system in community primary care and medical subspecialty practices in a cluster randomized controlled trial with 2x2 factorial design. The project includes a qualitative analysis of the barriers to and facilitators of laboratory monitoring and timely followup of abnormal results among clinicians in ambulatory primary care practices. This information will be used to develop, implement, and evaluate computerized CDS to facilitate the indicated laboratory monitoring of medications at initiation or continuation of therapy and an enhanced computerized results management system. Baseline analyses will yield novel information on the rates and correlates of laboratory monitoring errors and the management of abnormal test results in community-based primary care settings. The study incorporates a dissemination plan, which includes not only publication and presentation of the results in scientific settings but also the creation of a dissemination guide that will be made freely available to other community-based ambulatory practices implementing EHRs and CDS.

**Specific Aims**

- Identify barriers to and facilitators of laboratory monitoring and timely followup of abnormal results. **(Achieved)**

- Design, implement, and evaluate CDS (point-of-care alerts) for laboratory monitoring in a widely used, commercially available EHR that addresses barriers to and facilitators of laboratory monitoring. **(Ongoing)**
- Design, implement, and evaluate a results management system to efficiently handle abnormal laboratory test results in ambulatory care. **(Ongoing)**
- Develop a detailed dissemination guide and widely distribute it to other practices and communities interested in implementing similar interventions. **(Upcoming)**

**2009 Activities:** The project completed the alert specifications, prioritization for the alerts, and 20 use-case scenarios for the EHR vendor to complete the alert programming. The vendor programmed the alerts and demonstrated their use and functionality to the research team via Web conferencing and provided the research team with a beta site for further alert testing.

The project plan was modified from the original proposal, and the team is working with eClinicalWorks to develop options for testing other interventions to improve results management. In the original plan, the research team proposed the development of a new results manager system within a commercial EHR vendor system; however, time constraints, existing programming, and technological limits within eClinicalWorks prevented the team from pursuing this intervention. The revised research plan focuses on a controlled time-series analysis of laboratory result notification using a patient portal, which is an existing eClinicalWorks feature that allows patients to access health information — including laboratory results — and communicate with physicians. The outcome of interest is the time to patient notification of both abnormal and normal laboratory results as well as physicians' time to perform appropriate followup action on abnormal tests through chart reviews. Due to time constraints, the study design has also been changed to implement the laboratory monitoring alerts and results management intervention simultaneously. There will still be four arms to the study as originally intended but only one phase.

Study staff compiled dissemination guide information, including a matrix of alerts and related programming, and developed a prioritization spreadsheet and use-case scenarios that will help other EHR vendors program these alerts for their products. As the training and rollout are initiated, the team will modify and add to these instruments to make them as user-friendly as possible.

**Preliminary Impact and Findings:** Focus group participants viewed laboratory monitoring as a critical, time-consuming task integral to their practice. Most believed they commit few laboratory monitoring errors and were surprised at the error rates reported in the literature. They listed various barriers to monitoring, including not knowing which physician was responsible for ensuring the completion of laboratory monitoring, uncertainty regarding the necessity of monitoring, lack of alerts or reminders, and patient nonadherence. The primary facilitator of monitoring was ordering laboratory tests while the patient is in the office. Primary care providers felt more strongly than specialists that computerized alerts could improve laboratory monitoring. Participants wanted to individualize alerts for their practices and warned that alerts must not interrupt workflow or require too many clicks. Physicians in community practices recognized the potential of computerized alerts to enhance their monitoring protocols for some medications. Interventions to improve laboratory monitoring should address physician workflow issues and increase patient awareness of the importance of fulfilling recommended therapeutic monitoring to prevent ADEs.

**Selected Outputs**

Hayward GL, Parnes AJ, Simon SR. Using health information technology to improve drug monitoring: a systematic review. Pharmacoepidemiol Drug Saf. 2009 Dec;18(12):1232-7.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Current project plans are slightly delayed. A no-cost extension year has been approved. It is expected that all funds will be used by the end of the project.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

| | |
|---|---|
| **Project Title:** | A Systems Engineering Approach: Improving Medication Safety |
| **Principal Investigator:** | Singh, Gurdev, Ph.D., M.Sc. |
| **Organization:** | State University of New York at Buffalo |
| **Mechanism:** | RFA: HS07-006: Ambulatory and Safety Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017020 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,200,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Elderly*

**Summary:** Medication errors in older adults in ambulatory settings are serious but preventable. This project studies the impact of an information technology (IT) based Crew Resource Management (CRM) tool on patient safety in primary care practices serving older adults. The IT system being adapted, A Collaboration of Resources Network (ACORN) was developed by the Dendress Corporation. The system facilitates quality improvement teams in hospital settings. A modified system, ACORNoffice, was completed and alpha-tested within the first 6 months of the project.

The project was formulated in consultation with Upstate New York Practice-based Research Network clinicians who use various electronic medical records and would like to identify affordable approaches that would be useful and generalizable to their practices. The project is an experimental design (single-blind randomized block cluster) of a site-level intervention. Outcome assessment will be focused on medication safety among geriatric patients and office staff use/application of the IT-based CRM tool. Participatory research methods will be used to assess provider- and staff-identified barriers to implementation.

The goal of this study is to conduct and publish the results of an IT demonstration project using a human-factors approach to geriatric medication safety to provide pilot data for larger confirmatory studies and possibly develop and market test the IT-CRM software via Small Business Innovation Research mechanisms for eventual national release.

**Specific Aims**

- Examine the impact of an IT-based CRM intervention on reducing selected adverse drug events (ADEs) among geriatric patients in primary care settings by evaluating changes in: 1) number of preventable ADEs that occur, 2) severity of those ADEs, and 3) stage of the medication use process in which they occur (i.e., diagnosis, prescribing, transcribing, dispensing, administration, and monitoring). **(Ongoing)**
- Examine the impact of an IT-based CRM intervention on improving monitoring for geriatric patients who are on persistent medications in primary care settings by evaluating changes in monitoring rates for subjects age 65 and older on: 1) angiotensin converting enzyme (ACE) inhibitors or angiotensin receptor blockers, 2) digoxin 3) diuretic, and 4) statins. **(Ongoing)**

- Evaluate office staff use and application of the IT-based CRM Tool for improving geriatric medication safety in primary care settings by examining use of the IT tool and any changes in safety attitude constructs (safety climate, teamwork climate, stress recognition, working conditions, and perceptions of management and job satisfaction). **(Ongoing)**

**2009 Activities:** Interventions were completed in three of the four sites. Practices have used the ACORNoffice tool to prioritize different methods for improving medication safety, assigning responsibility, and tracking their implementation. To address safety problems, sites implemented practice changes such as: providing patient education brochures for high-risk medications; listing diagnosis on prescriptions; reminding patients about followup appointments; providing patient-carried medication lists; changing the way refill requests are handled; and forming teams to address ongoing communication problems. The Indicators tool within ACORNoffice was used to define specific measurable outcomes for each initiative and to track the success at meeting these objectives over time.

Feedback was solicited from participants at the intervention sites to evaluate use and application of ACORNoffice software to address patient safety. Participants completed the initial survey which describes how the patient safety climate and working conditions changed as a result of the intervention.

The project team made progress in analyzing a primary outcome measure of reducing adverse events. The team completed the first step of screening the charts of participating sites for triggers of potential adverse events such as medication discontinuation or hospitalization. The second step of review is underway, which includes final determination of whether an adverse event occurred, and if so, an assessment of the severity of each event by a physician and pharmacist.

**Preliminary Impact and Findings:** Initial results are available for the two main outcomes of the intervention: 1) rate of adverse events in participating practices identified through the use of the trigger tool, and 2) compliance with the Healthcare Effectiveness and Data Information Set (HEDIS) guidelines for laboratory monitoring of chronic medications. The baseline trigger review screening process included 700 charts, and 1160 triggers were identified in more than half (398) of the charts. Charts were also reviewed for recommended laboratory monitoring for patients on chronic medications including ACE inhibitor, diuretic, digoxin/lanoxin, statin, and anticonvulsants.

HEDIS recommends that specific laboratory tests be obtained for patients who are on these chronic medications. The review found that ACE inhibitors, diuretics, and statins are used by a high proportion of patients (around 40 percent or more at most practices). At all practices, the majority of patients had appropriate laboratory monitoring for these medications. However, compliance was not complete and there was considerable variation between practices, especially for the statin group of medications.

**Selected Outputs**

Singh G. Improving medication safety in primary care. Joint annual meeting of the Oklahoma Practice based Research Network and Oklahoma Academy of Family Physicians; June 18-21, 2009. Tulsa, OK.

Singh G. Prioritizing quality improvement initiatives in a practice through consensus. Joint annual meeting of the Oklahoma Practice based Research Network and Oklahoma Academy of Family Physicians; June 18-21, 2009. Tulsa, OK.

Singh R, Singh A, Anumba C, et al. Web-based systems approach to improvement of patient safety. Second International North-American Simulation Technology Conference on Soft Computing. Simulation and Software Engineering; Aug 26-28, 2009. Atlanta, GA.

Frequently Asked Questions for SAQ (Safety Attitudes Questionnaire) and Safety Enhancement and Monitoring Instrument that is Patient-Centered (SEMI-P).

Online tool with:

- Delphi technique for prioritization of safety problems based on SEMI-P results
- Visual presentation of SEMI-P results
- Visual presentation of SAQ results
- Anonymous completion of SEMI-P survey via anonymous password and
- Completion of SAQ via anonymous password

For more information the online tool, please see:

http://fammed.buffalo.edu/safety/files/6_Change_Management_Workshop_AHRQ_HIT_2010.pdf

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**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project team continues to evaluate practices' experience with the CRM intervention using ACORNoffice and their perceptions of the intervention on the safety culture of the practice. The physician and pharmacist began reviewing baseline triggers and will continue assessing whether each trigger can identify and indicate the severity of adverse events.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

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**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Using Information Technology to Provide Measurement Based Care for Chronic Illness |
| **Principal Investigator:** | Trivedi, Madhukar, M.D. |
| **Organization:** | University of Texas SW Medical Center – Dallas |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017189 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,196,703 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*, Mental Health/Depression

**Summary:** Current routine practice in psychiatric settings does not depend on a systematic measurement-based approach but on global clinical judgment. This approach results in suboptimal care and outcomes. Depression is the most common mental health cause for disability, and treatment needs to consider the chronic nature of the disorder. Despite the development of effective treatments over the last 30 years, evidence from practice settings continues to show inadequate antidepressant medication treatment in terms of dose and duration. This project applies expertise in algorithm/guideline implementation toward the development of a clinical decision support system (CDSS) integrated with an electronic health record (EHR) with the goal of disseminating the principles of evidence-based treatment for depression in large systems of care.

The investigators are testing the implementation of measurement-based care (MBC) in an ambulatory care setting with an integrated CDSS and EHR. The project focuses on the use of MBC to improve the quality of care for patients with major depressive disorder (MDD). The EHR-CDSS program will facilitate MBC and will improve medication management for patients with this chronic disorder by using information technology (IT) to ensure that clinicians are monitoring three critical response domains (symptom severity, side-effect burden, and treatment adherence) using standardized measures. The IT system will also provide decision support during each medication treatment phase and will help prevent medication errors.

This project is a collaboration between the University of Texas Southwestern Medical Center and the Centerstone Community Mental Health Center, Inc. (Centerstone). Centerstone is a behavioral health services provider that provides treatment throughout Tennessee. The first phase of the project was primarily devoted to: 1) customization of the CDSS to take into account the specific needs of Centerstone and 2) integration of CDSS into Centerstone's EHR CenterNet. The objective of the current phase of the project is to test the effectiveness of the EHR-CDSS to increase clinicians' use of MBC principles in medication management for patients with MDD.

To fully evaluate effectiveness of the EHR-CDSS, this project involves two research studies. The first is a comprehensive, system-wide evaluation that will include all clinicians using the EHR-CDSS and all their patients with depression who require a treatment change, either a medication change or dose increase. The

second study is an in-depth evaluation of the impact of the EHR-CDSS on a limited sample of physicians and their patients, directly assessing the use of MBC using a pre-post test design.

**Specific Aims**

- Integrate a CDSS that facilitates MBC with physician needs and the EHR at Centerstone. **(Ongoing)**
- Evaluate EHR-CDSS's successful promotion of MBC in improving medication management. **(Ongoing)**

**2009 Activities:** All application modifications were incorporated into a single new build of the CompTMAP (the project CDSS), including updating medications in the algorithm, integrating MBC assessment instruments, and improving EHR-CDSS interface. The integrated application was implemented in the first group of post-implementation clinics in July 2009. After implementation, it was discovered that the EHR-CDSS interface did not consistently transfer the prescription record correctly, and the implementation had to be stopped because the interface created documentation errors in the prescription section of the EHR. Troubleshooting, corrective programming, and beta-testing on the test server environment resumed, and further improvements to the EHR-CDSS interface were made. Subsequently, clinician testing in the production server environment resumed, and clinicians discovered additional variations of this interface issue. Programmers continued to modify the process for transferring data from the CDSS to the EHR until no further problems were detected.

It was necessary for the study team to make adjustments to the study timeline by simultaneously implementing the two post-implementation groups in Study 2 and the post-implementation groups in Study 1. The study team postponed the implementation phase to ensure a user-friendly package that meets all requests identified in the needs assessment. The project is slightly behind the internal timeline in accomplishing technical milestone tasks. Because unforeseeable delays were taken into account when the project timeline was planned, the team expects to stay within the original timeline for study completion in spite of the rollout delay.

Ultimately the team corrected the EHR-CDSS prescription transfer problems, completed beta testing of the integrated EHR-CDSS application, continued clinician testing of the integrated EHR-CDSS application, and rolled out the EHR-CDSS to the first wave of clinics by the end of the calendar year.

**Preliminary Impact and Findings:** Of the 294 needs assessment questionnaires that were sent to employees in the Centerstone Behavioral Healthcare System, 209 (73 percent) were completed and returned. The primary concern expressed in the survey responses was the perception that the provision of MBC will require increased time in the length and number of treatment visits. While it is expected that providing MBC will require more time at first, once the system is established, any increased visit time will be needed mostly for patient self-reporting (based on physician reports from the National Institute of Mental Health-Funded Sequenced Treatment Alternatives to Relieve Depression study).

**Selected Outputs**

Warden D, Rush AJ, Carmody TJ, et al. Predictors of attrition during one year of depression treatment: a roadmap to personalized intervention. J Psychiatr Pract. 2009 Mar;15(2):113-24.

Electronic Measurement-based Care Guiding Evidence in Depression (e-MERGE) Clinic End-User Needs Assessment report.

eMERGE Focus Group Summaries.

**Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is slightly behind the internal timeline in accomplishing technical milestone tasks. However, it is still within the overall project timeline and has ample time to complete the project on schedule.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Electronic Prescribing and Decision Support to Improve Rural Primary Care Quality |
| **Principal Investigator:** | Veline, James, M.S., M.A. |
| **Organization:** | Avera Health |
| **Mechanism:** | RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT) |
| **Grant Number:** | R18 HS 017149 |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $1,181,866 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions and the electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*, Hypertension, Rural Health*

**Summary:** For many chronic conditions, poor patient compliance with prescribed medications can adversely affect the treatment outcome. It is estimated that the compliance rate for patients receiving long-term treatment for chronic asymptomatic conditions, such as hypertension, can be as low as 50 percent. The introduction of electronic prescribing (e-prescribing) systems has the potential to greatly improve the accuracy and efficiency of pharmaceutical treatments. Electronic prescribing systems can alert the ordering provider of prescription fill status for patient followup and education. The use of e-prescribing systems can help physicians avoid prescribing errors, adhere to treatment guidelines, and monitor patient's response to treatment. They also offer physician decision support to prevent harmful drug-to-drug and drug-to-disease interactions.

The purpose of Avera Health's Improving Quality Through the Use of Electronic Prescribing with Electronic Decision Support project is to examine whether, in rural ambulatory care settings, the use of an e-prescribing system with clinical decision support related to medication management increases patient prescription adherence, improves the medication management process, and improves health outcomes in hypertensive patients. As part of its overall Avera HealtheCARE™ Initiative, the South Dakota-based health system is working with 28 hospitals and 116 clinics to implement a regional electronic medical record (EMR). The technology package will include advanced e-prescribing software (DrFirst Rcopia) that provides physicians the capability to track the fill status of prescribed medications and provides interaction alerts, formulary listings, dosing options, patient medication history, and printed wallet-size medication lists. The study examines the impact of the technology on the medication management for patients with hypertension in nine rural/frontier primary care facilities. The project will focus on the following health information technology (IT) systems:

- DrFirst Rcopia electronic prescription management system as a stand-alone product.
- DrFirst Rcopia integrated within the Meditech/LSS Data Systems Medical EMR and Practice Management Suite, the EMR system being implemented by Avera Health in the ambulatory setting. This EMR includes Zynx Health decision support technology and is Certification Commission for Health Information Technology-certified.

The project takes advantage of a staged implementation, first gathering baseline measures and then tracking clinics that are using e-prescribing as a stand-alone tool before moving to an EMR and clinics that are moving directly to an EMR with integrated e-prescribing. To examine whether patient prescription adherence improves, medical claims data and the e-prescribing patient-fill histories will be used. Improved outcomes will be measured in blood pressure levels and changes in treatment for patients with blood pressure higher than 140/90.

This study is based on the observation of a "natural" process of disseminating and implementing a set of health IT innovations. As such, the experiment can be characterized as a quasi-experimental design with opportunistic, nonrandom assignment of clinics to the experimental condition.

**Specific Aims**

- Improve the rate of adherence to prescribed medications among patients with hypertension in rural communities. **(Ongoing)**
- Improve adherence to prescribed medications among patients with hypertension through use of e-prescribing tools in rural care settings. **(Ongoing)**
- Improve health outcomes for patients with hypertension in rural communities through the use of e-prescribing and associated clinical decision support tools. **(Ongoing)**
- Enhance patient and provider satisfaction with the e-prescribing tool. **(Ongoing)**
- Overcome barriers to successful adoption of e-prescribing. **(Ongoing)**

**2009 Activities:** The DrFirst Rcopia enhancements to display Medication First Fill and Medication Possession Ratio were completed and tested. The implementation of DrFirst Rcopia stand-alone e-prescribing in all nine clinics is complete. LSS EMR is also developing enhancements to display the same data available through DrFirst Rcopia. The next step in the staged implementation is transitioning the clinics to the LSS EMR.

In addition to the Medication First Fill and Medication Possession Ratio enhancements, DrFirst Rcopia added an area in the application for providers to document educational interventions. The project team has developed a patient education handout and form letter for clinics to use during interventions to reinforce the importance of medication compliance.

More than 5,000 patients enrolled in the study between the beginning of August 2008 and the end of August 2009. In July 2009, the coders began collecting baseline study metrics on enrolled patients at the Avera Flandreau Medical Center and the Avera Dell Rapids Medical Clinic. The coders reviewed the charts of enrolled patients and documented the following: confirmed a hypertension diagnosis, documented all blood pressure readings, and documented all educational interventions. The collection of baseline data at the two clinics was successful. Baseline data collection will continue and be iterative, whereby coders will collect data every 3 months until each clinic transitions to the LSS EMR. Once clinics are live on the LSS EMR, a report will extract this data directly.

**Preliminary Impact and Findings:** The project team has collected information from participating pharmacies. Pharmacies have reported a number of errors, including incorrect product selection and improper use of text fields, being transmitted from the clinics. The project team continues to work with the clinics to ensure proper use of the system, but many errors are keystroke and/or hand-to-mouse mistakes. While e-prescribing is thought to improve quality and reduce dispensing errors, if the potential for error has shifted to a different step in the process, the real impact e-prescribing has on quality remains in question.

In an ideal e-prescribing transaction, the dispensing pharmacist performs minimal data entry. However, pharmacists in the study are often required to enter much of the prescription data because e-prescribing data does not match data in the pharmacy dispensing software. Finally, although e-prescribing

transactions are typically delivered to the dispensing pharmacy in a matter of minutes, pharmacies have reported transmissions taking longer than 45 minutes.

**Selected Outputs**

Baseline Patient Satisfaction Survey report.

Internal reports:

- AHRQ Metric Reference: AHRQ measures being calculated by the grant team.
- Avera total electronic prescriptions per week.
- Avera Compliance Blueprint: The business requirements for the study data and compliance and adherence enhancements.
- Avera Compliance and Adherence User Guide: Most current draft of training material for compliance and adherence enhancements.
- Average prescriptions per provider per week.
- Electronic Prescription Style of Use: A graphical display of how DrFirst Rcopia is being used.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is meeting the majority of its milestones.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Chronic Mental Health: Improving Outcomes Through Ambulatory Care Coordination |
| **Principal Investigator:** | Baker, Wende, M.Ed. |
| **Organization:** | Southeast Nebraska Behavioral Health Information Network, Inc. |
| **Mechanism:** | RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP) |
| **Grant Number:** | R18 HS 017838 |
| **Project Period:** | 09/08 – 09/11 |
| **AHRQ Funding Amount:** | $1,199,871 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*, Mental Health/Depression

**Summary:** Without electronic communication, behavioral health providers cannot follow the full treatment path of patients from various providers in the urban or rural outpatient setting to mental health hospitals, protective custody, or crisis mental health holds. People with mental illness face challenges as they transition between medical care providers, mental health providers, and, in the cases of inpatient care, their inpatient providers, when crucial information may not be shared.

This project explores how the exchange of health information between rural and urban providers in the behavioral health field can improve ambulatory patient care coordination and safety across treatment settings. Specifically, the project examines provider barriers to technology acceptance in the behavioral health setting, behavioral health care technology acceptance and adoption, and the effects of health information exchange (HIE) on clinical outcomes.

The development and implementation of a regional HIE will decrease the time it takes for providers to access comprehensive and accurate information, thus creating better access to patient information between and among the provider care team serving an individual with mental illness. This, in turn, will improve continuity of care by providing an electronic link between the multiple service settings that serve residents of southeast Nebraska. The provision of basic electronic information to coordinate patient care between behavioral health providers, primary care physicians, rural hospitals, and the emergency behavioral health system, will improve the long-term health outcomes of individuals with serious, persistent mental illness.

During the first phase of the project, a committee issued a request for proposals, researched vendor qualifications, and ultimately selected products from NextGen Healthcare based on criteria that included certification by the Certification Commission for Health Information Technology (CCHIT). At the same time, the team began to design the HIE and the research team conducted a behavioral health provider survey focused on technology acceptance. In the second phase of the project, the team will develop the HIE infrastructure and equip provider offices with new or updated technology and provide training to participating providers. In phase three, the team will pilot the HIE in three provider facilities. Once the environment is established, data will be collected to evaluate the way timely access to accurate information might improve the quality of care for those experiencing a behavioral health crisis and who have an immediate need for entrance into the emergency behavioral health care system.

**Specific Aims**

- Identify provider barriers to technology acceptance. **(Ongoing)**
- Implement an HIE among three major behavioral health provider facilities. **(Ongoing)**
- Collect data on how timely access to accurate information relates to quality of care. **(Upcoming)**

**2009 Activities:** System design activities were focused on vendor selection as well as on organizational development of the Southeast Nebraska Behavioral Health Information Network (SNBHIN) Regional Health Information Organization. The project team issued a request for proposals, reviewed vendor qualifications, and conducted site visits based on criteria including CCHIT certification, data repository and general HIE design, and behavioral health workflow. Ultimately, the team selected the NextGen Healthcare behavioral health electronic medical record (EMR) and Practice Management applications, along with a central data repository called "Community Health Solutions." Related SNBHIN activities focused on continuing to build the viability and reach of the organization and included a strategic planning retreat, development of an action plan, business sustainability planning, and submission of a request for continuation funding for a Health Resources and Services Administration Rural Health Network Development Grant.

Research activities focused on collection and analysis of qualitative data from 32 behavioral health providers on the benefits and barriers to sharing client information electronically and how this differs from perceptions of medical providers. Three preliminary themes were identified: client safety and quality of care; privacy and security; and delivery of behavioral health services. More providers cited benefits than barriers within the client safety and quality of care theme. Within the privacy and security and delivery of behavioral health services themes, more providers cited barriers than benefits. This was particularly the case in the privacy and security theme. A manuscript was prepared detailing these findings. The research team is now preparing a statewide survey for institutional review board (IRB) approval, focused on the benefits and barriers to electronic sharing of client information. Pending IRB approval, this statewide survey will be sent to all practicing behavioral health providers in Nebraska.

**Preliminary Impact and Findings:** Analysis of research data is ongoing, and provider barriers to technology acceptance have been grouped into preliminary themes: client safety and quality of care; privacy and security; and delivery of behavioral health services.

**Selected Outputs**

No outputs available.

**Grantee's Most Recent Self-Reported Status (as of December 2009):** Progress is mostly on track. Preliminary qualitative analyses are complete on the initial provider survey. Pending IRB review and approval, a statewide survey will be sent to all practicing behavioral health providers in Nebraska. A vendor was selected for the EMR and Practice Management applications and for a central data repository. Underspending during this calendar year was due to pending acquisition of the product.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Significantly underspent, more than 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Evaluation of Effectiveness of a Health Information Technology-Based Care Transition Information Transfer System |
| **Principal Investigator:** | Ciemins, Elizabeth, Ph.D. |
| **Organization:** | Billings Clinic Foundation |
| **Mechanism:** | RFA: HS08-002: Ambulatory Safety and Quality Program Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP) |
| **Grant Number:** | R18 HS 017864 |
| **Project Period:** | 09/08 – 09/11 |
| **AHRQ Funding Amount:** | $1,155,371 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*, Rural Health*

**Summary:** This project seeks to improve the coordination of care for patients with two or more chronic conditions who are discharged from a hospital to rural primary care clinics. The project team will modify the current Billings Clinic electronic health record (EHR) system, the Certification Commission for Health Information Technology-certified Cerner EHR, to develop, implement, and evaluate a Care Transition Information Transfer (CTIT) system that rural clinics can access.

The four Billings Clinic-owned clinics, which have EHR-integrated systems, will access CTIT directly through the Billings Clinic Health Information Technology (IT) system. Primary care clinics outside of the Billings Clinic system will access the Billings Clinic Health IT system through a Web-based portal and through the receipt of e-fax, e-mail, or phone messages. The system will provide patients and their primary care providers (PCPs) with discharge information, including information regarding medication management, followup visits, laboratory testing and results, and operative reports. Project staff will conduct a prospective study to evaluate whether the intervention improved patient clinical outcomes, system efficiency and process outcomes, and patient and rural provider satisfaction with the hospital discharge process.

**Specific Aims**

- Develop a health IT-based CTIT system. **(Ongoing)**
- Evaluate the effects of the CTIT system on:
  - Clinical and systems-level outcomes. **(Ongoing)**
  - System efficiency. **(Ongoing)**
  - Satisfaction with care transitions among rural PCPs. **(Ongoing)**
  - Patient satisfaction with care transitions. **(Ongoing)**
  - Timely communication of patient information. **(Ongoing)**

**2009 Activities:** Project staff focused on standardizing the discharge process through the development of an EHR-based discharge tool called the Housewide Discharge (HWD), which is essentially a discharge checklist with both patient and provider discharge information forms. Approximately mid-way through the year, the staff completed a 3-day Kaizen event, which is a focused, intense, short-term event to

improve a process, conducted by the Operational Excellence Team. The purpose of the Kaizen Event was to standardize the discharge process and associated forms, through mapping of current and future states, for all patients discharged from the Billings Clinic.

Project staff created a template for the HWD in the EHR and is now refining the tool. In collaboration with their information systems department, project staff developed notifications for PCPs as Discharge Power Notes, which are automatically sent to PCPs, via fax or EHR message center, when their patients are discharged from the Billings Clinic Hospital by a hospitalist. So far, 238 PCP notifications have been sent to 74 providers. All of these providers were also sent PCP notification satisfaction surveys including a solicitation for process and content improvement suggestions.

Four-hundred transition period interviews were conducted with eligible patients via telephone by registered nurses who have specific experience in medication assessment. Patients were asked to provide details of all current medications, information about medication and other education they received during and after their hospitalization, and health care utilization information (PCP visits, hospitalizations, emergent care visits). All interview data have been recorded.

Transition period charts are being reviewed using a data collection instrument developed earlier in the year. Chart reviews are separated into two categories: Medications (reviews are ongoing), and Healthcare Utilization and Education (completed, n=400). The Medication chart review compares four documents: 1) Patient Telephone Interview, 2) EHR Medication List, 3) Discharge Summary, and 4) Patient Friendly Discharge Medication List. The project team will determine whether medications were reconciled at discharge and at the time of the Patient Telephone Interview, and will also determine whether the patient is correctly taking medications at the time of the Patient Telephone Interview. An Access database is being used to record the Telephone Survey and the Medication Chart Review data. The Healthcare Utilization and Education chart review database is still being developed but is expected to be ready in time for upcoming data entry needs.

**Preliminary Impact and Findings:** Three-quarters of respondents to the survey of PCPs regarding the Discharge Power Notes indicated that receipt of the note prompted them to view their patient's EHR. Based on a preliminary assessment of workflow processes, the grantee determined that a standardized hospital discharge process did not exist. The team has implemented a plan to develop a standardized process before starting to automate the discharge procedure.

**Selected Outputs**

Presentation of Results: Operational Excellence Discharge Process Kaizen Event, Nov. 3-5, 2009.

Presentation of results to the Billings Clinic Extended Division Chief Council to increase visibility of the project in the organization and with leaders.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The grantee has made significant progress in standardizing the discharge process through development of an EHR discharge tool, which includes a patient discharge information form, as well as through development of discharge notifications for PCPs. Although some data collection has been completed, data collection continues in some areas, and data entry and analysis are ongoing.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Enhancing Complex Care Through an Integrated Care Coordination Information System |
| **Principal Investigator:** | Dorr, David, M.D., M.S. |
| **Organization:** | Oregon Health and Science University |
| **Mechanism:** | RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP) |
| **Grant Number:** | R18 HS 017832 |
| **Project Period:** | 09/08 – 09/11 |
| **AHRQ Funding Amount:** | $1,155,147 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*

**Summary:** Patients with chronic illnesses are at risk for complications and unnecessary disease exacerbations due to a lack of coordination and quality in a fragmented health care system. This project is investigating whether care for patients with complex needs can be improved by implementing an Oregon Health and Science University-developed integrated care coordination information system (ICCIS) that incorporates population management techniques, patient-centered goals, quality measures, and clinical reminders to support clinical care teams and patient self management. There are three objectives for the study: 1) to understand if ICCIS can be created in a diverse set of clinics using Certification Commission for Health Information Technology-certified electronic health records (EHRs) and existing standards, 2) to assess if the functions in the ICCIS can be used by the clinics, and 3) to evaluate if these system changes lead to improved patient outcomes.

A randomized controlled trial will examine whether six participating clinics can use health information technology (IT) to monitor and deliver care for high-risk patients with a care coordination model (arm 1) or quality performance model (arm 2). Two inner-city locations and four rural clinics are participating in the study. Dr. Dorr and his team are evaluating how well care coordination functions are used at the clinics. Measures include indicators of patient activation, clinic-level quality of care, clinic-level process, and patient health outcomes.

**Specific Aims**

- Implement the Care Management Plus and ICCIS models. **(Ongoing)**
- Perform a cluster randomized controlled trial in the six clinics on the ability to use the IT functions to monitor and deliver care to high-risk patients through a care coordination (arm 1) or a quality performance model (arm 2). **(Ongoing)**
- Assess the implementation. **(Upcoming)**
- Understand and disseminate the outcome, benefits, challenges, and unintended consequences from use of these functions for patients and the system. **(Ongoing)**

**2009 Activities:** The project team made significant progress toward completing the application programming interface, which facilitates the direct transfer of specific patient health information from a clinic's EHR to ICCIS. The team also completed a conjoint analysis of transcribed interviews to determine which combination of features would make the ideal product. Preferred system functions and

features were divided into three groups: features to be added before the trial start date, features to be added during the trial, and features for future versions of the software. The team edited many of its protocol pages to conform to the analysis-identified needs.

Revisions were made to a patient worksheet to facilitate communication between the care manager and the patient, and between the care manager and the physician, about a patient's progress. These revisions were designed to capture more detailed information about the patient's adherence to disease-specific and clinic standards of care. The project team completed administering the usability test questions, including patient-centered test cases, which were designed to test the care manager's ability to interact with ICCIS to all the current care managers at each clinic.

Staff at all six clinics have now been trained in care management according to the protocol. The project team is creating a system for measuring implementation and has finalized the quality measure selections for each clinic. These measures have been exhaustively defined, and the project team has determined how and where to extract the data out of the EHRs and into ICCIS for quality measure tracking. All sites have access to a report that allows the user to exclude individual patients from specific measures or from a group of similar measures. Baseline information on costs, utilization, and patient panels was received from four of six clinics, and pre-survey patient satisfaction survey data are coming in.

**Preliminary Impact and Findings:** The project has 70,000 clients in the database. More than 2,000 are enrolled in care management, and the team is confident that it has reached appropriate populations. Baseline quality measures have been shared with the clinics.

**Selected Outputs**

De-identified patient worksheet with goals, encounters, medications, diagnoses, and laboratory values.

ICCIS prototype available for review and populated with test patients.

Script used by interviewer during usability test with care managers.

Usability test questions used to interview care managers about their interactions with the ICCIS.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is generally on track. The system has been implemented, implementation assessment was conducted, and the trial began in the fall.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | An Electronic Personal Health Record for Mental Health Consumers |
| **Principal Investigator:** | Druss, Benjamin, M.D., M.P.H. |
| **Organization:** | Emory University |
| **Mechanism:** | RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP) |
| **Grant Number:** | R18 HS 017829 |
| **Project Period:** | 09/08 – 09/11 |
| **AHRQ Funding Amount:** | $1,199,379 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Mental Health/Depression

**Summary:** Poor quality of care may be an important risk factor for accelerated rates of morbidity in people with serious mental disorders. Electronic personal health records (PHRs) can shift the ownership and locus of health records and make them less likely to be scattered across multiple providers and more likely to be longitudinal and patient-centered. Due to the complex health care needs and fragmentation of care faced by individuals with mental health disorders, these patients may benefit from the use of PHRs. Because of the lack of mental health-related modules in currently available PHRs, Dr. Druss and his team adapted an existing PHR to better meet the needs of a patient population with serious mental illness and one or more co-morbid medical conditions. The investigators are evaluating the impact of this modified mental health PHR (MH-PHR) in a 12-month, randomized controlled trial. During the first 6 months of the intervention phase, a clinical care nurse helps patients access and maintain use of the MH-PHR; during the second 6 months, patients continue use without support. A control group is receiving education materials about health and self management. The investigators will evaluate the impact of the MH-PHR on patient self-activation and provider effectiveness in managing chronic disease by conducting chart reviews and interviews with patients. Originally, the mental health module was developed in an older version of an established PHR, the Shared Care Plan; however, the software was not functioning correctly and the module moved to Microsoft HealthVault.

**Specific Aims**

- Develop a MH-PHR. **(Achieved)**
- Implement a randomized trial of the MH-PHR. **(Ongoing)**
- Evaluate impact of the MH-PHR. **(Upcoming)**
- Disseminate results. **(Upcoming)**

**2009 Activities:** Investigators finalized the MH-PHR and began recruitment for the randomized controlled trial. However, the investigators suspended recruitment mid-year when the MH-PHR was not functioning properly. This issue was resolved by moving the application to Microsoft HealthVault, but recruitment slowed and investigators experienced some attrition as a result of the computer literacy skills required in order for patients to use the MH-PHR. Investigators devised two approaches to increase recruitment and retention. First, at the time of screening and enrollment, patients are given more detailed information about the computer skills required for the study, and investigators explain the resources that

are available. This helps to ensure that participants know what is expected of them. Second, investigators hired a nursing student who was trained as computer literacy coach. Each participant is assessed for computer literacy and receives as much help as requested to use the MH-PHR effectively.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

My Health Record Computer Assessment and Education Curriculum. This manual was developed for the My Health Record study. The first part of the manual describes how to assess a participants' computer and Internet skills. The second part is a modular guide to teaching the computer and Internet skills that are necessary to use the MH-PHR.

**Grantee's Most Recent Self-Reported Status (as of December 2009):** Progress stalled when recruitment was suspended due to MH-PHR malfunction. Project is back on track with recruitment and data collection.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent

| | |
|---|---|
| **Project Title:** | Improving Medication Management Practices and Care Transitions Through Technology |
| **Principal Investigator:** | Feldman, Penny, Ph.D. |
| **Organization:** | Visiting Nurse Service of New York |
| **Mechanism:** | RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP) |
| **Grant Number:** | R18 HS 017837 |
| **Project Period:** | 09/08 – 09/11 |
| **AHRQ Funding Amount:** | $1,199,998 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*

**Summary:** The overall aims of the project are to examine the relative effectiveness and cost-effectiveness of an information technology (IT) intervention designed to identify patients with complex/high-risk medications, provide electronic decision support for clinicians, and provide supplementary information to patients, thereby improving nursing practices and patient outcomes. This project is designing and testing in a randomized controlled study a medication management strategy that uses IT to facilitate high-quality care transitions through improved clinician practice and enhanced patient engagement. The intervention to be tested uses an algorithm to alert the home health nurse to a patient at risk of a potentially serious medication problem at the point of service. This intervention also provides the clinician with decision support, including high-risk medication management recommendations that are integrated into the clinician's visit documentation system and the patient's electronic health record. The intervention also includes patient educational materials. This intervention will be compared to a usual care group. This project is an extension of the existing Visiting Nurse Service of New York health IT system and uses many of the features that the home health nurses regularly use.

**Specific Aims**

- Examine the relative effect of the intervention on workflow and medication management practices of home health care nurses. **(Ongoing)**
- Examine the relative effect of the intervention on the outcomes and service use of patients in the respective intervention groups. **(Ongoing)**
- Estimate the costs associated with the intervention and subsequent care and compare these costs relative to usual care. **(Ongoing)**

**2009 Activities:** The grant team finalized the content and programming of the computerized medication risk algorithm, which is now undergoing final testing. The project team also finalized the content, programming, and testing of the medication management module. This module, along with the trigger that will activate the module, has been uploaded to more than 800 coordinator-of-care nurse tablet computers in preparation for randomization. The project team also finalized content and made significant progress with the automation of the clinical alert. The programming and testing for the initial clinical alert was finished and is in the final testing phase. This same process will be conducted for the followup

clinical alert in 2010. The grant team is also developing an intervention and recruitment tracking database to import electronic information on newly eligible study patients and nurses and generate the second e-mail to nurses and print labels for their interoffice packets. It will also generate assignment lists for field interviewers and track the status of subject recruitment.

The grant team is developing complementary inserts for an existing patient self-care guide on taking medications, as well as a situation-background-assessment-recommendation (SBAR) tool to provide guidance to nurses on how to speak with physicians about simplifying medication regimens. In addition, the grant team is finalizing the patient survey and recruitment protocol. Significant work has been completed on the patient survey, which will be pilot tested and finalized in the next quarter. Patient recruitment scripts were drafted, and the interviewer training manual was developed.

The grant team is also investigating the costs associated with the intervention and subsequent care and is comparing these costs relative to usual care. The team is in the process of reviewing variables used in previous studies to evaluate their integrity and usefulness for this study. Next steps will include finalizing the patient survey and obtaining home care service utilization files.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

Initial clinical e-mail alert.

SBAR communication tool for complex medication regimens.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The grant team made significant progress with the automation of the clinical alert, the electronic decision support tool, and the medication regimen complexity index. They are in the final phase of testing and are preparing for full intervention implementation.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Using Health Information Technology to Improve Transitions of Complex Elderly Patients from Skilled Nursing Facilities to Home |
| **Principal Investigator:** | Field, Terry, D.Sc. |
| **Organization:** | University of Massachusetts Medical School – Worcester |
| **Mechanism:** | RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP) |
| **Grant Number:** | R18 HS 017817 |
| **Project Period:** | 09/08 – 09/11 |
| **AHRQ Funding Amount:** | $1,188,157 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Elderly*

**Summary:** The incidence of drug-induced injury is high in the ambulatory geriatric population, especially when people with complex health care needs make high-risk transitions to the ambulatory setting. This project is developing and evaluating a transitional care intervention: an electronic medical record (EMR)-based medication reconciliation system for medication monitoring and followup of elderly patients discharged from a skilled nursing facility (SNF) to ambulatory settings, including communication of key health information and alerts to the outpatient primary care physicians and the visiting nurses (depending on the arm of the randomized control trial). Therapeutic monitoring guidelines have been developed and will be integrated into EpicCare, a Commission for Health Information Technology-certified, ambulatory EMR used at the study sites. Dr. Field and her team will measure a range of outcomes to determine if the intervention facilitates high quality transitions. Using a randomized, three-arm, controlled trial, evaluated outcomes will include the rate of followup office visits, the rate of appropriate monitoring for high-risk medications, and the incidence of adverse drug events. Finally, they will analyze the costs of developing and implementing the intervention. The results from this study will provide important insights into the effective use of clinical alerts and coordinated delivery of actionable information to improve the quality of care delivered to complex elderly patients transitioning from sub-acute care to the ambulatory setting.

**Specific Aims**

- Establish electronic transmission of information to the Visiting Nurse Association of Central Massachusetts. **(Achieved)**
- Ensure clear connection to the EMR at participating SNFs. **(Achieved)**
- Develop therapeutic monitoring guidelines. **(Achieved)**
- Prepare blueprints to direct programmers. **(Achieved)**
- Program the alerts and EMR components. **(Ongoing)**
- Train geriatricians and geriatric nurse practitioners. **(Upcoming)**
- Implement the intervention. **(Upcoming)**
- Evaluate the intervention. **(Upcoming)**

**2009 Activities:** The team has completed several milestones of the project, including the development of a time-tracking system to support the analysis of the costs of developing the intervention, establishing the electronic transmission of information to the Visiting Nurse Association, and the development of the therapeutic monitoring guidelines in conjunction with faculty from the Massachusetts College of Pharmacy and colleagues from the Health Maintenance Organization Research Network. To do this, they used a modified Delphi process and engaged local physicians, pharmacists, and leaders of the multispecialty group practice to ensure buy-in. A significant amount of time was spent developing, programming, and refining the clinical alerts and messages in the EMR. While this took longer than anticipated, the added time allowed the investigators to add a clinical pilot review of the alerts and messages. This helped to ensure that the frequency and content of the alerts and messages are appropriate to lessen alert fatigue and convey clinically useful information.

**Preliminary Impact and Findings:** There are no findings at this time.

**Selected Outputs**

Complete Therapeutic Monitoring Guidelines. Used to evaluate the monitoring of high-risk medications as the intervention is launched.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** While there were some project delays in developing, programming, and refining the alerts and messages, the project team was able to devote time to designing and testing the procedures that will be used to identify primary outcomes including adverse drug events.

**Milestones:** Progress is on track in some respects, but not others.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | A Longitudinal Telephone and Multiple Disease Management System to Improve Ambulatory Care |
| **Principal Investigator:** | Friedman, Robert, M.D. |
| **Organization:** | Boston Medical Center |
| **Mechanism:** | RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP) |
| **Grant Number:** | R18 HS 017855 |
| **Project Period:** | 09/08 – 09/11 |
| **AHRQ Funding Amount:** | $1,199,934 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*, Low SES/Low Income*, Medicaid, Medically Underserved, Safety Net, Uninsured.

**Summary:** This study will assess the effectiveness of Telephone-Linked Care for Complex Patients (TLC-C) in the care of patients with multiple complex chronic diseases and socio-demographic vulnerabilities who experience increased health care utilization and transitions from ambulatory to hospital care. The objective is to reduce preventable hospital utilization, improve quality of life, increase satisfaction with ambulatory care, improve disease-specific metrics, and reduce net payer costs. TLC-C is a modification of the existing TLC-MultiDisease (TLC-MD) system that targets patients with multiple chronic diseases combined with a post-hospital discharge intervention. TLC-C uses conversational computer telephony to monitor patients' multiple diseases between their ambulatory care visits, focusing on detecting changes in clinical status that are associated with disease exacerbation and heightened risk of unscheduled hospitalizations or emergency department (ED) visits. The system monitors patients through "virtual visits," detects, and then notifies clinicians about important clinical problems. It also promotes patient self-care management (e.g., medication regimen adherence, scheduled medical visit appointment promotion, and patient preparation).

TLC-C utilizes information reported by patients during the virtual visits and clinical information about the patients that reside in their providers' clinical data repositories. Information in the repositories is derived from the patients' clinical encounters in clinics, laboratories, and other settings where they receive medical care. Information from the repository is transferred automatically to TLC-C daily. This information includes diagnoses, prescribed medications, scheduled primary care visits, and their disposition, laboratory and other test results and selected other information used by TLC-C. In addition, the investigators implemented an expert system for directing the patient user to TLC-C modules likely to be of special use and interest to the patient during each virtual visit.

A multi-method evaluation study of the patients, the providers, and the practice will include a two-arm randomized clinical trial of TLC-C versus usual care for patients with two or more chronic diseases. The trial will evaluate the system in 440 patients followed for 6 months. The primary outcome will be acute hospital care utilization (unplanned hospitalizations and ED visits). Secondary outcomes will include patient quality of life (EQ-5D), satisfaction (G-CAHPS), ambulatory appointment show rate, and net payer costs. Evaluation methods will include formative and summative qualitative studies of the

implementation of the system; its use and performance over time; and its impact on the patients, the providers, and the practice as a whole.

**Specific Aims**

- Design, program, and lab test the system. **(Ongoing)**
- Pilot test the system. **(Ongoing)**
- Redesign and reprogram the system based on the pilot. **(Ongoing)**
- Conduct an evaluation study. **(Upcoming)**
- Recruit patients. **(Upcoming)**
- Evaluate project. **(Upcoming)**
- Analyze study data. **(Upcoming)**
- Sustain and disseminate the system. **(Upcoming)**
- Write the final report and other manuscripts. **(Upcoming)**

**2009 Activities:** During 2009, Dr. Friedman's team worked on content modifications to the TLC-MD to address the needs of patients with multiple chronic diseases who transition to ambulatory care from acute care settings (e.g., an acute care hospital inpatient stay or an ED visit) for an acute episode related to one or more of their chronic diseases. These modifications are designed to 1) to utilize relevant clinical information residing in the patients' electronic health record (EHR) and other electronic medical care sources, and 2) to combine this information with clinical data collected routinely during virtual visits that take place between scheduled ambulatory care visits. The modifications focus on: a new office visit module to promote outpatient visit adherence and to activate patients for their visits with their providers; modifications to a medication adherence module to take less time and be easier for participants to use; and modifications to disease modules for coronary artery disease, congestive heart failure, chronic obstructive pulmonary disease, and asthma.

Dr. Friedman has now engaged key members of the Boston Medical Center Information Technology (IT) group toward specifying exactly what data will be sent from the clinical systems to the TLC system. Data will include medications, future scheduled appointments and tests, the status of prior appointments and tests (e.g., no show, cancelled, attended), dates of unplanned utilization (e.g., urgent care, emergency department, hospitalization), dates of discharge from hospitalization, and allergies. The team is still in the process of refining this integration, and additional testing will be required. To date the most significant and complex example is medications, so the team has developed rules to be able to identify with a high degree of specificity if a medication is an accurate and active medication. Significant progress has been made in this area, and thorough testing has been conducted with actual hospital data to ensure proper transfer and verification of key components such as dosage information, medication name, frequency of administration, and route of administration. Further testing with real data continues to ensure additional modification is not needed.

Transfer of other types of information (patient visit data, unplanned service utilization, dates of hospital discharge, and allergies) is in progress and requires further testing. Work is also progressing on the coronary artery and heart failure modules, and the research team is currently designing rules for the appointment modules.

One major variation was made from the original design. Dr. Friedman has decided to drop the home telemonitoring system for collection of blood pressure, glucose, and body weight data from measurement devices used in patients' homes because home telemonitoring systems are not used for many patients in clinical care in the U.S. This modification makes the system less expensive, more easily implemented and maintained, more easily disseminated, and makes study results more generalizable. Instead of the telemonitoring system, Dr. Friedman will utilize self-report by the patient as they have done in past studies; however, it is possible for future users to easily implement a version of the complex patient system to accommodate directly-measured device data.

**Preliminary Impact and Findings:** There have been no findings to date because the trial has not started.

**Selected Outputs**

No outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Dr. Friedman's team has been working on content modifications to be able to integrate information coming from the EHR. Dr. Friedman has engaged key members of the IT department toward specifying exactly what data will be sent from the clinical systems to the TLC system. To date the most significant and complex example of these data is medications, and significant progress has been made in this area with thorough testing conducted to ensure proper transfer and verification of key data elements. The grantee is underspent due to delays in programming of modifications, and the trial has not yet started. Underspending is expected to be resolved in the near future.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Significantly underspent, more than 20 percent.

**AHRQ Priority Population*

| | |
|---|---|
| **Project Title:** | Randomized Control Trial Embedded in an Electronic Health Record |
| **Principal Investigator:** | Kahn, James O., M.D. |
| **Organization:** | University of California San Francisco (UCSF) |
| **Mechanism:** | RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP) |
| **Grant Number:** | R18 HS 017784 |
| **Project Period:** | 09/08 – 08/11 |
| **AHRQ Funding Amount:** | $1,199,928 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*, HIV/AIDS

Summary: HIV/AIDS is a chronic illness. The application of the chronic care model (CCM) to this disease may lead to improved outpatient care and easier, safer clinical transitions for HIV-infected patients. Clinical information systems (CISs) are a key element in the CCM. While most CISs have focused on the provider as the recipient of critical data, CISs that target patients might also improve health care. The electronic personal health record (PHR) is a recent, increasingly common patient-oriented information system allowing patients to view data necessary to guide practical outpatient decisions and provide portability of clinical data between health care venues.

This project proposes to expand an existing secure enhanced PHR (ePHR) known as myHERO to provide information, Web-based tools, and reminders to promote self-management, increase safer clinical transitions, and improve outcomes among patients with HIV/AIDS in a public health setting. The first part of the project enhanced myHERO, which is integrated with Healthcare Evaluation Record Organizer (HERO), the electronic health record system used by the Positive Health Program, the primary care clinic at the University of California at San Francisco which specializes in care for patients with HIV/AIDS. These enhancements included adding established tools to assess tobacco use, depression, anxiety, and medication adherence, and to translate responses into numeric scores that trigger decision-support for patients and direct them to help or Web-based interventions.

A 12-month randomized controlled trial will evaluate the impact of the ePHR on clinical outcomes including: quality of the patient-clinician interaction (trust, communication, health promotion); changes in patient behaviors (adherence to antiretroviral medications, tobacco use); clinical outcomes (CD4+ T-lymphocytes, detectable plasma HIV RNA, depression, anxiety, quality of life); safety (documentation of drug allergies, adverse events, medication reconciliation); and utilization (office visits). In addition, the project team will evaluate patient and clinician experiences in engaging with the PHR tools including patient access and use of support for tobacco cessation, depression abatement, anxiety reduction, adherence improvement, and patient and clinician satisfaction with ePHR.

This study builds on existing resources, experience, and expertise to provide a detailed evaluation of ePHR usage and its impact on health care outcomes in a public health setting. The ePHR could be a cost-effective approach to reducing health disparities and bridge the digital divide for underserved patients. The results of this study could have wide application and a potentially large impact on public health.

**Specific Aims**

- Build the infrastructure and content of the ePHR to provide patient decision support, information retrieval, and communication tools. **(Achieved)**
- Evaluate patient and provider experiences using the ePHR, including patient access and use of health education materials and patient-provider satisfaction with the ePHR. **(Ongoing)**
- Assess outcomes, including quality of patient-provider interactions, changes in patient behaviors, clinical outcomes, safety, and health services utilization. **(Ongoing)**

**2009 Activities:** The project team recruited more than 300 patients for the 12-month study.

**Preliminary Impact and Findings:** Data collection is ongoing. The project team has reported these initial observations: study population has a wide variety of health literacy and computer access; ePHRs can extend beyond current use (information retrieval) to bi-directional patient-provider communication; and standardized timely clinical review of patient communication originating from the ePHR is required.

**Selected Outputs**

Kahn J, Aulakh V, Bosworth A. What it takes: characteristics of the ideal personal health record. Health Aff 2009 Mar/Apr;28(2):369-76.

Sarkar U, Schillinger D, Bryant K, et al. Monitoring Medication Safety via an Enhanced Personal Health Record in an Urban, Diverse, HIV Positive Population [poster]. AHRQ Health IT Grantee and Contractor meeting; 2010 June 2: Washington, DC.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The randomized control trial is ongoing.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population*

| | |
|---|---|
| **Project Title:** | Improving Care Transitions for Complex Patients through Decision Support |
| **Principal Investigator:** | Lobach, David F., M.D., Ph.D., M.S. |
| **Organization:** | Duke University |
| **Mechanism:** | RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP) |
| **Grant Number:** | R18 HS 017795 |
| **Project Period:** | 09/08 – 09/11 |
| **AHRQ Funding Amount:** | $1,198,254 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Chronic Care*, Medicaid

**Summary:** The care of patients with complex health care needs is often fragmented because they receive care from multiple providers in disparate locations and because information related to this care is frequently not transmitted between providers or locations. Inadequate inter-provider communication and care coordination significantly lower care quality and compromise patient safety. This project seeks to improve outcomes, quality, and coordination of care for patients with complex health care needs by facilitating the availability of information following three types of care transitions into ambulatory care: hospital discharge, emergency department (ED) discharge, and specialty care evaluations.

The project builds upon an existing regional health information exchange (HIE) network, the Community-Oriented Approach to Coordinated Healthcare (COACH) that connects providers serving Medicaid beneficiaries in rural and urban North Carolina. It also expands the existing clinical decision support (CDS) application, System for Evidence-Based Advice through Simultaneous Transaction with an Intelligent Agent across a Network, (SEBASTIAN) to detect care transitions and produce and send care event summary reports to patients, patients' assigned medical homes, and care managers. The changes will support traditional clinic-based models of care as well as models that incorporate population health management and cross-disciplinary teams.

The intervention will be tested by randomizing patients with complex health care needs into one of three arms: 1) information on care transitions is sent to patients and clinic-based caregivers; 2) information on care transitions is sent to patients, clinic-based caregivers, and care managers; and 3) no information is sent (i.e., usual care). The primary outcome measure is the overall rate of ED use. In addition, the economic impact of the intervention will be measured relative to usual care. Information-augmented care transitions between sites are expected to improve care coordination, quality, and appropriateness.

**Specific Aims**

- Enhance the existing HIE network and decision support tool. **(Ongoing)**
- Implement and evaluate the intervention. **(Ongoing)**
- Conduct the economic attractiveness assessment. **(Upcoming)**
- Disseminate the findings. **(Upcoming)**

**2009 Activities:** During 2009, the project team developed relationships with leaders at the two participating primary care clinics, North State Medical and the Rural Health Group, to negotiate the transfer of scheduling and billing data. They obtained permission to establish data feeds containing both encounter and appointment scheduling data from both clinics. In addition, they conducted a COACH training session with the North State Medical staff and planned a project orientation meeting and COACH training at Rural Health Group for early February 2010. Data normalization continues to be a high priority and a critical factor in determining the feasibility of full implementation and evaluation of study interventions. In the latter part of the year, the project team began developing a common data dictionary for care encounter type, which is needed by algorithms that normalize imported data to a standard format before it is incorporated into the COACH database.

During 2009, the project team refined methods and data sources for detecting care transitions so they can be coded into SEBASTIAN CDS modules. The project team discovered that coded data for documenting hospital discharges vary considerably among the five hospitals included in this study and sometimes even within a single hospital. They completed a comprehensive review of discharge procedures at each hospital and found that there are no standards across the hospitals that contribute data to the COACH HIE. The team reviewed data abnormalities with the understanding that each ED/hospital has different sets of data issues to manage and that data normalization is a critical component of this project. The team investigated the availability of Admission/Discharge/Transfer data feeds via the HL7 standard transmission protocol from each hospital as the timeliest way to detect hospital admissions and discharges and engaged external information technology stakeholders at each hospital to specify and secure specific HL7 messages. They engaged a subcontractor to work with two of those hospitals (Person Memorial Hospital and Granville Medical Center) to generate nightly admission and discharge reports and are working with Duke University Hospital and Durham Regional Hospital to identify the best route for obtaining data that would allow the project team to reliably detect hospital admissions, discharges, and ED visits.

During the year, the project team held several focus groups with providers, patients, and care managers to gather information to inform the development and content of the four interventions (care event summary reports, patient letters, care event notices, and release of information requests).

One major change to their project was the addition of a second phase of the project, due to a mandate by North Carolina Medicaid to reduce costs for hospitalizations and ED utilization. The network partners requested that Dr. Lobach's team provide daily notices of hospital discharges and ED encounters from data in the COACH HIE; these requested notices are very similar to the care manager-oriented interventions for the proposed study. A revised study plan was developed to allow the team to conduct the proposed study while also supporting the operational needs of the care management networks. The plan was approved by the leadership teams for the two care management networks and will be implemented in two phases. The new Phase 1 implementation will provide care manager notices for operational needs for approximately 47,000 Medicaid beneficiaries for 6 months. The Phase 2 trial will provide the originally proposed study interventions for approximately 4,600 patients with complex health needs for 12 months.

Phase 1 was launched in December 2009. In this phase, care manager notices will be generated for all hospital admissions for patients enrolled in straight Medicaid. These individuals will not be included in the Phase 2 evaluation. The start of the originally planned randomized, controlled trial (RCT), now called Phase 2, is rescheduled from January 2010 to June 2010.

**Preliminary Impact and Findings:** Evaluation outcomes will not be available until the RCT is complete.

**Selected Outputs**

No reported outputs at this time

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Due to the mandate by North Carolina Medicaid, the project team revised the study plan to include a 6-month trial and delayed the timeline of the originally planned RCT, now Phase 2, for 6 months, to June 2010.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Improving Pediatric Cancer Survivorship Care through SurvivorLink |
| **Principal Investigator:** | Mertens, Ann C., Ph.D. |
| **Organization:** | Emory University |
| **Mechanism:** | RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP) |
| **Grant Number:** | R18 HS 017831 |
| **Project Period:** | 09/08 – 09/11 |
| **AHRQ Funding Amount:** | $1,199,198 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Cancer, Pediatric*

**Summary:** With the number of survivors growing, cancer survivorship has become a National public health priority. This is particularly true for childhood cancer survivors for whom cancer therapies are highly successful with overall cure rates of 75 to 80 percent; however, high quality, individualized survivorship care is challenging due to 1) multiple transitions in care to various primary and specialty care providers and 2) lack of knowledge about survivor issues among both providers and patients and their families.

This project aims to address these challenges by building the SurvivorLink system, which will serve as a personal health record designed to support pediatric cancer survivor care by improving transitions to primary and specialty care for pediatric cancer survivors and by increasing patient, family, and provider knowledge about survivor issues. SurvivorLink will include a cancer treatment summary, individualized risk profile, individualized late effects screening profile, and other clinical information needed to provide high quality care for survivors in the long term. In addition, educational materials will be provided to improve awareness of survivorship issues and best practices in survivor care.

SurvivorLink has three target user groups: patients/families, providers, and researchers. For this pilot study, patient/family and provider participants will be recruited through the five cancer treatment centers in the State of Georgia and through the records from the Georgia Comprehensive Cancer Registry. The impact of SurvivorLink will be evaluated by measuring outcomes related to both SurvivorLink utilization and the impact SurvivorLink utilization has on aspects of survivor care, including patient and provider awareness of survivor issues and percentage of patients receiving recommended survivor care.

**Specific Aims**

- Collect data on pediatric cancer survivors in SurvivorLink. **(Ongoing)**
- Facilitate the exchange of clinical information at key transitions. **(Upcoming)**
- Provide patients with easy access to individualized educational materials and evidence-based late effects screening recommendations. **(Ongoing)**
- Provide researchers with longitudinal information on incidence of late effects in pediatric cancer survivors. **(Ongoing)**

**2009 Activities:** The physician portal was completed this year and includes educational materials for physicians. Evidence-based recommendations and other education materials are now available online for any physician or specialty provider to access. The grantee has been promoting the resource to providers through lectures, and there has been a great deal of interest so far.

Significant progress has also been made on the patient/parent portal. The roadmap for the portal has been completed, reviewed, and approved by all project investigators. Recent efforts on the patient/parent portal have been focused on the look and feel of the system and on how data will be loaded into the system. These efforts are now complete, and the grantee has beta versions. Patients/parents will be able to store their data in the system by entering it into a database and also by uploading scanned documents.

Once the patient/parent portal is complete, the project team will then randomly select 500 patients to participate, and they will be able to store data as a personal health record. Patients/parents will then be able to invite their primary care doctor (and other physicians) to access their survivor health plan online to facilitate information exchange. Similar to a social networking site, they will be able invite doctors to view their information and can un-invite them at any point. When patients/parents sign up, they will get a survivor health care plan and will give permission to their providers to post.

Dr. Mertens has also started to put educational information on the portal, including Health Links, which are teaching handouts for patients and providers, developed by researchers at the Children's Oncology Group, a nationwide cooperative clinical trials consortium established by the National Cancer Institute. Eventually, the portal will highlight tailored information for individual patients based on their risks. Patients/parents will also be able to link their current medications with relevant health links and to store other information as a scanable document.

The research team is planning to be able to conduct beta testing at the end of May 2010, and patient recruitment will begin actively in September 2010.

**Preliminary Impact and Findings:** Findings from focus groups of parents of pediatric cancer survivors have been incorporated into the development of the parent/patient component of the SurvivorLink system.

**Selected Outputs**

Needs Assessment to Facilitate Pediatric Cancer Survivorship Care through SurvivorLink. Platform presentation at the 2009 Georgia Cancer Research Symposium; 2009 Nov; Athens, GA.

Physician portal for Survivor Link

**Grantee's Most Recent Self-Reported Status (as of December 2009):** The physician portal was completed this year, and significant process has been made on the patient/parent portal. Some educational materials are already available as a resource for phyisicians and other specialty providers, and materials are also being loaded onto the patient/parent portal. The research team is planning to be able to conduct beta testing at the end of May 2010, and patient recruitment will begin actively in September 2010.

**Milestones:** Project is completely on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population*

| | |
|---|---|
| **Project Title:** | e-Coaching: Interactive Voice Response-Enhanced Care Transition Support for Complex Patients |
| **Principal Investigator:** | Ritchie, Christine S., M.D., M.S.P.H. |
| **Organization:** | University of Alabama at Birmingham |
| **Mechanism:** | RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP) |
| **Grant Number:** | R18 HS 017786 |
| **Project Period:** | 09/08 – 09/11 |
| **AHRQ Funding Amount:** | $1,199,999 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Chronic Care*, Chronic Obstructive Pulmonary Disease, Congestive Heart Failure, Elderly*

**Summary:** For complex medical patients, the transition from hospital to home-based care is a vulnerable period, placing the patient at high risk for adverse events, including the experience of a medical error or loss of community tenure. Studies examining the Care Transition Intervention (CTI), which provides nurses who conduct home visits, telephone followup, and provide assistance at and after discharge, is a successful program but is costly and not feasible in settings serving geographically dispersed populations.

Dr. Ritchie and her team developed a cost-efficient technological solution that is based on the CTI: an interactive voice response (IVR)-supported care transition coaching intervention, e-Coach, that supports complex medical patients as they transition from hospital to home-based care. The e-Coach, using the TeleSage software application, supports patients with medication self-management assistance, maintenance of a paper-based personal health record (PHR), timely followup with primary or specialty care, and identifies 'red flags' indicating worsening of the patient's condition. The e-Coach also has a Web-delivered monitoring dashboard for the care transition nurse to monitor data collected, listen to patient messages, and record responses. The team, currently in Year 2 of the study, is recruiting patients with congestive heart failure (CHF) or chronic obstructive pulmonary disease (COPD) for a randomized control trial (RCT), randomizing patients discharging from the hospital to either the intervention or usual care. During 2010, the team will be completing the trial and evaluating the use of the e-Coach by patients and health care providers and the impact of the e-Coach on patient outcomes, including 90-day rehospitalizations, successful community tenure over a 3-month period, medication discrepancies, and patient self-efficacy. In addition, the investigators will quantify the cost associated with the e-Coach. If e-Coach is successful, it is likely to be easily disseminated and could result in substantial avoidance of medical errors in the hospital-to-home transition period, along with notable reductions in the risks and costs of rehospitalizations.

**Specific Aims**

- Randomize 720 patients to the e-Coach intervention or to usual care. **(Ongoing)**
- Evaluate the use of the e-Coach system by patient and health care providers. **(Upcoming)**

- Evaluate the effect of e-Coach on patient outcomes, including 90-day rehospitalizations, successful community tenure at home after discharge from the hospital, and patient self-efficacy based on the Care Transition Measure. **(Upcoming)**
- Quantify the costs associated with the e-Coach intervention. **(Upcoming)**

**2009 Activities:** Dr. Ritchie and her team conducted formative research, including focus groups with providers, care managers, and patients, to inform the development of the e-Coach intervention and complete the development of the IVR script and materials for the e-Coach intervention. Significant time was spent programming the IVR and the dashboards for both the CHF and COPD interventions. Although there were several delays due to discussions with the vendor and issues with programming, programming was complete by the end of the year, and pilot testing of the e-Coach intervention for patients with CHF was conducted in December 2009, with roll-out of the RCT and the pilot for patients with COPD scheduled for early 2010.

**Preliminary Impact and Findings:** Preliminary findings include the high receptivity from patients on the intervention, a lack of clarity from providers about who was in control of the discharge plan, and the potential pivotal role of the patient in providing information for the plan.

**Selected Outputs**

Development of the Treatment Information Planner: Patient education materials that are part of the intervention and emphasize the Care Transitions Pillars of Care, including a PHR, Red Flag Action Plan, Medication Management Tool, and general information about CHF and COPD.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** There were delays in programming of the IVR software and e-Coach dashboard, leading to delays in the initiation of the RCT. The team has added an additional research assistant to increase recruitment and will likely request a no-cost extension.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Using Electronic Data to Improve Care of Patients with Known or Suspected Cancer |
| **Principal Investigator:** | Singh, Hardeep, M.D., M.P.H. |
| **Organization:** | Baylor College of Medicine |
| **Mechanism:** | RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP) |
| **Grant Number:** | R18 HS 017820 |
| **Project Period:** | 09/08 – 09/11 |
| **AHRQ Funding Amount:** | $1,199,531 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Cancer: Colon, Lung, and Prostate

Summary: Patients with known or suspected cancers transition through several ambulatory care settings to receive timely diagnosis and treatment. The survival benefit conferred by early diagnosis and treatment depends on well-coordinated care. This project tests the use of health information technology (IT) to identify patients where the diagnosis of specific cancers (prostate, lung, and colon) has been delayed. The project develops, tests, and refines queries to mine a clinical data warehouse for triggers that might signal diagnosis delays using data from the Veterans Administration's (VA's) electronic health record (EHR) i.e. the Computerized Patient Record System maintained by the Veterans Health Information Systems and Technology Architecture; and EMRx, the Scott and White Health system's EHR. Providers in the intervention group of the upcoming randomized, controlled trial will receive electronic communication and surveillance if potential delays in their patients' diagnostic work-up are identified by the triggers. Outcome measures, obtained through chart reviews, consist of time intervals between several key steps in the optimal pathway of diagnosis.

**Specific Aims**

- Identify patients with cancer-related diagnostic delays using trigger-based data mining of an EHR repository. **(Ongoing)**
- Determine the effectiveness of a health IT-based intervention to facilitate cancer diagnosis as compared with usual care. **(Upcoming)**

**2009 Activities:** During 2009, the project team completed the creation of the Safety-Trigger Research Data Repository (STDR) at the VA site. This is a fully operational data repository containing all the necessary data to design, develop, verify, and validate the safety triggers. This process took longer than expected, but was very informative on challenges faced in health IT research.

During the early part of 2009, Dr. Singh and his team began designing and testing proposed safety triggers (data mining triggers) at the non-VA site using electronic medical record data. An iterative process of medical expert record review followed by the design of data mining techniques led to the development of a standard procedure for refining proposed safety triggers. This procedure was systematically applied to the development of all triggers for colon cancer.

Each trigger required mining more than 200,000 potential medical records over a 6-month period. A team composed of clinical providers and a programmer met weekly to define the appropriate clinical criteria and determine how to best implement them, taking into account the limitations of the health information systems at the sites. Each trigger is composed of at least six clinical rules (criteria). Each rule required multiple record review sessions, during which providers tested the triggers by identifying the documented clinical evidence that supported or contradicted the triggers' rules. On average, the development team reviewed 40 to 50 records per trigger, providing feedback that improved the trigger's accuracy and performance. When possible after the initial verification of the triggers' logic and technical performance, the team standardized the triggers' criteria.

At the end of the year, colon cancer diagnostic triggers at both sites were refined in preparation for the validation phase, which focuses on calculating formal measures of performance (i.e., positive predictive value). The refinement process used a panel of experts that included a gastroenterologist and an oncologist to review each trigger. During the expert panel session, the development team (two clinicians and one programmer) presented the triggers and each of the rules to the specialists, who provided feedback based on their experience and current evidence from the literature. Four triggers were discussed during the expert panel session: 1) newly-diagnosed hematochezia, 2) positive fecal occult blood test (+FOBT), 3) iron deficiency anemia, and 4) bleeding triggers. Bleeding trigger was rejected because of its overlap with upper gastrointestinal bleeding. The remaining three triggers are valid at the non-VA site, but only two could be used at the VA site, because the newly diagnosed hematochezia trigger was discovered to have too many inconsistencies in how hematochezia was coded. This made it impossible to distinguish from melena.

The expert panel session refined the logic behind the triggers, adding additional clinical criteria to strengthen the specificity and performance of the triggers resulting in a final set of three triggers at the non-VA site and two at the VA. In 2010, the investigators will start the validation phase of the triggers at both sites in parallel and will begin developing triggers for both lung and prostate cancer.

**Preliminary Impact and Findings:** Dr. Singh and his team gained significant experience designing and developing diagnostic triggers using EHRs and other information systems that support the diagnostic process. The team developed a framework of three steps to guide the design and development of electronic triggers that identify potential and actual delays in diagnosis using data from integrated EHRs. The framework involves: 1) mapping all followup events expected to occur in response to a particular diagnostic clue, 2) verifying the trigger's logic as it is developed (e.g. anemia not followed by colonoscopy in a defined time period), and 3) providing continuous and iterative feedback to improve the trigger.

**Selected Outputs**

The project has no reported outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The announcement of a new National VA policy on developing data repositories for research purposes delayed the creation of the STDR at the VA for the project. This new policy required the project team to revise their request for access to data by developing an operations protocol, updating the previously approved data usage agreement, and adding an agreement that details the expected data transfers to the proposed STDR. In addition, the development of the first trigger (colon cancer) took more time than anticipated. However, the experience and knowledge gained will inform and expedite the development of the triggers for the next two cancers (prostate and lung).

**Milestones:** Progress is on track in some respects.

**Budget:** Somewhat is roughly on target.

| | |
|---|---|
| **Project Title:** | Surveillance for Adverse Drug Events in Ambulatory Pediatrics |
| **Principal Investigator:** | Bailey, Thomas, M.D. |
| **Organization:** | Washington University in St. Louis |
| **Mechanism:** | RFA: HS07-002: Ambulatory and Safety Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017010 |
| **Project Period:** | 09/07 – 08/10, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $992,600 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Cancer, Chronic Care*, Condition Specific: Cystic Fibrosis, Pediatric*, Sickle Cell Anemia

**Summary:** Adverse drug events (ADEs) comprise one of the largest categories of adverse events in the principal studies examining the epidemiology of patient safety. Measurement of ADEs was identified as a critical patient safety metric in the Institute of Medicine's 2004 report on patient safety and in their National Healthcare Quality Report. Measuring the incidence of ADEs in care environments is essential to: 1) establish a baseline performance metric against which to measure improvement, 2) separate medication errors and system failures that result in harm to patients from those that do not, and 3) accurately direct interventions to prevent the failures that are harmful. Despite extensive literature on medication safety, medication errors, and adverse drug events in adult populations, little is known about the frequency and nature of these events in children, and less is known about ADE incidence in children with chronic disease.

This project is using automated surveillance to measure the incidence of outpatient ADEs suffered by children with sickle cell disease, cystic fibrosis, or cancer, either in the emergency department (ED) or during the transitions between hospital admission and discharge. The project will analyze data generated from BJC HealthCare system, which includes the St. Louis Children's Hospital. The St. Louis Children's Hospital ED uses the Wellsoft ED computer system and the McKesson Corporation's Certification Commission for Health Information Technology-certified Horizon Expert Documentation for inpatient care. The BJC/Washington University Medical Informatics Laboratory group is using its rule-based expert systems architecture for discrete data, and the open-source cancer Text Informatics Extraction System (caTIES) for textual data, to automatically scan laboratory, pharmacy, demographic, documentation, and diagnostic code data from the target populations for "signals," or data combinations that suggest the occurrence of an ADE. The automated system, encompassing rules based upon discrete and textual data, is being evaluated for efficiency (positive predictive value [PPV] and time/resource efficiency) and effectiveness in ADE detection compared with targeted explicit chart review, and the project will examine the impact of access to ADE metrics by practitioners. The data from the system will be used to improve medication use safety in clinic, emergency, and inpatient environments.

**Specific Aims**

- Implement an automated surveillance system for measuring the incidence of ADEs occurring in the outpatient setting (including the emergency department) in pediatric patients with specific chronic diseases that result in the need for emergency department care or admission to the St. Louis Children's Hospital. **(Achieved)**

- Use the automated surveillance system for measuring the incidence of ADEs occurring in these patient populations during transitions in care from outpatient to inpatient setting, e.g., originating during the admission process. **(Ongoing)**
- Use the automated surveillance system to measure the incidence of ADEs in the target pediatric populations within 4 weeks of discharge. **(Ongoing)**
- Evaluate the performance of the event detection system as employed in the three above aims. **(Ongoing)**

**2009 Activities:** Web interfaces were completed and reports were produced daily and in real time for evaluation of alerts by a physician and a pharmacist. Automated alert (signal) evaluation and chart review were completed. Three hundred ninety-four charts were reviewed, selected from 1,990 study patients, and the sample was stratified by patient condition (sickle cell, cystic fibrosis, cancer). A study pharmacist reviewed the chart sample for ADEs to identify ADEs intended to be detected by the automated tool. For each prompt, the pharmacist assessed whether an ADE occurred and documented the ADE. Another study pharmacist matched chart review ADEs to ADEs detected by automated alerts. A study physician reviewed every chart review event that was not found by the automated method, or was found by the automated method but differed in the assessment of whether an ADE was present.

**Preliminary Impact and Findings:** In the study population of 1,990 patients, there were 212 discrete alerts that detected 73 adverse drug events, and 1,055 natural language processing (NLP) alerts that detected 70 ADEs. Preliminary analysis shows the system is discovering harmful ADEs in 1.3 percent of inpatient admissions with a PPV of 13 percent. Data suggest that the rate of NLP-detected ADEs per year (i.e., alone, not counting ADEs detectable with discrete alerts) in the study populations was approximately 6.8 events per 100 patients per year; this is the same order of magnitude described by studies in adult populations.

**Selected Outputs**

Gysbers M, Reichley R, Kilbridge PM, et al. Natural language processing to identify adverse drug events. AMIA Annu Symp Proc. 2008 Nov 6:961.

Kilbridge PM, Noirot LA, Reichley RM, et al. Computerized surveillance for adverse drug events in a pediatric hospital. AMIA Annu Symp Proc 2008:1004.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project has made significant progress in implementing the intervention and publishing results.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Closing the Feedback Loop to Improve Diagnostic Quality |
| **Principal Investigator:** | Berner, Eta, Ed.D. |
| **Organization:** | University of Alabama at Birmingham |
| **Mechanism:** | RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017060 |
| **Project Period:** | 11/07 – 08/10, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $998,509 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Adults, Cerebral Palsy, HIV/AIDS

**Summary:** Determining whether a diagnosis is "correct" in an outpatient setting may be very difficult. A surrogate measure of diagnostic quality is whether the diagnosis appropriately resolves the reason for the patient's visit when new complaints or diagnoses arise during the visit. The proposed system focuses on mitigating the harm from an initial diagnosis that does not resolve the patient's underlying problem. The hypothesis is that harm can be prevented or mitigated by providing rapid feedback to the physician, thereby closing the diagnostic loop.

The project is developing automated processes for proactive followup and ongoing rapid feedback to physicians in two types of outpatient settings: two ambulatory clinics (University of Alabama at Birmingham-Huntsville Family Practice and the University of Alabama at Birmingham-HIV Clinic), and one emergency department (ED) setting (Shands-Jacksonville Emergency Medicine Department). The ambulatory sites have different electronic health records (EHRs). The EHRs at these sites are the Certification Commission for Health Information Technology (CCHIT)-certified WorldVistA EHR and the Touchworks™ EHR. In the ED study, the systems are the CCHIT-certified McKesson Horizon Patient Folder™ and a proprietary ED system (Xpress Charts) that provides a computer-generated paper template customized to the patient's chief complaint.

Different interventions are used at each type of site. The clinic site intervention is an interactive voice response (IVR) system that collects followup data for a feedback report to physicians on patient health status and medication adherence. The feedback report uses an interface between the EHR and a database that can be integrated with a variety of systems. The ED intervention is an automated followup and feedback report to the ED physicians on the final diagnoses of patients who were admitted to the hospital as compared to their initial ED diagnoses.

Providers' responses to the feedback, their satisfaction with the feedback process, the impact on diagnostic and therapeutic quality, response to use of the IVR and ED feedback systems, and the use of the feedback by physicians will be assessed as outcome measures. For the clinic sites, additional assessments include patient satisfaction and impact on health care costs.

**Specific Aims**

- Develop a system within three different ambulatory EHR systems in three different types of ambulatory settings that includes proactive followup of patients' response to treatment (including medication adherence and adverse events) and feedback to health care providers. **(Achieved)**

- Assess the impact of automating the followup/feedback system. Impact will be measured in terms of: 1) diagnostic quality; 2) prevention of adverse events; 3) patient satisfaction with clinical care; and 4) health care costs. **(Ongoing)**
- Develop and evaluate an automated system for feedback to emergency medicine physicians of the concordance between their diagnoses and patients' final diagnostic outcomes. **(Ongoing)**

**2009 Activities:** The study team completed baseline data collection, clinic staff training, and installing and configuring the system for each clinic. After 4 months of recruitment, a total of 142 patients contacted who expressed interest in receiving a followup telephone call were called. The research team reached 80 percent of those who provided contact information. Of the patients reached, 96 percent completed the telephone survey. There were site differences in: 1) followup interest, 2) patient contact with the clinic in the period between the visit and the phone call (28 percent overall), and 3) conditions unresolved 3 weeks after the visit (9 percent overall). The survey data provide baseline data for comparison with the fully automated followup and feedback process.

Prior to data collection, study staff gave presentations on the plans for feedback to physicians at all three sites. A human interviewer made followup phone calls to patients within a week of the patient visit in all clinics, and physicians were provided feedback on their original diagnosis. The protocol for the followup call requires that a patient found to be worse or having a medication issue (e.g., not taking medicines or having an adverse reaction) is referred immediately to care and treated in the usual manner.

System installation and configuration was completed in each of the clinics. The same system was used in the HIV and Cerebral Palsy clinics. This system has sophisticated features that automatically notify the interviewer when a patient needs to be followed up, prepopulates the interview form with data from the EHR, and provides the aggregate feedback to the physician with drill-down capabilities to see specific data. Enhancements to improve the system were completed based upon ongoing assessment of system functioning.

**Preliminary Impact and Findings:** Publicly available findings will be disseminated closer to the end of the project.

**Selected Outputs**

Data Collection Tool: includes data elements necessary to collect prior to followup and during followup.

Patient Screening Tool: to identify patients that volunteer to be part of the study.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is progressing well with data collection and manuscript development. The project may request a short no-cost extension to assure adequate time for data analysis.

**Milestones:** Project is mostly on track.

**Budget:** Spending is roughly on target.

| | |
|---|---|
| **Project Title:** | Colorado Associated Community Health Information Exchange |
| **Principal Investigator:** | Davidson, Arthur, M.D. M.S.P.H |
| **Organization:** | Denver Health and Hospital Authority |
| **Mechanism:** | RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017205 |
| **Project Period:** | 01/08 – 06/10, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $986,302 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Chronic Care*, Diabetes, Safety Net,

**Summary:** The Colorado Associated Community Health Information Exchange (CACHIE) project is designing, developing, implementing, and evaluating an interoperable quality information system (QIS) for a collaborative network of seven community health centers (CHCs) that will permit real-time, synchronous quality reporting to inform patient care, quality interventions, health policy, and advocacy efforts. The QIS is foundational in nature, ultimately supporting many types of quality and safety analyses. The QIS will compile data elements from disparate electronic health record (EHR) systems into a common standardized data warehouse and build business intelligence programming to generate meaningful quality measures and reports at the patient, physician, practice, and population level. The initial chronic disease focus is diabetes mellitus; the second planned focus is tobacco cessation.

The project is working with clinicians to develop consensus on the quality measures required for diabetes reporting, along with the specification of those measures, and on the ancillary information that allows reports to be actionable for quality improvement. Although some CHC physician leaders have concerns regarding the need for templates in clinical care and the impact of template use on workflow, others are working on template development independent of this project. Baseline reporting and benchmarking available via the QIS will assist in identifying and supporting the need for future templates. Clinical reporting allows providers and practices to "question the data," a process required to uncover areas where guideline appropriate care is not uniformly delivered or by uncovering circumstances of inaccurate and/or incomplete documentation, which may make data extraction more difficult or even impossible due to non-standard coding and storage.

A second focus is to establish a replicable process for quality report measurement and actionable report development in other clinical domains, using diabetes as the prototype. Clinicians and technical support staff share the goals of creating and implementing a standard, efficient process for building consensus around metrics and their definitions, documenting functional requirements, and sharing the lessons learned from quality improvement initiatives. The CACHIE team feels this is essential if the project is to extend beyond diabetes.

The QIS system is standardizing data using emerging National standard vocabularies and will report quality measures in a timely, efficient, and user-convenient manner. The QIS supports: 1) identification of best practices; 2) establishment of appropriate CHC benchmarks; 3) development, implementation, and evaluation of targeted quality improvement interventions; 4) use of clinical decision support systems; and 5) promotion of public policies to improve health and health services to low-income populations. The Certification Commission for Health Information Technology-certified pilot EHRs used in this project are NextGen and GE Centricity.

**Specific Aims**

- Obtain detailed business and technical requirements for development of: 1) a flexible, evidence-based, clinical template system that interoperates with commercially-available EHRs and 2) a timely and efficient quality information reporting system that aggregates and integrates multiple data sources within seven CHCs. **(Achieved)**
- Develop a system for reaching consensus among various CHCs on diabetes quality and actionable report measures. **(Ongoing)**
- Extract data from two disparate EHRs, standardize to Nationally recognized vocabularies, and import into a shared data warehouse. **(Ongoing)**
- Implement and deploy a business intelligence tool for self-service and static reporting. **(Ongoing)**
- Guide, support, and evaluate each CHC practice to build capacity and monitor associated costs as they independently (i.e., without vendor support) implement an evidence-based guideline template. **(Upcoming)**
- Evaluate the usability, utility, accuracy, and best methods for incorporating quality measure reporting as a feedback mechanism to providers and practice managers. **(Upcoming)**

**2009 Activities:** The CACHIE project team, with the assistance of two partners, has been working to map and extract the required clinical data from the disparate EHRs, design and build the data warehouse and data marts, and select a business intelligence tool. In addition, the project team has more intensively engaged with clinician leaders regarding quality measure development and detailed specifications about their implementation. White Cloud Analytics, a business intelligence firm that has expertise in the building of data cubes to support pre-designed and ad hoc reporting, is providing the team with a system of checks and balances between external collaborators and data warehouse engineers. The CACHIE co-investigator and project manager have been participating in report-building training to learn more about the nuances of data cube design to support queries. The project team, in communication with the Colorado Department of Health Care Policy and Finance, is exploring how the combination of claims data into the data warehouse might facilitate the provision of other valued services.

**Preliminary Impact and Findings:** Findings will be disseminated upon completion of the evaluation phase.

**Selected Outputs**

A one-page Use Case and Workflow handout that illustrates QIS visit and post-visit constructs.

Davidson, A. Presentation of the Colorado Associated Community Health Information Exchange (CACHIE) to the Colorado Community Associated Network. 2009 March 12; Denver, CO.

CACHIE Technical Specifications outlining the technical requirements based on QIS user requirements.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project has met over two-thirds of the targeted milestones, and the project team has a viable plan for achieving those not yet being met to allow the project to remain close to schedule.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Automating Assessment of Asthma Care Quality |
| **Principal Investigator:** | Hazlehurst, Brian, M.D. |
| **Organization:** | Kaiser Foundation Research Institute |
| **Mechanism:** | RFA HS07-002: Ambulatory and Safety Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017022 |
| **Project Period:** | 09/07 – 09/10, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $871,711 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Asthma, Chronic Care*, Pediatric*, Teenagers

**Summary:** This project aims to develop, validate, apply, and evaluate a scalable method for routine and comprehensive measurement of outpatient asthma care quality (ACQ). This project leverages health information technology (IT) to assess and improve quality of care for the insured, indigent, uninsured, and underinsured populations of this region. To accomplish this, the project will employ MediClass (a medical classifier), which is a proven natural language processing (NLP) technology for extracting care quality data from both coded data and free-text clinical notes in the electronic medical record (EMR). The project will perform retrospective analysis of EMR data from two distinct health systems: a mid-sized health maintenance organization (HMO) (Kaiser Permanente Northwest [KPNW]) and a consortium of Federally Qualified Health Center clinics (Our Community Health Information Networks [OCHIN, Inc.]). The study will include a diverse sample of patients, providers, and health care practices in the Pacific Northwest. Data will be extracted from Kaiser Permanente's Certification Commission for Health Information Technology-Certified Epic-based EMR, HealthConnect, and OCHIN's Epic-based EMR, EpicCare. Since these EMR applications reside in separate health systems, the implementation of the products generates differences in the data, which must be accommodated when these data are interpreted for quality assessments. This project is leveraging MediClass to implement methods for collecting and transforming data into common formats for quality assessment across multiple data capture, representation, and storage processes. A newly awarded grant from the Agency for Healthcare Research and Quality under the PROSPECT initiative provides funds for building a centralized Comparative Effectiveness Research Hub (CER HUB) making MediClass applications, including the results of processing EMR data using those applications, more valid, robust, and broadly available to end-user researchers.

The starting study participants included patients older than 12 years who were identified to have asthma by a single visit diagnosis code. Subsequently, a modified Healthcare Effectiveness Data and Information Set method that included text processing of clinician notes was applied in order to qualify patients as having persistent asthma for inclusion in assessments of care delivered. The study population was drawn from approximately 24 months of OCHIN data and about 120 months of KPNW data.

Validation of the "target concepts" identified by the MediClass application will be based on chart reviews at the encounter level. Most quality measures will be associated with several unique target concepts identified by MediClass processing. Validation of the ACQ measures will be based on chart reviews at the patient level. Sensitivity, specificity, false positive and negative rates, and 95-percent confidence intervals (CIs) will be computed for each measure based on the review of 900 patient charts. After the automated measurement method has been refined and applied to the target population for each quality

measure, the proportions and 95-percent CIs will be computed for patients receiving the indicated care measures. In addition, patient-level summary ACQ scores will be analyzed. These measures will be reported on the entire target population and by age, severity, and health care system subgroups. The availability of several years of EMR data at KPNW will enable the project to evaluate the relationship of the automated ACQ measures with health outcomes. Logistic regression will be employed to model the association between the automated ACQ summary score and the primary outcome measure.

**Specific Aims**

- Refine ACQ measures from the RAND Quality Assessment Tools Project for use as a quality measure set to evaluate ambulatory asthma care performance. **(Achieved)**
- Develop and validate an automated (generalizable and scalable) method for applying the above care quality measures using comprehensive EMR data. **(Achieved)**
- Apply the automated method developed above to assess ambulatory ACQ in two distinct health plans representing diverse patient populations and care practices. **(Ongoing)**
- Evaluate the association between automated measures of adherence to recommended asthma care processes and measures of clinical outcomes using KPNW data only. **(Ongoing)**

**2009 Activities:** The primary focus was the development and implementation of the architecture enabling health IT to create the automated measurement. The prototype was developed and validated in each of the two health systems.

An extensive chart review of stratified random samples of persistent asthma patients and exacerbation events was completed at each site. The chart review process involved a sample of roughly 450 patients per site. The sample included patients who have persistent asthma and/or an exacerbation of asthma and was balanced by age and sex. The chart review collected the data necessary to evaluate criteria for assessing performance on each quality measure. As adjudicated by the clinician investigator, a 10-percent quality assurance sample was conducted to provide secondary review and to resolve discrepancies.

**Preliminary Impact and Findings:** Preliminary findings focus on data captured in the EMR and data flow out of the EMR. Many of the data elements that are required for in-depth, comprehensive, domain-specific (e.g., asthma care) quality assessment do not flow automatically to a data warehouse from the clinical information system (e.g., EMR). This flow is necessary for automated assessment, but will require specific configuration of the data warehousing practices at each implementation site. There are many ways for clinicians to document their care. Within progress notes of the EMR, the common use of automated templates and macros for adding content may increase documentation speed but may also make the interpretation of these loosely organized content segments difficult or ambiguous.

Roughly 45,000 KPNW members and 5,000 OCHIN patients over the age of 12 had at least one asthma visit during a 3-year observation window. From this group patients with “persistent asthma” were identified as anyone who met any of the following criteria within any 12-month period of the first 2 years of the observation window: 1) had four "fills" ordered of asthma-specific medications; 2) had two "fills" ordered of asthma-specific medications and four outpatient visits coded with asthma diagnosis; 3) had asthma-related emergency department (ED) visit or hospitalization (KPNW only); 4) had an explicit provider notation that patient has persistent asthma; or 5) had a visit coded with an internal (health plan specific) persistent asthma diagnosis code. This identified roughly 13,000 patients in KPNW and 1,000 patients in OCHIN for a single observation window. In this population, asthma exacerbations were defined by either: 1) a hospitalization with primary diagnosis of asthma; 2) a hospitalization, ED, or outpatient visit with any diagnosis of asthma exacerbation; or 3) an outpatient visit with a primary diagnosis of asthma and a dispensing or order for a respiratory steroid medication.

Asthma exacerbations are a key outcome and severity marker for asthma. Unfortunately, they are not routinely coded as such in the outpatient setting. By contrast, when the patient is hospitalized for asthma,

codes for exacerbation are regularly applied to the visit to characterize the main reason for hospitalization. By adding an NLP processing component to the method for identifying exacerbations, which requires an asthma visit code and an order for steroids, the project was able to improve the identification of asthma exacerbation events in the ambulatory EMR.

**Selected Outputs**

Mularski RA, Hazlehurst BH, McBurnie MA. Building an automated asthma care quality performance measure set. Poster presented at: American Thoracic Society Annual Conference, May 2009, San Diego.

Hazlehurst B, McBurnie M, Mularski R, Puro J, Chauvie S. Automating quality measurement: a system for scalable, comprehensive, and routine care quality assessment. AMIA Annu Symp Proc. 2009 Nov 14;2009:229-33.

Mularski RA, McBurnie MA, Hazlehurst BH. Automating asthma care quality performance measurement for clinical effectiveness. Research Poster session at: Clinical Medicine & Research HMO Research Network Meeting, April 2009 Danville, PA.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** As the project comes to a close, the primary focus is on the analysis and development of manuscripts.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Developing and Using Valid Clinical Quality Metrics for Health Information Technology with Health Information Exchange |
| **Principal Investigator:** | Kaushal, Rainu, M.D. |
| **Organization:** | Joan and Sanford I. Weill Medical College of Cornell University |
| **Mechanism:** | RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017067 |
| **Project Period:** | 09/07 – 03/11, Including No Cost Extension |
| **AHRQ Funding Amount:** | $974,545 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Not Applicable

**Summary:** Recently proposed metrics for measuring quality of care in ambulatory settings have been largely designed to measure ambulatory care in isolation, independent of interactions with other health care providers and other health care settings. Innovations in health care driven by implementation of health information technology (IT) with health information exchange (HIE) require revised sets of quality metrics that can capture the types of effects these interventions promise. For example, new metrics are needed to capture the effects of data sharing between generalists and specialists in the ambulatory setting, and sharing data across transitions between inpatient and outpatient settings. Further, new quality metrics are needed to capitalize on the rich clinical data that could be extracted from electronic health records (EHRs) and other electronic sources.

This project derived a set of quality metrics that built on existing metrics and added metrics that can capture the effects of health IT with HIE and can be retrieved electronically. This was accomplished through the contributions of the Health Information Technology Evaluation Collaborative (a multi-institutional academic collaborative established to evaluate health IT and HIE initiatives in New York State), the New York State Department of Health, and four regional health information organizations (RHIOs) that are implementing health IT with HIE and focusing on the ambulatory setting. Once derived, this quality metric set was presented to two groups for validation: a panel of National experts in quality measurement and the New York eHealth Collaborative, a multi-stakeholder organization dedicated to advancing health care performance measurement as supported by health IT. The metric set was then refined with the expert panel.

Dr. Kaushal's team will test the accuracy of electronic retrieval of the data for the metric set, compared to the gold standard of manual chart review. The metric set will then be used to evaluate the effects on quality of using health IT with HIE, specifically EHRs and electronic portals. To do so, Dr. Kaushal's team will prospectively follow a randomly selected sample of physicians in ambulatory practices to determine if quality improves over 1 year of using health IT with HIE.

This work has the potential to move closer toward capitalizing on the promise of health IT and HIE for improving quality measurement. If validated and effective, the metrics developed and interventions studied could also be disseminated widely to other ambulatory care communities.

**Specific Aims**

- Develop a modified set of quality metrics that can be retrieved electronically and is sensitive to the types of improvements in quality that health IT with HIE may contribute in an ambulatory care setting. **(Achieved)**
- Validate the modified quality metric set. **(Achieved)**
- Test the reliability of electronic retrieval of the modified quality metric set. **(Ongoing)**
- Use the modified quality metric set to evaluate the long-term effects of using health IT with HIE on improving health care quality. **(Ongoing)**

**2009 Activities:** A manuscript describing the final metric set (18 existing metrics plus 14 novel metrics focusing on utilization) and the methodology by which it was created was published in the July 2009 issue of the Joint Commission Journal on Quality and Patient Safety. The article was accompanied by an editorial by Dr. David W. Bates on the future of quality measurement.

Data collection reliability testing was scheduled to occur toward the end of this calendar year; however, Dr. Kaushal's team was unable to identify a community provider using a commercial vendor that could electronically report these metrics from their EHR. Existing vendor systems at community-based providers were not able to report the types of metrics defined for this study as had been initially expected. Instead, the research team had to form a new collaboration with a clinical group of providers in the Hudson Valley who had the ability to use EHRs to report the metrics electronically.

Twelve metrics were ultimately selected for this purpose, and Dr. Kaushal's team is currently working with the clinical group on the specifications for data collection. Data will be collected at baseline and followup. Data will be collected retrospectively as quality data have been accruing in the electronic record system. This process will be followed by data cleaning, analysis, manuscript preparation, and dissemination of findings.

**Preliminary Impact and Findings:** National discussions about interoperability are focusing on the definition of Meaningful Use (MU), and there is an assumption that providers will be able to report MU metrics from their EHRs; however, the metrics developed for this study are similar to potential MU metrics, and as such, the team's vendor identification challenges also highlight larger policy ramifications as community providers strive to demonstrate MU.

**Selected Outputs**

Kern LM, Dhopeshwarkar R, Barrón Y, et al. Measuring the effects of health information technology on quality of care: a novel set of proposed metrics for electronic quality reporting. Jt Comm J Qual Patient Saf. 2009 Jul;35(7):359-69.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Dr. Kaushal's team is now on track to complete the study using no-cost extension funds.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Spending is roughly on target.

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|---|---|
| **Project Title:** | Cardio-Hit Phase II |
| **Principal Investigator:** | Kmetik, Karen, Ph.D. |
| **Organization:** | American Medical Association |
| **Mechanism:** | RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017160 |
| **Project Period:** | 09/07 – 12/09, Including No Cost Extension |
| **AHRQ Funding Amount:** | $996,166 |
| **Summary Status as of:** | December 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Heart Failure, Heart Disease

**Summary:** Quality measure exceptions are defined by the Physician Consortium for Performance Improvement® (PCPI) as reasons why patients who are eligible for a measure based on a broad criterion such as diagnosis (the patient has coronary artery disease), or age, may not be candidates for a particular aspect of care because of a medical (allergy to drug), patient (preference), or system (shortage of influenza vaccine or inability to pay) reason. With the growing levels of public and private clinical performance measurement activity in the United States, the use of exceptions has received increasing attention from varying stakeholders including consumer and patient groups, physicians, payers, policymakers, performance measure developers, and product vendors of electronic health records (EHRs). In the context of physician performance measurement, exceptions are an element of physician performance measure design that is intended to fulfill four functions: promote appropriateness of care, facilitate quality improvement and patient management, track variations, and prevent unintended penalization of physicians.

The quality measure/EHR collaboration, known as Cardio-HIT, explored analysis of exception reporting across physician practice sites with different EHR products. This project was a 2-year, observational study of quality measure exception reporting designed to study the feasibility and reliability of integrating the Nationally recognized American College of Cardiology (ACC)/American Heart Association (AHA)/PCPI-developed physician performance measures for coronary artery disease (CAD) and heart failure (HF) into five EHR-equipped cardiology and internal medicine practices. As far as the project researchers are aware, this project was the first systematic investigation into these key issues concerning exception reporting that emphasize the use of different EHRs at different independent practice sites.

The overarching objectives of the study were to:

- Advance the science of performance measurement through quantitative study of the prevalence and patterns of exception and performance reporting.
- Advance empiric knowledge of the relative accuracy of exceptions.
- Help inform the National debate on the role of exception reporting in physician performance measurement through a qualitative study of key stakeholder perspectives on exception reporting in performance measurement.
- Develop ways to better delineate patient populations through more detailed exception categorization.

The process of integrating the ACC/AHA/PCPI measures into an EHR, exporting de-identified data to a central warehouse, and the subsequent report development and distribution was a multi-phased approach involving each practice site and the Iowa Foundation for Medical Care, which managed the Cardio-HIT clinical data warehouse. The team from the individual practices consisted of staff that was well versed in the technical requirements of data extraction from their EHR, as well as a physician leader that possessed detailed knowledge of the clinical workflow of the practice as it related to how clinicians are utilizing the EHR data fields. The data to inform the work were collected from the following vendor products: Epic Spring; NextGen; Hybrid EHR; Touchworks by Allscripts; and GE Centricity. At the time of the study the EHR product versions the sites used were not certified by the Certification Commission for Health Information Technology; however, all vendors currently are certified, with the exception of the Hybrid EHR.

Two sources of data were used for this study: 1) the CAD and HF performance measure data, which were collected in practice site EHRs and exported to a data warehouse by all Cardio-HIT sites, and, 2) detailed data on reported performance and exceptions, which were collected via manual abstraction by trained abstractors. The data generated through the Cardio-HIT project also provided actionable feedback to physicians about the quality of care being provided by the analyses of the integrated performance measures exception reporting data. Physician access to exception data from the EHRs at the point of care is critical for clinical decisionmaking and improving patient outcomes.

**Specific Aims**

- Develop an empirical understanding about prevalence and patterns of exception reporting among physicians using EHRs and reporting National performance measurements. Exception and performance reporting data were used from the Cardio-HIT sites to quantify prevalence and patterns of exceptions and performance for two measure sets: CAD and HF. **(Achieved)**
- Evaluate the feasibility and accuracy of exception reporting among physicians in the following ways: 1) conduct organizational evaluations to characterize and assess the ability of EHR-enabled practices to capture data required for exception reporting, and to assess variation in this process; and 2) evaluate the accuracy and validity of automated exception reports and identify key sources of measurement error. **(Achieved)**
- Analyze and then address stakeholder perspectives concerning exception reporting in physician performance measurement to develop refined principles and methods regarding the use of exception reporting in performance measures. Convene key stakeholders in physician performance measurement, document stakeholder perspectives, and develop a consensus guideline concerning the use and operationalization of exceptions in National physician performance measures. **(Achieved)**

**2009 Activities:** The grant team completed data abstraction, review, and analysis of patient-level data from the five practices participating in Cardio-HIT for selected AHA/ACC/PCPI CAD and HF performance measures.

The practices reported data on 47,075 CAD patients for 4 CAD drug therapy performance measures (antiplatelet, low-density lipoprotein lowering, beta-blocker, and angiotensin converting enzyme inhibitors/angiotensin II receptor blockers [ACEI/ARB]), including exception reasons. Retrospective manual reviews of the EHRs were conducted on a sample of 538 patients with reported exceptions. Among patients with reported exceptions, agreement between the reported exception and documentation in the EHRs based on an a priori list of appropriate exceptions was very high and the "applied or true exception" rate where an exception was reported and no drug was prescribed, across all sites and all measures was low. A manuscript regarding the CAD findings currently is under consideration for publication.

The practices reported to the data warehouse 13,985 eligible HF patients for three HF drug therapy performance measures (beta-blocker, ACEI/ARB, and warfarin), including exception reasons. Retrospective manual reviews of the EHRs were conducted on a sample of 559 patients with exceptions reported to the data warehouse that included patients with multiple exceptions and patients who met the numerator specifications. Among patients with reported exceptions, agreement between the reported exception and documentation in the EHRs based on an a priori list of appropriate exceptions was high and the "applied or true exception" rate where an exception was reported and no drug was prescribed, across all sites and all measures was low.

The practices reported to the data warehouse 12,403 eligible HF records for 6 HF performance measures (beta-blocker, ACEI/ARB, warfarin, left ventricular ejection fraction assessment, weight measurement, and blood pressure measurement). Retrospective manual reviews of the EHRs were conducted on a sample of 678 records reviewed for cases where the numerator was reported. Few records were identified as "misclassification – exception found" because the numerator was reported to the warehouse, which upon manual abstraction of the EHR, the measure was found not to be met and an acceptable exception was identified. A small number of records were identified as "invalid – apparent quality failures" because the numerator was reported to the warehouse, which upon manual abstraction of the EHR, the measure was found not to have been met and an acceptable exception was not identified.

**Impact and Findings:** Exception reporting was generally low, with high rates of agreement. This study identified aspects of care important to capture in an EHR for care coordination as well as patient safety. The specific reasons for a medical exception suggest standard categories of medical exceptions (e.g., clinical contraindications, drug allergy, or interaction). Because many exceptions are not absolute, physicians may decide to "override" an exception and provide the relevant aspect of care. Automatic reporting often missed critical information. With improvements to automated reporting, additional granularity may be possible in the future.

Physicians are more likely to accept the quality measure results as valid if they can account for exceptions. Others report frustration when exceptions are not permitted. Exceptions also provide a means to track variations in care and focus quality improvement efforts. For example, rather than simply reporting that 40 percent of eligible patients did not receive a particular drug, the data can show that 30 percent did not receive the drug for a reported medical reason and 10 percent did not receive the drug with no reason provided. Further investigation of the 10 percent may be a good first step in targeting quality improvement efforts. The ability to collect and analyze exception data may prove valuable in understanding variations in care. Physician access to exception data from the EHR at the point of care is critical for decisionmaking and may help improve patient outcomes, perhaps through clinical decision support systems. These findings will enable the development and dissemination of health information technology evidence and evidence-based tools to improve health care decisionmaking using integrated data and knowledge management.

**Selected Outputs:**

Grantee's 2009 Final Report.

Several manuscripts are pending publication.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project has been completed.

**Milestones:** All aims/milestones have been achieved.

**Budget:** Roughly on track.

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|---|---|
| **Project Title:** | Electronic Support for Public Health–Vaccine Adverse Event Reporting System |
| **Project Investigator:** | Lazarus, Ross, M.B.B.S., M.P.H., M.Med., G.D.Comp.Sci. |
| **Organization:** | Harvard Pilgrim Health Care, Inc. |
| **Mechanism:** | RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017045 |
| **Project Period:** | 12/07 – 09/10, Including No-Cost Extension |
| **AHRQ Funding:** | $999,995 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** General

**Summary:** Public and professional confidence in vaccination depends on reliable postmarketing surveillance systems to ensure that rare and unexpected adverse effects are rapidly identified. The goal of this project is to improve the quality of vaccination programs by improving the quality of physician adverse vaccine event detection and reporting to the National Vaccine Adverse Event Reporting System (VAERS). This project is serving as an extension of the Electronic Support for Public Health (ESP) project, an automated system using electronic health record (EHR) data to detect and securely report cases of certain diseases to a local public health authority. ESP provides a ready-made platform for automatically converting clinical, laboratory, prescription, and demographic data from almost any EHR system into database tables on a completely independent server, physically located and secured by the same logical and physical security as the EHR data itself. The ESP:VAERS project is specifically developing criteria and algorithms to identify important adverse events related to vaccinations in ambulatory care EHR data, and formatting and securely sending electronic VAERS reports directly to the Centers for Disease Control and Prevention (CDC).

Patient data are available from Epic System's Certification Commission for Health Information Technology-certified EpicCare system at all ambulatory care encounters within Atrius Health, a large multispecialty group practice with over 35 facilities. Every patient receiving a vaccine is automatically identified, and for the next 30 days, their health care diagnostic codes, laboratory tests, and medication prescriptions are evaluated for values suggestive of an adverse vaccine event. When a possible adverse event is detected, it is recorded, and the appropriate clinician is notified electronically.

Clinicians will be able to preview a prepopulated report with information from the EHR about the patient, including vaccine type, lot number, and possible adverse effect, to inform their clinical judgment regarding whether they wish to send a report to VAERS. Clinicians have the option of adding free-text comments to prepopulated VAERS reports or to document their decision not to send a report. The CDC's Public Health Information Network Messaging System (PHIN-MS) software has been installed within the facilities so that the approved reports are securely transferred to VAERS as electronic messages in an interoperable health data exchange format using Health Level 7 (HL7).

**Specific Aims**

- Identify required data elements, and develop systems to monitor ambulatory care EHRs for adverse events following vaccine administration. **(Achieved)**

- Prepare and securely submit clinician-approved electronic reports to the National VAERS. **(Ongoing)**
- Comprehensively evaluate ESP:VAERS performance in a randomized trial and in comparison to existing VAERS and Vaccine Safety Datalink data. **(Unlikely to Achieve)**
- Distribute documentation and application software developed and refined in the first two aims listed above that are portable to other ambulatory care settings and to other EMR systems. **(Achieved)**

**2009 Activities:** During this second year, the majority of effort has been to build on the work completed in the first year, in which criteria were developed consultatively to implement, validate, and test adverse event definitions identifying case histories that might be suggestive of an adverse effect following vaccination. The grantee has a functioning adverse event detection implementation capable of being expanded and modified to deal with a wide range of conditions. Testing is complete, and validation is underway.

Some development, refinement, and testing of the software continues, but functioning source code is now available to share under an approved open source license. The grantee has added the ESP:VAERS code, HL7, and other specifications and documentation to the existing ESP Web documentation and distribution resource center. The existing Web site served as the prototype as planned. The ESP:VAERS case-management Web site has been completed.

Software and identification keys have been obtained from CDC in order to complete PHIN-MS installation on a test server for testing, and secure message transport to the target server has been successfully tested.

The HL7 specification describing the elements for an electronic message to the consultants engaged by CDC for this project has been implemented. Synthetic and real test data have been generated and transmitted between Harvard and the consultant group. Real data transmissions will begin in the near future.

Adverse event criteria have been developed to assess parameters for new or abnormal values that might be suggestive of an adverse effect, and the first version of the reporting protocol was approved by both internal and external partners. A draft document was prepared, describing the elements, algorithms, interval of interest after vaccination, and actions for broad classes of postvaccination events, including those to be reported immediately without delay (such as acute anaphylactic reaction following vaccination), those never to be reported (such as routine check-ups following vaccination), and those to be reported at the discretion and with additional information from the attending physician through a feedback mechanism. The draft was then widely circulated as an initial working draft for comment by relevant staff in the CDC (the internal CDC Brighton Collaboration liaison, and CDC's Clinical Immunization Safety Assessment Network) and among clinical colleagues at Atrius.

The team had planned to evaluate the system by comparing adverse event findings to those in the Vaccine Safety Datalink project—a collaborative effort between CDC's Immunization Safety Office and eight large managed care organizations. Through a randomized trial, they had also planned to test the hypothesis that the combination of secure, computer-assisted, clinician-approved, adverse event detection, and automated electronic reporting will substantially increase the number, completeness, validity, and timeliness of physician-approved case reports to VAERS compared to the existing spontaneous reporting system; however, due to restructuring at CDC and consequent delays in terms of decisionmaking, it has been challenging for the grantee to move forward with discussions regarding the evaluation of ESP:VAERS performance in a randomized trial, and compare ESP:VAERS performance to existing VAERS and Vaccine Safety Datalink data. It is unlikely that the trial will be achieved.

**Preliminary Impact and Findings:** Preliminary data were collected from June 2006 through October 2009 on 715,000 patients, and 1.4 million doses (of 45 different vaccines) were given to 376,452

individuals. Of these doses, 35,570 possible reactions (2.6 percent of vaccinations) were identified. This is an average of 890 possible events, an average of 1.3 events per clinician, per month.

**Selected Outputs**

ESP:VAERS (source code available as part of the ESP source code distribution). Licensed under the GNU Lesser General Public License (LGPL), an open source license compatible with commercial use. Freely available under an approved open source license at: http://esphealth.org.

Linder J, Klompas M, Cass B, et al. Spontaneous Electronic Adverse Event Reporting: Perspectives from Clinicians, EHR Vendors, Biopharma, and the FDA. Presented at the American Medical Informatics Association Annual Symposium; 2009 November 14–18: San Francisco, CA.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Progress mostly on track, and all aims and milestones are on track or achieved with the exception of evaluation. Programming delays reported previously have been overcome. Restructuring at CDC and consequent delays in terms of decisionmaking have made it challenging despite the grantee's best efforts to move forward with discussions regarding the evaluation of ESP:VAERS performance in a randomized trial and comparison of ESP:VAERS performance to existing VAERS and Vaccine Safety Datalink data. It is unlikely that the trial will be achieved; however, the grantee continues to make every effort to move forward with these discussions.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Spending is roughly on target.

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| **Project Title:** | Medication Monitoring for Vulnerable Populations via Information Technology |
| **Principal Investigator:** | Lehmann, Christoph, M.D. |
| **Organization:** | Johns Hopkins University |
| **Mechanism:** | RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017018 |
| **Project Period:** | 09/07 – 08/10, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $994,325 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Adults, Chronic Care*, Diabetes, Heart Disease, Lung Disease

**Summary:** The Institute of Medicine report, Preventing Medication Errors, offered some of the first broad insights into the risk of medication errors in ambulatory settings. Across all care settings, including ambulatory care, quality lapses and errors related to medications are some of the most prevalent risks, and morbidity due to these errors is costly. Medication monitoring is the least well understood phase of medication use as it pertains to quality and safety, especially in the ambulatory setting. Available data highlights significant potential for patient safety improvement by increasing rates of medication therapeutic monitoring. It is not known how to best identify patients in need of medication therapeutic monitoring in the ambulatory setting, but the use of electronic health records (EHRs) is promising. It is also not known, given the lack of National guidelines on laboratory monitoring, if providers fully understand how to link the process of therapeutic monitoring to differences in patient outcomes.

The overall goal of this project is a practice-based, cross-sectional demonstration of the ability of interoperable health information exchange and a Certification Commission for Health Information Technology-certified EHR to provide useful quality and safety measures for the vulnerable populations served by two Baltimore Medical System (BMS) Community Health Center (CHC) clinics. The quality and safety measures being evaluated were developed for ambulatory care by the National Committee for Quality Assurance, supported by the National Quality Forum, and focus on the safety monitoring for chronic medications that are commonly used by patients with heart disease and diabetes mellitus. The project's intervention includes a monitoring bulletin provided to physicians every 2 months to inform them of patients who require therapeutic monitoring tests for one or more of the quality measures. The project is also evaluating the relationship between contextual factors (teamwork and safety climate at BMS), and provider assessments of EHR quality and safety data as useful and actionable, as well as whether deployment of EHR quality and safety measurement efforts will improve clinics' teamwork and safety climate.

A machine query that uses the BMS EHR to find eligible patients for the measures was developed. Data to fulfill the measures are collected using a newly developed, bidirectional interface and patient laboratory history back-loading capability between Johns Hopkins' Pathology Data Systems Department and the BMS EHRs.

**Specific Aims**

- Develop and implement via EHR accurate quality and safety measures focused on medication monitoring for vulnerable populations that are served by BMS CHC. Explore factors that influence accuracy of EHR-derived measures. **(Achieved)**
- Develop and implement EHR-based quality and safety measures of medication monitoring for vulnerable populations that are served by BMS CHC that are useful to clinicians and senior leaders. **(Achieved)**
- Develop and implement EHR-based quality and safety measures of medication monitoring for vulnerable populations that are served by BMS CHC that impact patient outcomes. **(Achieved)**
- Evaluate the relationship between contextual factors (teamwork and safety climate at BMS) and provider assessments of EHR quality and safety data as useful and actionable, and evaluate whether deployment of these measurement efforts will improve teamwork and safety climate at CHC. **(Achieved)**

**2009 Activities:** The third, fourth, fifth, and sixth rounds of the monitoring bulletin and the provider survey were distributed to all 15 providers at the two BMS sites. In order for the BMS clinic sites to continue the bulletin roll out after the project end date and as an internal quality improvement effort, two staff members of BMS were trained on the data extraction and bulletin preparation. Data from the six survey rounds were collected and analysis was done in consultation with the Biostatistics Consulting Center. Manuscript drafts based on analysis of the bulletin and survey data collected were prepared.

Interviews with providers at both clinic sites were conducted. The first round of interviews for both the providers and leadership was conducted, with 11 of the 15 providers interviewed. Qualitative analysis of the interview data collected and assessment of the relationship of these data to other project data (bulletin and survey data) was completed. Manuscript drafts based on ongoing analysis of the interview data and bulletin and survey data collected were prepared.

The third and last round of the Safety and Attitudes Questionnaire was administered in August and September to all the staff at both clinics. The data received were analyzed and shared with the clinic staff, and a detailed review and discussion of the combined results were held in separate sessions with the clinical leadership and staff at both sites.

**Preliminary Impact and Findings:** The preliminary impact of the laboratory interface activity has reduced the number of tasks involved in accessing patient information by providers. Additional findings related to patient identification between the programmed query and manual review are included in a manuscript that was submitted for publication and will be available closer to project completion.

**Selected Outputs**

A provider survey designed to measure provider experiences using the bulletin.

Interview guide designed to further investigate a provider's understanding of a patient's health status if the guidelines identified in the monitoring bulletin are not implemented.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December, 2009):** The project is collecting and analyzing data and anticipates production of manuscripts in the upcoming year.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Improving Quality in Cancer Screening: The Excellence Report for Colonoscopy |
| **Principal Investigator:** | Logan, Judith, M.D. |
| **Organization:** | Oregon Health and Science University |
| **Mechanism:** | RFA: HS07-002: Ambulatory and Safety Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017017 |
| **Project Period:** | 08/07 – 08/10, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $616,207 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Adults, Cancer

**Summary:** Colorectal cancer is the second leading cause of cancer-related deaths in the United States. Colonoscopy is used increasingly for primary screening and to evaluate positive screening tests, but the effectiveness of colonoscopy depends on providing high-quality examinations with few complications. This initiative is designed to evaluate and improve the quality of screening and diagnostic colonoscopies in ambulatory care settings by presenting the Excellence Report, a quality report card to clinicians.

Using the Clinical Outcomes Research Initiative (CORI) software application and the National Endoscopic Database, the project is developing and testing the Excellence Report, a quality report card for gastrointestinal (GI) endoscopy, focusing on nationally recognized quality process measures for colonoscopy. Using a clustered randomized trial design, CORI-affiliated clinicians working in ambulatory care centers or offices receive monthly reports of their quality measures through a secure Web site along with comparisons to other CORI clinicians and National benchmarks. The effects of reporting quality measures data, adherence to quality recommendations, and durability of changes upon discontinuing the reports are being measured. Concurrently, field observations and interviews are performed with a representative sample of clinicians who are receiving the Excellence Report. The objectives of the project are: 1) to understand clinician perceptions of reliability and validity of the data presented, 2) to understand clinician acceptance of the quality initiative, and 3) to look for effects on workflow and any unintended consequences of the Excellence Report. Concurrently, this project is coordinating a series of four Webinars with representatives from GI reporting software vendors, imaging system vendors, and GI pathology laboratories, along with the GI specialty societies. The Webinars provide information on the development of a sustainable and standards-based architecture that will allow the Excellence Report to expand beyond CORI.

**Specific Aims**

- Create the Excellence Report, a quality report card of individual performance on quality measures, and present this as monthly feedback to the ambulatory care providers of CORI. **(Achieved)**
- Measure the effect of the Excellence Report on individual performance in adherence to the recommended quality measures for colonoscopy. **(Ongoing)**
- Perform a qualitative assessment of the effect of the Excellence Report on providers, study the acceptance of the individual Excellence Report and effects on workflow, and identify any unintended consequences. **(Achieved)**

- Lead an industry consortium comprised of endoscopy reporting software vendors, pathology laboratories, and endoscopy imaging vendors to develop industry-wide standards for the exchange of data on colonoscopy quality measures. **(Achieved)**

**2009 Activities:** Four Webinars were presented between May and August. Vendors, GI society members, and others interested in GI quality measures were invited to attend. The series, "Define the Pieces and Solve the Puzzle: Implementing GI Quality Measures," included the following Webinars: 1) Minimal Standard Terminology in Digestive Endoscopy and Ontologies in Biomedicine, 2) Document Architecture, 3) Messaging for Interoperability, and 4) Quality Measure Specification.

Site visits and interviews were held to complete the qualitative assessment of the acceptance of the Excellence Report by physicians and its effect on workflow. Audiotapes from qualitative data collection were transcribed and analyzed. A manuscript is in process of being completed on qualitative findings.

The project continued to provide monthly quality reports on 15 colonoscopy quality measures to 142 endoscopists providing quality care. Data regarding the effects of the Excellence Report were collected throughout the project period and will be analyzed in the subsequent calendar year.

**Preliminary Impact and Findings:** Publicly-available findings will be made available closer to the end of the project.

**Selected Outputs**

A set of Frequently Asked Questions to support clinicians' use of The Excellence Report.

A clinician interview guide for use during the site visits.

**Grantee's Self-Reported Quarterly Status (as of December 2009):** The project has made significant progress and is currently focused on final data collection, analysis, and preparation of manuscripts.

**Milestones:** Progress is on track in some respects.

**Budget:** Spending roughly on target.

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|---|---|
| **Project Title:** | Standardization and Automatic Extraction of Quality Measures in an Ambulatory Electronic Medical Record |
| **Principal Investigator:** | McColm, Denni, M.B.A. |
| **Organization:** | Citizens Memorial Hospital District and Citizens Memorial Healthcare Foundation (CMH) |
| **Mechanism:** | RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017094 |
| **Project Period:** | 09/07 – 08/09 |
| **AHRQ Funding Amount:** | $889,681 |
| **Summary Status as of:** | August 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Not Applicable

**Summary:** The Physician Quality Reporting Initiative (PQRI) is a pay-for-reporting program administered by the Centers for Medicare and Medicaid Services. The program offers an incentive payment to eligible professionals who satisfactorily report on quality measures for covered professional services provided to Medicare beneficiaries. For small and solo physician practices, use of an expert third party enhances their ability to extract, analyze, and report on quality data, such as for the PQRI. Automated data extraction should require less staff and physician time, increase accuracy, enhance the usability of the data, and improve timeliness of reporting quality measures both to outside agencies and for use within the practice.

Citizens Memorial Hospital (CMH) sought to build quality measures into an ambulatory electronic medical record (EMR) system, to implement an automated system for data extraction of quality measures, and to compare the completeness and accuracy of quality measure code assignment through manual coding and the automated system. The study was conducted in 15 physician practices that were already utilizing an ambulatory EMR. There are 13 physicians and 10 nurse practitioners caring for patients in these practice, and these providers deliver 70,000 patient encounters each year.

The ambulatory EMR record is linked into a community wide EMR. Within the community wide EMR, patient visits from the ambulatory, inpatient, home care, and long term care settings are combined into one patient centric view. Care information is maintained electronically, and no paper medical records are created or maintained in these practices. The CMH EMR is known as Project Infocare.

Phase I of the project, from October 2007 through September 2008, consisted of standardizing the documentation systems and processes within the CMH ambulatory EMR so that data required for quality measurement would be available as extractable data elements without compromising physician productivity. Standardization included provider documentation templates, electronic prescribing, and documentation of allergies. During this phase, CMH established and implemented a claims-coding method to report to PQRI for comparison. During Phase II of the project, from October 2008 through December 2009, project activities focused on mapping, extracting, normalizing, updating, reporting on, and preparing the PQRI measures for ambulatory care for export using an automated data extraction tool. During the comparison period, October 2008 through February 2009, providers and coders utilized the claims-coding method for a set of PQRI quality measures. Automated data extraction was also done for comparison.

Sixty-two quality measures were built into the documentation and workflow in the 15 clinics studied. Automated coding was significantly more complete and accurate than manual coding for the quality measures examined. The process of building quality measures for automated data extraction relied heavily on the use of custom documentation queries. A toolkit including these custom queries was expanded, refined, and distributed to 53 organizations representing 2,720 health care providers for use in their EMR systems by the EMR vendor. This project establishes the standardization efforts necessary for data capture of 62 of the PQRI quality measures in the EMR system. It also demonstrated the efficiency and accuracy of using a data extraction and reporting expert to perform quality measurement.

**Specific Aims**

- Establish the standardization necessary for data capture of quality measures in an ambulatory EMR system. **(Achieved)**
- Standardize and integrate data capture for quality of care evaluation into the routine documentation of care in an ambulatory EMR. **(Achieved)**
- Implement an automated system for data extraction of quality measures in the ambulatory setting, including valid, reliable reports that provide actionable insight for the measurement and analysis of care. **(Achieved)**
- Demonstrate the efficiency and accuracy of using data extraction and reporting to perform quality measurement in the ambulatory care setting. **(Achieved)**
- Address technical, organizational culture, and workflow issues associated with quality data capture. **(Achieved)**

**2009 Activities:** CMH updated the PQRI measures to be extracted from the system to include the 2009 PQRI measure changes. The new measures were added into the system for each of the appropriate primary care and specialty documentation templates. CMH also retired eight expired measures.

**Impact and Findings:** This project establishes the standardization efforts necessary for data capture of 62 of the PQRI quality measures in the EMR system. While only 52 percent of the overall providers who reported to PQRI successfully reported on 3 quality measures in 2009, CMH and Institute for Health Metrics (IHM) were able to extract and report on 62 measures.

Automated data extraction was more complete than coders at identifying the eligible populations and more accurate in reporting the quality measure results as recorded in data fields. This result is qualified by a low compliance rate for manual claims coding of the quality measures. CMH and IHM were able to achieve 100 percent coding completeness using automatic data extraction; however, automated data extraction relied heavily on the use of custom documentation queries. One half of the 62 measures required a custom query for accurate quality measurement. Eleven of 12 additional eligibility requirements required a query, and all quality measure exclusions required queries.

Coders were unable to code all charts for the 62 quality measures within the PQRI program that apply to CMH provider specialties. Even with additional coding staff, they were not able to code all of the measures that could be utilized for each specialty. To limit the scope of coding required, coders were instructed to code for three measures for each provider. Those measures were used for comparison to the automated data extraction method. Coders were unable to accurately track the additional time associated with coding for PQRI in a detailed manner.

CMH coder compliance using manual coding methods was extremely low. Coders had no direct incentive to add the quality measures codes to these cases. Even though additional time was budgeted and allowed for this additional coding, the connection between the extra time and extra tasks did not serve as a direct incentive. Providers were also not provided with a financial incentive to assure that the PQRI codes were applied consistently. By design, no feedback was provided to the coders on their level of completeness

during the study period. Feedback to providers was also not available until the automated data extraction reports were created and validated.

Automated data extraction relied heavily on documentation queries or data fields for additional requirements, results, and measure exclusions. Without incentives and feedback, providers may not use the documentation queries that are needed for accurate quality measurement. Without provider use of those queries, quality measurement can be done but may not be reflective the care provided. Modifications and further standardization of the measures could improve use and measurement.

Use of the quality measures documentation that requires the use of new documentation queries has, so far, been low among providers at CMH. EMR documentation to enable capture of all PQRI data elements was implemented during this project. So far, however, provider documentation of PQRI data elements, especially for documenting measure exclusions, has been low. As intended, no feedback was given to providers on their use of the documentation queries or on their performance on the quality measures during this study. Strategies to improve use of the quality measurement queries may include feedback, workflow enhancements, and training.

Data extraction services, which are not registries according to current definition, might be considered as another category for reporting purposes of PQRI. A repository of quality measure documentation queries and data fields (exclusions, additional requirements, and evidence-based assessments) would be helpful to vendors and ambulatory providers, particularly if there would be a mechanism to keep those queries and fields updated as the quality measures evolve. Future studies are indicated on the use of quality measure queries, data fields, and assessments within an EMR system. Targeted feedback, workflow enhancement, and training are methods to be considered for further research.

**Selected Outputs**

Grantee's 2009 Final Report.

McColm D. Enabling Quality Measurement through Health IT: Standardization and Automatic Extraction of Quality Measures in an Ambulatory Electronic Medical Record. Presentation at the Annual Conference of the Agency for Healthcare Research and Quality, 2008 September 8; Bethesda, MD.

McColm D. Automated Quality Data Extraction and Analysis. MUSE (Medical Users Software Exchange) International Conference; May 2008; Dallas, TX.

**Grantee's Most Recent Self-Reported Quarterly Status (as of September 2009):** The project was completed with all major tasks achieved.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

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| **Project Title:** | Massachusetts Quality E-Measure Validation Study |
| **Principal Investigator:** | Schneider, Eric, M.D. |
| **Organization:** | RAND Corporation |
| **Mechanism:** | RFA: HS07-002: Ambulatory and Safety Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017048 |
| **Project Period:** | 09/07 – 08/10, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $995,575 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Adults

**Summary:** Although the National Quality Forum has endorsed 26 standardized measures of ambulatory care for national priority conditions, measurement and reporting on the quality of care delivered by office-based ambulatory care physicians has lagged. The implementation of electronic health records (EHRs) could revolutionize ambulatory quality measurement by increasing the validity of clinical measures and reducing the cost and burden of data collection.

This project is evaluating the readiness of structured EHR data to support ambulatory clinical quality measurement. Using the Ambulatory Care Quality Alliance (AQA) ambulatory care measurement set, the study team is comparing quality measures by applying two standard measurement methods: 1) a "hybrid method," combining claims data with medical record review; and 2) a "claims-only method," based upon claims data aggregated across commercial health plans and the Medicare program. The project includes primary analyses with formal hypothesis testing and secondary analyses that will help to identify and prioritize the high-impact, short- and long-term modifications to community-wide, office-based EHR systems that could support and accelerate the dissemination of ambulatory clinical quality measurement. The data used for this grant are being collected and aggregated as part of the Massachusetts eHealth Collaborative's (MAeHC) community-wide interoperable EHR implementation pilot in two Massachusetts communities. Massachusetts Health Quality Partners is developing EHR-based quality measure specifications and data extraction logic for the AQA ambulatory quality measure set. In addition to the implementation of interoperable EHRs, the Quality and Usage Data Coordinating Center was developed and implemented for selective retrieval, linkage, and storage of patient-level clinical data elements that can be used to calculate clinical quality measure results. The project is using eClinicalWorks, a Certification Commission for Health Information Technology-certified EHR product.

**Specific Aims**

- Recruit a cohort of adult ambulatory patients from two communities that are piloting community-wide implementation of structured EHRs to compare a quality measurement method based on a structured EHR data to a hybrid method involving a combination of aggregated claims data and medical record review. **(Ongoing)**
- Compare a measurement method based on structured EHR data to a claims-only method based on a novel database that aggregates claims data from commercial health plans and Medicare. **(Ongoing)**

**2009 Activities:** The study team was successful in identifying health plans and gaining their support to provide the data and data use agreements to identify the samples for the study. Concurrently, the EHR sample structure (which will be matched with health plan data) was identified, in collaboration with MAeHC. The patient survey design was completed and approximately 90 percent of the work to complete the medical record abstraction tool was accomplished. Final data use agreements are expected to be completed in the upcoming calendar year.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Difficulties in obtaining institutional review board approval and data use agreements slowed the overall progress. While significant progress is expected during 2010, a no-cost extension will be requested to complete all project aims.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Significantly underspent, more than 20 percent.

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|---|---|
| **Project Title:** | Feedback of Treatment Intensification Data to Reduce Cardiovascular Disease Risk |
| **Principal Investigator:** | Selby, Joseph, M.D. |
| **Organization:** | Kaiser Foundation Research Institute |
| **Mechanism:** | RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017031 |
| **Project Period:** | 11/07 – 08/10, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $997,069 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Adults, Diabetes, Heart Disease

**Summary:** Despite the availability of highly effective medications for controlling the major cardiovascular disease (CVD) risk factors, many patients, including many at high risk for developing CVD, continue to be in poor control of systolic blood pressure (SBP), low-density lipoprotein cholesterol (LDL-c), and glycosylated hemoglobin (hemoglobin A1c). Evidence indicates that clinician failure to prescribe recommended increases in the intensity of medication regimens is frequently associated with poor control of these outcomes. Treatment intensification, the frequency with which clinicians appropriately increase pharmacotherapy in the face of poor control, has been proposed as a new measure of clinical quality. The linkage of process measures such as treatment intensification to clinical benefit is often supported by strong clinical trial evidence. Such measures could also be more useful than reports of risk factor control because the actions needed to improve control are implicit in the measures and because concerns about case-mix differences are largely avoided. However, there is little empirical evidence that reporting and improving these process measures can lead to better outcomes.

The Intensification Feedback and Outcomes Study is working with eight primary care and large medical facilities of Kaiser Permanente Northern California to assess whether the use of systematic feedback on need for treatment intensification in patients with poor control of CVD risk factors improves risk-factor control. Using a cluster randomized trial design, this project is leveraging health information technology, including Kaiser Permanente's Certification Commission for Health Information Technology-certified Epic-based electronic medical record (EMR) HealthConnect and the population management software tool used for the Preventing Heart Attacks and Strokes Everyday (PHASE) program, to create and deliver this information to providers who have high CVD-risk patients. At intervention facilities, patient-level information is obtained from the EMR on the need for treatment intensification for SBP, LDL-c, and hemoglobin A1c, and recent medication adherence. This information is added to the PHASE population management database and fed back through software currently used by the PHASE staff working with primary care providers. Staff at control facilities continue to use the same population management database and software but receive information only on risk-factor levels and selected medications.

The proposed feedback intervention will be applied for 6 months. The study population for primary analyses will include all PHASE patients who are found to have had poor control of two or more of the CVD risk factors and a need for treatment intensification at any point during the 6-month period. Primary endpoints include both tightly-linked processes (i.e., was treatment intensified more frequently) measured during the 3 months following initial reporting of need for intensification, and mean levels of intermediate outcomes (SBP, LDL-c, and A1c), measured for all study population subjects during a 9-month period

that begins 3 months after the end of the intervention. Secondary endpoints include proportions in control for each risk factor; treatment intensification and risk-factor improvements in patient subgroups defined by prior adherence to prescribed medications; efficiency of the intervention in terms of patient contacts, visits, and costs per unit improvement in risk-factor control; and provider reports of the utility and efficiency of the treatment intensification feedback. Positive findings should point the way for other systems to achieve an effective means of lowering the occurrence of CVD and will also serve to validate treatment intensification as a new process-of-care quality metric.

**Specific Aims**

- Evaluate the effectiveness of measuring and reporting information on the need for treatment intensification in patients at high risk for CVD to improve rates of treatment intensification and to reduce levels of poorly controlled SBP, LDL-c, and A1c. **(Achieved)**
- Evaluate the impact of the intervention, compared to current population management practice, on total numbers of patient contacts, outpatient visits, and costs of care in relation to improvements in risk factor control. **(Achieved)**
- Evaluate the effect of the intervention on physician and staff perceptions of the value (effectiveness and efficiency) of the population management program for high risk patients. **(Ongoing)**

**2009 Activities:** The study team focused on initiating the intervention, data collection, and analysis. Manuscripts have been produced and are due to be published in 2010.

**Preliminary Impact and Findings:** Preliminary data from the first 2 months of the intervention period suggest that intervention facilities have slightly higher rates of treatment intensification than the control facilities, but it is too early to state whether these differences will be statistically significant. A second finding pertains to program efficiency. Approximately half of the patients eligible for the intervention were contacted by PHASE staff. These patients do have higher rates of intensification, suggesting that the lower-than-expected contact rates with patients may be impacting the intervention's overall effectiveness. Preliminary analysis of the intervention indicates that it has a modest impact but not enough to improve risk-factor control.

**Selected Outputs**

The project has no outputs at this time.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project focused on monitoring the intervention, collecting and analyzing data, and publishing results.

**Milestones:** Progress is mostly on track.

**Budget:** Spending roughly on target.

| | |
|---|---|
| **Project Title:** | Using Electronic Records to Detect and Learn From Ambulatory Diagnostic Errors |
| **Principal Investigator:** | Thomas, Eric, M.D. |
| **Organization:** | University of Texas Health Science Center Houston |
| **Mechanism:** | RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality Measurement Through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017244 |
| **Project Period:** | 11/07 – 09/10, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $873,108 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Pediatric*

**Summary:** This project, initiated in November 2007, is in the final year of the grant period. The project utilizes data from electronic health records (EHR) in the Michael E. DeBakey Veterans Administration Medical Center (VAMC) in Houston and in the Scott & White Regional Health System's primary care clinics to detect diagnostic errors and understand their causes. It then lays the groundwork for future prevention strategies.

The project evaluates two methods to detect diagnostic errors. The first method applies a trigger algorithm to the EHR at both sites to detect patterns of visits that could have been precipitated by diagnostic errors. Manual chart reviews of the electronic records are conducted to verify the presence of diagnostic errors. The second intervention uses the alert management software of the VAMC to track and identify cases where care providers did not electronically acknowledge pre-specified abnormal test results. Manual chart reviews of the electronic records are performed to determine the presence or absence of diagnostic errors related to test result followup. The project tests the interventions by comparing their positive predictive values (PPV) with a random sample of visits that do not meet the trigger criteria. To improve the triggers, a logistics regression model will be used to test the additive PPV of integrating the trigger with specific independent clinical variables such as vital signs, laboratory values, or radiology data.

The data for this project are collected from the VAMC's Certification Commission for Health Information Technology-certified VistA Computerized Patient Record System (CPRS) and Scott & White's proprietary Electronic Medical Record Exchange (EMRx) system, which serves as a document repository for all clinical data pertaining to patient care within the Scott & White system, including physician notes, laboratory and radiology reports, and other electronic data. To access information from CPRS, the project uses the South Central Veterans Health Care Network Data Warehouse, a collection of administrative and clinical data from ten Veterans Administration (VA) hospitals in the south central United States. The Scott & White EMRx system provides a single interface, known as "Sequoia," to allow access to the data collected in the EMRx system. Thirty-thousand new documents, representing outpatient notes, admission notes, consultation notes, lab/pathology reports, and radiology reports, are automatically sorted, marked-up, and added to the clinical data repository each day.

**Specific Aims**

- Apply and improve computerized triggers based on visit patterns to detect, measure, and learn from diagnostic errors in diverse primary care settings. **(Ongoing)**

- Test whether a method of computerized tracking for abnormal test results that are potentially lost to followup can be used as a trigger to identify diagnostic near-misses in primary care. **(Ongoing)**

**2009 Activities:** In 2009, datasets for chart reviews for both Trigger 1 and Trigger 2 were identified at multiple sites (the VA hospital and the Scott & White facilities in Temple, Texas). Trigger 1 is a primary care visit (index visit) with hospitalization in the next 14 days. Trigger 2 is an index visit followed by one or more primary care visits, an urgent care visit, or an emergency department visit within 14 days, but excludes index visits that were detected by Trigger 1. A review of charts was completed for Trigger 1 and will continue into 2010 for Trigger 2. The project team decided to double the sample size, which improved the analytic ability, but also lengthened the data collection period. Preliminary analysis of data for Trigger 1 has begun. Regression analysis will occur in 2010. The team also conducted several planning meetings for data analysis and publication.

**Preliminary Impact and Findings:** Analysis of the computerized trigger tools is ongoing. Initial findings are that the positive predictive value of the trigger tool to detect, measure, and learn from diagnostic errors as recorded in the EHR is in the range of 25 percent, which is a significant improvement.

**Selected Outputs**

Singh H, Thomas EJ, Sittig DF, et al. Notification of abnormal lab test results in an electronic medical record: do any safety concerns remain? Am J Med. 2010 Mar;123(3):238-44.

Singh H, Thomas EJ, Mani S, et al. Timely follow-up of abnormal diagnostic imaging test results in an outpatient setting: are electronic medical records achieving their potential? Arch Intern Med. 2009 Sept 28;169(17):1578-86.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The focus of the work was on completing data collection for Trigger 2 and analysis of Trigger 1.

**Milestones:** Progress is mostly on track.

**Budget:** Spending roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Monitoring Intensification of Treatment for Hyperglycemia and Hyperlipidemia |
| **Principal Investigator:** | Turchin, Alexander, M.D. |
| **Organization:** | Brigham and Women's Hospital |
| **Mechanism:** | RFA: HS07-002: Ambulatory and Safety Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017030 |
| **Project Period:** | 09/07 – 09/10 |
| **AHRQ Funding Amount:** | $533,431 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Chronic Care*, Diabetes

**Summary:** Diabetes quality-of-care measurement is increasingly used to evaluate quality improvement programs and to compare physicians and health plans. It is important to know which measures are best associated with clinical outcomes. The most widely used process measures for diabetes quality-of-care, hemoglobin (HbA1c) and low-density lipoprotein (LDL) screening rates, have multiple limitations. This project tests the sensitivity and specificity of new informatics tools on improving diabetes quality-of-care measurement.

Increased prevalence of elevated blood pressure and glycosylated HbA1c have been linked to low frequency of treatment intensification. Dr. Turchin and his team are developing a physician performance process measure using both structured and unstructured data on the frequency of treatment intensification in managing hyperglycemia and hyperlipidemia. Two informatics tools have been developed to determine, based on data from the patient's electronic health record (EHR), if treatment medication was increased. The first tool extracts structured data from the EHR. The second is a natural language processing tool that assesses whether accurate measures of treatment intensification can be obtained through computational analysis of unstructured text in physician notes.

By testing the sensitivity and specificity of the measures in a manual review of the electronic patient records, the project will determine if the treatment measures obtained through the informatics tools are clinically valid. This research is being done by two independent reviewers who did not participate in the tool development. The project uses a variety of statistical analyses to demonstrate a relationship between HbA1c and LDL cholesterol levels and two measures of treatment intensification: frequency of treatment intensification, and time to treatment intensification. Statistical analyses will also be used to: 1) identify specific patient and visit characteristics that affect the probability of anti-hyperglycemic and anti-hyperlipidemic treatment intensification at a given visit, and 2) test that case mix-adjusted measure of intensification of treating hyperglycemia and hyperlipidemia is more strongly associated with clinical outcomes than currently used process measures of diabetes care.

This project is applying the informatics tools to retrospective data generated from an internally-developed EHR, (the longitudinal medical record), which is collected in Partners Healthcare System's proprietary Research Patient Data Registry. The data collected are based on patient visits to primary care practices or endocrinology practices affiliated with Massachusetts General Hospital and Brigham and Women's Hospital.

**Specific Aims**

- Test the hypothesis that an accurate measure of treatment intensification in the management of hyperglycemia and hyperlipidemia can be obtained through computational analysis of the text of physician notes in the EHR. **(Achieved)**
- Test the hypothesis that the measure of treatment intensification developed in the first aim is related to glucose and lipid control. **(Ongoing)**
- Identify specific patient and visit characteristics that affect the probability of anti-hyperglycemic and anti-hyperlipidemic treatment intensification at a given visit. **(Upcoming)**
- Test the hypothesis that case mix-adjusted measure of intensification for treating hyperglycemia and hyperlipidemia is more strongly associated with clinical outcomes than currently used process measures of diabetes care. **(Ongoing)**

**2009 Activities:** Most work involved ongoing data analysis and preparation of manuscripts on reported outcomes. It is anticipated that results will start to appear in peer reviewed journals in 2010.

**Preliminary Impact and Findings:** The project's findings illustrate that medication intensification data from structured and narrative sources are complementary and in both cases independently associated with changes in relevant clinical outcomes. Documentation data on patient medication adherence obtained using the informatics tool was developed. The findings reveal that patients documented as non-adherent in their medications are more likely to have significantly elevated blood pressure (> 150/95). This confirms clinical relevance of the information computationally extracted from the text of the notes.

The study analyzed the distribution of intensification events (dose increase versus new medication initiation) for anti-hyperglycemic, anti-hyperlipidemic, and anti-hypertensive medications in patients with diabetes, and found that it correlates strongly with the therapeutic range for these medications in everyday clinical practice (as represented by prescriptions in EHR).

Analysis found that it is possible to computationally identify, with high accuracy, documentation of counseling for diet, exercise, and weight loss from the unstructured text of provider notes.

**Selected Outputs**

Turchin A, Goldberg SI, Shubina M, et al. Encounter Frequency and Blood Pressure in Hypertensive Patients with Diabetes Mellitus. Hypertension. 2010 Jul;56(1):68-74.

Kramer MH, Breydo E, Shubina M, et al. Prevalence and factors affecting home blood pressure documentation in routine clinical care: a retrospective study. BMC Health Serv Res. 2010 May 27;10:139.

Turchin A, Shubina M, Breydo E, et al. Comparison of Information Content of Structured and Narrative Text Data Sources on the Example of Medication Intensification. J Am Med Inform Assoc. 2009 May-Jun;16(3):362-70.

Turchin A, Wheeler HI, Labreche M, et al. Identification of documented medication non-adherence in physician notes. AMIA Annu Symp Proc. 2008:732-6.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is in the final stages of data analysis and the development of manuscripts.

**Milestones:** Progress is mostly on track.

**Budget:** Spending roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Using IT to Improve the Quality of Cardiovascular Disease Prevention and Management |
| **Principal Investigator:** | Williams, Andrew, Ph.D. |
| **Organization:** | Kaiser Foundation Research Institute |
| **Mechanism:** | RFA: HS07-002: Ambulatory and Safety Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017016 |
| **Project Period:** | 11/07 – 06/10 |
| **AHRQ Funding Amount:** | $605,862 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decision making through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Chronic Care*, Heart Disease

**Summary:** Electronic medical records (EMRs) have the potential to determine the actual relationship between patterns of preventive and disease management care, and the occurrence of disease events that this care is designed to prevent. However, new approaches are needed to realize this potential. This project will refine and test a method that can quickly, and at reasonable cost, generate actionable information about practice variation relative to evidence-based guidelines and estimate its association with variation in health outcomes and health care utilization. This information could profoundly impact the quality of health care by providing a means to evaluate the effectiveness and costs of alternative approaches to care and by characterizing patient-, physician-, and system-level units that should be targeted to determine the causes of unusually low or high performance.

This project is using Epic's Certification Commission for Health Information Technology-certified EMR system (HealthConnect) in two large health care systems to test and refine a method for determining the actual relationship between patterns of preventive and disease management care of cardiovascular disease (CVD). The preventive and disease management services that are being analyzed include: blood pressure management, tobacco counseling, weight/nutrition counseling, and blood pressure screening. The primary unit of interest is the Primary Care Physician (PCP). The indices for the panel-year of each PCP will be rolled up from scores calculated on the service-eligible patients in their panel each year. The data to calculate these individual patient level for each year are being calculated at the using longitudinal (up to 10-year) datasets from Kaiser Permanente Hawaii and Kaiser Permanente Portland. Using a person-time methodology that evaluates adherence to prevention and selected CVD management guidelines, this project will calculate PCP-level indices (a prevention index [PI] or a disease management index [DMI]) for CVD prevention and preventive management of patients with hypertension, hyperlipidemia, diabetes, congestive heart failure, and past myocardial infarction. We will then determine the relationship between adherence to care guidelines and subsequent CVD morbidity and mortality in propensity score adjusted multi-level regression models. Patients without diabetes, hypertension, hyperlipidemia, and prior CVD are being examined separately for preventive services. Patients with prior CVD and related diagnoses are being examined for both preventive and management guidelines adherence. These data will clarify the relationship between PCP's adherence to evidence-based guidelines and outcomes.

**Specific Aims**

- Identify practice-level primary care variations in preventive care, weight management, and selected chronic disease management, including drug prescription patterns aimed at reducing CVD morbidity. **(Ongoing)**
- Determine the associations of quality of preventive care and disease management practices to morbidity, mortality, and costs of care. **(Ongoing)**
- Improve delivery of care. **(Ongoing)**

**2009 Activities:** Six of the eight expected data specification templates were completed, and data extraction and data analysis became the major focus of activities during this period for the targeted services. Originally, the research team anticipated including 10 services in the project; however, given the intensity of the work this was reduced to eight. The project added a second health system so that cross-comparable data could be used to validate findings and explore and resolve difficulties in pooling data.

Collaborations and partnerships were explored with several entities. Conference calls were held with the National Committee for Quality Assurance to gauge their interest in applying the research methodology. Dialogue was established with the Hawaii Optimizer Project, a demonstration project to test the David Eddy Archimedes algorithms in setting patient priorities. Through the National Resource Center support provided by the Agency for Healthcare Research and Quality, the team established a dialogue with investigators at the University of Pennsylvania to discuss development of some cross-project papers on quality management.

**Preliminary Impact and Findings:** Preliminary results of the blood pressure screening and management and tobacco management services have been reviewed. For systolic blood pressure management, clinical practices in the top tertile of performance as measured by the DMI had 15 percent fewer strokes and 20 percent fewer hospital days during a 10-year observation period compared to the bottom tertile. Diastolic performance, however, varies in the opposite direction, but to a lesser degree. This finding appears to be related to the much higher levels of diastolic than systolic blood pressure management scores during the 10-year observation period. During that period, diastolic management exceeded 90 (on a scale of 0 to 100) in all years, while systolic management began in the mid-40s and rose gradually into the 90s by 2005. As mean scores reached their highest levels, the association between the quality index and outcome faded as maximal gain from management was achieved, and even reversed, probably because the sickest patients end up in the care of physicians who focus most heavily on blood pressure control. In preliminary tobacco reports, there is a similar pattern—those clinicians most likely to counsel patients to quit smoking have higher patient rates of CVD. These unadjusted analyses are confounded by the tendency of physicians who specialize in CVD and pulmonary disease to more aggressively manage tobacco smoking. Multivariate analyses currently underway will adjust for this using propensity variable analyses.

**Selected Outputs**

Altonn H. Kaiser culls own data for insight. The Honolulu Star-Bulletin; 2008 Mar 19.

Blood Pressure Management Data Request Tool and Practice Survey Questionnaire designed to help inform the provision of feedback to managers on guidelines adherence at the practice, health care team, and system levels.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project has made considerable progress in completion of its aims and appears to be on track to completing all aspects on time. The number of services included in the research will be reduced from 10 to eight.

**Milestones**: Progress is mostly on track.

**Budget:** Spending roughly on target.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Crossing the Quality Assessment Chasm: Aligning Measured and True Quality of Care |
| **Principal Investigator:** | Weiner, Mark, M.D. |
| **Organization:** | University of Pennsylvania |
| **Mechanism:** | RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017099 |
| **Project Period:** | 09/07 – 09/10, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $812,237 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Chronic Care*, Diabetes

**Summary:** The purpose of this study is to identify and quantify the impact on quality assessments of real-world circumstances at the Philadelphia Veterans Administration Medical Center (PVAMC) and at the University of Pennsylvania Health System's (UPHS's) ambulatory practices where the current cross-sectional measures of quality do not reflect the true quality of care being rendered. The project is leveraging more detailed and discrete data available from electronic medical records (EMRs) in order to develop measures that account for heterogeneity among different diabetic patient panels, credit improvement in the control of diabetes among individuals in a given population over time, recognize provider effort in medical management, and incorporate management of diabetes comorbidities such as high blood pressure and hyperlipidemia.

The project team is collecting and analyzing data from two EMRs, each certified by the Certification Commission for Health Information Technology. The UPHS uses EpicCare Hyperspace, and the PVAMC uses the VistA-based Computerized Patient Record System. The project is re-analyzing data from the Diabetes Control and Complications Trial (DCCT) to determine evidence in a randomized, controlled trial setting regarding the impact of an individual's variability in glycosylated hemoglobin (HbA1c) outcomes, and the suitability of using HbA1c variability over time in addition to or as an alternative to the absolute level of HbA1c as a quality measure. The result of the analysis is intended to create a new set of quality measures that better reflects actual clinical care.

**Specific Aims**

- Evaluate structural and clinical issues that may affect the validity of comparisons made by providers using quality measures for diabetes. These include: 1) the manner in which diabetes is defined, 2) the way patients are linked to providers, and 3) the concordance between use of diabetes medications and achieving thresholds for quality-of-care. **(Ongoing)**
- Develop a quality measure for diabetes that accounts for patient heterogeneity in terms of baseline HbA1c and expected trajectory of improvement in diabetes control, based on clinical parameters and other data available through the EMR. **(Achieved)**
- Explore the DCCT and patient data for year-to-year individual variability in diabetes control to assess the impact of variability over time in an individual's diabetes control on microvascular outcomes. **(Ongoing)**

- Disseminate findings through public policy communications at the Leonard Davis Institute, and work with practitioners and additional institutions to assess their current and proposed new quality-of-care measures. **(Upcoming)**

**2009 Activities:** The project focused on developing a candidate set of characteristics to use as predictors of expectation of diabetes control. Hierarchical generalized linear models were applied to the process of ranking providers' quality-of-care. Each patient in a panel was assigned an estimate of odds of subsequently being in control based on his/her prior level of HbA1c. The set of odds for patients in a given panel was then used to calculate an overall expected percent of patients in control for that panel. To address some analytic issues that were raised following the analysis, a wider range of outcomes was explored, and relevant endpoints for the notion of diabetic control were expanded to include control of low-density lipoprotein (LDL) cholesterol and blood pressure in addition to HbA1c. To decrease the degree to which providers are ranked based on a single clinical endpoint, the project team has been working with composite endpoints that combine the degree of HbA1c, LDL, and blood pressure into a single measure. The team has also begun to explore provider effort in terms of number of medication classes being prescribed to manage blood sugar and blood pressure, and the relationship of these measures of provider effort with objective success of control. This involves looking at medication classes both in the past year, to reflect current efforts, as well as those throughout the medical history in the EMR system to reflect attempts at control with medications that were either not tolerated or felt to be ineffective.

Given that comorbidity itself has not been indicated as a reliable predictive factor of future diabetic control, the project team is working with staff from the Regenstrief Institute to request some additional data (e.g., patient, provider, history of HbA1c levels) that could be analyzed to see if, when using an expanded dataset, they continue to find that additional variables do not change the ability to predict HbA1c levels.

**Preliminary Impact and Findings:** Preliminary data indicate that predicting control of HbA1c is attributed primarily to the prior level of controls versus other factors such as comorbidities, age, duration of diabetes, visit activity, and sex. When comparing diabetes patients seen at the PVAMC and UPHS, the project team found that more than one-third of PVAMC patients had also been seen in primary care or subspecialty practices within UPHS. Among patients with a diabetes diagnosis in their PVAMC record, only a minority of the patients had a corresponding diagnosis of diabetes also documented in the UPHS record, and there was a substantial redundancy in HbA1c ordering across the institutions and opportunities where data from the other institution could impact the measures of quality. The notion that HbA1c levels are more a predictor of diabetes control than other factors raises the question of why this is not being looked at more closely. Therefore, the project team is trying to obtain and analyze a more comprehensive dataset to see if it supports the idea that additional variables do not change the ability of previous HbA1c levels to predict future diabetic control.

**Selected Outputs**

Field S, Weiner M, Long J. Physician influences on patient care: random vs fixed effects. Arch Intern Med 2009 Jan 26;169(2):202-3.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is on track with most of its milestones and has been approved for a no-cost extension through September 2010 to allow for the completion of the analysis phase.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Bringing Measurement to the Point of Care |
| **Principal Investigator:** | Wu, Winfred, M.D. |
| **Organization:** | New York City Department of Health and Mental Hygiene |
| **Mechanism:** | RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality Measurement through Health Information Technology (EQM) |
| **Grant Number:** | R18 HS 017059 |
| **Project Period:** | 09/07 – 09/10, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $694,961 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Inner City*, Low SES/Low Income*, Medicaid, Medically Underserved, Racial or Ethnic Minorities*: African American, Hispanic Latino, Safety Net, Uninsured

**Summary:** The overall goal of this project is to enable meaningful measurement of the quality of care, with a focus on public health priority issues, disadvantaged populations, and small office practices. The New York City Department of Health and Mental Hygiene (DOHMH) Take Care New York initiative has articulated 10 priority public health issues that require coordinated action between health care providers, patients, community organizations, and government agencies. The DOHMH Primary Care Information Project is using health information technology for population-wide measurement and improvement of clinical care in these 10 domains, particularly among disadvantaged populations. Over 1,000 medical providers have implemented electronic health records (EHRs) with enhanced preventive care functionality. Ambulatory Certification Commission for Health Information Technology-certified EHR products will include Epic, NextGen, and eClinicalWorks. Clinical partners include of New York City's Federally Qualified Health Centers, several hospital outpatient departments, and hundreds of primary care providers in small office settings. A set of 38 clinical quality measures designed to address priority public health issues has been developed, and automated reporting of these measures internally and to the DOHMH will be coordinated with the EHR vendors.

Successful EHR-enabled quality measurement requires that physicians document relevant information at the point of care. The research team will also develop a simple and intuitive clinical decision support system (CDSS) with eClinicalWorks, suitable for small office practices, that integrates quality measurement and clinical decision support at the point of care. The CDSS will display a dashboard of quality indicators as part of the patient's record, showing medical providers which measurement cohorts the patient belongs to and whether their care complies with screening and treatment recommendations. Integrated decision support tools will enable providers to take appropriate action to bring the measure into compliance or remove the patient from the measurement cohort due to valid exclusions or contraindications.

A randomized controlled trial will be conducted to assess the impact of both the CDSS and pay-for-quality incentives on quality measurement and improvement across four of the quality measurement areas. The project will also assess provider attitudes toward measuring performance and incentivizing quality care. Using a pre-post EHR go-live design, surveys will be designed to measure the impact of EHR adoption on provider attitudes and engagement with quality measurement.

**Specific Aims**

- Validate a set of automated clinical quality measures that address priority public health issues. **(Ongoing)**
- Characterize provider attitudes and measure provider satisfaction with performance indicators. **(Ongoing)**
- Design a simple and intuitive point-of-care quality measurement and decision support user interface (quality dashboard). **(Achieved)**
- Conduct a randomized clinical trial to determine the impact of this quality dashboard on the accuracy of, and provider satisfaction with, EHR-derived quality measures. **(Ongoing)**
- Disseminate findings through the National Quality Forum's Standardizing Ambulatory Care Performance Measures project through the EHR vendors' participation in this project and through reviewed publications. **(Ongoing)**

**2009 Activities:** The Primary Care Information Project EHR development team, in collaboration with eClinicalWorks, continues to validate the automated calculation of selected quality measures (e.g. Aspirin therapy, Blood Pressure Control, Cholesterol Control, and Smoking Cessation Intervention). Additional testing revealed programming issues that require changes to the software and upgrades across all practices participating in this study. Several issues were related to defining time intervals for reporting or the allowable window of time when a service is counted toward the numerator. The research team continues to work with the EHR vendor to test and verify the automated calculation of measures. In addition, a separate team is comparing the monthly data collected from the quality measures against other data sources (e.g. encounter data, self-reported practice and provider characteristics, and potential rise of symptoms related to infectious disease—syndromic surveillance) available within the health department.

A survey assessing provider attitudes and satisfaction with the performance indicators is in development and will be administered to providers in the summer and fall of 2010. This survey will assess postimplementation issues, use of the CDSS, quality measurement, and reporting.

Data collection is in progress for the randomized clinical trial. The grantee developed several documents and tools for chart abstraction and data collection for the manual chart review process of the eClinicalWorks EHR software. Charts are reviewed for three time periods: 1) pre-EHR implementation (likely to be paper documentation), 2) the period from EHR implementation until the reminder CDSS system was implemented (between approximately 6 and 18 months), and 3) after implementation of CDSS system (a minimum of 6 months later). Each patient record is being reviewed for documentation to identify whether the patient is eligible for measurement in the denominator, and if the patient is eligible, whether he or she met the numerator criteria. Preliminary results are expected in early 2010.

The validation process had been significantly delayed due to system implementation (software implementation). There had been some software challenges in terms of assigning groupings for different practices. Instead the grantee focused on building the tool to capture the abstraction, focusing on the key elements. This process led to the development of a new randomization design: the study population now includes 120 patients between the ages of 18 to 75 years that had a visit during the past year, randomly selected from each practice across 80 small practices (most practices are solo or two person offices), rather than the 20 to 25 practices originally proposed.

**Preliminary Impact and Findings:** The research team has preliminary results and expects to have a draft manuscript by the end of the grant. They also plan to crosscheck findings against confirmation datasets from other sources. They hope these data will illuminate whether process and outcome measures are more likely to benefit from the documentation or from reminder systems to improve care. They will use the provider surveys to gain a better understanding of why providers do or do not use the tools and also to identify effective strategies to improve quality measures.

**Selected Outputs**

A list of EHR-generated quality measures for the 10 clinical areas was finalized, and the research team programmed the CDSS and Quality Reporting Tool functions for the eClinicalWorks EHR.

A provider survey and a provider interview guide were developed to assess perceptions and opinions regarding quality measurement and the reliability of data used to generate quality reports.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The validation process for the randomized clinical trial was somewhat delayed due to software implementation issues; however, data collection for the trial is now in progress and preliminary findings are being reviewed. All other aims and milestones are on track or have been achieved.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population*

## Table 11: Grant-Specific Summaries (TQHIT)

| Transforming Healthcare Quality Through Information Technology (THQIT)—Implementation Grants | | | | |
|---|---|---|---|---|
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| Yes | Garber, Lawrence, MD | Secure Architecture for Exchanging Health Information | HS04-011 | Page 227 |
| **Demonstrating the Value of Health Information Technology (TQHIT)** | | | | |
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| Yes | Carayon, Pascale, PhD | Computer-Based Provider Order Entry Implementation in Intensive Care Units | HS04-012 | Page 230 |
| Yes | Guise, Jeanne-Marie, MD | Improving Safety and Quality with Integrated Technology | HS04-012 | Page 233 |
| Yes | Middleton, Blackford, MD, MPH, MSc | Evaluating Smart Forms and Quality Dashboards in an Electronic Health Record | HS04-012 | Page 236 |
| Yes | Overhage, J. Marc, MD, PhD | Value of Health Information Exchange in Ambulatory Care | HS04-012 | Page 239 |
| **Limited Competition for AHRQ Transforming Healthcare Quality Through Information Technology—Implementation Grants (TQHIT)** | | | | |
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| Yes | Bergner, Gregory W., MD, FAAFP | El Dorado County Safety Net Technology Project/Access El Dorado County | HS05-013 | Page 241 |
| Yes | Connelly, Donald, MD, PhD | A Community-Shared Clinical Abstract to Improve Care | HS05-013 | Page 244 |
| Yes | DeLuca, Michael, MBA, MS | Ambulatory Electronic Medical Record and Shared Access | HS05-013 | Page 247 |
| Yes | Lewis, Thomas L., MD | Metro DC Health Information Exchange | HS05-013 | Page 250 |
| Yes | Lozzio, Carmen B., MD, FACMG | Improving Quality Care for Children with Special Needs | HS05-013 | Page 255 |
| Yes | Nashan, Georges, RN, MS, CPHQ | The Chronic Care Technology Project | HS05-013 | Page 257 |
| Yes | Nocella, Kiki, PhD, MHA | Accessing the Cutting Edge: Implementing Technology to Transform Quality in Southeast Kern County | HS05-013 | Page 260 |
| Yes | Rachal, Valerie, RN, PhD | Creating Online Newborn Intensive Care Unit Networks to Educate, Consult & Team | HS05-013 | Page 262 |

| | | | | |
|---|---|---|---|---|
| Yes | Richards, Francis | Regional Approach for Transforming Healthcare Quality Through Information Technology in Rural Settings | HS05-013 | Page 265 |
| Yes | Sakuda, Christine M., MBA | Holomua Project Improving Transitional Care in Hawaii | HS05-013 | Page 268 |
| Yes | Shank, Nancy C., MBA | Health Information Exchange: A Frontier Model | HS05-013 | Page 271 |
| Yes | Wheeler, Donald A., MHA, FACHE | Critical Access Hospital Partnership Health Information Technology Implementation | HS05-013 | Page 274 |

| | |
|---|---|
| **Project Title:** | Secure Architecture for Exchanging Health Information |
| **Principal Investigator:** | Garber, Lawrence, M.D. |
| **Organization:** | Fallon Clinic, Inc |
| **Mechanism:** | RFA: HS04-011: Transforming Healthcare Quality through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 015220 |
| **Project Period:** | 09/04 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,499,999 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

Target Population: General

**Summary:** The goal of this study was to implement and evaluate a financially sustainable health information exchange (HIE) that would improve patient safety, quality of care, and efficiency of health care delivery, and elucidate how others could do this most efficiently in the future. Secure Architecture for Exchanging Health Information (SAFEHealth) is an HIE for patients, health care providers, payers, and public health agencies of central Massachusetts. The long-term goals of SAFEHealth include improving health care quality and safety while reducing health care costs.

The ongoing project is piloted through the Fallon Clinic; Milford Hospital; and the HealthAlliance Hospital, Leominster Campus Emergency Room, and is interfacing with preexisting electronic medical record (EMR) systems. SAFEHealth developed policies and procedures to ensure compliance with Health Insurance Portability and Accountability Act (HIPAA) privacy and security rules. Using Nationally accepted data exchange standards and a federated, decentralized edge proxy-server approach to authentication, data repositories, and an enterprise master person index (EMPI), SAFEHealth provides a secure, scalable, and sustainable HIE model that can be replicated and interfaced to other HIEs. Unique to SAFEHealth is an infrastructure hybrid approach to patient consent, allowing clinical data to flow for order/result processing based on the treatment, payment, and operations provisions of HIPAA, as well as push/pull of clinical data based on opt-in consent. The system is also designed to allow for cross-population queries and public health reporting.

Functional requirements for the HIE were defined based on the findings from focus groups, stakeholder interviews, and extensive literature review. After several unsuccessful attempts to find a vendor to develop the software, the project team decided to scale down software development to Fallon Clinic's information technology staff only. The participating organizations agreed to share the development and implementation costs, including providing resources for testing the software.

Workgroups were created to define and develop data standards, policies, and procedures. Universal consent and revocation of authorization forms were created and approved by the participating organizations. Registration staff each received hands-on training in a computer lab classroom environment. While physicians and nurses received no formal training (clinical data from SAFEHealth appears within the EMR that they had already been taught to use), Dr. Garber presented a hospital grand rounds to provide general education on HIEs. Patients received general education through the SAFEHealth.org Web site, newspaper articles, and advertisements, as well as posters in the waiting

rooms. They also received individual education and brochures from the registration clerks when obtaining consent.

SAFEHealth became fully operational on June 24, 2009, using a federated edge-proxy server architecture with patient "opt-in" for clinical data exchange managed by a consent engine external to the EMR. A central EMPI was pre-loaded with the demographic information (name, sex, date of birth, and zip code) from one million patients. HealthAlliance Hospital's Leominster Campus Emergency Department provided emergency room notes, while Fallon Clinic provided 2 years of historical notes, including medication lists, allergies, problem lists, immunizations, code/advanced directive status, vital signs, recent lab/radiology results, and the primary care physician's name and phone number. Clinical data were imported directly into the receiving organization's EMR for use during treatment. Physicians and staff were subsequently surveyed in December 2009 regarding the impact of SAFEHealth. Separately, a one-way interface was established from the Milford Regional Medical Center's EMR into Fallon Clinic's EMR on July 1, 2009. Reports were transmitted if the patient was under the care of a Fallon Clinic physician or had a Fallon Clinic referring physician. Physicians were surveyed in December 2009 regarding the impact of the interface.

After 15 weeks of use, 750 patients had consented and approximately 6,000 clinical documents had been exchanged. Project delays limited the project team's ability to complete all evaluation metrics. However, patient focus groups revealed that patients overwhelmingly thought the benefit of HIE outweighed any security risk, but formal consent should be obtained from each patient (i.e. opt-in") prior to the exchange of any clinical data. Physician focus groups revealed concerns about information overload and liability, but overall, they rated the SAFEHealth concept highly.

**Specific Aims**

- Conduct pre-implementation focus groups with patients and physicians. **(Achieved)**
- Develop software algorithms to allow information from three different entities to interface and integrate in the SAFEHealth environment. **(Achieved)**
- Develop working policy and procedures to assure compliance with HIPAA privacy and security rules. **(Achieved)**
- Implement and use SAFEHealth at Milford Hospital and HealthAlliance Hospital, Leominster Campus, Emergency Room. **(Achieved)**

**2009 Activities:** SAFEHealth software development was completed in June 2009. Unit and integration testing of the software with Leominster Health Alliance Hospital and Fallon Clinic using the "opt-in pull approach" was completed. Similarly, in June 2009, unit and integration testing of the software with Milford Hospital and Fallon Clinic using the "notice-of-privacy push approach" was completed. Both systems subsequently went into production with real patient data being exchanged in real-time as part of patient care. The software continues to be enhanced in an iterative fashion, and data mapping continues to support evolving needs.

**Impact and Findings:** After the first 15 weeks of use, 750 patients had signed consents to participate in SAFEHealth. Two people had revoked their consent. Approximately 50 percent of patients consented to share their records with any health care organization in Massachusetts that cares for them, and 70 percent agreed to allow information from their health insurer to be shared with their health care providers. However, less that 50 percent of patients who were offered to participate in SAFEHealth actually signed the consent form. Interviews with the registration clerks provided insight to the reasons for this low (as compared to the 95 percent consent rate demonstrated in the Massachusetts eHealth Collaborative communities) consent rate. Currently, only two organizations are connected to SAFEHealth. As a result, many patients said they would not go to other organizations for care so did not see a need to participate. If more health care providers participated, more patients would likely have consented. This suggests the

need for the expansion of SAFEHealth to other organizations and more generalized marketing of the HIE concept and its benefits.

Overall, physicians found SAFEHealth valuable, although they did identify room for improvement. While finding information in their EMR was more convenient than having to call for records or accessing information through a separate Web site, they still felt that having access to information filed more discretely in their EMR (e.g., laboratory results in the laboratory section) would be better. Subsequent testing of an enhanced interface that provided this functionality led to improved physician satisfaction. The physician focus groups yielded some unexpected findings, including some distrust of secure e-mail. Not surprisingly, the younger physicians tended to be more comfortable with the technology, while decision support received mixed reviews overall. Message overload and liability were issues of great concern among physicians.

The cost of implementation and financial sustainability of HIEs is an ongoing concern for health care organizations that are considering HIE networks. The experiences of this project strongly suggest that close collaboration among the partners with existing human and capital resources is a more effective and sustainable approach than formal, structured, and elaborate approaches. Lastly, integrating an HIE into the real-life health care workflows of patients, registration clerks, and physicians is a critical success factor. By using a central EMPI and consent portal/repository outside the EMR, patients can sign a single universal consent form. System functionality that supports automated printing of patient consent forms improved and simplified registration workflows. Also, physicians did not need to wonder whether outside data existed on their patients because they could see it using their own EMRs.

**Selected Outputs**

Grantee's 2009 Final Report.

Garber LD. SAFEHealth – Architecture, Workflows and Policies. Massachusetts Health Data Consortium CIO Forum; 2009 Nov 18. (Web Version).

Garber LD. SAFEHealth - A Public Utility for Electronically Exchanging Clinical Information in Central Massachusetts. HealthAlliance Hospital Grand Rounds; 2009 Mar 3. (Web Version)

Opportunities and Risks in Clinical Data Sharing. Patient-Centered Computing and eHealth: State of the Field, Harvard Medical School Continuing Medical Education Course; March 2008; Boston.

**Grantee's Most Recent Self-Reported Quarterly Status (as of September 2009):** Due to a delay in implementation resulting from a change in partnering hospitals, evaluation will need to be completed after the end of the grant period. Also, with the reduced pilot scope, the number of metrics has been reduced. Ideally, 6-to-12 months of data collection in a live system is necessary to clearly show benefits. In addition, since data exchange is limited to textual documents and radiology reports, the ability to impact many of the Healthcare Effectiveness Data and Information Set measures that were originally intended to be measured has been significantly reduced.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

| | |
|---|---|
| **Project Title:** | Computer-Based Provider Order Entry Implementation in Intensive Care Units |
| **Principal Investigator:** | Carayon, Pascale, Ph.D. |
| **Organization:** | University of Wisconsin–Madison |
| **Mechanism:** | RFA: HS-04-012: Demonstrating the Value of Health Information Technology (THQIT) |
| **Grant Number:** | R01 HS 015274 |
| **Project Period:** | 09/04 – 08/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,455,066 |
| **Summary Status as of:** | August 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Pediatric*

**Summary:** While health care technologies can improve quality of care, technology implementation can also have negative repercussions. The Computer-Based Provider Order Entry (CPOE) Implementation in Intensive Care Units (ICUs) project is a collaboration between researchers at the Center for Quality and Productivity Improvement at the University of Wisconsin–Madison and Geisinger Medical Center (GMC) in Danville, Pennsylvania. It builds on an existing interdisciplinary research network to examine the impact of CPOE technology integrated in an electronic health record (EHR) in four ICUs (24-bed adult, 18-bed cardiac, 38-bed neonatal, and 12-bed pediatric) at GMC.

The research examined the effects of technology implementation on patient safety, quality of care, financial costs, and end users. The project used prospective human factors analysis methods to improve the design and implementation of CPOE in the ICUs at GMC. Applying a human factors engineering approach to CPOE/EHR implementation in ICUs is unique and, because of its theoretical basis, can provide important information on methods for improving the design and usage of CPOE in health care institutions. Specifically, Dr. Carayon and her team sought to: 1) determine the effect of CPOE/EHR on safety and quality of care—including medication errors, adverse drug events, infection rates, protocol compliance, length of stay, mortality rates, and antibiotic turnaround time—in ICUs, 2) determine the impact of CPOE/EHR on physicians, nurses, physician assistants (PAs), and nurse practitioners in ICUs, including end users' job tasks, communication, coordination, quality of working life, and perceptions of patient safety and quality of care, 3) determine the financial value of CPOE/EHR implementation by examining the cost of patient care in the ICUs before and after CPOE/EHR implementation, and, 4) examine the role of human factors analysis in CPOE/EHR implementation through a usability analysis and a proactive risk analysis.

**Specific Aims**

- Conduct preliminary job task analysis of nurses and physicians. **(Achieved)**
- Conduct preliminary prospective risk analysis. **(Achieved)**
- Implement timeline revision with partner organization. **(Achieved)**
- Collect data to determine the impact of CPOE implementation on quality of care in and financial value to ICUs. **(Achieved)**
- Collect and analyze data to determine the impact of CPOE on end users. **(Achieved)**
- Collect data to determine the impact of CPOE on ICU safety. **(Achieved)**

**2009 Activities:** Data were collected and cleaned and several analyses were either completed or neared completion.

**Impact and Findings:** The project team observed some short-term negative effects, such as decreased perception of communication timeliness. However, these negative effects disappeared one year postimplementation. In addition, the investigators observed changes in job tasks conducted by nurses, physicians, and PAs, such as increased time spent on documentation and review tasks. Finally, the results show some benefit of CPOE/EHR on timeliness of IV medication delivery. The CPOE/EHR implementation was accompanied by major attention to organizational issues and change management. The investigators demonstrated the feasibility and benefits of using human factors methods, such as usability and proactive risk assessment, before the technology was fully designed and implemented. Future research should focus on the longitudinal use of CPOE/EHR technology. This research can help identify ways that the technology can be used to improve systems, care processes, quality of care, and patient safety. Issues related to end user adaptation of and to the technology should also be examined in future longitudinal research.

**Selected Outputs**

Grantee's 2009 Final Report.


Carayon P, Wood KE. Patient safety: the role of human factors and systems engineering. In: Rouse WB, Cortese DA, editors. Engineering the system of healthcare delivery. Fairfax, VA: IOS Press; 2009.

Hoonakker PL, Carayon P. Selection of an instrument to measure end-user satisfaction. Paper presented at the Work With Computing Systems conference; 2007 May 21-24; Stockholm, Sweden.

Hoonakker PL, Carayon P, Douglas S, et al. Communication in intensive care units and the relation with quality of care and patient safety from a nurse perspective. In: Sznelwar F, Mascia L, Montedo U, editors. Human factors in organizational design and management—IX. Santa Monica, CA: IEA Press; 2008. p. 715-21.

Hoonakker PL, Carayon P, Walker J, et al. Coordination in the ICU and the Relation With Quality of Care and Patient Safety. Proceedings on the International Conference on Healthcare Ergonomics Systems and Patient Safety; 2008 June 25-28; Strasbourg, France.

Li Q, Douglas S, Hundt AS, et al. A heuristic evaluation of a computerized provider order entry (CPOE) technology. In: Pikaar RN, Koningsveld EA, Settels PJ, editors. Proceedings of the IEA 2006 Congress. Elsevier; 2006.

Paris B, Carayon P, Wetterneck T, et al. Safety of the Antibiotic Medication Use Process in the Intensive Care Unit. Proceedings of the Human Factors and Ergonomics Society 52nd Annual Meeting; 2008 Sept 22-26; New York.

Schultz K, Slagle J, Brown R, et al. Development of a job task analysis tool for assessing the work of physicians in the intensive care unit. Proceedings of the Human Factors and Ergonomics Society 50th Annual Meeting, Santa Monica, CA; 2006.

Schultz Van Roy, K. The perceived workload of ICU physicians and physician extenders and its relationship to burnout, patient safety, and quality of care [dissertation]. University of Wisconsin-Madison, Department of Industrial and Systems Engineering; 2008.

Wetterneck TB, Paris B, Walker J, et al. CPOE functionalities and medication ordering errors in the ICU. In: Sznelwar F, Mascia L, Montedo U, editors. Human factors in organizational design and management—IX. Santa Monica, CA: IEA Press; 2008p. 369-75.

**Grantee's Most Recent Self-Reported Quarterly Status:** The project ended August 2009.

**Milestones:** Progress was mostly on track at conclusion of the project.

**Budget:** Spending was on target at conclusion of project.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Improving Safety and Quality with Integrated Technology |
| **Principal Investigator:** | Guise, Jeanne-Marie, M.D. |
| **Organization:** | Oregon Health & Science University (OHSU) |
| **Mechanism:** | RFA: HS04-012: Demonstrating the Value of Health Information Technology (THQIT) |
| **Grant Number:** | R01 HS 015321 |
| **Project Period:** | 09/04 – 08/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,461,150 |
| **Summary Status as of:** | August 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Women*

**Summary:** The goal of this recently completed project was to demonstrate the value of integrating the State Obstetric and Pediatric Research Collaboration (STORC), an inpatient and outpatient electronic health record (EHR), with an electronic alert system to in order to improve quality of health care and patient safety. Obstetrics (OB) was chosen as the health care setting because pregnant women inevitably transition between inpatient and outpatient settings in a matter of months.

Evidence-based treatment guidelines have been developed to improve the identification and treatment of Group B Streptococcus (GBS), a common and potentially life-threatening condition. The implementation includes alerts to both increase the likelihood of patient screening and decrease the unnecessary prescription of antibiotics for women who are GBS-negative.

The project team evaluated the impact of the integrated system on patient safety and quality of care with a mixed-methods approach that included a work-sampling study to examine medical staff workflow, a before-and-after chart review to examine documentation of key information, and a prospective intervention study to examine the effect on GBS screening rates.

This project demonstrated that an integrated outpatient and inpatient data system can improve patient safety. In particular, it demonstrated the value of comprehensive records. The project team found that there was improvement in access to time-critical information, and decision support to promote safe care practices relating to GBS screening and treatment. Additionally, the breadth of data supported a policy analysis comparing Canadian, United States, and United Kingdom screening and management policies for GBS and costs relating to each. Such data are critical for the discussion about the safe and cost-effective redesign of the U.S. health care delivery system. The findings, though applied specifically to OB, can be applied to many areas of medicine and surgery and may inform stakeholders making decisions regarding other health information technology (IT) systems in both inpatient and outpatient settings.

**Specific Aims:**

- Demonstrate the value of an integrated outpatient and inpatient EHR to improve quality of care and safety for women and infants. **(Achieved)**
- Demonstrate the value of an electronic alert system to increase GBS screening in the outpatient setting. **(Achieved)**

- Perform a policy analysis comparing the costs and implications for GBS screening according to the United States, Canadian, and United Kingdom policy to inform health care delivery and obstetric safety discussions. **(Achieved)**

**2009 Activities:** A policy analysis was performed comparing the costs and implications for GBS screening according to the United States, Canadian, and United Kingdom policy for GBS screening. Results informed health care delivery and obstetric safety discussions. Two decision models were created to evaluate the policies. The first model, "optimal treatment," used Oregon Health and Science University (OHSU) data to provide the probabilities for: GBS +, GBS–, and unknown status, and GBS risk factors and the frequencies of the different types of medications and associated costs. The second model displays the actual treatment paths and probabilities and was created subsequently.

**Impact and Findings:** Analysis found that from October 2004, when paper records were used, through March 2008, when a fully-integrated inpatient and outpatient EHR with an outpatient alert system for GBS screening was used, the rate of patients missing GBS lab results dropped from 11 to 6 percent for OHSU patients, while the proportion of the patients without GBS labs who delivered at OHSU but received prenatal care elsewhere increased from 22 to 28 percent. This suggests that improvements in compliance with clinical guidelines at OHSU were a significant factor in the change. Final results also found that the implementation of an integrated inpatient and outpatient EHR with outpatient alert system increased one-on-one time of clinical staff and patients.

Preliminary results from a survey evaluating the impact of the integrated EHR with outpatient alert system on clinical practice and satisfaction found that providers frequently/always felt that the nonintegrated EHR records were missing important OB information (45.9 percent nonintegrated EHR vs. 9.5 percent integrated EHR), and that use of the decision support tools was high, especially with regard to the frequently/always use of the dating calculator (84.9 percent), guidelines (57.6 percent), and Bishop's calculator (66.7 percent). Key features of the integrated EHR that providers would most hate to lose include data pulling forward into notes (71.4 percent), and the problem list (76.1 percent). The study also found that the introduction of a customized OB EHR system (STORC) improved documentation completeness in a busy obstetric unit without reducing direct patient care.

This study provides several results to inform both health IT and health care delivery discussions. The introduction of a clinical information system into a busy labor and delivery setting did not reduce the amount of time providers spent in direct patient care activities and, in fact, increased direct patient care activities. This study also demonstrated that the integrated system improved documentation completeness and communication of important clinical information to other providers and demonstrated the incremental gains in patient safety achieved with each level of health IT integration. Structured clinical data also inform health care policy decisionmaking by modeling the implications and costs of various countries' GBS-related health care policies.

**Selected Outputs:**

Grantee's 2009 Final Report.

Campbell EM, Li H, Mori T, et al. The impact of health information technology on work process and patient care on labor and delivery. In: Advances in Patient Safety: New Directions and Alternative Approaches. Rockville, MD: Agency for Healthcare Research and Quality; August 2009.

Eden KB, Messina R, Li H, et al. Examining the value of electronic health records on labor and delivery. Am J Obstet Gynecol 2008; 199: 307.e1 – e9.

Guise JM, Eden K, Osterweil P, et al. Electronic health records with decision support reduce uncertainty in Group B Streptococcus status. American College of Obstetricians and Gynecologists 57th Annual

Clinical Meeting; 2009 May: Chicago. Awarded the Blue Ribbon for Scientific Presentation at the American College of Obstetricians and Gynecologists 57th Annual Clinical Meeting.

Guise JM, Messina R, Li H, et al. STORC OB SAFETY INITIATIVE: Catalyzing research while promoting clinical care and safety through OB Electronic Health Records. The Annual Meeting of the Society for Maternal Fetal Medicine; 2008 Jan 28–Feb 2: Dallas, TX.

**Grantee's Most Recent Self-Reported Quarterly Status:** The project received a no-cost extension that has allowed for progress toward milestones and spending of budget.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population*

| | |
|---|---|
| **Project Title:** | Evaluating Smart Forms and Quality Dashboards in an Electronic Health Record |
| **Principal Investigator:** | Middleton, Blackford, M.D., M.P.H., M.Sc. |
| **Organization:** | Brigham and Women's Hospital |
| **Mechanism:** | RFA: HS04-012: Demonstrating the Value of Health Information Technology (THQIT) |
| **Grant Number:** | R01 HS 015169 |
| **Project Period:** | 09/04 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,153,892 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Acute Respiratory Infections, Adults, Chronic Care*, Diabetes, Heart Disease

**Summary:** This project evaluates the potential for improving the management of patients with acute and chronic medical conditions through the creation of clinical decision support (CDS) tools integrated with clinical documentation workflow, and the provision of physician performance feedback on guideline compliance and quality benchmarks in an electronic health record (EHR). The project seeks to increase patient safety and quality, and address the combined needs of clinical workflow support and decision support with innovative EHR technology.

The project examines two EHR-based interventions to determine if their use in chronic and acute conditions significantly improves patient clinical outcomes. The first intervention focuses on the impact of a forms-based, clinical documentation approach to decision support (Smart Forms [SFs]). The SFs incorporate on-screen patient chart review, effective coded data capture, note generation, and actionable CDS at the point-of-care to help physicians manage chronic and acute disease, including coronary artery disease (CAD), diabetes mellitus (DM), and acute respiratory infection (ARI). Patient education materials on self-management skills can also be generated from the same screen. The second EHR-based intervention provides clinician-specific performance reports on guideline compliance and quality benchmark achievement (Quality Dashboards [QDs]). The QDs help physicians, medical directors, and practice leaders by reporting patients' adherence to recommended clinical guidelines. The QD graphical displays allow for comparison with other physicians within a practice and with local and National benchmarks.

The two interventions were implemented in more than 20 primary care practices in the Partners HealthCare System (PHS) with more than 400 clinician study participants. To evaluate the SF and QD technology integrated with a pre-existing EHR system (the Longitudinal Medical Record [LMR], a Certification Commission for Health Information Technology-certified EHR developed in-house at PHS), the following randomized, controlled trials (RCTs) were conducted:

- Acute Respiratory Infection Smart Form Randomized Controlled Trial (ARI SF RCT)
- Coronary Artery Disease/Diabetes Mellitus Smart Form Randomized Controlled Trial (CAD/DM SF RCT)
- Acute Respiratory Infection Quality Dashboard Randomized Controlled Trial (ARI QD RCT)
- Coronary Artery Disease Quality Dashboard Randomized Controlled Trial (CAD QD RCT)

In each RCT, PHS-affiliated primary care practices were randomized to follow established protocol, the SF-enhanced protocol, or the SF plus QD enhanced protocol. Data collected from the RCTs and physician surveys were used to answer the following questions: 1) Can a usable EHR-based intervention that provides CDS in the context of clinical documentation workflow and that integrates population-based performance feedback to the physician be developed? and 2) Do these interventions improve the quality of clinical documentation, capture of key clinical data for CDS and quality assessment, and compliance with best practice guidelines?

**Specific Aims**

- Design and implement an integrated documentation-based CDS and physician feedback system provided in an EHR to improve the management of patients with acute and chronic medical conditions. **(Achieved)**
- Determine the effectiveness of a documentation-based CDS tool and physician feedback with respect to documentation and the clinical management of patients with CAD and ARI for the following
    - ARI SF RCT. **(Achieved)**
    - CAD/DM SF RCT. **(C Achieved)**
    - Analysis of surveys related to CAD/DM SF RCT. **(Achieved)**
- Assess the perceived value of QDs by clinicians and if they impact SFs' compliance with best practices in ARI and CAD for the following
    - ARI QD RCT. **(Achieved)**
    - Data retrieval and analysis of ARI QD RCT. **(Ongoing*)**
    - CAD QD RCT. **(Achieved)**
- Data retrieval and analysis of CAD QD RCT. **(Ongoing*)**

**Two of the aims of the grant were not completed prior to the scheduled conclusion of the grant (September 2009) but are still targeted for completion.*

**2009 Activities:** Analysis of surveys related to the CAD/DM SF RCT was completed. Data analysis of the ARI QD RCT is ongoing and will be completed in 2010. The CAD QD RCT was completed in March 2009 and encompassed 15 primary care practices involving approximately 350 clinicians. Relevant preliminary results were collected and analyzed. Final data analysis is ongoing.

**Impact and Findings:** A documentation-based CDS tool and a physician feedback system can be designed and implemented in an outpatient clinical setting. Reported use and evaluation of usability suggest that including such a CDS tool into clinical practice facilitates common tasks such as documentation and order-entry.

The results of the ARI study demonstrate that use of SFs decreases instances of antibiotic prescribing for non-antibiotic-appropriate diagnoses, suggesting better adherence to clinical guidelines on the part of the clinician. The results of the CAD/DM study suggest that using SFs as a CDS tool provides for more up-to-date documentation of clinical data, particularly of patients with chronic conditions. Although the QD studies are pending further analysis, the preliminary results indicate the potential for an EHR-based QD system to provide additional benefit beyond a CDS tool like SFs in the management of patients with CAD/DM and ARI.

Although the data analysis is ongoing, a trend has emerged from the study results up to this point. Overall, use of SFs and QDs as a part of clinical decision support correlates with better adherence to the clinical guidelines within the areas described. Also, most users found these tools intuitive to use, easy to integrate into clinicians' workflow, and beneficial in terms of quality of patient care.

**Selected Outputs**

Grantee's 2009 Final Report.

Linder JA, Schnipper JL, Tsurikova R, et al. Documentation-based clinical decision support to improve antibiotic prescribing for acute respiratory infections in primary care: a cluster randomized controlled trial. Inform Prim Care. 2009;17(4):231-40.

Linder JA, Rigotti NA, Schneider LI, et al. An electronic health record-based intervention to improve tobacco treatment in primary care: a cluster randomized controlled trial. Arch Intern Med. 2009 Apr 27; 169(8):781-7.

Schnipper JL, Linder JA, Palchuk MB, et al. "Smart Forms" in an Electronic Medical Record: documentation-based clinical decision support to improve disease management. J Am Med Inform Assoc. 2008 Jul-Aug; 15(4):513-23.

McColgan K, Schnipper JL, Middleton B, et al. Self-reported Familiarity with Acute Respiratory Infections Treatment Guidelines is Associated with Higher Antibiotic Prescribing Rates [poster]. SGIM 2008 Annual Meeting; 2008 April 9-12; Pittsburg, PA.

Jung E, Linder JA, Housma D, et al. The Acute Respiratory Infection Quality Dashboard: A Performance Measurement Reporting Tool in an Electronic Health Record [poster]. AMIA 2007 Annual Symposium; 2007 Nov 10-14; Chicago, IL.

Jung E, Schnipper JL, Li Q, et al. Coronary Artery Disease Quality Dashboard: A Chronic Care Disease Management Tool in an Electronic Health Record [poster]. AMIA 2007 Annual Symposium; 2007 Nov 10-14; Chicago, IL.

Palchuk M, Postilnik A, Olsha-Yehiav M, et al. User Interface Accelerators for Clinical Documentation in Smart Form [poster]. AMIA 2007 Annual Symposium; 2007 Nov 10-14; Chicago, IL.

Tsurikova R, McColgan K, Linder JA, et al. Quality Dashboards: Providing Performance Measurement and Disease Management Tools in an Electronic Health Record. AHRQ Annual Conference 2007 Sep 26-28; Bethesda, MD.

Linder JA, Schnipper JL, Volk L, et al. Clinical Decision Support to Improve Antibiotic Prescribing for Acute Respiratory Infections: Results of a Pilot Study [poster]. MedInfo 2007; 2007 Aug 20–24; Brisbane, Australia.

Linder JA, Rose AF, Palchuk MB, et al. Decision support for acute problems: the role of the standardized patient in usability testing. J Biomed Inform. 2006 Dec;39(6):648-55.

**Grantee's Most Recent Self-Reported Quarterly Status (as of September 2009):** The project is mostly on schedule. The ARI and CAD QD RCTs were completed but data analysis is ongoing. Although all milestones have not been met, there is a viable plan for achieving those that remain.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Spending roughly on target.

**AHRQ Priority Population*

| | |
|---|---|
| **Project Title:** | Value of Health Information Exchange in Ambulatory Care |
| **Principal Investigator:** | Overhage, J. Marc, M.D., Ph.D. |
| **Organization:** | Indiana University/Purdue University at Indianapolis |
| **Mechanism:** | RFA: HS04-012: Demonstrating the Value of Health Information Technology (THQIT) |
| **Grant Number:** | R01 HS 015409 |
| **Project Period:** | 09/04 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,499,662 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** General

**Summary:** This project assesses the value of health information exchange (HIE) in ambulatory care settings. HIE is a critical component of any broad health information technology (IT) effort. Any health IT-based application requires appropriate data, and it is rare that all required data are generated within a single health IT solution or care delivery organization, particularly in ambulatory settings. For this study, an existing HIE, the Indiana Network for Patient Care, is expanded to include several ambulatory care settings within the community.

This project refines an established economic model of HIE (from the Center for Information Technology Leadership [CITL]), creates a "laboratory" in which that model can be tested, and tests the model's predictions in a randomized, controlled trial. To measure the value of making data available from the HIE, access to these data is randomly allocated by patient, which allows controlling for practice and provider characteristics that have been identified as important covariates in previous studies. Claims data are used to measure any reduction in charges that result from the intervention. In addition, a prominent health care payer will provide clinical data and lay the foundation for changes in reimbursement models based on conclusions drawn from the project's findings.

Insights gained from this modeling exercise will help design the analyses for this study. Given the incentives and investments included in the American Recovery and Reinvestment Act, it is important to understand the potential return from investments in HIE, especially at the level of the individual physician practice. This study should provide some of this important information. Savings may be realized through decreases in diagnostic testing, resource utilization (e.g. referrals), hospitalizations, or adverse drug events.

**Specific Aims**

- Apply a previously developed economic model for the benefits of HIE to a specific geographic community or Metropolitan Statistical Area in order to determine the expected savings for the community. **(Achieved)**
- Identify, through utilization of the model, the categories of data (e.g., laboratory, radiology, administrative) that contribute the most to these savings and which participants (e.g., physicians, hospitals, payers) benefit. **(Achieved)**
- Create an HIE "laboratory" to measure the value of HIE. **(Achieved)**

- Conduct a randomized, controlled trial to measure the value of HIE (value to be measured in terms of reduced costs of care and selected quality measures). **(Achieved)**

**2009 Activities:** A number of new data feeds went live in 2009, including new hospitals and a new laboratory. Direct phone followup was made with three originally identified specialty clinics to check whether their status has changed (organizational merger/partnerships) and if they may now be able to participate. Data extraction and analysis was the major activity in 2009.

**Impact and Findings:** The model quantified savings from health IT and HIE that projected net values over time and by type of organization. The model provides insights into the potential value of health IT and HIE for these organizations. The net value for small and medium practices and hospitals is quite low, which may make engaging these organizations difficult. These insights have informed business model development by the Indiana Health Information Exchange.

The model also quantified the benefits from providing access to community wide data through a lightweight electronic health record (EHR)—which is basically a viewer—versus a heavyweight EHR as was assumed in the original CITL models. The model demonstrated that deploying less-sophisticated EHR systems reaches breakeven more quickly than deploying full function EHRs and HIE, though full function systems have a larger potential return in the long run. This insight may suggest an approach that leverages HIE and less sophisticated EHRs to create value that can then be invested in deploying full function EHRs. This is particularly relevant since clinical decision support (CDS) is essential to achieving this full value and there is little experience to guide us on how difficult it is to implement CDS at scale.

One of the key insights from this effort is that significant portions of the savings predicted by the model are "shadow costs." Shadow costs occur if an organization is carrying out the activity prior to HIE implementation. The CITL model, for example, assumes that practices are forwarding patient information to consultants for every referral that obviously would require an investment of staff time and other resources, such as fax transmission and mailing. The project's validation highlighted that, in fact, the practice is often not sending these data and, therefore, is not incurring these costs. Eliminating this task through HIE will not achieve any savings. HIE has value but does not reduce the practice's expenses.

Future analyses are necessary to draw firm conclusions about the impact of HIE on charges, test utilization, or hospitalization. The results of the modeling, the difficulty in engaging specialty practices, and providers' skepticism about the value of data available through HIE suggest that deployment of health IT and HIE will be challenging and may require an extended period of time to successfully complete. This conclusion strengthens the finding that less sophisticated health IT deployed sooner is a viable National strategy to reach the goal of a fully interoperable electronic record for all citizens and may even represent a more sensible pathway. The savings generated from deploying EHRs with a reduced feature set can be invested to support deployment of fully interoperable EHRs. Depending on the assumptions made for the length of time required to deploy a fully interoperable EHR, this phased, incremental strategy could provide greater value return and greater net value than a strategy that relies on an initial deployment of fully interoperable EHRs.

**Selected Outputs**

Grantee's 2009 Final Report.

**Grantee's Most Recent Self-Reported Quarterly Status (as of June 2009):** All project milestones have been achieved. More detailed analysis of data is being performed through 2010.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

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|---|---|
| **Project Title:** | El Dorado County Safety Net Technology Project/Access El Dorado |
| **Principal Investigator:** | Bergner, Gregory W., M.D., F.A.A.F.P. |
| **Organization:** | Marshall Medical |
| **Mechanism:** | RFA: HS05-013: Limited Competition for AHRQ Transforming Health Care Quality Through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 016129 |
| **Project Period:** | 09/05 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,491,985 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Low SES/Low Income*, Medically Underserved, Uninsured, Mental Health/Depression, Safety Net, Pediatric*

**Summary:** The Access El Dorado (ACCEL) County Safety Net Technology Project evaluated the ability of health information technology (IT)-enabled health care coordination to improve access to care for low-income, minority, and uninsured or publicly insured residents. The goal of this project, which ended in September 2009, was to create a functional and sustainable health information exchange (HIE) connecting more than a dozen ACCEL partner facilities throughout El Dorado County, California. These included both private and public providers and represented a diversity of practices, including a community health center and a tribally run clinic. This partnership worked to reach all patients, especially the underserved populations in this rural, northern California county. The project focused on automating existing care coordination protocols—Care Pathways—through a shared Web-based application—iREACH—followed by the creation of an HIE to enable participating organizations to electronically share patient information.

The project team envisions that a confidential and secure HIE network will allow health care providers with the appropriate patient permissions to access patient information no matter where the patient is treated in El Dorado County, whether the provider has an electronic health record system or not. Aggregated and timely health data will be available to enhance public health surveillance, reporting, program management, and clinical/medical research. The long-term goal of the project is to enable El Dorado County to link to the California HIE when that exchange becomes functional.

The impact of the Care Pathways solution was measured using quantitative data from the program. Through a set of six Care Pathways measures, the project team assessed whether the implementation of Care Pathways is improving access to health care. The number of Care Pathways in operation, the number of clients served, and the share of successful cases were compared annually over the grant's 4 years. Evaluation of iREACH was performed through semi-structured interviews and focus groups with project participants.

Due to the successes in Pathways outcomes, the shared Pathways workflow processes are being expanded into areas of a more clinical nature. Care Pathways has successfully assisted more than 3,300 children. Those who were connected to a medical home visited the emergency department (ED) less frequently, leading to a 40-percent reduction in ED costs. The transition of Care Pathways to iREACH has led to greater case management efficiency.

**Specific Aims**

- Develop the governance structure and privacy protections needed to operate an HIE. **(Achieved)**
- Implement Care Pathways-stepped workflows, coordinated through a county-wide shared software application (iREACH), developed to help uninsured and underinsured residents locate resources and services to receive needed care for themselves and their families. **(Achieved)**
- Implement the enterprise master patient index (EMPI) for the county. **(Achieved)**
- Work with a vendor to develop and implement an HIE. **(Ongoing*)**

**One aim of the grant was not completed prior to the scheduled conclusion of the grant (September 2009). However, this aim is still targeted for completion.*

**2009 Activities:** By the end of the grant period, ACCEL had accomplished its goal of designing and installing iREACH, a Web-based tool that allows users in multiple locations to track, share, and update client progress more efficiently through the Care Pathways. Data accuracy is an evolving concern with Care Pathways. Overall, the data are accurate but inconsistencies have been uncovered via ongoing quality assurance assessments. Many inconsistencies are on the user level and have been addressed individually. Other inconsistencies required some programming changes within iREACH.

While HIE development has been delayed due to funding requirements and prior commitments of partner hospitals, the project team has laid groundwork to support adoption. Private funding sources are being pursued, and the project received a 2-year California Endowment grant of $250,000 to support the purchase of the HIE. American Recovery and Reinvestment Act opportunities are being evaluated and State-level representatives have been engaged. A sustainable business plan is being developed.

Because ACCEL is not a legal entity, its ability to attract funding may be limited. Participating hospitals are considering a joint venture or LLC. Preliminary review of vendor proposals for the HIE have been completed and three potential vendors are being considered. However, parallel HIE-related activities at the two partner hospitals have delayed critical decisions. Project participants remain actively engaged and anticipate vendor selection once partner hospitals make key decisions.

New provisions for privacy and security in both the Health Information Technology for Economic and Clinical Health Act requirements and State of California requirements are being monitored and evaluated.

**Impact and Findings:** El Dorado County's progress in improving coordination of care, especially in pediatric mental health via Care Pathways was cited in the National Initiative for Children's Healthcare Quality. The report was funded through the California Endowment to highlight successful and innovative programs that can be adopted elsewhere. The shared Pathways were cited as having electronically connected the El Dorado County Mental Health Department with safety net providers to access services for pediatric patients in need. The success rate in this endeavor is double that of the current National statistic of success (more than 60 percent, versus National statistic of 30 percent).

The 'Medical Home' Care Pathway has had a positive impact (i.e., decline) in non-urgent pediatric patient use of the emergency department. Reduced time per community health workers' client case occurred following implementation of Care Pathways. The Securing Health Coverage pathway has served more than 3,000 clients, helping 96 percent of those clients find health coverage for their children. Further analyses of the data from Care Pathways are ongoing.

Overall, data availability and accuracy are significantly better than what was available before the project. Studies have shown consistent improvement in favorable outcomes over time, which has led to the expansion of the shared workflow processes into the area of orthopedic care access and coordination.

Several valuable lessons have been learned in the course of health IT implementation. The privacy and security workgroup examined privacy issues and legal rights which led ACCEL to establish a countywide

patient permission structure that considers privacy concerns even as it encourages participation in the HIE system. The need for a more formalized organizational and governance structure has become evident in support of obtaining grant funding. There is also a need for close and sustained collaboration among partners as the project moves toward vendor selection and HIE implementation.

**Selected Outputs**

Grantee's 2009 Final Report.

Rogers G, Homer CJ. (National Initiative for Children's Healthcare Quality). Innovative Prevention Programs for Improving Children's Healthcare in California. The California Endowment; 2009 June. Available at: http://www.nichq.org/innovations.html

AHRQ Health Care Innovations Exchange. County-Wide Collaborative Uses Pathways Model to Enhance Access to Insurance, Primary Care, and Mental Health Services for Low-Income Children [Online]; 2009 Jan. Available at: http://www.innovations.ahrq.gov/content.aspx?id=2391

Bergner G. (Access El Dorado, Placerville, CA). ACCEL. Presented at the AHRQ Annual Conference; 2008 Sep 7-10; Bethesda, MD.

Dunn SD. ACCEL Notification of Privacy Practices. Presented at the Convening of Blue Shield of California Foundation HIE Grantees and Stakeholders; 2008 Apr 22; San Francisco, CA.

Wise N. (Healthcare Technology Management Services, Indianapolis, IN). ACCEL Health Information Exchange Business Case. ACCEL/County of El Dorado; 2007 May. Contract No.: 503-PHD0106. Available from: ACCEL/County of El Dorado, Placerville, CA.

**Grantee's Most Recent Self-Reported Quarterly Status (as of September 2009):** HIE implementation was delayed due to funding requirements and pending commitments of partner hospitals. The governance structure is being reviewed with expectations that a more formalized structure is required.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** On target.

**AHRQ Priority Population*

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|---|---|
| **Project Title:** | A Community-Shared Clinical Abstract to Improve Care |
| **Principal Investigator:** | Connelly, Donald, M.D., Ph.D. |
| **Organization:** | Fairview Health Services |
| **Mechanism:** | RFA: HS05-013: Limited Competition for AHRQ Transforming Health Care Quality through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 016155 |
| **Project Period:** | 09/05 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,482,674 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Adults, Congestive Heart Failure

**Summary:** This project seeks to improve continuity of care for emergency department (ED) patients by implementing a health information exchange (HIE) among three health care systems. Handoffs between medical providers are recognized as a potential source of medical error. Such risks are compounded during emergency visits, when patients may use the nearest available ED rather than their usual source of care. The project assesses the effect of providing additional clinical information during care transitions.

The project initially planned to exchange full continuity of care documentation among EDs in three health care systems; however, recent additions to Minnesota privacy law made this goal infeasible. The plan was revised to have ED clerical personnel prepare patient record abstracts from ambulatory care electronic medical record (EMR) systems and make them available to clinicians in the participating EDs.

An observational study of congestive heart failure (CHF) patients at an ED in each health system was conducted to assess the effect of prior information on care quality and efficiency measures. Although project partners are still interested in advancing the HIE model and applying it to the local area, regulatory changes and the early status of the statewide Minnesota Health Information Exchange (MN HIE) delayed electronic exchange of patient record abstracts beyond the timeframe of this project.

**Specific Aims**

- Extract and analyze de-identified patient ED visit data from participating facilities in order to determine which populations would be best served by implementation of the HIE. **(Achieved)**
- Resolve technical and nontechnical issues related to the changing legal landscape for medical privacy in Minnesota and the designation of the MN HIE as the State-recognized HIE. **(Ongoing*)**
- Implement the HIE technology at participating hospitals, and collect data on the efficacy of the intervention. **(Ongoing*)**

**Several aims were not completed prior to the scheduled conclusion of the grant (September 2009) due to uncertainty introduced by changes to Minnesota State privacy regulations as well as the perception that MN HIE could potentially offer redundant HIE services relative to those planned by this study. As these issues are resolved and other sources of funding are secured, these aims are still targeted for completion.*

**2009 Activities:** The lack of a technology-based HIE to support project goals led to extensive collaboration among project participants, health care system managers, and clinicians to formalize the introduction of Health Information Retrieval Specialists into the Fairview Southdale ED. Data collection (complete in October 2009), data cleaning, and data analysis were primary activities in 2009. The executive board committee overseeing this collaboration averaged approximately three meetings per quarter during the year. Dr. Connelly kept the board up-to-date on project scheduling problems. Based on early analytical results, the board discussed how the project's findings may be helpful in other current or future initiatives in Minnesota.

**Impact and Findings:** The impact of several external factors forced the project team to amend their plans. The EMR vendor common to the three health systems adopted a closed exchange strategy that required customers to agree to unlimited geographic scope of exchange rather than regional exchange. Privacy and security concerns about the vendor's approach limited the health systems' acceptance until later in 2009. The Minnesota legislature updated privacy regulations to accommodate HIE and to affirm its commitment to a state-based HIE organization; however, these changes led to uncertainty among the legal counsels of the health systems and delayed implementation decisions. Recognizing the need for an exchange organization in Minnesota led to the inception of the MN HIE in late 2007. The project's executive board committed the project to use the nascent HIE once its communication services became available to avoid developing redundant and temporary communication channels. Finally, the national health information technology (IT) picture dramatically changed over the term of this project. While health IT attained much higher visibility and has substantial Federal financial incentives, the temporal prioritization of HIE has not increased. Rather, meaningful use criteria are being established by the Federal government to drive deployment of health IT functions and have effectively postponed exchange until 2013 and beyond, a full decade after the current project was envisioned. Although national efforts are now bringing about encouraging progress, most of these barriers still remain.

Once it became clear that true exchange was not going to be feasible during the project's term, the team modified the evaluation plan to focus on two ED patient groups (internal and external) at each of the three participating EDs. Internal patients are those with CHF who already had an electronic clinical record in that health system at the time of their first ED visit in the study period, and external patients are those with no available electronic record. There were 5,166 patients designated as index cases with 3,974 (77 percent) determined to be internal patients. After adjusting for age, sex, race, marital status, and comorbidities, internal patients in one of the settings had fewer orders for laboratory tests and medications while in the ED, lower odds of hospitalization, and if hospitalized, lower odds of mortality than external patients. The study has shown that once multiple barriers to HIE are overcome, an HIE-supported equivalent process can become a valuable adjunct in the care of ED patients.

**Selected Outputs**

Grantee's 2009 Final Report.

Theera-Ampornpunt N, Speedie SM, Du J, et al. Impact of prior clinical information in an EHR on care outcomes of emergency patients. AMIA Annu Symp Proc 2009:634-8.

Speedie SM, Du J, Theera-Ampompunt N, et al. Does access to EHR information improve ED performance? Presented at 2008 Annual Agency for Healthcare Quality and Research Conference; 2008 Sept 9; Bethesda, MD.

Connelly DP. Health Information Exchange: Myths, Mirages and Reality. Presented at 2008 Annual Agency for Healthcare Quality and Research Conference; 2008 Sept 8; Bethesda, MD.

Connelly DP, Kijsanaytoin B, Speedie SM. Synthesis of a database test bed for evaluating record linkage algorithm. AMIA Annu Symp Proc 2007:917.

Kijsanaytoin B, Speedie SM, Connelly DP. Linking patients' records across organizations while maintaining anonymity. AMIA Annu Symp Proc 2007:1008.

Potthoff S, Du J, Speedie S, et al. Emergency room providers' perceptions of MyChart's My Emergency Data: findings from a focus group study. AMIA Annu Symp Proc 2007:1082.

**Grantee's Most Recent Self-Reported Quarterly Status (September 2009):** The MN HIE was conducting a number of pilot studies and was not available before the project's end date. The contingency plan of creating paper-based health summary reports was completed successfully and data analysis is underway.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

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|---|---|
| **Project Title:** | Ambulatory Electronic Medical Record and Shared Access |
| **Principal Investigator:** | DeLuca, Michael, M.B.A., M.S. |
| **Organization:** | Sarah Bush Lincoln Health Center |
| **Mechanism:** | RFA: HS05-013: Limited Competition for AHRQ Transforming Health Care Quality through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 016128 |
| **Project Period:** | 09/05 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,500,000 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Medically Underserved

**Summary:** This project aimed to implement an ambulatory electronic medical record (EMR) across multiple and varied health care settings in a medically underserved region of east central Illinois. Sarah Bush Lincoln Health Center (SBLHC), a not-for-profit community health care corporation, served as the fiscal agent and lead organization for a collaborative partnership. The goal of this implementation was to improve patient safety and assess provider and patient attitudes toward health information technology by: 1) providing access to patient records across hospital services, home health, hospice, physician practices, and nonhospital provider settings, and 2) integrating electronic tools for prescription orders and management of medications. The project used a Certification Commission for Health Information Technology-certified EMR, the Medical Practice Management (MPM) suite of software developed by LSS Data Systems. Project partners included two private practice organizations and the Health Services Division of Eastern Illinois University. The purpose of the shared EMR was to facilitate coordinated care across services by sharing pertinent patient information between the emergency department and home health, hospice, family, and internal medicine providers, and other specialists throughout the rural community. The ambulatory EMR provides a means to share a longitudinal medical record that contains, at a minimum, a patient problem list, medication list, allergies, radiology images and data, laboratory data, and a patient care plan.

Prior to implementation, the Information Systems and System Practices Departments of SBLHC visited health care systems that use ambulatory EMRs. After this research, SBLHC implemented the software and modified it to their specifications. From there, the software was piloted in the organization's ambulatory clinic at Neoga, IL. During the pilot, the information systems team analyzed what worked well and what needed improvement. A spectrum of factors, from the training manual format and training environment to followup support, was evaluated. The system implementation's success was measured through direct user feedback.

**Specific Aims**

- Upgrade broadband network infrastructure at implementation sites. **(Achieved)**
- Customize system software for implementation sites, including data dictionaries, analogues of paper forms, a billing module, and backup procedures in case of system failure. **(Ongoing*)**
- Implement system at 20 clinics in the local area. **(Ongoing*)**

**Two aims were not completed prior to the scheduled conclusion of the grant (September 2009). As other sources of funding are secured, these aims are still targeted for completion.*

**2009 Activities:** The first site went live on the MPM software in October of 2007, and use of the system expanded to 11 additional sites, all of them smaller clinics. Currently, the EMR is being used by 16 physicians and midlevel providers (approximately one third of the planned providers). The timeliness and overall success of implementations improved due to lessons learned and resulting improvements to the overall process, training resources, and supporting documentation. Implementation of a Women's Health Clinic was attempted during the period, but the team had difficulty creating an electronic equivalent of an effective paper process for tracking a woman's pregnancy.

The project aim of deploying the MPM system at SLBHC, which has a high-volume ambulatory practice, is on hold. In addition, efforts to promote clinician buy-in have produced less significant results than initially hoped. This delayed the implementation of the site beyond the end of the grant funding period.

**Impact and Findings:** The project team found that emergency department and inpatient caregivers benefit from having access to the patients' ambulatory medications electronically. Creating the electronic chart from the information in the paper chart can be overwhelming in busy clinics, and most physicians, midlevel providers, and nursing staff concluded that the system would not increase productivity until the charts are more established. However, although the users do not view the system as ideal, they would not choose to return to paper charts.

In 2006, the implementation team conducted a survey of emergency department caregivers. The initial survey results indicated that the caregivers were not always able to obtain a complete list of medications for patients because the patients could not communicate or simply did not understand their medications. Emergency department caregivers were polled again in 2009 to see if the ambulatory electronic medical record implementation influenced their ability to provide care. All staff surveyed stated that their ability to access patients' ambulatory medications was enhanced, and looked forward to having more information available when the remainder of the clinics implements electronic records.

The project team found that physicians and midlevel providers were not as accepting of the software as expected. Although the system was not marketed as a time-savings tool, many physicians and midlevel providers were unhappy with the time needed to enter data into the computer system. To these providers, the benefits of complete and more accessible patient information to all caregivers does not outweigh the increased initial time it takes to build the patient's electronic record. However, the team noted, nurses' acceptance of the system was extremely important because if nurses adapt to changes in software and processes, providers usually follow.

In addition, the project team learned many lessons that will help them implement the program in future clinics. Prior to the first implementation, a group of providers met and decided that anything that did not exist within the Enterprise Medical Record should be scanned into the system. The team learned that scanning is extremely labor intensive and should be started well in advance of implementation. They also reported that transcription into the system should be done at the earliest opportunity—even if the clinic will not be electronic right away.

Rather than following a standard approach, training sessions are best customized to each clinic. Clinic dynamics vary on issues such as computer literacy, staff workload, and overall environment. It is also important that differences between test and live systems be kept to a minimum. Inconsistencies between test and live systems can lead to confusion during training and frustration on the part of users and support staff. Also, postimplementation support is important to ensure a smooth transition and full commitment to the system. Each implementation team member carried a pocket phone, so users only needed to remember one telephone number for assistance. It is important to resolve issues with the users as soon as possible to prevent the patients from experiencing delays, and immediate access to the implementation team allows caregivers to answer patient treatment questions on the spot.

**Selected Outputs:**

Grantee's 2009 Final Report.

The project developed a training manual for the EMR system.

**Grantee's Most Recent Self-Reported Quarterly Status (as of September 2009):** Project momentum was interrupted due to technological delays, including development of some system functionality and availability of compatible point-of-care tablet PC devices. Difficulties associated with physician buy-in and support also impacted the project. Efforts to expand system implementation to other practices continue.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is mostly on target.

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|---|---|
| **Project Title:** | Metro DC Health Information Exchange |
| **Principal Investigator:** | Lewis, Thomas L., M. D. |
| **Organization:** | Primary Care Coalition of Montgomery County |
| **Mechanism:** | RFA: HS05-013: Limited Competition for AHRQ Transforming Health Care Quality through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 016130 |
| **Project Period:** | 09/05 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,363,135 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Low SES/Low Income*, Safety Net, Uninsured

**Summary:** The project seeks to improve medical care for medically underserved populations that require transitions among care providers. This will be done by implementing a multi-jurisdictional health information exchange (HIE), linking safety net clinics, hospital emergency departments (EDs), and specialists spanning the Washington, DC, metropolitan area. The Metro DC Health Information Exchange (MeDHIX) links the electronic health record (EHR) systems of safety net clinics in the region with each other and with mainstream health care providers, forming a regional community of interest focused on the specific and unique needs of the uninsured population.

MeDHIX provides ED clinicians with health information and medication data from the safety net clinics and provides safety net clinics with similar information from the EDs. This information increases the knowledge base for clinical assessments and medication decisions, with the aims of improving patient safety and quality of care. Additionally, MeDHIX seeks to reduce duplicative laboratory tests and medical procedures and curtail unnecessary ED visits.

Initial evaluative interviews and group discussions documented perceived benefits, barriers, willingness to participate, current EHR use, and desired HIE content and features. Focus groups of underserved individuals elicited opinions on risks and benefits of HIE. Post-implementation provider feedback on actual HIE utility was planned. A model was designed to measure cost and sustainability from potential reductions in ED visits resulting from the adoption of medical homes and open source HIE.

At the end of the project timeframe, the open source HIE linked data from 14 safety net clinics, 40 care sites, and 3 jurisdictions for 110,000 unique patients and 560,000 clinic visits while adhering to different privacy and confidentiality standards. Only minimal deployment was achieved by the end of Year 4, which delayed HIE evaluation. Factors delaying implementation included legal concerns, shifting hospital priorities, dwindling support for a regional approach, and increased funding for local initiatives.

**Specific Aims**

- Implement a sustainable HIE linking the EHR systems of the region's safety net clinics with mainstream health care providers to improve patient care quality, safety, and efficiency for the region's most vulnerable populations, focusing specifically on the unique needs of the uninsured population and safety net environment. **(Achieved)**

- Work with safety net clinic providers, hospital EDs, and specialists that are a major source of care for safety net patients to identify specific data, applications, and use cases that are of the most benefit to them. **(Achieved)**
- Broadly involve health care organizations, community groups, philanthropies, and governments across the region, focusing on education and outreach about the benefits, risks, opportunities, priorities, implementation strategies, National successes and failures, and the potential for HIE to help bring better, more cost effective health care to their constituencies. **(Achieved)**
- Engage ethnically, racially, and economically disadvantaged individuals and their representative organizations to better understand the factors that inhibit or promote their acceptance of HIE and the steps that must be taken to maximize trust and mutual benefits. **(Achieved)**
- Reduce unnecessary visits to hospital EDs. **(Upcoming*)**
- Provide data for public health planning, epidemiological surveillance, and targeting of services to the low income, uninsured population. **(Upcoming*)**

**Several aims were not completed prior to the scheduled conclusion of the grant (September 2009) but are still targeted for completion.*

Of the two continuing activities, the implementation and measurement strategy for ED visit reductions has been folded into a much larger grant "Emergency Department - Primary Care Connect" (ED-PC connect) that involves all five hospitals in Montgomery County and 6 safety net primary care clinics collaborating on the identification of low income emergency department patients and connecting them to a medical home clinic. This project is tracking encounters, pre- and post-ED usage, medical conditions, and costs. This project uses MeDHIX for patient identification, tracking, and integration. Analysis of first year data has been informative and the coalition building to achieve effective interventions even more so.

The integration of public health, social determinants of health, and clinical intervention using MeDHIX for data sharing is part of an evolving initiative with county government and non-profits centered around social determinants of health and data integration across multiple organizations serving low income uninsured individuals and families.

**2009 Activities:** The original plan for Year 4 was to implement the eChart, a Web-based clinical summary of the integrated Community HealthLink Care EHR for use by physicians and specialists at all five Montgomery County hospital EDs. Implementation was delayed at each hospital for different reasons. In one case, it took nearly a year to obtain clearance for shared data access. A second hospital was in the midst of installing a comprehensive hospital information system on a time schedule set by a parent organization. A third one was evaluating a replacement for their hospital information system and did not have resources to spare. Project staff used this delay to assist in opening two new safety net clinics, increasing the number of patients who could participate in the exchange. Montgomery General Hospital registration staff began using the eChart to verify safety net patient eligibility and demographic information. The MeDHIX fax capability was also implemented for specialists to fax consultative reports for inclusion in the EHR.

In a related activity, a new collaborative program was started with all five Montgomery County hospitals and six safety net clinics to identify patients with primary care preventable ED visits, enroll them in a medical home, compare pre-and post-ED utilization, and identify influencing factors. The MeDHIX eChart is an essential component of this project for identifying safety net clinic patients in the ED and communicating with their clinics. Without it, the project could not have gone forward.

The last year of the project focused resources on exploring the technical and operational feasibility of creating and operating a shared data warehouse to support consolidated administrative reporting, clinical quality assurance initiatives, and patient ID card distribution for the Montgomery Cares Safety Net Clinic Program.

**Impact and Findings:** Two significant long-term benefits emerged from the project. First, the safety net providers were enthusiastic about participating in the EHR and HIE projects, including: workflow analysis, use case development, care delivery redesign, legal and governance discussions, privacy protection, and medical care quality forums. These organizations now see the benefits of HIE and EHRs, understand how to effectively use these tools in the safety net environment, and will continue to participate, advocate, and progress along the continuum from basic to comprehensive systems. Second, and equally significant, is the likelihood that safety net patients will benefit even more than insured patients from an effective HIE. Insured patients typically have a small set of providers who already communicate effectively with one another for most medical problems. In contrast, safety net patients typically are seen by multiple providers at multiple sites, have records that are less complete, have information more diffusely scattered, and often must visit multiple providers to physically collect and assemble their own medical records. The challenges of providing high quality, cost effective, and timely preventative and therapeutic interventions are correspondingly greater, and the outcomes are less certain.

The project team reported many other lessons learned and challenges to EHR and HIE implemenation. They are summarized below:

Barriers to Implementation and Use of and HIE: Barriers to effective HIE among safety net clinics and mainstream health care providers include: more pressing medical priorities, the small number of paid staff, a heavy volunteer component with limited technology skills in the clinics, technical complexity and cost of data interchange systems, and privacy concerns.

Environmental Constraints: Environmental constraints define the boundaries of HIE for each hospital, introducing additional hospital-centric evaluation criteria beyond the anticipated technical ones. Some hospitals are reluctant to share data unless the data are already being shared through traditional methods. Some prefer to be silent partners in the day-to-day operations of MeDHIX, not wanting responsibility for responding to inquiries or unexpected access to their databases. Others may be reluctant to absorb the costs of deploying a separate server outside the firewall, preferring to delegate to MeDHIX the responsibility for hosting the databases that receive health data. Browser choice may be controlled or prohibited, along with contract limitations imposed by software vendors.

Safety Net Patient ID Cards: A new set of procedural, legal, and liability concerns were encountered as technical discussions were held with hospitals on the details of the message exchange. Hospitals required assurance in two areas before they were willing to share data: positive identification of the patient and evidence that the patient was being seen in one of the safety net clinics, a surrogate for assuring that the patient had been informed of the clinic's data-sharing policies, and received proper Health Insurance Portability and Accountability Act counseling.

HIE Governance and Operations: Member hospitals stressed the importance of having a neutral party manage the MeDHIX infrastructure due to concerns about how the shared data might be used if a competitor managed it. Also, there was concern that priorities for system features and operational rules would be determined by the HIE service provider, with little say by partner institutions.

Differences in the Perceived Value of Data: Community hospitals and safety net clinics viewed exchanging basic patient data as having significant benefit for both clinics and ED physicians. ED physicians value a patient's "eChart summary" as a quick guide to potential problems and a source of contact information for providers. Clinic physicians value an electronic discharge summary, as they often are not aware that a patient has been seen until much later, if at all. Hospital physicians value the ability to refer a patient back to the primary provider to ensure effective followup and to arrange for a medical home for patients who do not yet have one. The information that seems to be most highly valued is identification of the patient's care provider, visit history, problem list, allergies, medications (for the EDs), laboratory results, and ED discharge summaries (for safety net clinics).

Importance of Public Education in Building Support for HIE: Discussions and interviews with community groups and focus group findings from safety net patients suggest that training and education focus on patient rights and responsibilities for medical information. Efforts need to be supported by policy, resources, and incentives; confidentiality and security need to be clearly demonstrated; HIE implementation must include standards for recording and classifying medical information in the system; and specific goals should be delineated on what HIE is intended to accomplish and for whom.

Legal Issues and Concerns: Legal issues concerning patient privacy and access to personal health information continue to be costly in terms of delayed implementation, expense, and reluctance to participate, constituting the single largest impediment to planning and implementing HIE. In spite of a growing National consensus on guidelines for sharing health information, each new organization—and individuals new to current member organizations—regularly revisit concerns that had been previously resolved. Differing interpretations are sincerely held, reflecting the complexity of the underlying statutes and regulations. For the MeDHIX project, privacy and data-sharing policies were especially significant because the project spanned three distinct jurisdictions: Maryland, Virginia, and the District of Columbia.

Collaboration Challenges: Even for organizations enthusiastically committed to target completion dates, project planning is challenging when tasks cross multiple organizations. Implementation is slowed when external and internal business and clinical priorities preempt HIE work. Well-defined expectations among participants are paramount to avoiding confusion and the need for subsequent crucial amendments to technology and business processes.

**Selected Outputs**

Grantee's 2009 Final Report.

Lewis TL, Watson MR. Health Information Technology, Health Information Exchange, and Community Perspectives. The Rockville Institute and Universities of Shady Grove. Contemporary Issues Seminar Series; 2009 May 5.

Available at: https://www.rockvilleinstitute.org/seminar/spring2009hit.asp?q=lewis

Strategies for a Person-Centric, Inclusive Maryland Health Information Exchange. Montgomery County Health Information Exchange Collaborative; 2009 Feb 19.

Available at: http://mhcc.maryland.gov/electronichealth/MCHIE_Final_Report.pdf

Lewis TL, Kajut L. Metro DC Health Information Exchange (MeDHIX) Characteristics, Challenges, Lessons Learned. Center for Community Based Health Informatics. Presentation at the Annual Conference of the Agency for Healthcare Research and Quality; 2008 September 8; Bethesda, MD.

Lewis TL, Kajut L. Partnering To Assist Montgomery County Maryland's Uninsured into Becoming the Healthiest Community in America. OpenHRE Conference; 2006 Dec 12.

Available at: www.openhre.org/local/UG06/PCC.pdf

**Grantee's Most Recent Self-Reported Quarterly Status (as of September 2009):** The project successfully created the MeDHIX HIE to link 14 safety net clinics at 40 care sites across 3 jurisdictions that can be accessed by 5 community hospitals, the Montgomery County Department of Health and Human Services, and medical specialists treating safety net patients, while incorporating differing multi-jurisdictional privacy and confidentiality standards. Due to delays, post-evaluation was not completed during the grant period but will still be conducted.

**Milestones:** Progress is on track in some respects but not others.

Budget: Somewhat underspent, approximately 5 to 20 percent.

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**AHRQ Priority Population.*

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| **Project Title:** | Improving Quality Care for Children with Special Needs |
| **Principal Investigator:** | Lozzio, Carmen B., M.D., F.A.C.M.G. |
| **Organization:** | University of Tennessee, Knoxville |
| **Mechanism:** | RFA: HS05-013: Limited Competition for AHRQ Transforming Health Care Quality through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 016133 |
| **Project Period:** | 09/05 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,096,491 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Pediatric*, Children with Special Health Care Needs

**Summary:** This 4-year project uses health information technology (IT) to improve quality of care to children with special health care needs (CSHCN). The project develops a secure, Web-based electronic health record (EHR) called the Tennessee Child Health Profile (TN-CHP) to provide comprehensive information (subject to parental approval) on CSHCN. The TN-CHP links data on newborn screening (NBS) and newborn hearing screening (NHS) from the public health database of the Tennessee Department of Health with data on diagnosis, treatment, and followup from programs providing CSHCN services. Outcome measures include rates of CSHCN identification from NBS and NHS, tracking of diagnosis, and delivery of CSHCN services. The project also investigates the effect of birth weight on the lag time between date of birth and diagnosis. The goal of the TN-CHP is to make primary diagnosis more efficient by making it easier for primary care providers, parents, and legal guardians to access and manage CSHCN information.

**Specific Aims**

- Make the TN-CHP available to providers and parents/legal guardians. **(Achieved)**
- Develop an integrated TN-CHP for CSHCN. **(Achieved)**
- Perform statistical analysis of data to measure outcomes. **(Achieved)**
- Improve the safety and quality of care of CSHCN. **(Achieved)**

**2009 Activities:** The major accomplishment of this project is the development of the TN-CHP. This Web-based EHR contains an educational component, one section on NBS with data on results of the NBS tests performed by the State laboratory and of NHS performed in the hospitals of birth, and data on short-term followup evaluations and results of tests performed to confirm the diagnosis. The other section, called child data, has information on long-term followup, medical treatment, and developmental information. The educational component is accessible to all providers, case managers, and families, whereas the confidential information on both the NBS and child data sections are secure and can be viewed by only the professionals authorized to access this information. The parents/legal guardians can view the data on their own child and can make comments but cannot change the information included in their child's record.

Significant progress was made in the programming of the Web site. The educational component has updated linkage to literature and resources, and the sections on NBS and child data were designed to allow viewing of the complete reports as attached PDF files. These sections also have complete

demographic information, reports of clinical evaluations, and results of laboratory studies and other diagnostic tests. The child data include a section on developmental disabilities with information on psychological and educational evaluations, Tennessee's Early Intervention System referrals, and behavioral management.

Active participation and collaboration of the six partners and of other major stakeholders representing various State departments, academic programs, and consumer organizations have been strong aspects of this project. The purpose of this collaboration is to improve the coordination of services, continuity of care, timeliness of followup services, and patient tracking to avoid loss of cases that need services and reduce delays in delivering appropriate treatments for CSHCN. The partners are the Genetic Centers at the University of Tennessee-Graduate School of Medicine in Knoxville, the Health Sciences Center in Memphis, the Vanderbilt School of Medicine, the Child Development Center at Vanderbilt, the UT Boling Center for Developmental Disabilities in Memphis, and the department of information services at UHS/UT Medical Center in Knoxville. These partners also collaborated with the Tennessee Department of Health and the Vanderbilt Center for Better Health. Extensive discussions and meetings were held with representatives of the TN e-health Council and the MidSouth e-Health Alliance (MSeHA), one of the State Health Information Exchange (HIE) programs to offer access of the data to pediatricians and other physicians through the TN eHealth Network and HIE programs. Statistical analysis of outcome measures for followup of NBS and NHS was conducted.

**Impact and Findings:** The major successes include: 1) the development of a comprehensive, Web-based EHR for CSHCN; 2) the participation of major stakeholders representing State departments, academic centers, and consumer agencies; and 3) data analysis of outcomes, including followup of NBS and NHS that was conducted and showed the lag times between birth and dates of screening tests and diagnosis and numbers of confirmed cases.

**Selected Outputs**

The principal investigator participated in the New York Connections Symposium held in Saratoga Springs, NY, on October 8-9, 2009, to discuss the New York State HIE programs and those in other States.

**Grantee's Most Recent Self-Reported Quarterly Status:** This project is complete. The allocated funds were underspent in the first 3 years but the funds were spent during the no-cost extension of the project.

**Milestones:** Progress was mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | The Chronic Care Technology Project |
| **Principal Investigator:** | Nashan, Georges, R.N., M.S., C.P.H.Q. |
| **Organization:** | Aroostook Medical Center |
| **Mechanism:** | RFA: HS05-013: Limited Competition for AHRQ Transforming Health Care Quality through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 016154 |
| **Project Period:** | 09/05 – 06/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,312,329 |
| **Summary Status as of:** | June 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and use

**Target Population:** Adults, Chronic Care*, Congestive Heart Failure, Chronic Obstructive Pulmonary Disease, Diabetes, Hypertension, Mental Health, Obesity, Rural Health*

**Summary:** This project helps providers in northern and eastern Maine to implement new technologies through a regional learning collaborative of health care providers and related stakeholders. Rather than the "usual" methods of adopting and implementing technology, the project uses a collaborative learning process based on the Institute for Health Care Improvement's (IHI's) Break Through Series (BTS), which is a proven model to achieve health care change at the practice level. The specific technology solutions and the associated implementation plans and execution are the products of this regional learning collaborative ("The Collaborative").

The project identifies and implements technology solutions to support the Planned Care Model, a care system framework organized around six fundamental areas, each with identified functionalities that can be supported by technology innovations. The technology solutions in the implementation phase of this project focused on two components of the Planned Care Model: 1) health practices and 2) patients and families, specifically addressing facilitation of the transfer of information among providers and between providers and patients.

In this project, the IHI BTS collaborative process helped participants reach consensus about the adoption and implementation of technologies in health care systems. The project was evaluated by measuring the effectiveness of the main elements of the IHI BTS collaborative process: Learning Sessions and Plan-Do-Study-Act change cycles. The main evaluative tool is a survey instrument that assesses the effectiveness of the IHI BTS process. While some of the survey questions are quantitative (e.g., ratings of learning sessions on a numerical scale), the effectiveness of the IHI BTS process is primarily measured qualitatively. The survey findings were summarized after each learning session to provide an evaluation of the IHI BTS process and participants' impressions of it at various stages of the project.

Twenty-eight health care teams participated in the project, including nursing homes, physician's practices, hospitals, rural health centers, a mental health center, a tribal health center, homecare services, a community action program, an industrial health program, and a pharmacy service. Teams represented a variety of settings, both rural/urban, independent/system affiliated, large/small, and inpatient/outpatient. In addition, several organizations provided information technology (IT) and program support.

Major projects undertaken by the teams included: hospital electronic medical record access by nursing home staff, electronic prescribing, electronic ordering of patient homecare supplies, fax server

implementation, phone system redesign, implementation of secure e-mail in primary care settings, and decision support system implementation for patient care and triage in primary care practices. In addition, two regional health Web portals were created to provide a trusted, accurate source for basic health, wellness, and chronic disease self-management information, including a calendar of local health-related educational events and a searchable database of local health care and wellness resources.

**Specific Aims**

- Assess whether the IHI collaborative model is an effective process to adopt and implement technological changes in health care systems (within practices and between practices). **(Achieved)**
- Assess whether technological changes improve the quality of information transfer by improving its timeliness, accuracy, efficiency, security, usefulness, and cost. **(Achieved)**
- Assess whether technological changes improve the quality of chronic disease care by improving both standards-based care delivery and patient health status. **(Achieved)**

**2009 Activities:** Analyses and evaluation continued into 2009 and through to the end of the project.

**Impact and Findings:**

*Impact of Technology Adoption on Practice Efficiency and Patient Safety:* For most organizations, the technologies adopted in this project were relatively simple in nature (secure e-mail, scanners, development of referral templates, additional work stations); however, some practices implemented more technically challenging projects. In general, the new processes/technologies implemented through The Collaborative required fewer resources, resulted in fewer errors, and were perceived to be more secure. They increased the likelihood that information transferred/received was complete and was easy to read and interpret.

Even when practices made only small changes, significant improvements in practice efficiency resulted. One of the most important take-away messages from this project is that for many small, rural Maine practices in The Collaborative, even simple, comparatively cheap technologies like secure e-mail or scanning systems can have significant impacts on practice efficiency and patient safety.

*Impact of Technology Adoption on Patient Care Management:* This project was intended to help organizations implement technology solutions to improve care as described in the Planned Care Model. Although actual improvements in patient care and patient health outcomes are not documented quantitatively, interviews and surveys of team leaders indicate that they perceive their projects improved patient care in some way, whether by improving the process of care, strengthening the care team, improving the efficiency of interactions with existing collaborators in the community, providing support for delivering evidence-based care, or providing better access to patient data.

By the end of the project, team leaders generally reported that substantial changes occurred. For example, before the project, more than 60 percent of team leaders reported that the process/technology they were using created problems with the security of health information; after the project, less than 10 percent reported security issues with the new process/technology. With the new process/technology, a substantial portion of team leaders also reported improvements in completeness of received and transmitted information, timelier receipt/transmittal of information, and reductions in cost to the organization.

*Forming a Collaborative:* Planning and organizing a collaborative around technology issues in rural Maine posed significant challenges, including the recruitment of an adequate number of team members. The project team found that recruitment was more difficult than expected, particularly in the second year, because of project staff turnover and the lack of a senior-level administrator to promote The Collaborative. For recruitment to proceed smoothly, senior system level leaders must promote the value of The Collaborative and engage leaders at the organizational and practice level early in the process.

Organizational leaders must see the benefits of participation and be willing to make a significant commitment to participation before signing up. Project staff must be assigned to carry out the day-to-day work of recruitment: identifying potential participants, answering questions, and doing extensive work with teams and leadership before the first learning session to ensure that teams have a full understanding of the commitment required.

Beyond recruitment, the project team learned that involvement of IT specialists from the first learning session onward—both organizational-level specialists and system-level specialists—is essential. Involvement of IT support from the start ensures that projects are in line with system-level priorities, that they are feasible, and that they will not be duplicative with other planned projects.

*Effectiveness of the IHI BTS Collaborative Model:* Despite the barriers faced by participating practices and associated frustrations, participation and interest in the project was maintained. For certain teams, The Collaborative was effective at getting teams together to start working on technological issues and prompting organizations to use existing technology or identify additional needs for technology. In some cases, small projects had significant impacts on practice efficiency and patient care, and even among teams that made little progress, the identification of new needs and the team building that occurred as a result of the IHI BTS collaborative process are expected to lead to additional improvements in the future.

For the most part, participants in The Collaborative came to meetings with far greater clinical and administrative skills than knowledge and experience with technology. Previously, the vast majority of health IT projects were driven by IT departments. The project significantly improved the technology literacy of the project participants and made them more knowledgeable about what was available to aid their processes, better able to communicate IT solutions, and be a better partner with their technology departments.

Additionally, unlike organizations that came into The Collaborative with major technology projects they were planning to focus on, organizations that focused on small, incremental changes were more likely to complete their projects because of the impetus of The Collaborative. These improvements to practice efficiency and patient safety would not have been achieved without The Collaborative.

**Selected Outputs**

Grantee's 2009 Final Report.

Deprez R, Kinner A, Cattabriga G, et al. Final Evaluation Report of the Aroostook Medical Center's (TAMC) Chronic Care Technology Project. Rockville (MD): Agency for Healthcare Research and Quality; 2009. AHRQ Contract No. UC1 HS 016154.

**Grantee's Most Recent Self-Reported Quarterly Status (as of June 2009):** Project grant is closed with all major aims achieved.

**Milestones:** Progress is mostly on track.

**Budget:** Spending roughly on target.

**AHRQ Priority Population.*

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| **Project Title:** | Accessing the Cutting Edge: Implementing Technology to Transform Quality in Southeast Kern County |
| **Principal Investigator:** | Nocella, Kiki, Ph.D., M.H.A. |
| **Organization:** | Tehachapi Hospital |
| **Mechanism:** | RFA: HS05-013: Limited Competition for AHRQ Transforming Healthcare Quality through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 016146 |
| **Project Period:** | 09/05 – 05/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,484,361 |
| **Summary Status as of:** | May 2009, Conclusion of Grant |

**Strategic Goal:** To develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Diabetes, Medically Underserved, Rural Health*

**Summary:** The project seeks to increase health quality in California's rural Southeast Kern County by implementing health information technology including electronic health records (EHRs), personal health records (PHRs), health information exchange (HIE), and tele-ophthalmology services.

The project established an administrative and governance infrastructure (the East Kern County Information Technology Association [EKCITA]) to guide and sustain development of the HIE, PHR, and tele-ophthalmology services. EHRs were implemented in three rural health centers (RHCs) and two provider offices, enabling these practices to electronically collect patient data and make them available via the HIE. A Web-based PHR system (MyHealthKeeper) was implemented as a diabetes self-management tool. A tele-ophthalmology service was implemented between the EKCITA Information Technology Association and an ophthalmologist in Bakersfield, California to address the needs of patients with diabetes and to screen for and manage patients with macular degeneration. The project was evaluated with a mixed-methods, nonexperimental methodology that used quantitative data from the HIE, tele-ophthalmology, and PHR systems and interviews with key informants.

All health care organizations and providers in Tehachapi agreed to participate in the HIE. Three rural health clinics, two private practices, and the region's hospital are exchanging data through the EKCITA HIE. Three primary care practices have Web links to EKCITA but with read-only access to the system because they do not have EHR capabilities. An additional two primary care practices that are EHR-enabled will be connected to the system post project as soon as interfaces between their EHR systems and the HIE can be built.

**Specific Aims**

- To build an infrastructure that will include a shared clinical data repository that will be used throughout the region linking the outpatient setting, inpatient setting, telemedicine, and other modalities. **(Achieved)**
- To develop a local workforce that is educated in how to make use of technology to enhance quality of care, is using technology to enhance knowledge and care, and to retrieve patient data. **(Achieved)**
- To develop a prototype for using technology in a rural setting to enhance care of patients with chronic disease, initially focusing on diabetes mellitus and then on heart disease. **(Achieved)**

**2009 Activities:** Project staff focused on completing final evaluation, analysis, and dissemination of the project and its findings during 2009 while continuing to support implementation at practices and the maintenance of the HIE. Quantitative data from the HIE, tele-ophthalmology, and PHR systems were analyzed for content and utilization. Interviews were conducted with eight key informants representing providers, administrators, and other key stakeholders about system development and governance, clinician use and satisfaction with the system, barriers and facilitators to development and use, and future plans. Financial analysis of the project development, implementation, and management (excluding matching funds) was completed. Abbreviated financial estimates were made of projected costs for sustaining the staffing, ongoing vendor support, administration, system registration, training, and system marketing.

**Impact and Findings:** EKCITA was established as a freestanding 501(c)(3) in the State of California, and as of August 2009, the EKCITA HIE contains a significant amount of patient data including encounter data for 59,711 patient visits, 4,532 radiology reports (but not images), and 1,318,747 laboratory observations. It contains data for 47,688 unduplicated patient identities: 42,337 that originated from the Tehachapi Valley Healthcare District (TVHD) hospital data systems, 2,191 from the TVHD RHCs, and an additional 436 and 2,724 from the two community-based family physician partners respectively. Despite the large amount of data in the system, utilization has been light to date. A total of 26 patients have given active consent for their data to be viewed through the HIE. Five providers have viewed a total of 55 patient records through the system. The average number of patient records accessed per user is 3. The low utilization rate could be caused by: the requirement that patients give active consent before their data can be viewed; the lack of integration of practice EHR systems with the HIE creating an additional barrier; or that providers must navigate out of their EHR screen to view the HIE system, thus interrupting the provider's workflow. While utilization was low, providers and administrators interviewed about the HIE were all enthusiastic about the potential of the HIE to improve care for patients in Tehachapi.

The MyHealthKeeper PHR was significantly underutilized with only 58 registered individuals and 8 active users by the end of calendar year 2008. The reasons for the low utilization rates are not clear pending further investigation, but one reason may be the "untethered" nature of stand-alone PHRs.

Twenty-six clinicians in the Tehachapi service area referred patients for tele-ophthalmology consults. The average number of referrals per clinician was 6.3 with a range of 1 to 54. Ten clinicians made a total of 5 or more referrals through the service. Two significant barriers were encountered in implementing a sustainable tele-ophthalmology solution for the region. The main barrier is the inability of specialists to bill for services directly unless they owned the equipment. The other barrier is the location of the equipment. The system was originally located at the hospital, but community-based providers were uncomfortable referring their patients to the hospital to have ophthalmology images taken.

**Selected Outputs:**

Grantee's 2009 Final Report.

Nocella KC, Horowitz KJ, Young JJ. Against all odds: designing and implementing a grassroots, community designed, RHIO in a rural region. J Healthc Inf Manag 2008 Spring;22(2):34-41.

**Grantee's Most Recent Self-Reported Quarterly Status (as of May 2009):** No quarterly status update provided.

**Milestones:** No quarterly status update provided.

**Budget:** No quarterly status update provided.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Creating Online Newborn Intensive Care Unit Networks to Educate, Consult, & Team |
| **Principal Investigator:** | Rachal, Valerie, R.N., Ph.D. |
| **Organization:** | University of Southern Mississippi |
| **Mechanism:** | RFA: HS05-013: Limited Competition for AHRQ Transforming Healthcare Quality through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 016147 |
| **Project Period:** | 09/05 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,499,995 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Medically Underserved, Pediatric*, Rural Health*

**Summary:** Mississippi is a primarily rural State with an uneven distribution of generalist and specialist physicians resulting in unequal access to health care. This misdistribution combined with a high rate of chronic diseases and their associated comorbidities requires Mississippi residents to seek medical services from multiple health care providers that are likely to be located in metropolitan areas.

A group of health care organizations in southern Mississippi recognized the need for better coordination of medical services for high-risk patients. They understood that a range of technological advances, such as electronic health records and portable health records, are critical to managing Mississippians' health care information. This project seeks to provide the benefits from the true interoperability of health care to neonates who reside in the southern part of the State, a high-risk population.

The Creating Online Newborn Intensive Care Unit (NICU) Networks to Educate, Consult, & Team (CONNECT) project develops, implements, and evaluates a variety of technology-based strategies to improve care to neonates at hospitals, rural physician offices, and in emergency rooms. CONNECT brings together the University of Southern Mississippi; Forrest General Hospital, a county acute care hospital; Southern Mississippi Neonatology Group, a private neonatology practice; Hattiesburg Clinic, the largest multispecialty clinic in the State; and Southeast Mississippi Rural Health Initiative with nine rural family health centers in medically underserved communities.

Because of the exploratory, as opposed to confirmatory, nature of this project, qualitative methods were deemed appropriate for the initial evaluation. The developed tools were evaluated by analyzing their use, surveying patient and physician satisfaction with the personal developmental/health record (PDHR) versus paper medical records and gauging agency and personnel buy-in for the movement toward shared electronic medical records.

This project implemented several health information technology (IT) solutions to improve the treatment of NICU infants and toddlers including portable PDHRs, a system to facilitate electronic sharing of medical records, and a Web-based decision support tool (Preterm Developmental Check). These technologies were used to prevent duplication of tests and increase direct consumer involvement in the health care decisionmaking process, resulting in improved neurological and general health of infants discharged from the NICU. PDHRs created for at-risk infants allow parents to have a portable, up-to-date

health record they can provide to primary care practitioners in the community, thereby ensuring developmental followup and continuity of care.

**Specific Aims**

- Facilitate adoption of an interoperable system for electronic sharing of medical records among agencies. **(Achieved)**
- Develop and test multimedia portable PDHRs on CD/DVD. **(Achieved)**
- Develop and maintain multimedia Web-based resources to serve as a decision support system and for training and information sharing. **(Achieved)**
- Use telemedicine technologies to enhance and expand the use of developmental care practices in Mississippi NICUs. **(Achieved)**

**2009 Activities:** To evaluate the adoption of an interoperable system and concerns related to electronic record sharing, a focus group was conducted with hospital employees who were familiar with the CONNECT project. The focus group explored how hospital personnel, administrators, and physicians perceived the usefulness of an interoperable system. To evaluate the use of portable, personal developmental health records, a focus group with hospital employees who were familiar with the CONNECT project and semi-structured interviews with parents or caregivers of babies who were discharged from the neonatal intensive care unit at Forrest General hospital were conducted. Through the focus group and interviews, researchers were able to investigate how caregivers and hospital personnel, administrators, and physicians perceived the usefulness of personal developmental health records. Caregiver interviews investigated similar questions related to benefits and barriers to the use of personal developmental health records.

The focus group transcript and notes from caregiver interviews were reviewed and analyzed for recurring themes. Data were analyzed following the strategy of grounded theory or constant comparative methodology, beginning with open coding, followed by composing categories of codes and designating the interrelationship of codes. Qualitative Solutions and Research Non-numerical Unstructured Data Indexing Searching and Theorizing software program was used to facilitate data management and to enhance the systematic organization and examination of the data. Data were analyzed by an external evaluator.

**Impact and Findings:** Through the CONNECT project, PDHRs (in the form of a CD) were developed as a particular type of personal health record for a special patient population, babies who were treated in a neonatal intensive care unit. To populate each PDHR, an interoperable system was required among three organizations which allowed data to be queried, selected, and burned to the CD. The benefits discussed for portable personal health records could be reaped for other special populations who undergo intensive specialized treatment and are later released to their community doctors with only limited check-ups from specialists.

Innovative technologies for managing health information could enhance the delivery of health care in Mississippi. There are certain high-risk populations who might benefit from portable personal medical records to increase continuity of care between specialist and primary care physicians. As data analysis from the CONNECT study suggests, portable personal medical records can increase caregivers sense of empowerment by providing them with a medical record to share with their medical providers. Similarly, physicians can provide higher quality care by gaining access to patients' health information thorough a portable medical record. Overall, the enhanced communication between the medical providers of high-risk patients will result in improved medical outcomes.

Despite the promise of technology, certain issues remain with portable health records. PDHRs, such as those developed through the CONNECT project, must be accessible by other health care organizations across the continuum of care. These organizations have valuable information that should be included to

ensure a comprehensive medical history is available in the portable health records. Contributions are not always possible due to technology challenges and limited communication among agencies. Future research could explore how continuity of care can be enhanced by making the PDHR writable by all entities contributing to the health care of the patient. Moreover, future research could investigate what other high-risk populations would benefit from a portable health record.

The idea of a portable health record is particularly important to regions of the country at risk of a natural disaster, such as the Gulf Coast. Health information management departments of hospitals have begun to discuss procedures for sending medical records with patients if they are evacuated to a different medical facility. Many, however, argue those policies would improve medical care even before a storm hits the region. Patients across Mississippi could benefit from portable personal health records, just as neonates in south Mississippi benefited, while the infrastructure of a statewide health information exchange system is established.

**Selected Outputs:**

Grantee's 2009 Final Report.

Atkinson TE, Daniels TH, Prehn J, et al. Monitoring preterm infant motor development: Web-based decision support. Neonatology Today 2009;4(3):5-6.

Garrison S. Connecting patients and healthcare providers to better care. Pointe Innovation Summer 2009: 63-5.

**Grantee's Most Recent Self-Reported Quarterly Status:** No quarterly status update provided.

**Milestones:** No quarterly status update provided.

**Budget:** No quarterly status update provided.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Regional Approach for Transforming Healthcare Quality Through Information Technology in Rural Settings |
| **Principal Investigator:** | Richards, Francis |
| **Organization:** | Weis Center for Research, Geisinger Clinic |
| **Mechanism:** | RFA: HS05-013: Limited Competition for AHRQ Transforming Healthcare Quality through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 016162 |
| **Project Period:** | 09/05 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,499,999 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** To develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Rural Health*

**Summary:** The Regional Approach for Transforming Healthcare Quality through Information Technology in Rural Settings project addresses the relatively low adoption of health information technology (IT) in rural areas due to factors such as cost, culture, technical expertise, and regulatory concerns. As part of this project, Geisinger Health System joined with two local hospitals to develop the Keystone Health Information Exchange (KeyHIE), a regional HIE that provides caregivers with access to region-wide clinical information, including preexisting electronic health records (EHRs) and laboratory results. The implementation of KeyHIE is designed to expand health IT in rural areas, primarily by leveraging existing health IT investment to provide incremental but important functionality that supports wider access to information, communication, and demonstration of the value of health IT.

The goal of the regional HIE implementation is to lead to more effective triage in rural emergency departments, better informed clinicians, and better coordination and higher quality of care. The project included the following main objectives: 1) improve access to existing clinical information by rural health care providers, 2) improve communication between primary care providers and specialists, and 3) lay the foundation for a regional network that supports information sharing among rural hospitals and providers and creates an environment that encourages the adoption of health IT.

KeyHIE and other aspects of the regional HIE were evaluated using the following criteria: 1) number of users accessing the regional exchange system per participating organization, 2) number of patient records accessed through the regional exchange system, and 3) analysis of surveys completed by clinicians to identify system usability concerns and determine whether clinicians are as likely to access regional information for certain patient conditions.

At the end of the grant period, the KeyHIE portal was implemented in emergency departments and clinics. With funding from the Pennsylvania Department of Health in 2007, a regional clinical document repository was implemented and four hospitals were added to the exchange. The KeyHIE organization currently consists of 13 member organizations, including several acute care facilities, primary care practices, home health, and long-term care facilities. More than 360,000 patients have authorized sharing information through the exchange that processes more than four million encounters annually from eight hospitals and 42 clinics. Additional stakeholders have been identified for subsequent broader adoption. The Geisinger Clinic employs five full time employees to operate this exchange on behalf of KeyHIE.

**Specific Aims**

- Improve transparency and consistency across on-file medical records. **(Achieved)**
- Implement KeyHIE, the regional HIE that provides caregivers with access to region-wide clinical information. **(Achieved)**
- Implement Community Lab Interfaces. **(Achieved)**
- Implement Community Portals. **(Achieved)**
- Administer surveys and measure use of the information by clinicians. **(Achieved)**

**2009 Activities:** The KeyHIE Governance team agreed to incorporate the KeyHIE. The application for trademark of "Keystone Health Information Exchange" was approved and as part of the process, the application will be published for review by third parties to allow the expression of opposition to the application.

While not all participating hospitals were able to provide a laboratory interface, most hospitals send laboratory results electronically through the laboratory information system to their EHRs. Health information published via the community portal into the KeyHIE document repository continues to expand and now includes discharge summaries, history and physical documents, and radiology reports. A pilot was completed with two clinics to allow physicians to access KeyHIE within their EHR. Physician office personnel in this pilot were able to see within their EHR that the patient had activity at an out-of-network facility, and by clicking a “regional info” link, they launched the KeyHIE viewer that automatically signed them into the KeyHIE application and selected their patient for viewing. KeyHIE integration was expanded into the Epic Ambulatory Visit Navigator that supports access to regional information from within Geisinger's 42 clinic settings.

The laboratory interface delivered by one hospital vendor in October 2008 did not provide for cancellation messages; however, a planned new document interface supported labs and allowed tests to be canceled, so the decision was made to wait for the new document interface. The interface delivered in April 2009 generated too many errors and could not be used. The vendor agreed to make corrections, but as of July 2009, the revised interface had not been delivered. The laboratory interface for the other hospital was successfully deployed in January 2007 with no issues. Physicians have reported high satisfaction with access to those laboratory results within the Epic EHR.

**Impact and Findings:** The formation of a qualified, trusted, and sustainable governance structure is required to address the highly complex and interrelated requirements of HIE, including recruitment of member health care organizations (HCOs), development of trust within the community by addressing patient privacy and security concerns, phased implementation of value-based technical architecture, ease of use by health care professionals across the continuum of care, and availability of resources to sustain and manage the HIE.

Because of a limited budget and uncertainty of a sustainable business model, it was determined that the HIE would be developed in an incremental approach built on existing technology wherever possible. The incremental approach decreased costs and enabled more rapid deployment of functionality but imposed critical usability and usefulness limitations.

A hybrid of a federated and centralized architectural model facilitated partner buy-in but proved unworkable in the long-term due to scalability (administrative and technical), data accessibility, and cost related issues. The use of an unstructured, high-value clinical document repository (centralized model) provided substantial benefits to clinicians while minimizing privacy and security concerns because the data cannot be mined. As partner trust deepens, more structured information can be added to the data store. For those organizations with greater concerns about the use of their information, a local (federated) repository can also be connected. For the project partners it made sense to start with a more centralized approach to contain costs until a clear value proposition could be identified.

A downside of an incremental approach is an initial absence of a "critical mass" of information that rewards HIE use. The resulting low user satisfaction made it hard for HCOs to justify expenditures for HIE, particularly in the face of multiple competing needs in a difficult financial period. This two-edged sword is likely one reason for the relatively low success rate of deployed HIEs. In the second release, the KeyHIE clinical viewer had the ability to connect clinicians to all the clinical information each facility maintained, yet the fact that information was difficult to obtain made it less desirable.

Managing patient identity within an HIE has significant costs and proved to be one of the larger challenges of the project. Most HCOs use a medical record number (MRN) to identify patients within their facility. Because patients are registered in a variety of settings, the creation of duplicate MRNs is a common occurrence. Typically, health information management staff is employed to review potential duplicate records and correct them by merging duplicates, usually under the original MRN. The need for this service is compounded when MRNs from multiple organizations must be managed within an HIE. Health information management staff must be well trained and well supported through the governing body (policies and procedures) and through the HIE (patient matching functionality) to manage issues with patient linkage and de-duplication.

**Selected Outputs**

Grantee's 2009 Final Report.

Walker JM, Younkin JR. LOINC for the laboratory—a primer for mapping laboratory codes to LOINC. Web-based tutorial presented at the First Northeast U.S. Healthcare Trade Faire and Regional Conference; 2007 May 11; Western PA Health Information Management Systems Society Healthcare: Pittsburgh, PA.

Walker JM, Younkin JR. The right information, right now. Poster presented at the First Northeast U.S. Healthcare Trade Faire and Regional Conference; 2007 May 11; Western PA Health Information Management Systems Society Healthcare: Pittsburgh, PA.

Younkin JR. Cost effective lab interoperability. Poster presented at AHRQ 2007 Annual Conference; 2007 September 27: Agency for Healthcare Research and Quality: Bethesda, MD.

Younkin JR. Health Information Exchanges (HIEs) in the real world, sponsored by Health Information Technology Standards Panel; 2009 July 9.

Younkin JR. KeyHIE: IHE Deployment Case Study. Presentation at the HIE Symposium, HIMSS09 Annual Conference; 2009 April 6: Chicago, IL.

**Grantee's Most Recent Self-Reported Quarterly Status, as of September 2009:** The capabilities of the KeyHIE continue to expand with the addition of new members, the migration of the KeyHIE infrastructure to a new environment, the addition of new document types to the KeyHIE document store, integration with the Epic EHR, and the expansion of the community lab interface to additional facilities.

**Milestones:** All project milestones have been met.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Holomua Project Improving Transitional Care in Hawai'i |
| **Principal Investigator:** | Sakuda, Christine, M.B.A. |
| **Organization:** | Hawaii Primary Care Association |
| **Mechanism:** | RFA: HS05-013: Limited Competition for AHRQ Transforming Healthcare Quality through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 016160 |
| **Project Period:** | 09/05 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,476,200 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Racial and Ethnic Minorities*: African American, Chinese, Filipino, Samoan, Rural Health*

**Summary:** Health care is becoming a shared, community-based responsibility with diverse care providers offering services to a common population of patients. Community health centers (CHCs) serve a vulnerable patient population who are at high-risk during their transition between health care facilities.

The Holomua Project brings together the Hawaii Primary Care Association (HPCA), the Kalihi-Palama Health Center, Kokua Kalihi Valley Health Center, Hawaii Pacific Health, and the Queens Medical Center to share information during transitional care. The project implements both technological and non-technological solutions to the problem of information loss during care transitions. The technological solution develops and implements a Holomoa Master Visit Registry (HMVR) with vendor Sun Microsystems, to share health information from pre-existing electronic health records between systems. The non-technological solutions chart workflow during transitional care, develop and implement policies and procedures for transitional care, and use dialogue and communication to facilitate transitional care. The technological method is a scalable, interoperable solution that takes into account the disparate resources of the partner organizations. The non-technological methods are based on abundant research on the need to attend to human factors to ensure the success of technology-based implementation efforts. The dual (technology-based and non-technology-based) approach helps the Holomua partners achieve the ultimate project goal of increased patient safety, quality, and continuity of care during transitional care for vulnerable populations in Hawaii.

Project evaluation focuses on increasing accuracy and timeliness of shared patient information during transitional care between CHCs and tertiary care hospitals (TCs) and increasing patient or family participation in health care related decisionmaking. Several types of data were collected to determine the impact of the HMVR on patient's coordination of care between the CHCs and the TCs (e.g., HMVR usage, end-user satisfaction surveys, and audit logs). Focus groups were held among health care provider groups, high-risk patient groups, and community members to assess perceptions of health information technology (IT).

A health information exchange (HIE) network was implemented with three facilities, approximately 150 clinician users, 250,000 patients, and 500,000 visits. The project enhances relationships between participating CHCs and TCs through active collaboration and participation of key stakeholders. It increases awareness of the health IT infrastructure, the need for data standardization to provide continuity during care transitions, the need for common transitional care policies and procedures, and once developed, the need for all clinical colleagues to independently adopt these policies and procedures.

**Specific Aims**

- Complete privacy and security contract documents needed for HIE. **(Achieved)**
- Complete production, implementation, and support phases of HIE, known as HMVR. **(Achieved)**
- Increase accuracy and timeliness of shared patient information during transitional care between primary care and TCs. **(Achieved)**
- Increase participation and involvement in decisionmaking by patients or family on health-related matters. **(Achieved)**
- Determine mechanisms by which information resources, information systems, and other IT initiatives and/or networks in Hawaii can best support both short- and long-term implementation activities of the Holomoa Project. **(Achieved)**
- Begin use of HMVR. **(Achieved)**

**2009 Activities:** During 2009, meetings were held with the Hawaii State Department of Health (DOH) and Hawaii Health Information Exchange (HHIE) board members to discuss the Hawaii Health Emergency Surveillance System and how Holomua and DOH can work together. A June 2009 meeting at the HPCA presented the HMVR to the DOH. The HHIE is expected to play a greater role with the HMVR through the development of a statewide regional health information organization (RHIO). HHIE members performed an extensive technical audit of the HMVR and are very active in supporting the next phase of the HMVR.

A sustainability plan is being refined by the Holomua Project members and the HHIE. Phase 2 of the HMVR includes the development of a statewide master patient index, and the inclusion of type-of-lab information from Diagnostic Lab Services and Clinical Labs Hawaii, and type-of-enabling services provided by CHCs. The HHIE is seeking funding to accomplish these tasks and will apply for 501(c)3 non-profit status. Progress is being made with HHIE colleagues as the HHIE is sanctioned by the Governor as the State HIE organization for Hawaii.

**Impact and Findings:** The HMVR is intentionally designed to be scalable and support adaptations to a larger HIE that may include a master physician index, clinical laboratory results, other laboratory results, problem lists, medication reconciliation lists, and allergy information. This information has been identified by physicians as being very valuable in their decisionmaking.

The project team reported the agreement of all partner institutions on a common dataset for HIE. Meetings were held to determine the minimal matching algorithm accepted by all sites. Four data extracts were completed from all three health care systems during the development and testing phase of the HMVR with successful integration and acceptance results. HL7 interfaces were deemed stable and daily batch file updates were scheduled and tested. Successful interoperability with the HMVR occurred with the hospitals providing HL7 feeds and the CHC providing batch feeds.

Each institution has its own perceptions, agenda, and ideas of how to improve transitional care of shared patients during the hand-off process. Some focused on nontechnical solutions and may not be prepared to cover the costs of technical solutions, while others focused on and were prepared to cover the costs (including liability insurance) of more technical solutions. The relationships built with the CHC and TC providers are invaluable for developing ongoing communication and support for this project and, by extension, other health IT projects such as the HHIE.

The current perception of the Holomua Project is that it yields limited data, mostly demographic in nature, offering only one piece of clinical information, the ICD-9 code field (including text of the diagnosis); however, with more education, awareness, and discussion, most users, and certainly the executive committee members, understand that the Holomua Project is merely the beginning of a bigger plan to create a RHIO. While establishing a RHIO remains the long-term goal, the Holomua Project is focused on immediate needs, namely, a record locator database with a master patient index.

The Holomua Project continues to work toward the goal of improving the quality of health care of the vulnerable populations that are shared among the CHCs and TCs of Hawaii. Continual motivation and consistent buy-in from all partner institutions' executive committee members are very important in the continuing success of the project. Furthermore, there is a need for continual efforts to maintain the buy-in from others, including end-users (particularly physicians), institutional IT staff, and privacy and security members.

The need to understand the collaborative dynamics of the participants in transitional care settings is a key finding of the project. Disparate and, at some level, competitive community participants can unify to produce a shared product, the HMVR. Strong partnerships, open communication, and enabling tools can be built among committed health care providers to overcome existing technical challenges and improve transitional care processes for shared patients. Collaborative efforts continue to improve the quality of transitional care during the patient hand-off process.

The HMVR is the "technical" solution to improving continuity of care for shared transitional patients; the Transitional Care Guidelines are the "non-technical" solution. Implementation of this non-technical solution appears to improve dialogue and communication among providers at the CHCs and TCs. Some members of the Healthcare Professionals workgroup have stated there has been "great improvement" and "dramatic changes" in the way that providers communicate with one another.

The project recognizes that IT is only one tool and, therefore, also relies on non-technological solutions to advance improvements in transitional care. This work involves identifying challenges, improving workflow policies and procedures, and using dialogue and communication to facilitate effective transitional care.

**Selected Outputs**

Grantee's 2009 Final Report.

Giesting E, Sakuda CM, Chin BJ, et al. The Holomua Project: Improving Transitional Care and Health Disparities in Hawaii. Poster presentation at the National Association of Community Health Centers Annual Conference; 2009 Aug 23-24; Chicago, IL.

Chin BJ, Sakuda CM, Balaraman V. Improving transitional care in Hawaii: opening communication between community-based and tertiary-care healthcare providers. Journal of Health Information Management 2009;23(1):46-9.

Sakuda CM, Chin BJ, Tse AM. Methodological Challenges and Supportive Factors Contributing to Community-Based Participatory Research in a Western Academic Research Partnership Infrastructure. Poster presentation at the Agency for Healthcare Research and Quality Annual conference; 2008 Sept 8 – 10; Bethesda, MD.

**Grantee's Most Recent Self-Reported Quarterly Status (as of September 2009):** This grant has closed, but progress continues.

**Milestones:** Progress is on track in some respects but not others.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population*

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|---|---|
| **Project Title:** | Health Information Exchange: A Frontier Model |
| **Principal Investigator:** | Shank, Nancy, M.B.A. |
| **Organization:** | Chadron Community Hospital |
| **Mechanism:** | RFA: HS05-013: Limited Competition for AHRQ Transforming Healthcare Quality through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 016143 |
| **Project Period:** | 09/05 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,498,623 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Rural Health*

**Summary:** Particularly in rural areas, health care is provided through an array of geographically dispersed providers, each often having only pieces of the total health care record. When full medical information is unavailable to providers, decisions must either be made with incomplete information or be delayed until the information can be obtained later and at considerable expense.

The Health Information Exchange: A Frontier Model project laid the groundwork for the formation of a health information exchange (HIE) within an established network of critical access hospitals (CAHs), clinics, public health providers, and behavioral health providers across the rural, remote Nebraska Panhandle. The three goals of the project were: 1) to develop an operational entity and incorporate a regional health information organization (RHIO) to support the development of a HIE, 2) to provide standardized training and user capacity development programs throughout the Panhandle, and 3) to implement electronic medical records (EMRs) in CAHs and rural health clinics (RHCs) through a shared process.

Partnering organizations envisioned a regional electronic HIE that would enable providers, patients, and others to share information, communicate orders and results, support evidence-based decisionmaking, streamline public health disease surveillance and reporting, and enable data management for non-clinical purposes (e.g., billing, quality management). The project modeled a solution applicable to small hospitals across the Nation because it would accommodate the wide variability in technological capacity and readiness represented by the partnering organizations. Project partners include all of the area's hospitals, a membership organization of nearly all health and human services providers, and the University of Nebraska.

A multidimensional program evaluation was used to assess the program and included both process and outcome evaluations. The process evaluation was conducted to assess whether the program was being delivered as intended. An outcome evaluation was conducted to determine the program results. The evaluation components were identified early in the project, reviewed, and revised as needed by the leadership team and managers during the course of the grant.

Beginning in 2006, the Regional West Medical Center (RWMC) portal allowed health care providers to access their patients' medical records from RWMC in real time, laying the initial groundwork for Panhandle-wide exchange. The Western Nebraska Health Information Exchange, LLC (WNHIE) was established as the operational entity, and the WNHIE managers are responsible for all implementation and

operational activities. Standardized training and user capacity development programs were delivered to hundreds of Panhandle participants, and progress was made toward implementing EMRs in participating critical access hospitals and rural health clinics. An HIE vendor was selected, and at the grant's conclusion, the managers were negotiating contract terms and identifying funding for the implementation of the network.

**Specific Aims**

- Form an operational entity, and incorporate a RHIO to provide the infrastructure necessary to support regional HIE and common developments in the EMRs. **(Achieved)**
- Provide standardized training and user capacity development programs throughout the Panhandle. **(Achieved)**
- Develop and implement EMRs in CAHs and RHCs through a common process and shared resources in order to enhance local and regional capacity development toward HIE. **(Partially Achieved)**

**2009 Activities:** Issues associated with the partnering strategies of participating vendors as well as financial concerns prompted WNHIE managers to engage WNHIE partners and reevaluate the implementation plans. The partnering organizations decided not to select a vendor until these issues could be rectified. The WNHIE managers continue to meet regularly to explore alternative solutions (such as a pilot project with one of the partnering organizations) to the vendor selection process while considering the financial constraints of the participating organizations.

Data collection continued for the outcomes evaluation via provider interviews, provider surveys, patient surveys, and patient billing data (days in accounts receivable); evaluation of portal use and data analysis is ongoing. At the conclusion of the project, the WNHIE had not installed enough new health information technology (IT) products over the last year to help determine whether health IT is influencing the financial outcomes.

**Impact and Findings:** The project successfully formed a RHIO to support the WNHIE. Key activities included hiring a project manager, retaining legal counsel, formalizing governance structure, developing by-laws, developing regional security policies and standards, developing regional financing plans for HIE development, developing user agreements, developing business plans, and formally incorporating the RHIO.

Ongoing fidelity analyses, through scheduled meetings with agendas by the project manager, WNHIE leadership teams, WNHIE consultants, and the evaluation team, helped keep the project grounded and transparent, and allowed all project stakeholders to have a greater understanding of and participation in the project on a variety of levels. Transparency regarding WNHIE activities and interactions was especially helpful during the HIE vendor selection process, during which stakeholders throughout Western Nebraska participated in several large group process sessions to ensure that all involved parties could contribute to the specific elements of the proposed request for proposal.

The project improved the capacity of participating organizations to adopt health IT (e.g., EMRs) through the provision of education, training, and user capacity development. Key activities included provision of change management workshops for all members of regional and local teams, development and provision of ongoing health information and technology educational sessions for current and future participants, development and provision of user competency training in preparation for EMR adoption, and development and provision of regional training modules for each implementation stage of EMR.

The project improved the capacity of participating health care organizations to implement EMRs by facilitating a local process for formalizing priorities for core functionality for EMRs addressing a variety of areas, ratifying or revising regional priorities for HIE implementation as defined by local clinics and hospitals, providing technical assistance for each CAH and RHC to complete a migration path from

existing to planned technologies, and completing work breakdown structure for EMR and HIE priority areas.

The outcome evaluation impact statements provided the WNHIE organizations with a better understanding of how providers in small CAHs and RHCs view technology. Portal users were surveyed using an Acceptance and Use of Technology Survey, and their overall response was very positive across all criteria including portal usefulness, ability to positively impact productivity, ease of use, adequacy of training, and organizational support. Overall, responses were very positive in terms of obtaining immediate and complete information from the RWMC portal, but respondents speculated that some barriers were so overwhelming that they kept providers from using the portal at all. The significant barriers included limited or inadequate technology or access at the CAHs, and end-user issues where, for a variety of reasons, the providers were hesitant or uncomfortable using this technology.

Not specific to the RWMC portal, providers from CAHs did not feel they were able to access patient information such as discharge instructions, test results, specialist visits, and medication records from other health care facilities. This finding suggests significant potential for the WNHIE HIE when implemented.

The initial groundwork has been laid for a Panhandle-wide exchange, but WNHIE has more work to do in terms of securing a vendor and a sustainable HIE. WNHIE has made great strides in building a good foundation for a HIE in a relatively short amount of time.

**Selected Outputs**

Grantee's 2009 Final Report.

Carrell B. Panhandle Collaborative Exchange. ACCESS, Newsletter of the Nebraska Office of Rural Health Association; May 2008; 51:5.

Woods K. Western Nebraska Health Information Exchange Closer to Reality. ACCESS, Newsletter of the Nebraska Office of Rural Health Association; October 2007; 49:3.

**Grantee's Most Recent Self-Reported Quarterly Status (as of September 2009):** The project was granted a no-cost extension to allow additional time to complete its work to execute all needed aspects of the health IT implementation.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Critical Access Hospital Partnership Health Information Technology Implementation |
| **Principal Investigator:** | Wheeler, Donald A., M.H.A., F.A.C.H.E. |
| **Organization:** | Upper Peninsula Health Care Network |
| **Mechanism:** | RFA: HS05-013: Limited Competition for AHRQ Transforming Healthcare Quality through Information Technology (THQIT) |
| **Grant Number:** | UC1 HS 016152 |
| **Project Period:** | 09/05 – 09/09, Including No-Cost Extension |
| **AHRQ Funding Amount:** | $1,484,167 |
| **Summary Status as of:** | September 2009, Conclusion of Grant |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Rural Health*, Medically Underserved

**Summary:** The Upper Peninsula Region of Michigan contains almost one-third of the land area of Michigan but just three percent of its population. Due to the geography and demographics of the region, access to advanced health care services is difficult. Nearly all of the region's 15 counties have full or partial health provider shortage area (HPSA) designation and full dental HPSA designation, and several are designated medically underserved.

This project designed and deployed a secure health information exchange (HIE) system to enable the communication of patient data among 10 critical access hospitals (CAHs) in Michigan's Upper Peninsula and physicians at Marquette General Hospital—the region's only medical center. The Critical Access Hospital Partnership Health Information Technology Implementation project created a Web-based, portal/repository application that allows selected clinical information to be accessed by authorized physicians and other health care providers to enhance patient care delivery and quality reporting. The network seeks to improve patient safety and quality of care through the regional planning, development, and implementation of health information technologies (IT).

The HIE is designed to improve patient safety and efficiency by: reducing duplicate tests or other exams when patients are transferred from one provider to another; improving inpatient transfers between the CAHs and Marquette General; allowing clinicians to identify which medications a patient is taking when he or she is transferred between emergency departments; and eliminating the need to send a courier service between hospitals to transport laboratory test results, medical records, x-rays, and other important patient data. Unfortunately, due to unanticipated delays in the implementation of the HIE, collection of meaningful evaluation data could not be completed within the project timeframe.

The project successfully developed a patient identification system to accurately identify patients and permit authorized physicians and other staff access to patient records; established database interoperability of disparate systems by developing a system to map received data to each of the selected site's electronic health record (EHR) system; developed a medical documents exchange system among hospitals within the federated domain; and developed a federated security architecture for accessing, sharing, and transferring various types of medical data.

**Specific Aims**

- Monitor health IT installations at the project's partner hospitals in Michigan. **(Achieved)**
- Plan, test, and integrate local health IT to the regional HIE. **(Achieved)**
- Implement regional HIE systems, central data repository, and services. **(Achieved)**
- Evaluate the success of the overall project implementation. **(Achieved)**
- Evaluate the impact of technology-supported patient data exchanges and reporting on patient care. **(Ongoing*)**

** This aim was not completed prior to conclusion of the funding period (September 2009) but is still targeted for completion.*

**2009 Activities:** The project team designed and implemented a replacement solution for the HIE given the inability of the original HIE developer to expand the Marquette HIE system (UP-Care) to include other EHR systems during the first 3 years of the project. A collaboration with Michigan Tech University (MTU) salvaged the initial Network's efforts by developing a new HIE solution. The bulk of activities in 2009 involved testing four pilot site servers at MTU with the new HIE architecture; however, the time necessary to develop the new HIE exceeded the project's ability to fully implement and evaluate the solution at the four pilot site hospitals.

**Impact and Findings:** During the 4-year implementation phase of the project, the scope of the project was expanded to include 13 of the 14 hospitals in the Upper Peninsula Health Care Network. Eleven of these rural community hospitals acquired and installed EHR systems within their facilities. This greatly enhanced the network's capacity to create the necessary electronic patient records to be shared between providers in the HIE.

Although the HIE system successfully operates among the four pilot site servers at MTU, there was insufficient time to deploy the HIE servers at the pilot sites and test the system using actual patient identifiers and clinical data. This prevented the project from comparing pre-installation user survey data with post-installation surveys as required to assess the impacts of the HIE solution at the local level.

A significant issue faced throughout the project was the creation of interfaces between the central HIE and each of the four separate EHR vendor systems. Each site tested different clinical software, which made compatibility difficult. To achieve connection, several hospitals needed to upgrade their EHRs to transmit data with the HIE.

Lack of data reporting consistency among hospitals was also an issue. To overcome these data compatibility issues, project leaders established a standards committee with broad representation from the participating organizations. The group set standards for data consistency using standards such as HL7, LOINC, and SNOMED for transmitting information. Recent work at the National level should greatly reduce this barrier in the future.

In addition to technical barriers, project leaders had to contend with physicians' reluctance to change the way they report data to the HIE. To address this issue, project leaders provided technical training and continuing education for physicians. Project staff also surveyed doctors thought to be the most reluctant to embrace the project. The survey gauged their potential concerns and fears about the project. Staff then worked with those doctors to address their concerns and help them get comfortable with the software.

Although the network has yet to become fully operational and has not achieved all its original objectives, the practices used in the planning, preparation, modification, and implementation of this project were effective and should prove to be very applicable, helpful, and relevant to other rural areas seeking to develop a regional HIE.

**Selected Outputs**

Grantee's 2009 Final Report.

Hembroff GC, Muftic S. Secure Healthcare Information Exchange for Local Domains. Published as part of the 3rd International Conference on Pervasive Computing Technologies for Healthcare; April 2009; London, UK.

Hembroff GC, Wheeler D., Boyle D. Design and Implementation of a Centralized Electronic Medical Records Consortium in a Rural Area of Michigan. Published as part of the 9th International Conference on e-Health Networking, Application & Services (Healthcom 2007); June 2007; Taipei, Taiwan.

**Grantee's Most Recent Self-Reported Quarterly Status (as of September 2009):** Although the HIE system successfully operates among the four pilot site servers at MTU, there was insufficient time to deploy the HIE servers at the pilot sites and to test the system using actual patient identifiers and clinical data. The project was therefore unable to compare pre-installation user survey data with post-installation surveys as required to assess the impacts of the HIE solution at the local level.

**Milestones:** Did not report.

**Budget:** Did not report.

**AHRQ Priority Population*

## Table 12: Grant-Specific Summaries (Health Information Technology PAs)

| Small Research Grant to Improve Health Care Quality Through Health Information Technology (IT) (R03) | | | | |
|---|---|---|---|---|
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| No | Fleming, Neil Stewart, MA, PhD, CQE | Impact of Health Information Technology on Primary Care Workflow and Financial Measures | HS08-268 | Page 279 |
| No | Vawdrey, David Kent, MS, PhD | Electronic Medication Management | HS08-268 | Page 281 |
| No | Zhou, Li, MS, PhD | Improving Outpatient Medication Lists Using Temporal Reasoning and Clinical Texts | HS08-268 | Page 283 |
| **Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (IT) (R21)** | | | | |
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| No | Eaton, Charles B., MD, DABFP, MS | eHealth BP Control Program | HS08-269 | Page 285 |
| No | Kearns, William D., MA, PhD | Evaluation and Integration of an Automatic Fall Prediction System | HS08-269 | Page 288 |
| No | Olson, Ardis L., MD | Healthy Teens TXT ME: Information Technology to Change Teen Health Risk Behaviors | HS08-269 | Page 290 |
| No | Poynton, Mollie Rebecca, MSN, PhD | Supporting Continuity of Care for Poisonings with Electronic Information Exchange | HS08-269 | Page 292 |
| No | Williams, Laurie Ann, PhD | Use of Affordable Open Source Systems by Rural and Small-Practice Health Professional | HS08-269 | Page 294 |
| No | Ziemer, David C., MD, MPH | Computer Assisted Medication and Patient Information Interface (CAMPII) | HS08-269 | Page 296 |
| **Utilizing Health Information Technology (IT) to Improve Health Care Quality (R18)** | | | | |
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| No | Arora, Sanjeev, MD | Project ECHO: Hepatitis C Ambulatory Care Quality Improvement in New Mexico through Health Information Technology | HS08-270 | Page 298 |
| No | Atlas, Steven J., MD | Technology for Optimizing Population Care in a Resource-Limited Environment | HS08-270 | Page 300 |
| No | Green, Lee A., MD, MPH | Information Technology Implementation by Cognitive Engineering of Organizational Routines | HS08-270 | Page 302 |
| No | Hazlehurst, Brian L., MA, PhD | Automating Assessment of Obesity Care Quality | HS08-270 | Page 304 |

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|---|---|---|---|---|
| No | Johnson, Kevin B., MD, MS | My MediHealth: A Paradigm for Children-Centered Medication Management | HS08-270 | Page 306 |
| No | McTigue, Kathleen M., MS, MD, MPH | Online Counseling to Enable Lifestyle-Focused Obesity Treatment in Primary Care | HS08-270 | Page 308 |
| No | Parsons, Amanda, MSc, MD | Bringing High Performing Systems to Small Practices | HS08-270 | Page 310 |
| No | Roberts, Mark Stenius, MPP, MD | Self Management & Reminders with Technology: SMART Appraisal of an Integrated Personal Health Record | HS08-270 | Page 312 |
| No | Sequist, Thomas D., MD, MPH | A Risk Based Approach to Improving Management of Chronic Kidney Disease | HS08-270 | Page 314 |
| No | Smith, Kenneth J., MD, MS | Virtual Continuity and its Impact on Complex Hospitalized Patients' Care | HS08-270 | Page 316 |
| No | Stockwell, Melissa S., MD, MPH | Flu Alert: Influenza Vaccine Alerts for Providers in the Electronic Health Record | HS08-270 | Page 318 |
| No | Weiner, Michael, MD | Medication Reconciliation to Improve Quality of Transitional Care | HS08-270 | Page 320 |

| | |
|---|---|
| **Project Title:** | Impact of Health Information Technology on Primary Care Workflow and Financial Measures |
| **Principal Investigator:** | Fleming, Neil Stewart, M.A., Ph.D., C.Q.E. |
| **Organization:** | Baylor Research Institute |
| **Mechanism:** | PAR: HS08-268: Small Research Grant to Improve Health Care Quality through Health Information Technology (R03) |
| **Grant Number:** | R03 HS 018220 |
| **Project Period:** | 10/09 – 09/10 |
| **AHRQ Funded Amount:** | $99,955 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Pediatric*

**Summary:** Little is known about the impact of "off-the-shelf" (i.e., commercially-available) electronic health record (EHR) systems on primary care workflow and financial measures, or about the financial and non-financial implementation and maintenance costs of these systems. Given the goal of universal EHR use in the United States within 5 years, such knowledge is of immediate and critical importance for the multiple stakeholders in the health care delivery arena.

The HealthTexas Provider Network (HTPN), a large fee-for-service ambulatory care physician network affiliated with an integrated health care delivery system in North Texas, began a staggered 3.5 year roll-out of Centricity, an "off-the-shelf," Certification Commission for Health Information Technology-certified ambulatory EHR system in mid-2006. The investigators are examining the impact of the implementation and maintenance of the ambulatory EHR on 33 primary care practices' workflow and financial measures prospectively, using billing and administrative data. Investigators are also examining the financial resources consumed and the non-financial time and effort costs of the HTPN implementation team and practice physicians, nurses, and office staff during the planning, workflow re-engineering, and training stages of implementation. Due to the staggering of the EHR implementation, comparisons will be both cross-sectional (between EHR and non-EHR practices at set points) and longitudinal (between measures collected at the same practice pre- and post-EHR implementation). The study will contribute to knowledge regarding frequently-cited perceived barriers to ambulatory EHR adoption, including uncertainty regarding financial and non-financial costs of implementation, loss of productivity during implementation, interference with workflow, and return on investment.

Reducing uncertainty in these areas should inform real-world health information technology (IT) implementation decisions and stimulate more comprehensive health IT implementation research in ambulatory care settings. Understanding the workflow and financial impacts, as well as financial and non-financial costs related to implementation of health IT, is important for stakeholders at all stages in the ambulatory EHR decision process, including adoption and implementation.

**Specific Aims**

- Estimate the effect of the EHR on workflow outcome measures. **(Ongoing)**
- Estimate the effect of the EHR on financial measures. **(Ongoing)**

- Quantify financial and non-financial costs of implementation and maintenance, providing information regarding perceived barriers and facilitators to adoption and implementation of the EHR. **(Ongoing)**

**2009 Activities:** The investigators made great progress in the first few months of this one-year project, including the preparation of the dataset for their first two aims; analyzing the impact of Centricity on workflow and financial measures. They are currently collecting administrative data containing the covariates and outcome variables for the statistical models to measure the financial and workflow impact associated with implementation and maintenance. To quantify this impact, they began discussions with appropriate operational leadership to understand and quantify the resources consumed and time and effort for implementation and maintenance from the two perspectives: that of HTPN's corporate implementation team; and that of the individual practice physicians, nurses, and office staff during the planning, workflow reengineering, and training stages of implementation. Additionally, fixed and variable implementation costs that consider the overall practice and number of physicians and staff are being quantified. Investigators have also been working to finalize the HTPN corporate organizational chart related to the EHR implementation, in order to elucidate and describe the mix of skill sets and effort required under this real-world scenario.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any reported outputs.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** This project began in October 2009 and is currently on track.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Electronic Medication Management |
| **Principal Investigator:** | Vawdrey, David Kent, M.S., Ph.D. |
| **Organization:** | Columbia University Health Sciences |
| **Mechanism:** | PAR: HS08-268: Small Research Grant to Improve Health Care Quality through Health Information Technology (R03) |
| **Grant Number:** | R03 HS 018250 |
| **Project Period:** | 12/09 – 11/10 |
| **AHRQ Funded Amount:** | $99,998 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Knowledge Creation

**Target Population:** Inner City*, Low SES/Low Income*, Medicaid, Medically Underserved, Racial/Ethnic Minorities*: Hispanic

**Summary:** When patients transfer to new health care settings, there is an increased risk of medication errors due to incomplete or inaccurate medication information. While most changes to a patient's medication regimen are purposeful and documented by the care provider, unintentional and potentially harmful medication discrepancies may exist. To decrease such errors, The Joint Commission in 2006 mandated medication reconciliation for each care transition where medication orders are changed or rewritten. Reconciliation compares a patient's new medication orders with all medications the patient is currently receiving.

In 2008, the New York-Presbyterian Healthcare System (NYP) instituted a structured, electronic process designed to improve medication reconciliation as patients transitioned between ambulatory-to-hospital and hospital-to-ambulatory care settings. Before the adoption of this intervention, pre-admission medications and discharge medications were kept as free-form text in the patient's electronic health record (EHR). After adoption, medications were documented using a structured electronic medication list shared across NYP's ambulatory and inpatient EHRs (including the ambulatory and inpatient Certification Commission for Health Information Technology-certified Eclipsys EHRs and an inpatient, legacy, Web-based clinical information system known as WebCIS).

This study is evaluating the effectiveness of the electronic medication reconciliation intervention by comparing outcomes pre- and post-implementation in six community-based primary care clinics and two inpatient facilities. Specifically, the study is evaluating: 1) the effects on provider workflow during medication reconciliation, 2) the evolution of the completeness of the ambulatory and inpatient medication lists, and 3) the possible decrease in the number of clinically important unintentional medication discrepancies. These results will yield knowledge on whether the adoption of a fully electronic medication reconciliation process is associated with a decrease in the rate of potentially harmful, unintentional medication discrepancies across care settings.

**Specific Aims**

- Assess differences in medication management workflow in two provider cohorts before and after the adoption of electronic medication reconciliation. **(Ongoing)**
- Assess differences in the completeness of documented medication lists in two provider cohorts before and after the adoption of electronic medication reconciliation. **(Upcoming)**

- Assess differences in the rate of clinically important medication discrepancies in two provider cohorts before and after the adoption of electronic medication reconciliation. **(Upcoming)**

**2009 Activities:** Project startup included the development of a computer algorithm to identify patients who have transitioned across multiple layers of care; i.e., a clinic visit followed by an inpatient stay followed by another clinic visit. Using this algorithm, Dr. Vawdrey identified 6,079 patients who had this utilization pattern during the 2-year study period of October 2007 through October 2009. Ambulatory visits that do not have an associated, electronically available medication list will be identified and excluded from the study. Activities in 2010 will include an electronic chart review by clinical experts to identify and document the completeness of the medication list at all transition points (clinic visit, hospital admission, hospital discharge, and followup clinic visits) and will identify the medication discrepancies that exist between the ambulatory and inpatient medication lists.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any reported outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** This project began in October 2009 and is currently on track.

**Milestones:** Progress is completely on track.

**Budget:** Spending roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Improving Outpatient Medication Lists Using Temporal Reasoning and Clinical Texts |
| **Principal Investigator:** | Zhou, Li, M.D., Ph.D. |
| **Organization:** | Brigham and Women's Hospital |
| **Mechanism:** | PAR: HS08-268: Small Research Grant to Improve Health Care Quality Through Health Information Technology (R03) |
| **Grant Number:** | R03 HS 018288 |
| **Project Period:** | 10/09 – 09/11 |
| **AHRQ Funded Amount:** | $99,949 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Knowledge Creation

**Target Population:** General

**Summary:** Accurate and complete medication information at the point of care is crucial for delivery of high-quality care and prevention of adverse events. Medication reconciliation—the process of comparing a patient's new medication orders with all medications the patient is currently taking—has been mandated by the Joint Commission on Accreditation of Healthcare Organizations. Most reconciliation is done by aggregating structured data from electronic medical records (EMRs) and computerized physician order entry systems into a reconciled medication list. However, critical information such as a change in medication regimen is often in non-structured narrative sources, such as clinical notes and free-text comments. This information must also be reconciled to document the patient's complete and accurate medication record.

Structured data in a standard, predictable form can be easily processed by a computer, but narrative data that do not have a well-defined structure pose challenges. Natural language processing (NLP) applications have been developed to identify and extract medical information from non-structured sources. ("Natural language processing" is any system that manipulates free-form text or speech.) However, few projects have examined the use of NLP as a method for improving medication reconciliation.

This study, started in October 2009, is investigating the feasibility of extracting medication information from non-structured electronic clinical sources within the Longitudinal Medical Record system, the Certification Commission for Health Information Technology-certified ambulatory-care electronic medical record at Partners HealthCare System. The extracted information can be subsequently used by clinicians at the point of care, thereby reducing prescription and administrative errors. In an effort to improve the correctness and completeness of medication lists, the project is piloting and testing the use of NLP and temporal-reasoning applications (which identify the timing of medication use) to automatically extract and encode medication and associated temporal information from clinical texts, and chronologically order and classify medications. The study will measure the feasibility and efficiency of these methods and identify tools for improving medication reconciliation.

**Specific Aims**

- Extract and encode medication information from clinical texts available in an ambulatory electronic medical record system. **(Ongoing)**

- Apply temporal information (a controlled terminology, domain knowledge, and linguistic knowledge) to develop a mechanism to represent the timing of medication use, detect the changes, and then to organize medications in a chronological order and classify them into appropriate groups. **(Upcoming)**
- Measure the feasibility and efficiency of the proposed methods and tools for improving the process of medication reconciliation. **(Upcoming)**

**2009 Activities:** 2009 project activities involved the initial project startup, including submitting and attaining institutional review board approval and hiring personnel. In addition, the team identified and sampled patients with chronic diseases in the EMR system who had at least one clinic note per year in the two-year study timeframe. The chronic diseases considered in this study include Diabetes, Hypertension, Congestive Heart Failure (CHF), Chronic Obstructive Pulmonary Disease (COPD), and Coronary Artery Disease (CAD). Two types of data were extracted for these patients: clinical notes and patients' medication information from their structured medication list.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any reported outputs.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** This project began in October 2009 and is currently on track.

**Milestones:** Progress is completely on track.

**Budget:** Spending roughly on target.

| | |
|---|---|
| **Project Title:** | eHealth BP Control Program |
| **Project Investigator:** | Eaton, Charles B., M.D., D.A.B.F.P., M.S. |
| **Organization:** | Memorial Hospital of Rhode Island |
| **Mechanism:** | RFA: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (R21) |
| **Grant Number:** | R21 HS 018238 |
| **Project Period:** | 12/09 – 11/11 |
| **AHRQ Funding Amount:** | $299,967 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Hypertension, Low Literacy, Medically Underserved, Safety Net

**Summary:** Memorial Hospital of Rhode Island has designed a two-phase study of the feasibility and acceptability of an e-health model for the treatment of hypertension. The study, the eHealth Blood Pressure (BP) Control Program, integrates electronic medical records (EMRs) and personal health records (PHRs) with monitoring devices through a Web portal that connects patients to their medical team. The goal of the project is to obtain the necessary pilot data for a randomized practical clinical trial of the eHealth BP Control Program.

With patient education, collaborative self-management support, and care coordination, the program strives to increase medication adherence, reduce clinical inertia, and improve patients' BP control. This will provide the pilot data needed for a randomized practical clinical trial of the eHealth BP Control Program. Phase 1 of the study will develop and field-test a PHR, a home BP monitoring (HBPM) device integrated into the PHR, a BP self-management Web portal, and a trained patient navigator (i.e., a community health worker). During Phase 2, the team will enroll 30 patients with uncontrolled BP. For the first 3 months of Phase 2, all 30 patients will only use a single component: HBPM. After 3 months the participants will be randomized to either the three-component program (HBPM + PHR + Web portal) or the four-component program (HBPM + PHR + Web portal + patient navigator).

**Specific Aims**

- Develop and refine a Web-based patient-centered decision support system for BP control using an iterative, user-centered design process so that it meets standards of feasibility and acceptability for patient navigators and participants. **(Ongoing)**
- Determine the appropriate and acceptable patient motivators (i.e., engaging content, social media, and incentives) leading to use of the eHealth BP control program (BP device, PHR, Web portal, patient navigator). **(Upcoming)**
- Develop and begin to field-test a patient navigator training program, a manual of procedures for the patient navigators, and a measure of patient navigator adherence to the training manual. **(Ongoing)**
- Test the functionality, security, and fidelity of the secure data exchange between the HBPM device, PHR, Web-based portal, and EMR interface engine in both test and live (enterprise) environments. **(Ongoing)**
- Determine the degree of adoption by participants of the four intervention components (HBPM, PHR, Web portal, patient navigator). **(Upcoming)**

- Estimate the effect sizes of the four-component program relative to the three-component program with regard to patient activation, self-care activities, medication adherence, reduced clinical inertia, and improved BP control with implementation of the e-Health BP control program. **(Upcoming)**

**2009 Activities:** The lead researchers have nearly completed a training and reference manual for patient navigators on BP care management. Key points include the appropriate interpretation of home BP monitoring results and the need to develop practice-wide decision rules on making timely changes in dosage, frequency of HBPM, or the addition of new BP medications to reduce clinical inertia. A document for adherence measures has also been drafted to provide guidance on what is an "acceptable" level of adherence for the procedures.

Biweekly meetings address project roles and communication between the participants, patient navigator, team nurse, and providers. Descriptions of preliminary roles and changes in the office chain of communication for key personnel are being incorporated into the procedure manual and academic detailing.

A functional specifications document for the Web-BP Module has been submitted to Abacus Technologies for incorporation into their Good Health Gateway Web portal platform that already delivers evidenced-based, behavior change programs for a variety of conditions including diabetes, depression, and BP management. For this study, the Good Health Gateway BP management module will be customized to provide collaborative self-management support to patients and a provider dashboard that patient navigators can use to assist patients in adhering to their BP monitoring schedule and treatment regimen. Presently the research team is evaluating and revising the prototype.

In collaboration with Abacus Management Technologies, the team successfully tested the connectivity between a commercial BP monitoring device and the PHR, allowing a BP reading to be taken and then uploaded through a computer. Abacus demonstrated PHR connectivity to a Web-based module by showing interoperability between the PHR repository and the Good Health Gateway Web portal. The team successfully read both hand-entered and automatically uploaded BP reading values from the PHR, utilized them in the Web portal, and wrote BP values back to the PHR repository. The next steps are to develop programmatic algorithms to interpret a patient's home BP readings and provide feedback via the Web portal. Work on making the transition to a production environment with full integration with the Good Health Gateway Web platform is underway. EMR integration will be provided through the Patient Navigator Interface, used to retrieve BP values of participants in a streamlined fashion to facilitate entry into the EMR to be shared with the clinical team. A template has been created within the EMR to document Patient Navigator encounters.

A dataset linking clinical and questionnaire visit data and socio-demographics is being reviewed and will be implemented with a unique ID for each patient. For chart audits, an MS Access chart audit database will be configured and installed on the laptops by the data manager. A "data dictionary" for all variables of interest from the patients' medical chart is also being reviewed. The data extracted from the charts will be limited to only the designated variables. Patient data will be saved, checked, and cleaned by the data management staff.

**Preliminary Impact and Findings:** There are no findings to date.

**Selected Outputs**

No outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Progress is on track for this project. The research team has drafted a patient navigator procedure manual describing BP care

management that will train and be used by the patient navigators. A functional specifications document for the Web-BP Module has been submitted for implementation into the Web portal platform. The team has successfully tested the connectivity between a commercial BP monitoring device and the PHR, allowing a BP reading to be taken and then uploaded through a computer.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

| | |
|---|---|
| **Project Title:** | Evaluation and Integration of an Automatic Fall Prediction System |
| **Principal Investigator:** | Kearns, William D., M.A., Ph.D. |
| **Organization:** | University of South Florida |
| **Mechanism:** | PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (R21) |
| **Grant Number:** | R21 HS 018205 |
| **Project Period:** | 12/09 – 11/11 |
| **AHRQ Funded Amount:** | $299,452 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Elderly*

**Summary:** Falls among the elderly are a significant cause of morbidity, mortality, and increased health care costs at the end of life. Reducing the occurrence of falls can also greatly improve patient quality of life. This study seeks to develop a means to relate health and medication changes to falls and to provide measures to predict the risk of falls for elderly residents in assisted living facilities (ALF).

This project, initiated in December 2009, will recruit 50 volunteer residents from two ALF facilities. Baseline standardized gait and balance (SGB) assessments will be completed. The velocity, direction, and duration of the volunteer's daytime movements in common areas of congregate living settings will be tracked for 12 months by a movement tracking system (MTS) via radio frequency identification devices. Prospective and retrospective fall histories will be evaluated to determine the relationship of SGB and a measure of movement variability called "tortuosity," derived from MTS data.

During the study interval, a complete evaluation of participant medications will be conducted, with particular emphasis on identifying and recording the number of psychoactive and nonpsychoactive medications. Each participant's activities of daily living (ADL) status will be measured at the time of enrollment, along with 12-month retrospective fall data from the ALF's fall incident records. To the extent possible, information about the causes of falls will be obtained from ALF nursing staff using a fall assessment scale developed at the James A. Haley Veterans Administration Veteran's Integrated Service Network (VISN8) Patient Safety Center of Inquiry. This instrument will also be used to collect the 12-month prospective fall data. Medications, ADLs, and residents' history of falls will be treated as covariates in the regression analysis predicting fractal dimension (Fractal D) and prospective falls.

The study team hypothesizes that SGB varies significantly with MTS tortuosity measures, allowing tortuosity to be a proxy for SGB assessments while yielding improved fall predictions. Further, tortuosity changes will predict falls, and changes occurring around the time of the fall are more predictive than changes that are more temporally distant.

**Specific Aims**

- Evaluate the relationship between conventional fall risk assessment measures using performance on SGB tests and Fractal D movement tortuosity measures obtained through the MTS. **(Ongoing)**
- Evaluate tortuosity changes preceding a fall. **(Ongoing)**
- Gather requirements for a software module to perform online fall risk assessment in community-based settings. **(Ongoing)**

**2009 Activities:** Project staff was hired and a database to hold medication history and fall history for each participant was constructed. The fractal dimension program was improved to provide near real-time functionality. Institutional review board (IRB) materials were submitted and IRB approval was granted.

The research assistant was trained in recruitment, data collection protocols, and database creation and alteration procedures. This will allow in-the-field modification of data structures when circumstances warrant and approval is given by the principal investigator.

Recruitment materials were finalized. The MTS apparatus in the two research sites was upgraded to the latest standards of software and firmware to enhance reliability. Subject identification and recruitment was started at one site, and subject identification was begun at the second research site.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs:**

Kearns W, Fozard JL, Nams VO, et al. High locomotor variability in free movements of assisted living facility residents predicts dementia. Presentation scheduled for February 28, 2010 at the Gait and Movement Disorders Congress 2010 Conference in Washington, DC.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Significant progress has been made and the project is ahead of schedule.

**Milestones:** Progress is completely on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Healthy Teens TXT ME: Information Technology to Change Teen Health Risk Behaviors |
| **Principal Investigator:** | Olson, Ardis L., M.D. |
| **Organization:** | Dartmouth College |
| **Mechanism:** | PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (R21) |
| **Grant Number:** | R21 HS 018214 |
| **Project Period:** | 11/09 – 10/11 |
| **AHRQ Funded Amount:** | $299,978 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Teenagers

**Summary:** Adolescence is a time of rapid and complex change during which health risks stem more from the behavioral than the biomedical. While many behaviors are experimental, habits and coping patterns developed during this developmental stage may continue into adulthood. Research has shown that school based-interventions for major risks are often nominally effective or ineffective. Interventions that use motivational interviewing and technology to enhance screening and counseling of adolescents are costly, intensive, and require additional time, staff, or computer resources that are not generally available to most primary care providers. This project seeks to utilize information technology (IT) to develop an integrated screening, counseling, and post-visit support system to change two key adolescent health risks: limited physical activity and tobacco use.

The project team will program and test the Healthy Teens personal digital assistant (PDA) screening program software that will support effective clinician counseling about exercise uptake and tobacco cessation. In addition, the software will be programmed to produce a summary report that will transfer data into patient electronic medical records for future reference. A system of IT-based post-health visit supports will be created to help teens increase exercise and decrease tobacco use. The first support will be tailored cell phone text messaging provided to teenagers who indicate that they are interested in behavior change. A Healthy Teens TXT ME (TXT ME) social network site will be established for project participants to share experiences and support their change efforts. Text messages sent to teens will inform them about developments and new links on the network site.

Two feasibility pilots of the TXT ME program will be implemented with post-visit supports in four primary care practices over 3 months. Clinicians and office staff assessment will determine the utility of and any barriers encountered with the enhanced office system. Two cohorts (per feasibility pilot) of adolescents who want to increase physical exercise at the visit will be recruited. The first cohort will be the control and its role limited to survey completion. The second cohort will receive the post-visit supports (for tobacco or exercise) via cell phone text messaging and will have access to the social network site. Teen acceptability and short-term-change efforts will be assessed. Tobacco use messages will be developed during year 2 for later delivery.

**Specific Aims**

- Enhance the TXT ME PDA-based health risk screening tool with clinician prompts to support effective counseling for exercise uptake and tobacco cessation from evidence-based literature and existing public health and patient counseling programs. **(Ongoing)**
- Develop the format, message delivery algorithm, and technological processes to link PDA-based teen health screening data from the primary care visit to tailored followup health behavior change text messages delivered by cell phone. **(Ongoing)**
- Develop the prototype of adolescent health behavior change support via a social network Web site that links adolescents in the project and provides access to Web-based resources. **(Ongoing)**
- Conduct a small feasibility trial of the exercise component of the TXT ME model that will use PDA technology to screen adolescents who are interested in changing exercise patterns and prompt clinicians to provide reinforcement via post-visit text messaging to help teens make these changes. Evaluation will include short-term outcomes related to text message design and health behavior outcomes. **(Ongoing)**

**2009 Activities:** The study staff explored different models of support for exercise, investigated smoking cessation Web sites for adolescents, and sought input from the target population. Message development included a literature review and key informant data gathering about motivators to change exercise habits. Messages were developed to help teens advance through the following phases: priming to take action, initiating, relapse, and maintenance. Six teen project advisors have been recruited. Develop the prototype of adolescent health behavior change support via an Internet social network site where adolescents will be linked to others in the project trying to change a specific health behavior (exercise or tobacco) and access Web-based resources.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project began the last quarter of 2009 and is in the initial startup phase.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

| | |
|---|---|
| **Project Title:** | Supporting Continuity of Care for Poisonings with Electronic Information Exchange |
| **Principal Investigator:** | Poynton, Mollie Rebecca, M.S.N., Ph.D. |
| **Organization:** | University of Utah |
| **Mechanism:** | PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (R21) |
| **Grant Number:** | R21 HS 018773 |
| **Project Period:** | 12/09 – 11/11 |
| **AHRQ Funded Amount:** | $299,078 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** General

**Summary:** Exchange of information between poison control centers (PCCs) and emergency departments (EDs) is almost entirely conducted via telephone at present. Verbal communication is a frequent source of medical error, especially in EDs, where providers experience heavy communication loads and frequent interruption. Reliance on verbal communication increases the potential for data loss, delayed time to treatment, and medical error. The electronic exchange of information can reduce time to treatment and medical errors, improve continuity of care for poisonings, facilitate communication and the availability of data and information to clinicians at the point of care, and ensure timely followup.

This project will describe the data requirements for electronic information exchange between PCCs and EDs to support individual patient care and care transitions. It will also describe current information exchange scenarios and identify important clinical, operational, and legal considerations. Specifically, the project team will use multiple approaches, including interviews with clinicians and stakeholders, document review, analysis of recorded PCC calls, storyboarding, and domain-analysis modeling. In addition, a four-round Delphi study will determine consensus among National experts on significant clinical, operational, and legal considerations.

The results of this study will provide concrete guidance for efficient research and development on PCC-ED information exchange, including information technology solutions, standards adoption or development, and policy. Long-term implications include the study of outcomes, quality improvement innovations, and the potential for computerized decision support.

**Specific Aims**

- Describe information requirements for electronic information exchange between PCCs and EDs. **(Upcoming)**
- Describe current data/information exchange scenarios between a regional PCC and an ED. **(Upcoming)**
- Identify salient clinical, operational, and legal considerations related to electronic exchange of data and information between PCCs and EDs. **(Upcoming)**

**2009 Activities:** Funding for this project was awarded in early 2010.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** No activities yet reported.

**Milestones:** No activities yet reported.

**Budget:** No activities yet reported.

| | |
|---|---|
| **Project Title:** | Use of Affordable Open Source Systems by Rural and Small-Practice Health Professionals |
| **Project Investigator:** | Williams, Laurie Ann, Ph.D. |
| **Organization:** | North Carolina State University, Raleigh |
| **Mechanism:** | RFA: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (R21) |
| **Grant Number:** | R21 HS 018218 |
| **Project Period:** | 9/09 – 9/11 |
| **AHRQ Funding Amount:** | $299,078 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Rural Health*

**Summary:** National efforts are focused on improving medical quality and reducing costs by implementing standardized electronic medical records (EMRs), which enable secure exchange of health information between different systems. However, rural health care providers and those with small practices may not have the financial resources or expertise to purchase and maintain the expensive hardware and software applications that are necessary to participate in this effort.

This project seeks to meet the EMR application needs of rural and small-practice ambulatory health care providers throughout the United States by using open-source EMR applications that are reliable, secure, confidential, standards/regulations-based, and able to be integrated with other health care systems. Hardware and software installation, usage, and maintenance costs will be optimized to maintain affordability.

This project's research team is conducting telephone interviews to assess the needs of rural/small practice doctors and is making detailed assessments of promising open-source EMR applications. The research team will then develop and disseminate a process for health care information technology (IT) professionals to evaluate existing open-source EMR applications and promote best practices for developing new or enhancing existing EMR applications. Ultimately, the team will implement servers using open-source EMR applications that enable rural and small medical practices to obtain the benefits of EMR technology.

**Specific Aims**

- Conduct an assessment of the needs of rural/small practice doctors with regard to the capabilities, strengths, and limitations of existing open-source EMR applications. **(Ongoing)**
- Identify and evaluate promising open-source EMR applications. **(Ongoing)**
- Develop and disseminate a process for evaluating the functionality, trustworthiness, interoperability, performance, compliance, and affordability of existing open source EMR applications. **(Upcoming)**
- Advance software engineers' understanding of best practices for developing new or enhancing existing EMR applications. **(Upcoming)**
- Implement servers using open source EMR applications that enable rural and small medical practices to obtain the benefits of EMR technology as they run their offices and securely store, utilize, and share patient data. **(Upcoming)**

**2009 Activities:** The research team developed a physician interview instrument for which it is pursuing institutional review board (IRB) approval. The analysis of available open-source health care IT applications began. Initially, one open-source application seemed promising but was rejected when it was determined that it could not be Certification Commission for Health Information Technology (CCHIT)-certified. The team started looking at a second open-source application, but found serious security concerns with this application as well. The team is continuing a thorough analysis of this second application as they structure the analysis process.

The research team had planned to find an acceptable application and encourage clinical providers to use it. However, the focus now is on defining better certification criteria for security. The team continues to explore open-source products and will partner with vendors of proprietary products to assess their products as well.

**Preliminary Impact and Findings:** Analyses of two open-source EMR applications led the team to believe that these applications are very insecure. These findings may not be generalizable beyond the two applications. However, it is notable that the vulnerabilities identified through the grantee's testing procedures would not have been detected by the security test scripts of the CCHIT criteria.

**Selected Outputs**

The project has no outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The research team developed an interview instrument for calls with physicians and is pursuing its IRB approval. However, findings from analyses to date indicate potential challenges to identifying open-source EMRs for use by rural and small-practice providers.

**Milestones:** Progress is roughly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Computer Assisted Medication and Patient Information Interface |
| **Project Investigator:** | Ziemer, David C., M.D., M.P.H. |
| **Organization:** | Emory University |
| **Mechanism:** | RFA: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (R21) |
| **Grant Number:** | R21 HS 018236 |
| **Project Period:** | 12/09 – 11/11 |
| **AHRQ Funding Amount:** | $299,998 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Chronic Care*, Diabetes

**Summary:** Although many studies show that the complications and costs of diabetes can be reduced by controlling glucose and other risk factors, many diabetics do not achieve good control. Data suggest that there is often a breakdown in information flow between patient and provider. Inadequate information from patients, particularly in the areas of medication adherence and associated adverse events, can lead to poorly-informed clinical decisionmaking and inadequate or unclear instructions for patients. The goal of the Computer Assisted Medication and Patient Information Interface project is to develop and test a tool to improve and standardize the flow of information between patients with type 2 diabetes and providers, thereby improving treatment outcomes and reducing complications.

The research team is developing an accessible computer interface that patients can use in a municipal hospital diabetes clinic to report medication information and adverse drug interactions, including hypoglycemia. The patient information interface will obtain complete and accurate information from patients so that providers can make informed therapeutic decisions for diabetes and its major cardiovascular risk factors, with a particular focus on adverse drug events and adherence.

A provider medication interface will be developed to improve the clarity and accuracy of the information received by providers and the quality of information shared with patients and other providers, with a particular focus on providing clear, detailed instructions and motivational information to patients. The provider interface will support medication management functions, including correcting incoming medication data, entry of the new drug regimen, printing of medication instructions, and production of a daily medication schedule for patients.

A full interface evaluation will compare the completeness and accuracy of medication information obtained by traditional and computer-assisted methods against the reference standard of comprehensive multi-source interview by an experienced pharmacy expert. The team will also assess the accuracy, acceptability, time efficiency, and utility of the patient information interface for both providers and patients in a study population of type 2 diabetes patients with at least two visits in the prior year.

**Specific Aims**

- Develop an accessible information computer interface in a municipal hospital diabetes clinic that patients can use to report medication information and adverse drug interactions. **(Upcoming)**

- Develop a provider medication interface to support medication management functions. **(Upcoming)**
- Assess the accuracy, acceptability, time efficiency, and utility of the information interface for both providers and patients. **(Upcoming)**

**2009 Activities:** This grant was funded in mid-December 2009. No activities have been conducted.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The project has no outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** This grant was funded in mid-December 2009. No activities have been conducted.

**Milestones:** Not yet reported.

**Budget:** Not yet reported.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Project ECHO: Hepatitis C Ambulatory Care Quality Improvement in New Mexico through Health Information Technology |
| **Principal Investigator:** | Arora, Sanjeev, M.D. |
| **Organization:** | University of New Mexico at Albuquerque |
| **Mechanism:** | PAR: HS08-270: Utilizing Health IT to Improve Health Care Quality Grant (R18) |
| **Grant Number:** | R18 HS 018171 |
| **Project Period:** | 07/09 – 06/12 |
| **AHRQ Funded Amount:** | $1,199,696 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Chronic Care*, Hepatitis C

**Summary:** This project builds on the work of a previous Agency for Healthcare Research and Quality-funded project, Project ECHO: Extension for Community Healthcare Outcomes. Providers require access to patient-specific information to consult on cases, track patient progress, and evaluate clinical outcomes. At Project ECHO's inception, community-based providers transmitted patient-specific information to specialists via the data management system. Data were entered and stored locally on a laptop, transmitted via a secure Virtual Private Network (VPN), and maintained in a centralized HIPAA-compliant SQL database server to support both clinical and research activities. With Project ECHO's rapid expansion, this type of data management quickly proved inadequate as it presented numerous, insurmountable barriers in site maintenance, VPN problems, and critical datafeed and reporting inadequacies.

To address these issues, Project ECHO will use an Internet-based clinical management system for patients undergoing treatment for hepatitis C virus (HCV). This will improve quality of care, afford smoother transitions between inpatient and outpatient settings, and lead to greater knowledge sharing among health care providers for rural and underserved populations. The enhancements to iHealth, the clinical management system, will standardize data collection, provide practice support, create a central data repository, and allow authorized personnel to view individual patient records. A Web portal will be a central identity for the HCV program, providing a single access point for its resources. The portal includes search tools that program personnel can use to extract data for monitoring data quality, profiling, quality improvement, and research. Laboratory data from TriCore Reference Laboratories (TriCore) will be automatically uploaded into the patients' electronic health record.

The underlying iHealth architecture supports effective management of patient data across multiple provider organizations. Web portals for patients provide educational links, allow patients to see their records, and enable them to communicate with their providers. The provider portal can be used to coordinate training activities and provide the tools for HCV treatment.

**Specific Aims**

- Develop a disease management tool (DMT) that will standardize data collection, provide practice support, create a central data repository, and allow authorized personnel to view individual patient records. **(Ongoing)**
- Develop a Web portal that creates a central identity for the HCV program and provides a single

access point for its resources. Create search tools that program personnel can use to extract data for monitoring data quality, profiling, quality improvement, and research. **(Ongoing)**
- Develop a system that automatically uploads laboratory data from TriCore. **(Ongoing)**
- Promote adoption of iHealth clinical management system. **(Ongoing)**

**2009 Activities:** Programming tasks for new reporting capabilities, data standardization, case-study submission, and practice support for improved clinical decisionmaking were initiated. Project ECHO held a series of meetings with TriCore and has obtained TriCore's commitment to provide iHealth with an initial structural framework for how data will be provided once the DMT database has been established. Finally, at the Project ECHO Annual Meeting, all attending partners were queried on their interest in participating on the Health Information Technology Advisory Council. Those indicating interest were contacted and oriented to the parameters of the study.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project began in the last quarter of 2009 and is in the startup phase.

**Milestones:** Progress is mostly on track.

**Budget:** Spending roughly on target.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Technology for Optimizing Population Care in a Resource-Limited Environment |
| **Principal Investigator:** | Atlas, Steven J., M.D. |
| **Organization:** | Massachusetts General Hospital |
| **Mechanism:** | PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18) |
| **Grant Number:** | R18 HS 018161 |
| **Project Period:** | 12/09 – 11/12 |
| **AHRQ Funded Amount:** | $1,199,264 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Adults

**Summary:** Patient registries and other health information technology (IT) initiatives have been designed by many organizations in recent years to help provide consistent, high-quality care to all people, thereby improving health care in the primary care setting. However, despite the increasing adoption of basic health IT capabilities, studies continue to reveal low rates of appropriate preventive screening. This study is designed to improve decision support and enhance preventive cancer screening by examining whether an IT platform that integrates electronic health record (EHR) data with clinical decision support can efficiently enhance preventive care—specifically, breast, cervical, colorectal, and prostate screening—in a primary care setting.

The goal of the project is to design, develop, and implement a novel cancer screening intervention program called Technology for Optimizing Population Care in A Resource-limited Environment (TOP-CARE). User feedback is considered critical to guide the successful design of the TOP-CARE system, particularly from key stakeholder such as: 1) primary care physicians (PCPs) and population managers; 2) practice contact delegates; 3) patient navigators; and 4) central administrative personnel. A practice cluster randomized trial of the TOP-CARE program will provide an opportunity to assess its impact on cancer screening rates in eligible patients. Practices within the Massachusetts General Primary Care Practice Based Research Network (MGPC-PBRN) will be randomly assigned to intervention or augmented standard care. This randomized clinical trial will use tailored outreach, including letters, shared decisionmaking aids, and practice personnel or patient navigator contact to see whether screening rates differ when outreach is linked to the patient's needs. The control group will receive a standard of augmented care that mimics current population-level reminder systems supplemented by the use of automation.

Using average cancer screening test completion rates for breast, cervical, colorectal, and prostate cancers, this study will demonstrate the use of a state-of-the-art approach to automated, cancer-specific patient reminders and its impact on involving clinicians in patient population management to facilitate between-visit, patient-centered cancer screening. This research is relevant to nationwide efforts to rigorously demonstrate the most effective ways to implement new IT-based delivery models. During the randomized trial, data related to the costs, preferences, and clinical and process outcomes will also be collected. While a formal cost-benefit analysis is outside the scope of this particular grant, the intention is that with yet-to-be-identified funding, the data from this randomized controlled trial can be used in future cost analyses of the TOP-CARE study.

**Specific Aims**

- Design, develop, and implement a novel cancer screening intervention program (TOP-CARE) that facilitates the identification, individualized contact, and subsequent tracking of patients overdue for screening. **(Ongoing)**
- Conduct a practice randomized trial of the TOP-CARE program within the PBRN assessing its impact on cancer screening rates in eligible patients. **(Upcoming)**
- Collect data prospectively throughout the randomized trial on costs, preferences, and clinical and process outcomes to inform a subsequent formal cost-benefit analysis. **(Upcoming)**

**2009 Activities:** A proposal was submitted to the Massachusetts General Physicians Organization in December to obtain institutional support to accelerate the delivery of scalable clinical population management software for use in clinical operations. This registry, which organizes and presents information about groups of patients to physicians, clinic managers, and hospital administrators, will serve as the framework for the TOP-CARE system and will enable users to effectively manage their population of patients. Approval of this proposal is anticipated in early 2010.

The initial focus of the software architect was developing key aspects of the generic system architecture including: a permission mechanism so only one user can access a particular patient record at a time; a robust security layer to control access permission for the software application; an interface system to connect to external services, such as a letter component to automate the generation and mailing of patient letters by the U.S. Postal Service; and the methodology for integrating a system that dynamically links patients to PCPs.

Using data from December 31, 2008, an analysis was conducted to determine how many men and women are overdue for any of the cancer screening exams evaluated in this study, and how many were overdue for multiple exams. These historical data will provide information about the scale of the intervention and control-arm patient outreach efforts. In addition, an initial focus was how to accurately identify women who have had a bilateral mastectomy and are not eligible for mammography. The project team is working to identify a list of search terms that can be used to identify such women. When this has been completed for breast cancer, this process will be repeated for cervical, colorectal, and prostate cancer screening.

**Preliminary Impact and Findings:** Preliminary analyses to determine the size of the study population were conducted using data from December 31, 2008. Within the MGPC-PBRN, 87,916 patients are eligible for breast, cervical, colorectal, and/or prostate cancer screening. Among these patients, 62,903 are up-to-date on screening exams for which they are eligible. Of the 25,013 patients who are overdue for at least one screening exam, 19,897 are overdue for one exam, 4,480 are overdue for two exams, and 636 are overdue for three exams. During subsequent quarters, these analyses will be revised and updated as eligibility criteria for the randomized controlled trial are finalized and as updated data files are available for subsequent analyses.

**Selected Outputs**

This project has no outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Underspending during the first quarter of the project will be corrected over upcoming quarters as the project ramps up its activities.

**Milestones:** Progress is completely on track.

**Budget:** Significantly underspent, more than 20 percent.

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|---|---|
| **Project Title:** | Information Technology Implementation by Cognitive Engineering of Organizational Routines |
| **Principal Investigator:** | Green, Lee A., M.D., M.P.H. |
| **Organization:** | University of Michigan at Ann Arbor |
| **Mechanism:** | PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18) |
| **Grant Number:** | R18 HS 018170 |
| **Project Period:** | 12/09 – 11/12 |
| **AHRQ Funded Amount:** | $1,199,139 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Medically Underserved, Safety Net, Uninsured

**Summary:** Successful implementation of health information technology (IT) systems requires substantial attention to workflow processes. This project closely examines the change process that must occur to enable the successful adoption of health IT and how to best reengineer workflows. The department of family medicine at the University of Michigan is partnering with the Michigan Primary Care Association to identify three Federally Qualified Health Centers (FQHCs) to implement Cielo Clinic™, a commercial clinical quality management system developed by family medicine physicians at the University of Michigan. The use of the Cielo Clinic™ will be tailored to each participating safety net clinics' interest and priorities. Each clinic will employ an iterative process to choose the screening, prevention, chronic disease management, and outreach components of the Cielo Clinic™ software that best fit their quality improvement priorities.

This project examines the change process that must occur to enable the successful adoption of the quality management system using Cognitive Task Analysis (CTA)—an advanced set of tools that are used to guide the implementation and reengineering work. Each clinic included in the study has an existing electronic health record (EHR), and practices vary in its use of different functional components of the EHR. Implementation will focus on training the sites as teams to understand and modify organizational routines using the Cielo Clinic™. Clinics will work iteratively on implementation until they achieve success, or until several Plan-Do-Study-Act cycles show no progress, making it clear that implementation will not succeed. Practices will be evaluated to determine whether the Cielo Clinic™ clinical system increases adherence to evidenced-based practices and whether CTA-guided implementation is advantageous to the health centers. The study will use a mixed-methods, stepped-wedge research and evaluation design to allow analysis of data across time within sites and to make across-site comparisons. The project will collect qualitative data on the implementation process, including the barriers and facilitators encountered, which will provide information to health care leaders on how to best implement new technology in the ambulatory safety net environment.

**Specific Aims**

- Identify the barriers and facilitators to implementing clinical quality management systems in safety-net ambulatory care settings. **(Upcoming)**
- Measure the impact of using cognitive engineering tools during implementation of a clinical quality management system (Cielo Clinic™). **(Upcoming)**

**2009 Activities:** The project kick-off and planning session included preliminary identification and selection of the three FQHCs to implement the Cielo Clinic™ software. The complete project team, including members of University of Michigan, Altarum, and the Michigan Primary Care Association were assembled to discuss respective roles in the project and initiate the first planned activities.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project team is on track with planning activities and will initiate working with selected sites early in 2010.

**Milestones:** Progress is completely on track.

**Budget:** Spending roughly on target.

| | |
|---|---|
| **Project Title:** | Automating Assessment of Obesity Care Quality |
| **Principal Investigator:** | Hazlehurst, Brian L., M.A., Ph.D. |
| **Organization:** | Kaiser Foundation Research Institute |
| **Mechanism:** | PAR: HS08-270: Utilizing Health IT to Improve Health Care Quality Grant (R18) |
| **Grant Number:** | R18 HS 018157 |
| **Project Period:** | 12/09 – 05/11 |
| **AHRQ Funded Amount:** | $1,194,761 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Obesity

**Summary:** Obesity and its public health effects are an increasing burden on the health care system. This project proposes to develop, implement, and evaluate a routine, automated method to assess outpatient obesity care quality using measures from comprehensive electronic medical record (EMR) data based upon the National Heart, Lung, and Blood Institute (NHLBI) obesity care guidelines.

The study team will use reasons for visit, orders and referrals, diagnosis codes, laboratory test values, and text clinical notes pertaining to weight loss counseling and other obesity intervention efforts to investigate associations between obesity care delivery steps and clinical outcomes known or suspected to be accelerated by obesity. Percent change in body weight was selected as the primary outcome measure.

Retrospective EMR data from both a midsized health maintenance organization and a consortium of Federally Qualified Health Centers will be used to evaluate the association between obesity guideline adherence and clinical outcomes. The project will use Kaiser Permanente's Certification Commission for Health Information Technology-certified Epic-based EMR HealthConnect and Oregon Community Health Information Network's Epic-based EMR EpicCare. Information from both structured and free-text fields will be used. Free-text fields will be automatically coded using natural language processing computer software. Data produced under the automated method of quality measurement will be compared to medical record reviews performed by human abstractors in order to assess the validity of the automated system.

The automated system will be applied to two diverse patient populations totaling more than 350,000 adults to determine: 1) the proportion of overweight or obese patients who are receiving advice, counseling, weight loss program referral, medication prescription, and other care prescribed by the guidelines; 2) correlates of overweight and obesity diagnosis and treatment guideline adherence including patient characteristics, comorbidity status, provider characteristics, and health system characteristics; and 3) changes in health status as a function of guideline adherence for obese patients.

**Specific Aims**

- Develop obesity care quality measures based on updated NHLBI guidelines to evaluate obesity care performance in primary care. **(Ongoing)**
- Use comprehensive EMR data to develop and validate an automated (generalizable and scalable) method for applying the measures identified in the first aim. **(Upcoming)**

- Apply the method developed in second aim to assess ambulatory obesity care quality in two distinct health plans representing diverse patient populations and care practices. **(Upcoming)**
- Evaluate the association between measures of obesity guideline adherence to recommended obesity care processes and clinical outcomes and provider characteristics. **(Upcoming)**

**2009 Activities:** The study team has implemented the NHLBI obesity care guidelines and translated them into key qualification and evaluation components. Study staff started to identify which data elements from the EMR can be used to define the relevant clinical events. In the upcoming quarter, the team will meet with their Clinical Advisory Panel to discuss and refine its approach.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project began in the last quarter of 2009 and is in the startup phase.

**Milestones:** Progress is completely on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

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|---|---|
| **Project Title:** | My MediHealth: A Paradigm for Children-Centered Medication Management |
| **Principal Investigator:** | Johnson, Kevin B., M.D., M.S. |
| **Organization:** | Vanderbilt University |
| **Mechanism:** | PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18) |
| **Grant Number:** | R18 HS 018168 |
| **Project Period:** | 12/09 – 11/12 |
| **AHRQ Funded Amount:** | $1,200,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Synthesis and Dissemination, Knowledge Creation

**Target Population:** Medicaid, Pediatric*, Chronic Care*, Asthma, Teens

**Summary:** Medication management of children with chronic conditions is complex because of the need to tailor dosages based on age and development and because of the potential for frequent handoffs between caregivers. To improve care of children with chronic disease, a team at Vanderbilt University Medical Center in Tennessee, led by Dr. Kevin Johnson, is working to address medication management in the pediatric population through further development of MyMediHealth, a mobile personal health application. The overarching goal of the MyMediHealth project is to investigate ways in which personal health records and supported applications can improve the safety and quality of medication delivery.

The study is a randomized controlled trial of children ages 12 to 18 with asthma in the Vanderbilt Primary Care Clinic. MyMediHealth will provide medication information and reminders by cell phone or pager, with additional support from a Web-based patient portal. Patients will be able to create medication schedules, schedule alerts to mobile devices, and examine medication administration information. The patient portal will provide laboratory results, relevant medical literature, email for direct communication with providers, and direct appointment scheduling.

The project will develop a knowledgebase of common pediatric asthma medications that will be incorporated into MyMediHealth to evaluate the impact of MyMediHealth on medication adherence. Study measures include medication adherence, effect on family dynamics, disease control, and impact on caregivers outside the home (i.e., school caregivers and health care providers). The results of this study will have important implications for understanding how to further patient-centered care and medication adherence in the pediatric population. Some findings may also be applicable to chronic disease management in the adult population.

**Specific Aims**

- Develop an information and scheduling knowledgebase for common pediatric asthma medications (including allergy medications). **(Ongoing)**
- Adapt MyMediHealth in its current prototype form to patients diagnosed with asthma. **(Ongoing)**
- Integrate MyMediHealth into the Vanderbilt patient portal to support medication scheduling and the creation of medication reminders. **(Ongoing)**
- Evaluate the impact of MyMediHealth on medication adherence. **(Upcoming)**

**2009 Activities:** The project team began to develop the medications knowledge database for adolescents with asthma, including identifying key medications and their dosing and frequency. The team received institutional review board approval for the use of their Ecological Momentary Assessment, which is the research tool that will be used to refine the MyMediHealth application to be consistent with current child and family behavior. The Ecological Momentary Assessment Tool consists of an oral interview and a Web-based survey that asks about daily behaviors, regular dosing time, why that time is chosen, and any variation in dosing time.

The team began building the scheduling tool that families will use to manage medication regimens to meet their specific needs. Developers have taken ideas from the prototype and are building it to work with predominant information technology structures. In 2010, they will build the test and production environments, which will enable testing iterations of the tool. This scheduling tool is designed to be incorporated with Google™ Health, Microsoft® Health Vault, and the Vanderbilt patient portal.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs:**

The project does not have any outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The first part of the grant period was focused on the refinement of the knowledgebase of pediatric asthma and allergy medications. This process includes abstracting medication instructions and indication-specific dosing frequency.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population*

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|---|---|
| **Project Title:** | Online Counseling to Enable Lifestyle-Focused Obesity Treatment in Primary Care |
| **Principal Investigator:** | McTigue, Kathleen M., M.S., M.D., M.P.H. |
| **Organization:** | University of Pittsburgh |
| **Mechanism:** | PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18) |
| **Grant Number:** | R18 HS 018155 |
| **Project Period:** | 10/09 – 09/12 |
| **AHRQ Funded Amount:** | $1,199,824 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Obesity

**Summary:** Obesity is a major cause of cardiovascular disease. More than half of the United States population is estimated to be overweight, and an estimated 31 percent are obese. While the United States Preventive Services Task Force (USPSTF) recommends that clinicians screen all adult patients for obesity and offer intensive counseling and behavioral interventions to promote sustained weight loss for obese adults, multiple barriers to intensive lifestyle counseling exist and the recommendation has not been widely implemented.

This study looks at using information technology to enable clinical lifestyle counseling on weight loss with the goal of integrating lifestyle issues into routine preventive medicine. The research is examining the effectiveness of delivering an online version of the Diabetes Prevention Program (DPP) lifestyle intervention in coordination with primary care medicine. Recruitment is targeted to a diverse group of participants in terms of gender, body mass index, and comorbidity status, and a racial/ethnic mix reflective of the region. The coaching strategies incorporate physician feedback, and assessment of the intervention looks at multiple outcomes, including change in weight, waist circumference, physical activity, and quality of life. Assessment also includes a calculation of intervention cost-effectiveness.

The study hopes to address the key problem of how to implement USPSTF obesity screening and treatment recommendations in a cost-effective manner and help translate well established methods into a clinical setting. Furthermore, the use of technology may provide a more patient-centered and cost-effective approach to clinical obesity management.

**Specific Aims**

- Use Internet technology to translate an evidence-based lifestyle intervention into diverse primary care settings in order to facilitate the delivery of evidence-based preventive counseling. **(Ongoing)**
- Examine how different strategies of delivering a DPP-based online lifestyle intervention differ in weight loss and cost-effectiveness. **(Ongoing)**

**2009 Activities:** The project prepared for study participant recruitment, which entailed hiring and training staff, ordering supplies, developing and printing advertising materials, securing space for orientation sessions, and creating an electronic referral form. The project team met with physicians from each of the

participating clinical sites to ensure that recruitment protocols would interface smoothly with their routine patient care routines. The team presented the project at two of the four participating sites to provide information, including referral procedures and mechanisms for feedback, to providers and clinic staff. The database for the study is nearing completion and a new protocol has been developed for the Virtual Lifestyle Management online lifestyle coaching strategy, which will be incorporated into the training sessions.

**Preliminary Impact and Findings:** No findings to date, as data collection has not yet begun. Informal feedback from physicians at the participating sites suggests considerable interest in having access to an online weight maintenance intervention.

**Selected Outputs**

This project has no reported outputs at this time.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Significant delays in the hiring procedures at the University of Pittsburgh slowed the rate at which the project team was able to hire staff, accounting for some budget underspending. However, research staff was hired by the end of the year, so the delay is not anticipated to have an impact on study timeline or future budget projections.

**Milestones:** Progress is mostly on track.

**Budget:** Significantly underspent, more than 20 percent.

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|---|---|
| **Project Title:** | Bringing High-Performing Systems to Small Practices |
| **Principal Investigator:** | Parsons, Amanda, M.Sc., M.D. |
| **Organization:** | New York City Health/Mental Hygiene |
| **Mechanism:** | PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18) |
| **Grant Number:** | R18 HS 018275 |
| **Project Period:** | 12/09 – 11/12 |
| **AHRQ Funded Amount:** | $1,199,853 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Inner City*, Medicaid, Medically Underserved, Safety Net

**Summary:** To date, there is limited evidence on the ability of small community health care providers to improve quality of care through the use of electronic health records (EHRs) and limited robust data on the impact of financial incentives for quality improvement on small providers. Investments in health information technology (IT) are being made to improve quality of care and, while there is evidence of improved quality in integrated delivery systems such as the Kaiser Permanente system, there is less evidence of the effectiveness of health IT on patient outcomes in nonintegrated health systems.

This study will provide information on the effects that supportive EHR implementation, clinical decision support (CDS) systems, and pay-for-quality improvements have on small community providers' cardiovascular health outcomes. The New York City Primary Care Information Project (PCIP) will compare the implementation of EHRs at 60 small ambulatory primary care practices that are not part of an integrated delivery system throughout New York City, to 60 similar practices in the area that do not have an EHR. This project targets EHR implementation throughout New York City, with a focus on some of the poorest neighborhoods. The majority of practices are using Certification Commission Heath Information Technology-certified eClinical Works.

The study will evaluate the impact of an EHR implemented with the support of technical assistance, and added tools including integrated registry systems, and CDS on improvements in quality of care as compared to practices that do not have an EHR or the aforementioned support programs. The primary goal is to determine whether practices that have supportive EHR implementation provide higher quality care and/or experience a more rapid rate of improvement of their quality measures than practices that do not have an EHR. A secondary goal is to determine the characteristics, if any, that indicate supported EHR practices are atypical, or have any consistently different characteristics, as compared to other small independent practices. At a more nuanced level, the research will assess the attributable impact of various interventions (adoption of EHR, CDS, and pay-for-quality) on changes in four cardiovascular health outcomes at small practices that provide adult primary care. This will provide specific information on the value of various types of support on the rate of improvement on cardiovascular quality measures.

**Specific Aims**

- Determine whether practices that participated in the PCIP program experienced a more rapid rate of improvement on their quality measures than practices that did not participate. **(Upcoming)**
- Determine if PCIP-participating practices are atypical in comparison to other small independent practices in New York City. **(Upcoming)**

- Assess the attributable impact of each intervention: adoption of EHR, CDS, and pilot pay-for-quality program. **(Upcoming)**

**2009 Activities:** The project team began the process of identifying the target group of PCIP providers that will be the comparison group to the active intervention practices that are receiving supportive EHR implementation. EHR adoption among small clinics in New York has moved rapidly since the writing of the grant, and there are fewer practices that have not begun EHR implementation. As a result, the project is shifting the definition of the "control" practices from non-EHR adopters to a subset of practices that are late adopters of the EHR. Development of the baseline provider survey tool on their experiences with quality measurement, reporting, and incentives began. A separate survey being fielded by PCIP as part of the overall regional extension center activities will assess the practice's orientation and experience in completing tasks such as documentation and ordering. Practice characteristics such as number of providers, ancillary staff, and patient demographics will be collected either through the practice's application or collected through the chart review process.

**Preliminary Impact and Findings:** No findings to date.

**Selected Outputs**

No outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is on track to identify 60 EHR implementation and 60 reference practices for comparison in early 2010.

**Milestones:** Progress is completely on track.

**Budget:** Spending roughly on target.

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|---|---|
| **Project Title:** | Self-Management & Reminders with Technology: SMART Appraisal of an Integrated Personal Health Record |
| **Principal Investigator:** | Roberts, Mark Stenius, M.P.P., M.D. |
| **Organization:** | University of Pittsburgh |
| **Mechanism:** | PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18) |
| **Grant Number:** | R18 HS 018167 |
| **Project Period:** | 10/09 – 09/12 |
| **AHRQ Funded Amount:** | $1,183,337 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Heart Disease

**Summary:** The complexity of patients' medical conditions is increasing, making preventive care and disease management more difficult. There is growing interest in integrating personal health records (PHRs) with providers' electronic medical records (EMRs) to assist patient self-management and improve care for complex diseases. However, studies that evaluate the impact of PHRs on care outcomes are few.

This project seeks to improve health care outcomes in complex patients who have or are at high risk for developing cardiovascular disease (CVD) by promoting patient self-management at more than 80 diverse primary care practices (including small and large practices) through the following three tasks: (1) develop a patient-specific, active component designed to reduce the risk of cardiovascular disease for patients with complex illnesses for an existing electronic PHR, (2) conduct a randomized controlled trial of the effectiveness of passive and active PHRs for improving adherence and clinical outcomes of complex patients in an ambulatory environment, and (3) enumerate the barriers and facilitators to implementing and using a PHR for providers and patients in an ambulatory setting.

To accomplish the first task, a user group will be assembled to determine which features of an active PHR are most acceptable and useful. To accomplish the second task, 1,000 patients with complex chronic disease leading to increased cardiovascular risk (i.e., CVD or two of the qualifying diseases associated with increased cardiovascular risk) will be randomized to a passive PHR (n = 500), or an active PHR (n = 500) at four sites where the PHR currently is installed and in use. Task 3 will survey all participants using the PHR, along with nurses and physicians at the study sites, and conduct focus groups of PHR participants, nurses, and physicians to determine the barriers and facilitators to PHR use. Outcomes to be assessed include improvement in control of risk factors (e.g., blood pressure), frequency of compliance with testing guidelines (e.g., annual dilated retinal exams in diabetes patients), and clinical outcomes (e.g., myocardial infarction, hospitalizations).

The PHR for this project interfaces with the organization's EMR system, the EpiCare Electronic Health Record, which is certified by the Certification Commission for Health Information Technology. The passive PHR allows patients to view portions of their EMR, including problem lists, medication lists, and test results, to communicate electronically with their physician's office, and to track values of home-monitored blood pressure and glucose. This is the standard form of a PHR that currently exists in many electronic health records. The active PHR has the features of the passive PHR, but also electronically

notifies patients to check a secure Web site when disease self-management tasks or preventive services need to be performed (e.g., diabetic eye exams or entry of blood pressure values into a self-management log). This project will help determine if the use of an active patient self-management version of an existing PHR can reduce cardiovascular risk factors.

**Specific Aims**

- Develop a patient-specific, active and interactive component to an existing electronic PHR directed towards patients with complex illness and conditions that contribute to the development of cardiovascular disease. **(Ongoing)**
- Conduct a randomized controlled trial of the effectiveness of passive and active PHR systems for improving adherence and clinical outcomes of complex patients in an ambulatory environment. **(Upcoming)**
- Enumerate and catalog the barriers and facilitators to implementation and use of an electronic PHR among providers and patients in an ambulatory setting. **(Upcoming)**

**2009 Activities:** The initial focus of this project has been on developing the active and interactive components of the PHR. Simultaneously, the study sites have been introduced to the project. A high level of enthusiasm for the research study prompted the University of Pittsburgh to allow participation across the entire organization. The total number of practices increased significantly (from 4 to over 80). This includes many small practices, so recruitment is still expected to take some time. This change in protocol has been approved by the institutional review board and did not affect the overall methodology. Additional accomplishments in 2009 include the completion of several focus groups with patients. These sessions helped to inform the development of the active reminders form and the structure of the intervention.

**Preliminary Impact and Findings:** This project has no findings to date.

**Selected Outputs**

This project has no outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** No activities yet reported.

**Milestones:** No activities yet reported.

**Budget:** No activities yet reported.

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|---|---|
| **Project Title:** | A Risk-Based Approach to Improving Management of Chronic Kidney Disease |
| **Principal Investigator:** | Sequist, Thomas D., M.D., M.P.H. |
| **Organization:** | Brigham and Women's Hospital |
| **Mechanism:** | PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18) |
| **Grant Number:** | R18 HS 018226 |
| **Project Period:** | 12/09 – 11/12 |
| **AHRQ Funded Amount:** | $1,127,741 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decision making through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Chronic Care*, Kidney Disease

**Summary:** Chronic kidney disease (CKD), though common, is often unrecognized by primary care physicians (PCPs). Better disease identification and management can improve health outcomes. However, there has been limited review of the outcomes of comprehensive disease management of CKD and no studies on the impact of patient education on this condition. Harvard Vanguard Medical Associates, an integrated delivery system in Massachusetts, is conducting a randomized controlled study on the care of patients with stage three CKD in the primary care setting. The study is implementing a disease management program at 14 health centers to improve clinical decision support for physicians and self-management support for patients.

During the first phase of the project, one health center will be selected for pilot testing the intervention components (clinical decision support and support materials mailed to patients). The randomized controlled trial will be conducted over 18 months and will include approximately 170 providers randomized into intervention and control groups. The physicians in the intervention group will receive patient–specific alerts at the time of office visits; physicians in the control group will not receive alerts.

The impact of combining advanced decision supports (electronic alerts), a disease registry, and a patient education program on adherence to best treatment practices will be measured by several indicators, including appropriate laboratory testing, achievement of blood pressure goals, and risk-appropriate involvement of nephrologists. These study outcomes will be measured via Harvard Vanguard's EpicCare 2007 electronic health record (EHR), which is certified by the Certification Commission for Health Information Technology. Providers will also be queried on how the use of the intervention tools impact their attitude towards CKD management and the use of electronic reminder systems. The study will provide information on best practices in the treatment of CKD in the primary care setting through the use of EHRs, advanced decision support, and patient outreach and education.

**Specific Aims**

- Use computerized clinical information systems to identify baseline predictors of appropriate evaluation and treatment of stage three and four CKD, including patient characteristics and nephrology involvement. **(Achieved)**
- Assess whether quality of care for stage three CKD can be substantially improved over 18 months by: 1) point-of-care electronic alerts to PCPs recommending risk-appropriate care and 2)

quarterly mailings to patients providing self-management support materials, including tailored recommendations based on personalized data from an electronic disease registry. **(Upcoming)**

- Assess the relationship between utilization of the intervention components and PCP attitudes toward both chronic kidney disease management and electronic reminder systems. **(Upcoming)**

**2009 Activities:** The team created a programming language to maintain a relational database using data from the EHR system. The process identified a new population of approximately 13,000 patients with CKD, based on a combination of laboratory results and office visits. The team began developing an automated process to update the patient registry monthly. This supports patient enrollment and the accurate delivery of electronic decision support to physicians.

The pilot intervention to inform the randomized trial is planned for June through September 2010. Once the pilot is completed, the main randomized trial will begin in the Fall of 2010. Preparations included the review of existing survey instruments to develop baseline and followup surveys for patients. Patients will be surveyed on their knowledge of CKD both at baseline and at followup. Baseline survey materials will be mailed out at the time of the initial patient self-management support mailings, and followup surveys will be mailed out at the time of the final patient self-management support mailings. The patient self-management materials, including a letter, an eight-page pamphlet, and a one-page trifold pamphlet, were created during the initial stage of the project. These materials will be personalized using clinical data from patient's EHR. The development of the provider survey has also been completed, following a similar process of reviewing existing surveys. The survey will be implemented in September 2010.

**Preliminary Impact and Findings:** Initial findings on predictors of quality of CKD care will be available in 2010.

**Selected Outputs:**

No project outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Project is on track to begin the randomized controlled trial in Fall 2010. A manuscript on the initial findings on the predictors of quality of CKD care has been accepted for publication in the Journal of General Internal Medicine. Underspending is due to a short delay in patient mailings, which comprise a significant component of the budget.

**Milestones:** Progress is completely on track.

**Budget:** Significantly underspent, more than 20 percent.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Virtual Continuity and its Impact on Complex Hospitalized Patients' Care |
| **Principal Investigator:** | Smith, Kenneth J., M.D., M.S. |
| **Organization:** | University of Pittsburgh at Pittsburgh |
| **Mechanism:** | PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18) |
| **Grant Number:** | R18 HS 018151 |
| **Project Period:** | 10/09 – 09/12 |
| **AHRQ Funded Amount:** | $1,193,052 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Adults

**Summary:** Hospital care processes have changed dramatically over the last 10 to 15 years. Previously, hospitalized patients were cared for by their primary care physician (PCP), facilitating continuity of care between inpatient and ambulatory care settings. Now, many hospitalized patients are cared for by hospital staff physicians and returned to their PCPs' care upon discharge. Without dedicated information transfer processes, this stratification of care can lead to information loss and medical error. Heightened communication with and involvement by the PCP in the care of hospitalized patients should decrease medication errors, diagnostic errors, and followup errors, thereby improving medical care quality and safety as well as patient and physician satisfaction.

The project, started in October 2009, will enhance MedTrak, the University of Pittsburgh Medical Center (UPMC) electronic physician communication tool, with an initiative called virtual continuity. Virtual continuity allows PCPs to follow their hospitalized patients electronically and participate more directly in their care through the use of e-mails that are triggered by clinical events with embedded links to electronic medical record (EMR) data and communication portals, medication lists electronically delivered at admission and discharge, and immediate notification of discharge with pertinent clinical details. The project is using the Cerner PowerChart EMR system, a Certification Commission for Health Information Technology-certified product.

To evaluate the impact of virtual continuity, a pre-post study will compare the frequency of discharge medication errors before and after initiation of the virtual continuity intervention. Additional evaluation measures include PCPs' frequency and timeliness of receiving information, PCPs' perception of information exchange adequacy and usefulness, patients' satisfaction with care and the information they receive, and rates of rehospitalization, post-discharge emergency department visits, and PCP followup visits. The information technology cost of implementing and maintaining the virtual continuity intervention will also be assessed.

**Specific Aims**

- Augment the present system of PCP notification through the development and use of electronic medical record links to allow virtual continuity for the PCP. **(Ongoing)**
- In a pre-post study, measure differences in patient care safety and quality between PCPs receiving virtual continuity versus usual communication. **(Upcoming)**

- Evaluate the impact of virtual continuity. **(Upcoming)**

**2009 Activities:** A steering committee and a working group of project investigators and UPMC Information Services Department personnel met regularly to develop procedures to enhance hospital-to-PCP communication. These groups are also assisting in the development of the PCP expert panel survey to further inform data elements to be communicated.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Project in startup phase; progress is on track.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

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|---|---|
| **Project Title:** | Flu Alert: Influenza Vaccine Alerts for Providers in the Electronic Health Record |
| **Principal Investigator:** | Stockwell, Melissa S., M.D., M.P.H. |
| **Organization:** | Columbia University |
| **Mechanism:** | PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18) |
| **Grant Number:** | R18 HS 018158 |
| **Project Period:** | 08/09 – 07/12 |
| **AHRQ Funded Amount:** | $1,198,851 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Low Income/Low SES*, Medicaid, Pediatric*, Racial or Ethnic Minorities*: Latino

**Summary:** The Advisory Committee on Immunization Practices recommends that all children age 6 months and older receive the influenza vaccine. Despite this recommendation, vaccine delivery rates at pediatric clinics are low even when the vaccine is available. This project aims to tailor, implement, and evaluate influenza vaccine alerts in an electronic health record (EHR) for pediatric providers serving minority, low-income populations at four community health centers.

Each of the four study sites is affiliated with the NewYork-Presbyterian Hospital Ambulatory Care Network (ACN) and Columbia University and is located in a Federally designated Health Professional Shortage Area. All providers in the study are part of the same General Pediatric Group Practice and receive uniform influenza vaccine-related provider education. In 2008, the practices responded to nearly 64,000 visits by approximately 22,000 children, 87 percent of whom were covered by Medicaid and the majority of whom were Latino. The Vaccine for Children Program provides the majority of vaccines given at the practices. All four study sites use the Certification Commission for Health Information Technology-certified product Eclipsys Ambulatory Care Manager EHR and the NewYork Presbyterian Hospital Immunization Registry, EzVAC.

In Year 1, focus groups, individual interviews, and surveys of health care providers, nurses, and parents are being conducted to elicit information for customizing the content, format, and features of the electronic alerts (FluAlert). The alerts will be iteratively refined and piloted among beta users based on the end-user feedback. In Year 2, the alerts will be implemented within the four pediatric ACN community health centers of NewYork-Presbyterian (NYP) Hospital using a cluster cross-over design. In Year 3, the alerts will be implemented at all four sites and compared to one other pediatric site, which is affiliated with another campus of NYP and uses EzVAC, but that uses a different EHR. Throughout the study period, process indicators will be tracked to follow the implementation of the system, and feedback with clinical sites will be regularly exchanged. At the end of the project, user satisfaction will be assessed through surveys. Costs will be measured by comparing alert costs with published vaccine effectiveness and cost data for influenza-associated hospitalizations, outpatient visits, and impact on parent productivity.

**Specific Aims**

- Integrate tailored provider influenza vaccine alerts into the EHR of urban pediatric community health centers. **(Ongoing)**

- Evaluate the impact of tailored provider influenza alerts on pediatric influenza vaccine delivery rates. **(Upcoming)**
- Evaluate the impact of tailored provider influenza alerts on pediatric influenza coverage rates. **(Upcoming)**

**2009 Activities:** During 2009, the most important functional aspects of the FluAlert application were successfully completed. The team has designed the FluAlert reminder, acting within the Eclipsys Ambulatory application, to retrieve immunization information, via a Web service, from the EzVAC immunization registry, which is synchronized with the New York City's Department of Health Citywide Immunization Registry. This synchronization ensures that the alert is acting on the most up-to-date influenza vaccine information available for individual patients. Second, FluAlert's graphical user interface (GUI) has been designed, evaluated, and revised in order to reflect feedback from the provider's supervisory panel concerning usability, consistency of data display, and efficiency in information assimilation. This GUI alerts the provider to the patient's influenza immunization status (using up-to-date rules) and allows providers to order influenza vaccine or document why a vaccine was not given, all directly from the alert. In addition, the team devised an end-to-end data transfer mechanism between FluAlert and Eclipsys Ambulatory application via Eclipsys' medical logic modules. This data transfer allows FluAlert to automatically paste information into the provider's Eclipsys note (e.g., information regarding the vaccination order or reason why vaccine was not ordered as entered in the user interface), allowing the provider's action to be successfully captured and documented in the patient's chart.

Several activities related to participatory research were completed during 2009. Data collection instruments to conduct systematic participatory research, including provider and parent focus group topic guides, a provider indepth interview questionnaire, provider surveys, and a parent interview template, were developed. Four provider focus groups with pediatric providers (n= 21) in the four health centers were facilitated. Participants were asked to comment on possible design features of the alert, as well as potential barriers to implementation. The focus groups were recorded and transcribed. The transcripts of these discussions were analyzed. Four focus groups with parents were also conducted and analyzed.

Preliminary Impact and Findings: Preliminary themes from focus groups include the providers' preference for a simple, straightforward alert with a "smart component" that links to orders and possible vaccine selections. Providers also suggest that the alert could improve documentation of vaccine-related decisions at various clinical encounters.

**Selected Outputs:**

The project does not have any outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** This project began in the last quarter of 2009 and is in the initial startup phase.

**Milestones:** Progress is mostly on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Medication Reconciliation to Improve Quality of Transitional Care |
| **Principal Investigator:** | Weiner, Michael, M.D., M.P.H. |
| **Organization:** | Indiana University-Purdue University at Indianapolis |
| **Mechanism:** | PAR: HS08-270: Utilizing Health IT to Improve Health Care Quality Grant (R18) |
| **Grant Number:** | R18 HS 018183 |
| **Project Period:** | 10/09 – 09/12 |
| **AHRQ Funded Amount:** | $1,181,628 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Safety Net

**Summary:** Medication errors, which account for approximately 20 percent of all medical errors, have been found to occur at care transitions, such as when patients transfer between locations or levels of care within a facility. Recent studies have shown that electronic medication reconciliation (MR) for hospitalized patients can decrease medication discrepancies and significantly improve outcomes in transitional and ambulatory care. Relatively little is known, however, about the extent to which MR systems improve clinical outcomes. This study seeks to integrate an electronic MR system with an electronic prescribing (e-prescribing) system within Wishard Health Services, a safety net provider to residents of Marion County, Indiana that includes the Wishard Hospital and eight community health centers where patients receive primary ambulatory care.

The goals of this study are to 1) integrate an electronic MR system with an e-prescribing system; 2) modify an electronic health record (EHR) system to handle MR; 3) conduct a randomized controlled trial of MR; and 4) determine whether electronic facilitation of MR alters MR and the incidence of medication errors in ambulatory care. This project has a technical team and a clinical team. The clinical team provides input and guidance for the technical team, which meets each week to discuss and advance system development. Dr. Weiner is a member of both teams. Because the proposed system requires a formative evaluation, the initial system is being reviewed by a group of three-to-five physicians and nurses who are not members of the study teams.

The randomized study design allows for a controlled comparison of electronic MR and usual care. Participants include patients and their inpatient and ambulatory care providers. While the intervention is based in an emergency department and hospital, it targets transitional care and is meant to improve outcomes for both inpatient and ambulatory care. Providers are surveyed before and after the intervention regarding satisfaction with care, managing medications, and usefulness of local information systems in managing medications. Additional analysis will be done to look at changes in the rates of adverse drug events and erroneous discrepancies/omissions in a patient's medication list between the time of discharge and return to ambulatory care. Associations between interventions and outcomes will be summarized for factors related to payer, race, gender, and age. The study will inform the question of whether electronic facilitation of inpatient MR improves completion of MR and decreases the incidence of drug-related medical errors.

**Specific Aims**

- Integrate an electronic medical reconciliation system with an e-prescribing system. **(Ongoing)**
- Modify an EHR system to handle medication reconciliation. **(Upcoming)**
- Conduct a randomized controlled trial of the medical reconciliation system. **(Upcoming)**
- Determine whether electronic facilitation alters medical reconciliation and the incidence of medication errors in ambulatory care. **(Upcoming)**

**2009 Activities:** The iterative process of the technical development of the medication reconciliation system continues. A prototype is near completion. Key successes have been the resolution of how the system will automatically import a list of dispensed medications and then allow the user to edit (correct) the list, based on discussion with the patient. The final list will be stored and also delivered to the e-prescribing system. The user will be able to indicate whether the patient is taking the medication as prescribed, taking the medication but not as prescribed, or not taking the medication. The project data tracking system will record each change made by the user.

The project's clinical team provided feedback on the prototype. When this is incorporated, the system will be tested and additional feedback will be solicited from a larger group of physicians. An initial draft of a physician survey to ask about satisfaction with local tools for managing inpatient medications, ease of managing medications, and accuracy of medication lists as noted in medical records has been prepared. Feedback on the draft survey is being solicited from the study team prior to institutional review board review and implementation.

A modification was made to the methodology of patient randomization for the clinical trial. After much discussion, the decision was made to randomize by medical team, using an established technique adapted by William M. Tierney, M.D. This will improve the ability to assess the total effect of the intervention and minimize contamination.

**Preliminary Impact and Findings:** This project has no findings to date.

**Selected Outputs**

This project has no outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** Budget spending is expected to be on track in 2010, due to increased project activities.

**Milestones:** Progress is completely on track.

**Budget:** Significantly underspent, more than 20 percent.

## Table 13: Other Grants (Career, Dissertation, and Other)

| AHRQ Small Grant Program for Conference Support (R13) and AHRQ Grant Program for Large Conference Support (R13) and (U13) | | | | |
|---|---|---|---|---|
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| No | Landon, Bruce, MD | A Research Agenda for the Patient-Centered Medical Home | PA09-231 | Page 324 |
| No | Marcin, James | 4th Annual Pediatric Telehealth Colloquium | PA09-231 | Page 326 |
| No | Calmbach, Walter | Primary Care Research Methods and Statistics Conference | PAR09-257 | Page 328 |
| **Special Emphasis Notice: AHRQ Announces Interest in Career Development (K01, K02, K08) and Dissertation (R36) Grants Focused on Health Information Technology (IT)** | | | | |
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| No | Barrette, Eric, MA | The Impact of Health Information Technology on Demand for Inpatient Services | HS08-014 | Page 329 |
| No | Howlett, Katia, MPP, MBA, PhD (in progress) | Web Based Intervention for Alcohol Use in Women | HS08-014 | Page 331 |
| No | Taha, Jessica Rose, MS | The Effects of Age, Cognition, and Health Literacy on use of a Patient EMR | HS08-014 | Page 333 |
| No | Armstrong, April, MD | Patient-Centered Online Care Model for Follow-Up Management of Atopic Dermatitis | HS08-014 | Page 335 |
| No | Gesteland, Per, MD, MS | Using Health Information Technology to Support Population-Based Clinical Practice | HS08-014 | Page 337 |
| No | Koopman, Richelle, MD, MSCR | Patient Readiness to Use Internet Health Resources | HS08-014 | Page 339 |
| No | Rand, Cynthia M., MS, MD, MPH | Using Health Information Technology to Improve Delivery of HPV Vaccine | HS08-014 | Page 341 |
| No | Were, Martin, MD, MS | Improving Management of Test Results that Return After Hospital Discharge | HS08-014 | Page 343 |
| No | Del Fiol, Guilherme, MD, MS, PhD | Context-Aware Knowledge Delivery into Electronic Health Records | HS08-014 | Page 345 |
| **Centers for Education and Research on Therapeutics (CERTs) (U18)** | | | | |
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| No | Bates, David, MD, MSc | Health Information Technology and Improving Medication Use | HS07-004 | Page 347 |

| AHRQ Health Services Research Projects (R01) | | | | |
|---|---|---|---|---|
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Funding Opportunity Announcement** | **Summary** |
| No | Carroll, Aaron, MD | Computer Automated Developmental Surveillance and Screening | PA09-070 | Page 350 |

| | |
|---|---|
| **Project Title:** | A Research Agenda for the Patient-Centered Medical Home |
| **Principal Investigator:** | Landon, Bruce, M.D. |
| **Organization:** | Society of General Internal Medicine |
| **Mechanism:** | PA: HS06-074: Small Grant Program for Conference Support (R13) |
| **Grant Number:** | R13 HS 017995 |
| **Project Period:** | 03/09 – 02/10 |
| **AHRQ Funded Amount:** | $46,010 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Not Applicable

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** The patient-centered medical home (PCMH) is emerging as a new model for providing population-based, patient-centered primary care. Despite professional interest and endorsement, there is limited evidence on the impact of the PCHM model on the cost and quality of health care services. Many questions remain on how to best implement, measure, and pay for this new service delivery model. Further implementation requires research to better understand the model's impact on providers and policymakers. Specifically, there is a need to understand the marginal effectiveness of the PCMH over the traditional primary care model.

The Research Agenda for a Patient-Centered Medical Home conference convened National researchers, representatives of major primary care professional organizations, health care purchasers, payers, patient advocates, and policymakers to discuss the research agenda needed to move PCMH from a demonstration model to an evidenced-based standard of care.

**Specific Aims**

- Inform and advance the state of the art and science and real-world experience about the PCMH. **(Achieved)**
- Develop partnerships and build capacity to implement a practical evaluation model that can be used by health plans, government payers, and policymakers to assess components of the PCMH and alternative models. **(Achieved)**
- Develop and recommend a research agenda to inform the development and broad implementation of the PCMH model. The research agenda will specifically address the "business case" for adopting the PCMH model as well as the clinical and cost consequences of implementing PCMH. **(Achieved)**
- Disseminate the synthesis of the conference, including background and descriptive information, via peer-reviewed literature, the Web, and presentations at relevant National health policy and professional association meetings. **(Achieved)**

**2009 Activities:** The conference was held on July 27th and 28th in Washington, DC. It was cohosted by the Society of General Internal Medicine, the Society of Teachers of Family Medicine, and the Academic Pediatrics Association, with support from the Agency for Healthcare Research and Quality, the American Board of Internal Medicine Foundation, and the Commonwealth Fund.

**Preliminary Impact and Findings:** Findings from the conference were discussed in several manuscripts, the majority of which were published in the Journal of General Internal Medicine (see below).

**Selected Outputs**

Berenson R, Rich E. How to buy a medical home? Policy options and practical questions. J Gen Intern Med 2010 Jun;25(6):619–24.

Berenson R, Rich E. U.S. approaches to physician payment: the deconstruction of primary care. J Gen Intern Med 2010 Jun;25(6):613–8.

Bitton A, Martin C, Landon B. A nationwide survey of patient-centered medical home demonstration projects. J Gen Intern Med 2010 Jun;25(6):584–92.

Homer C, Baron R. How to scale up primary care transformation: what we know and what we need to know? J Gen Intern Med 2010 June 25(6):625–9.

Landon B, Gill J, Antonelli R, et al. Using evidence to inform policy: developing a policy-relevant research agenda for the patient-centered medical home. J Gen Intern Med 2010 Jun;25(6):581–3.

Landon BE, Gill J, Antonelli R, et al. Prospects for rebuilding primary care using the patient-centered medical home. Health Aff (Millwood) 2010 May;29(5):827–34.

Rittenhouse D, Thom D, Schmittdiel J. Developing a policy-relevant research agenda for the patient-centered medical home: a focus on outcomes. J Gen Intern Med 2010 Jun;25(6):593–600.

Stange K, Nutting P, Miller W, et al. Defining and measuring the patient-centered medical home. J Gen Intern Med 2010 Jun;25(6):601–12.

| | |
|---|---|
| **Project Title:** | Fourth Annual Pediatric Telehealth Colloquium |
| **Principal Investigator:** | Marcin, James |
| **Organization:** | University of California, Davis |
| **Mechanism:** | PA: HS06-074: Small Grant Program for Conference Support (R13) |
| **Grant Number:** | R13 HS 018310 |
| **Project Period:** | 09/09 – 08/10 |
| **AHRQ Funded Amount:** | $49,520 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Pediatric*, Medically Underserved

**Summary:** Regionalization of children's services has led to higher quality care and improved outcomes among pediatric patients. However, this model of care can lead to disparities in access for children living in nonurban areas. Telemedicine allows pediatricians and pediatric specialists to provide care to children living in rural, remote, and underserved communities, thereby reducing health care delivery disparities. The Fourth Annual Pediatric Telehealth Colloquium—built upon the three previous annual conferences—educated participants about how telemedicine can be used in a variety of care settings, how to create a financially sustainable framework, and how to increase the quality of care and reduce health care costs through the use of telemedicine. The conference covered the topics of basic telemedicine and telecommunications technology; how telemedicine can be used to improve outreach, strategic, and administrative planning; funding opportunities; technical and equipment support; and techniques for education, research, and advancement of telemedicine in existing programs. The program was promoted to all remote sites currently using telemedicine as well as sites interested in using telemedicine. The conference subsidized the attendance of rural providers and providers working in medically underserved communities.

**Specific Aims**

- Disseminate information about how telemedicine is used in a variety of care settings, how telemedicine improves access and increases education, and about how to create a financially sustainable framework to address disparities in care, increase the overall quality of care, and decrease overall health care costs. **(Achieved)**

**2009 Activities:** The conference was held on September 24th and 25th in Palm Springs, California, as part of the American Telemedicine Association Mid-Year Meeting. All presentations at the conference were compiled in a conference CD.

The learning objectives and main areas of the conference were: overview of current status of telemedicine in pediatric care, administrative and strategic planning, inpatient and outpatient specialty care, international telemedicine, education and telemedicine, child development and telemental health, and alternate applications and telehealth.

**Preliminary Impact and Findings:** Not Applicable

**Selected Outputs**

Abstracts from the 2009 American Telemedicine Association Mid-Year Meeting. Telemedicine and e-Health. 2009 Sep; 15(7): 718-27.

The Annual Pediatric Telehealth Colloquium 2009, Palm Springs, California, Conference CD.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Primary Care Research Methods and Statistics Conference |
| **Principal Investigator:** | Calmbach, Walter |
| **Organization:** | University of Texas Health Sciences Center |
| **Mechanism:** | PA: HS06-378: AHRQ Grant Program for Large Conference Support (R13) and (U13) |
| **Grant Number:** | R13 HS 017658 |
| **Project Period:** | 09/08 – 09/11 |
| **AHRQ Funded Amount:** | $182,621 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Not Applicable

**Business Goal:** Synthesis and Dissemination

**Target Population:** General

**Summary:** Economic constraints have limited the number of fellowship programs that train primary care researchers. This presents a gap in the necessary mentoring and ongoing training of both fellowship- and nonfellowship-trained researchers. To address this need, Primary Care Research and Methods and Statistics Conferences have been held to build research capacity of both novice and experienced researchers. For novice researchers, the conferences develop basic research skills, such as planning and conducting simple studies and communicating results. For experienced researchers, the conferences build understanding of research techniques and statistical approaches to conducting high-quality sophisticated primary care studies.

Primary Care Research and Methods and Statistics Conferences were held December 5-7, 2008, March 19-22, 2009, and January 22-24, 2010. The conferences included a pre-conference workshop for experienced researchers; plenary sessions; two workshops "Dissection of Innovative Studies Workshop" and the "Methodological Think Tank Process Workshop"; and two tracks of seminars that were grouped by theme. Conference attendees were asked to evaluate each speaker and the conference itself. Information on the conference to promote attendance is disseminated to primary care researchers through professional society newsletters, e-mail Listservs, Web sites, and professional annual meetings.

**Specific Aims**

- Help novice researchers develop basic research skills. **(Achieved)**
- Help experienced researchers expand their repertoire of research methodologies. **(Achieved)**

**2009 Activities:** The 2009 conference was held March 19-22. The conference theme was "Patient-Centered Care, Patient-Centered Research." It was designed to be multidisciplinary and attract a wide variety of researchers, including health services, family medicine, internists, and pediatricians.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs:** The project has no outputs to date.

| | |
|---|---|
| **Project Title:** | The Impact of Health Information Technology on Demand for Inpatient Services |
| **Principal Investigator:** | Barrette, Eric, M.A. |
| **Organization:** | University of Minnesota, Twin Cities |
| **Mechanism:** | PAR: HS06-118: AHRQ Grants for Health Services Research Dissertation (R36) |
| **Grant Number:** | R36 HS 018272 |
| **Project Period:** | 09/09 – 08/10 |
| **AHRQ Funded Amount:** | $24,642 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Elderly*, Medicare

**Summary:** The influence of the adoption of health information technology (IT) on where consumers decide to receive hospital inpatient services is largely unknown. These decisions affect the costs and quality of those services and the market power of the hospitals. This project examines the role of health IT in meeting inpatient health care service demands. This demand analysis complements existing supply side analyses to provide more complete and dynamic estimates of the impact health IT has on health care markets. It allows policymakers and the health care industry to make better decisions on optimal health IT adoption and implementation strategies.

The analysis requires information about hospitals' characteristics and information technology as well as patients' characteristics and hospital choices. Data needed to perform this analysis come from several sources. Hospital characteristics data are obtained from the American Hospital Association (AHA) annual survey. This database contains information on hospitals' physical and organizational characteristics such as location, number of full-time physicians, services provided, and number of beds. The AHA database is linked with the Health Information and Management Systems Society Analytics Database. This dataset contains detailed historical information on the health IT software, hardware, and infrastructure installed in the surveyed hospitals. Inpatient Medicare claims data are the source of patient-level choices and characteristics. Regional demographic data from the 2000 U.S. Census are also included.

The econometric methods for this project estimate the demand for hospital services using patient characteristics, hospital characteristics, and observed patient choices. A hospital's decision to implement health IT is considered a treatment or policy intervention, and the change in the total number of patients using the hospital is the outcome of interest. A discrete choice model uses patient-level data to estimate the probabilities of patients choosing each hospital in their choice set. The parameter estimates from these models will show how health IT affects a patient's likely hospital choice. Advanced, discrete-choice modeling will be applied to deal with biased and inconsistent parameter estimates if they arise.

**Specific Aims**

- Measure the effect of hospital adoption of health IT on the demand for inpatient care. **(Ongoing)**
- Estimate the impact of health IT by type of inpatient service. **(Ongoing)**
- Evaluate the effect of changes in patient hospital choices using consumer surplus as a welfare measure. **(Ongoing)**

**2009 Activities:** Data use and data sharing agreements were established, and the study team worked on building the combined dataset using all sources. Preliminary writing and documentation of the methods and datasets was also a focus.

**Preliminary Impact and Findings:** Preliminary results suggest health IT does not have a significant effect on patient demand.

**Selected Outputs**

The project does not have any outputs to date.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Web Based Intervention for Alcohol Use in Women |
| **Principal Investigator:** | Delrahim-Howlett, Katia, M.P.P., M.B.A., Ph.D. (in progress) |
| **Organization:** | University of California San Diego |
| **Mechanism:** | PAR: HS06-118: AHRQ Grants for Health Services Research Dissertation (R36) |
| **Grant Number:** | R36 HS 018071 |
| **Project Period:** | 06/09 – 05/10 |
| **AHRQ Funded Amount:** | $37,800 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal: Knowledge Creation**

**Target Population:** Low SES/Low Income*, Women*

**Summary:** Fetal Alcohol Spectrum Disorders (FASDs) arise from prenatal exposure to alcohol and are among the most common developmental disabilities in the United States, occurring in as many as one in 100 children. Despite widespread educational efforts about the fetal health risks associated with prenatal alcohol use, recent estimates from the Centers for Disease Control and Prevention indicate that 10 percent of women who know they are pregnant report alcohol use. Thus, there is a need for more effective primary prevention and intervention programs to reduce alcohol intake before conception and during pregnancy. This need is amplified among low-income women who may be more vulnerable to prenatal alcohol use and, therefore, whose children are at higher risk of alcohol-related developmental abnormalities. From a public health perspective, the use of health information technology to develop self-administered, cost-efficient methods for conducting alcohol assessments and delivering targeted interventions has broad-based appeal for integration into maternal and child primary care. Furthermore, if such methods could be applied to low-income populations, the recognized health disparities associated with alcohol use in pregnancy can be better addressed.

This project works with women whose children or dependents are receiving services through the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) in San Diego County, California. A small-scale, randomized, controlled trial tests an adapted version of an existing Web-based program to reduce alcohol consumption in nonpregnant women who currently drink at risky levels. A second objective evaluates the sustainability in the reduction of alcohol consumption between women who receive the Web-based feedback intervention and women who do not. Qualified and consenting participants are randomly assigned to complete the Web-based assessment and receive generic information about FASD or to complete the Web-based assessment and receive a personalized feedback intervention. All participants will complete followup assessments on reported alcohol consumption at 1 and 2 months post baseline.

The results of this study will contribute to: 1) knowledge of the feasibility of using a Web-based medium to efficiently and accurately assess alcohol use in vulnerable populations, 2) identification of potentially cost-effective prevention and intervention strategies that can address health disparities in preconception and prenatal education and health care, 3) validation of the effectiveness of an existing Web-based program that may have wide-ranging applicability in maternal and child health primary care, and, 4) extension of theoretical frameworks involved in using an innovative intervention delivery medium to further advance the science of eHealth.

**Specific Aims**

- Evaluate the effectiveness of the adapted Web-based assessment and intervention program in reducing risky alcohol consumption in nonpregnant women who have children or dependents enrolled in WIC by comparing rates of reduction in alcohol consumption (mean drinks per occasion and number of risky drinking occasions) between women who receive the Web-based feedback intervention and women who do not at 1 month post baseline. **(Ongoing)**
- Evaluate the sustainability of reduction in alcohol consumption (number of risky drinking occasions) between women who receive the Web-based feedback intervention and women who do not at 2 months post baseline among women reporting a reduction at 1 month post baseline. **(Ongoing)**

In addition to the specific research project aims, this grant for Health Services Research Dissertation Award supports Katia Delrahim-Howlett, M.P.P., M.B.A., a 3rd year student in the Joint Doctoral Program in Public Health at San Diego State University and University of California, San Diego.

**2009 Activities:** The first half of the project focused on participant recruitment, baseline assessment, implementation of the intervention, and followup assessments. Of a total of 150 enrolled in the study, 135 participants in three clinics completed the study with a retention rate around 90 percent. There were no baseline differences between the study populations across the clinics. Participants were randomized to one of two study groups: either the control group (assessment and generic information) or the exposure group (assessment and personalized feedback intervention). Followup assessment calls were conducted by the principal investigator 1 and 2 months after the baseline assessment was completed. All participants were presented with information on local alcohol treatment resources. Additional data analysis is ongoing.

**Preliminary Impact and Findings:** Preliminary results indicate no main effect in the multivariate analysis, that is, no significant differences between the treatment and control groups were found. However, there does appear to be a treatment effect as indicated by an increased odds ratio (from 1.2 to 3.0) when looking at a reduction in risky drinking behavior and the decrease in the number of mean drinks. The project team is working to identify the specific variables that may be driving this change.

**Selected Outputs**

This project has no outputs to date.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | The Effects of Age, Cognition, and Health Literacy on Use of a Patient EMR |
| **Principal Investigator:** | Taha, Jessica Rose, M.S. |
| **Organization:** | University of Miami |
| **Mechanism:** | PAR: HS06-118: AHRQ Grants for Health Services Research Dissertation (R36) |
| **Grant Number:** | R36 HS 018239 |
| **Project Period:** | 09/09 – 11/10 |
| **AHRQ Funded Amount:** | $37,800 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Elderly*, Low Literacy

**Summary:** The use of patient portals of electronic medical records (EMRs) is spreading and continues to gain popularity as patient involvement in disease prevention, management, and decisionmaking is emphasized in our health care system. To date, there has been little usability testing of patient portals, especially with older adult populations. This study will systematically assess the ability of older adults to use the patient portal of an EMR to perform health management tasks and examine how individual characteristics, such as health literacy and cognitive abilities, impact the use of such systems.

Participants will include individuals aged 40 to 85 years with low and high health-literacy levels, as measured by the Test of Functional Health Literacy in Adults (TOFHLA). The specific focus will be on three common health management tasks associated with patient portals: 1) medication management; 2) interpreting laboratory/test results; and 3) health maintenance activities. By systematically assessing the relationship between individual characteristics and the ability to use a patient portal of an EMR system, the study will identify "the root" of usability problems and develop empirically based interventions to help those who are most likely to face problems interacting with these systems. At the same time, this research should increase the general usability of these systems, which will ultimately benefit all patient populations.

Participants will be given a background questionnaire to gather demographic data such as gender, age, ethnicity, educational level, income, health information, and medication usage, a technology experience questionnaire, and a cognitive battery test. Participants will also be given the TOFHLA and subjective and objective numeracy tests. Basic information will be provided on how to navigate the EMR record and view its information. Each participant will then use the portal to perform three common types of health-related tasks: medication management, health maintenance, and reviewing laboratory/test results. Following the completion of the tasks, participants will be asked to complete a portal usability questionnaire. At the completion of data collection, brief interviews will be conducted with each participant to get additional feedback on use of the patient portal.

**Specific Aims**

- Examine the ability of middle-aged and older adults to use a patient portal of an EMR to perform common health management tasks. **(Ongoing)**

- Examine the relationships between individual characteristics such as age, cognitive abilities, health literacy, and task performance. **(Ongoing)**
- Identify usability problems inherent in the use of patient portals and identify design solutions. **(Ongoing)**

**2009 Activities:** The project focused on finalizing the research protocols and establishing the measures which will be used in the research. The principal investigator began drafting surveys and exit interviews.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project began in the last quarter of 2009 and is in the startup phase.

**Milestones:** Progress is mostly on track.

**Budget:** Spending roughly on target.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Patient-Centered Online Care Model for Followup Management of Atopic Dermatitis |
| **Principal Investigator:** | Armstrong, April, M.D. |
| **Organization:** | University of California Davis |
| **Mechanism:** | PAR: HS09-085: Mentored Clinical Scientist Research Career Development Award (K08) |
| **Grant Number:** | K08 HS 018341 |
| **Project Period:** | 11/09 – 11/14 |
| **AHRQ Funded Amount:** | $713,340 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Pediatric*, Atopic Dermatitis

**Summary:** Access to timely, high-quality dermatologic care poses a significant challenge in the U.S. health care system. Store-and-forward teledermatology—defined as the practice of dermatology through digital capturing and storage of clinical images and information, followed by asynchronous review of the clinical information by a dermatologist—presents an opportunity to improve patient satisfaction and access to dermatological specialist care.

The project, started in November 2009, introduces a patient-centered, technology-enabled model for delivering followup specialty care. Specifically, dermatologists from UC Davis Medical Center will participate in an asynchronous, online model for delivering direct followup dermatology care to patients with atopic dermatitis, a chronic skin disease from which millions of Americans suffer. In this online model, the patients communicate directly with their dermatologists, capture and transmit digital skin images, and receive online treatment recommendations and prescriptions from their dermatologists.

The year-long randomized controlled trial will compare clinical outcomes, quality of life and patient satisfaction, and knowledge about their skin disease between dermatology patients receiving conventional, face-to-face followup care and those that are receiving followup care via the patient-centered care online model. This model has the potential to be adapted for patients suffering from other types of chronic medical conditions that require regular followup visits to specialists.

In addition to the specific research project aims, as part of this Mentored Clinical Scientist Research Career Development Award, Dr. Armstrong aims to achieve the long-term career goal of increasing access to specialist care for patients in rural and medically underserved communities. To reach this goal, the funding will allow her to acquire advanced skills in health services research through structured coursework and regular seminars and mentoring with leaders in health services research, dermatology, and telemedicine.

**Specific Aims**

- Assess the effect of this asynchronous, online model for delivering direct, followup dermatologic care on clinical outcomes in patients with atopic dermatitis. **(Ongoing)**
- Evaluate the effect of this asynchronous, online model for delivering direct, followup dermatologic care on quality of life in patients with atopic dermatitis. **(Ongoing)**

- Determine the level of patient satisfaction and patient knowledge about atopic dermatitis in the asynchronous, online model for delivering direct, followup dermatologic care. **(Ongoing)**

**2009 Activities:** Project work in 2009 involved the initial set up of the project including the evaluation and testing of the online application (ultimately choosing Relay Health), training of participating dermatologists, and preparation of the patient education materials.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any reported outputs.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Using Health Information Technology to Support Population-Based Clinical Practice |
| **Principal Investigator:** | Gesteland, Per, M.D., M.S. |
| **Organization:** | University of Utah |
| **Mechanism:** | PAR: HS09-085: Mentored Clinical Scientist Research Career Development Award (K08) |
| **Grant Number:** | K08 HS 018538 |
| **Project Period:** | 09/09 – 07/14 |
| **AHRQ Funded Amount:** | $795,960 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Acute Respiratory Infections, Pediatric*

**Summary:** Acute respiratory infections (ARI) are a major burden to the heath care delivery system and the public's health. The overuse of antibiotics for viral infections has contributed to the rapid emergence of antimicrobial resistance and a substantial number of adverse drug events. As a result, research on preventing the overuse of antibiotics is a National priority.

This project, started in late 2009, aims to improve providers' ability to distinguish viral infections from bacterial infections by providing physicians and patients with timely, accessible information about the local incidence of common respiratory viruses through the use of a population health repository and decision support tools.

This study will address important gaps in the knowledge of patient and provider population-based health information needs and the data and information technology tools required to fill these gaps. The lessons learned through developing, implementing, and evaluating the impact of population-health and decision support tools for ARI treatment will lead to significant scientific contributions in this priority research area and improvements in integrating decision support tools into health care practices.

**Specific Aims**

- Assess primary care clinician use of current population-based ARI health information resources and decision support tools using focus groups and structured observation. **(Ongoing)**
- Refine population-based ARI health information resources and decision support tools to improve clinical information system workflow integration and patient communication. **(Upcoming)**
- Implement these population-based ARI health information resources and decision support tools in primary and urgent care settings. **(Upcoming)**
- Measure the effects of population-based ARI health information resources and decision support tools on population-based clinical practice and patient/parent compliance. The goal of these interventions is to increase the effectiveness and appropriateness of antibiotic prescribing for ARI. **(Upcoming)**

In addition to the specific research project aims, as part of this Mentored Clinical Scientist Research Career Development Award, Dr. Gesteland has the following short-term career goals:

- To expand existing skills in the extraction, analysis, and graphical display of health care data using electronic data warehouses, business intelligence platforms, and the Web 2.0.
- To develop new expertise in the cognitive science of data and information visualization and display to support clinical decisionmaking and patient-centered care delivery.
- To develop additional expertise in the integration and implementation of knowledge management and decision support tools in clinical information systems.
- To develop additional skills in conducting health information technology intervention studies including workflow analysis, cluster-randomized control and quasi-randomized controlled trials, interrupted time series analysis, and controlled before and after studies suitable for testing his proposed intervention.
- To expand and refine existing skills in measuring the effect of information/communications systems on the quality and productivity of health care.

**2009 Activities:** The project started in late 2009. Initial work has focused on determining how providers use population-based ARI health information resources and decision support tools. The original plan was to conduct focus groups with providers, but on advice from the research organization's Strategic Planning Group, this was changed to contextual interviews in which investigators sit down with providers and go over how they use tools and resources. Activities in 2009 also included setting up focus groups with parents of patients to help inform decision support tools. Participants include a Spanish-speaking group. The intent of these parent focus groups is to assess their information needs relevant to ARI, understand where they get their ARI information, and determine preferences on what type of information they would like on ARI and how it would be presented.

**Preliminary Impact and Findings:** This project does not have any findings to date.

**Selected Outputs**

This project does not have any reported outputs to date.

**AHRQ Priority Population*

| | |
|---|---|
| **Project Title:** | Patient Readiness to Use Internet Health Resources |
| **Principal Investigator:** | Koopman, Richelle, M.D., M.S.C.R. |
| **Organization:** | University of Missouri, Columbia |
| **Mechanism:** | PAR: HS09-085: Mentored Clinical Scientist Research Career Development Award (K08) |
| **Grant Number:** | K08 HS 017948 |
| **Project Period:** | 03/09 – 02/14 |
| **AHRQ Funded Amount:** | $723,592 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Adults, Chronic Care*, Congestive Heart Failure, Diabetes, Hypertension

**Summary:** As the burden of chronic disease increases in the United States and throughout the world, new approaches are needed to adequately care for people with chronic conditions. The Chronic Care Model suggests processes and systems that can help optimize the care of patients with chronic disease. It emphasizes patient self-activation because activated patients are prepared to take a collaborative, if not central, role in managing their own health. Online health resources could potentially provide a sustainable and patient-centered format for delivering the education, communication, and self-management resources needed to optimize patient activation. However, Web-based resources for chronically ill patients are only valuable if patients have the computer skills and motivation to use them.

This project examines the readiness (aptitude and desire) of patients to use Web-based health resources such as patient education, self-management tools, online prescription refills, requests, medication reconciliation, and secure messaging. The study looks at the relationship between motivation for behavior change and the use of health information exchange, defined as the use of online health resources and interactive online communication between the patient and the health care team. To help examine the question of patient readiness, the project team is developing a practical measure of the readiness of ambulatory patients with chronic conditions to use Web-based health resources. The first aim of the study is to test the measure's predictive validity against logs of actual use of Web-based health resources by such patients and directly observe their use of these Web resources. The second aim is to examine how use of an interactive online patient portal is associated with improvements in clinical measures for patients with type 2 diabetes.

This examination of preferences for use of Web-based health resources among ambulatory patients with chronic disease will inform projects, systems, and policies that seek to use the online environment as part of a comprehensive disease management strategy.

**Specific Aims**

- To develop a measure of the readiness (aptitude and desire) of patients with chronic conditions attending primary care clinics to use Web-based health resources for health information exchange. This measure will be called the Electronic Health Information Exchange Readiness Scale (E-HIERS). **(Ongoing)**
- To determine how the frequency and type of use of Web-based health resources are associated with improvements in clinical measures for patients with type 2 diabetes. **(Upcoming)**

In addition to the specific research project aims, Dr. Koopman, as part of this Mentored Clinical Scientist Research Career Development Award, has an overarching goal to improve the quality and safety of patient care for those with chronic conditions. This will be attained via the following short-term career goals: 1) to acquire expertise in scale development; 2) to develop an understanding of the intersection of information and learning in health applications, focusing on both the human and technological dimensions; 3) to gain scientific and career guidance from local collaborators, advisors, and consultants; and 4) to acquire skills in leadership and management from professional development seminars and a longitudinal self-improvement plan developed in collaboration with a mentor.

**2009 Activities:** Activities had primarily to do with developing the readiness scale. The first step in this process was to develop the items for the scale, which required an information-gathering phase that included focus groups of ambulatory patients with chronic disease. A total of four focus groups were conducted with 16 chronically ill ambulatory patients who are users and non-users of the Internet. Although the research plan allowed for as many as 30 participants, the project team was able to reach theoretical saturation with the four groups. Qualitative software is being used to analyze responses from the focus groups to inform item development for the scale. A medical research student was hired to assist with this work as well as to conduct a comprehensive literature review of validated items from previously published scales.

**Preliminary Impact and Findings:** Focus group findings indicated that promoters of online health resource use include speed and convenience (when compared to calling a member of their health care team), and the ability to look up information before a visit with a physician. Primary barriers to online health resource use included Internet security and privacy concerns. General conclusions drawn from the results are that the use of online information among patients with chronic conditions is an accessory to their relationship with their physician, that patients with less-established relationships may rely on the Internet more heavily, and that patients are using the Internet to enhance care by becoming more informed consumers, confirming the Chronic Care Model. The results will be used to inform development of the scale to measure patient readiness to use Internet health resources.

**Selected Outputs**

None available at this time.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The budget was slightly underspent due to the lack of a research assistant during the first 3 months of the study. The budget is expected to be completely on track in 2010 as the research assistant is more fully utilized.

**Milestones:** Progress is completely on track.

**Budget:** Somewhat underspent, approximately 5 to 20 percent.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Using Health Information Technology to Improve Delivery of HPV Vaccine |
| **Principal Investigator:** | Rand, Cynthia M., M.S., M.D., M.P.H. |
| **Organization:** | University of Rochester |
| **Mechanism:** | PAR: HS09-085: Mentored Clinical Scientist Research Career Development Award (K08) |
| **Grant Number:** | K08 HS 017951 |
| **Project Period:** | 09/09 – 09/14 |
| **AHRQ Funded Amount:** | $745,995 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business** Goal: Knowledge Creation

**Target Population:** Adults, Inner City*, Teenagers, Women*

**Summary:** A vaccine to prevent human papillomavirus (HPV) infection is now recommended for all women aged 11 to 26 years. It is highly effective if all three doses are received prior to exposure to HPV strains. However, approval and recommendation of a vaccine does not ensure its receipt. Barriers to completion of the three-dose HPV vaccine regimen include health care provider factors (e.g., competing health care priorities during medical visits), and parent or adolescent factors that prevent patients from returning for booster doses.

This project, initiated in September 2009, will determine whether the use of electronic patient reminders can shorten intervals between HPV vaccine doses and increase overall rates of completion of HPV vaccination regimen in inner-city settings when compared to practices without reminders. Two health information technology (IT) interventions are planned. The first will use electronic medical record (EMR) prompts to reduce missed opportunities for immunization. Prompting effectiveness will be measured using a before-and-after study design. The second and primary intervention will be an electronic reminder to patients for followup doses of vaccine, delivered by e-mail, text message, or a social networking site.

Qualitative interviews with health care providers, parents of adolescent girls, and adolescents themselves will guide the intervention design. A retrospective cross-sectional analysis of the intervention will be performed in four inner-city primary care practices. Postintervention rates of missed opportunities for HPV vaccination, intervals between vaccine doses, overall rates of completed HPV vaccination (three doses), and health maintenance visits will be measured in several intervals at each practice. Data will be analyzed to assess the overall effectiveness of the prompting and patient reminder intervention in reducing missed opportunities and improving vaccination completion rates, and to assess rates of health maintenance visits and other vaccinations for adolescents in intervention and comparison practices. Outcomes will be measured at baseline and again 6 months after the EMR prompt is added. The electronic patient reminder will then be implemented, and summary statistics will be generated 6, 12, and 18 months after the intervention begins.

**Specific Aims**

- Measure baseline rates of missed opportunities for HPV vaccination, the intervals between HPV vaccine doses, and the proportion of patients who received one, two, or three vaccinations. **(Upcoming)**

- Develop and implement a health IT-based intervention to reduce missed opportunities, reduce intervals between doses, and increase completion of the HPV vaccination series in inner-city practices. **(Upcoming)**
- Measure postintervention rates and analyze data. **(Upcoming)**
- Complete educational objectives, see below **(Ongoing):**

In addition to the specific research project aims, as part of this Mentored Clinical Scientist Research Career Development Award, Dr. Rand will complete the following education objectives: learn health informatics theory, and be able to apply it to both clinical decision support for providers and self-management support for patients; become expert in implementing and sustaining quality improvement (QI) projects based in health IT, and teach these skills to other health care providers; skillfully implement qualitative research methods and develop advanced skills in the application of quantitative statistical methods; and improve career skills by writing sound manuscripts and competitive grants, and networking with leaders in health IT, immunization delivery, QI, and adolescent preventive health.

**2009 Activities:** Primary activities focused on enrollment in courses as part of professional development aims of Dr. Rand.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Improving Management of Test Results That Return After Hospital Discharge |
| **Principal Investigator:** | Were, Martin, M.D., M.S. |
| **Organization:** | Indiana University |
| **Mechanism:** | PAR: HS09-085: Mentored Clinical Scientist Research Career Development Award (K08) |
| **Grant Number:** | K08 HS 018539 |
| **Project Period:** | 10/09 – 9/13 |
| **AHRQ Funded Amount:** | $577,880 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Adults

**Summary:** Nearly half of the hospital patients discharged with pending test results experience medical errors related to missed results for those tests. These errors largely arise from poor methods for managing test results and from poor communication with the followup providers. Discharge summaries, the main mode of inpatient-to-outpatient communication, remain highly inadequate at documenting tests with pending results at discharge. While the problems related to poor management of test results returning after hospital discharge is widely acknowledged, little has been done to implement and evaluate interventions to improve existing systems.

This project will implement and evaluate two health information technology interventions aimed at improving management of tests with pending results at hospital discharge. Specifically, the project will: (1) develop a tool to automatically identify tests with pending results at hospital discharge and assist in incorporating these tests into the discharge summary, (2) evaluate the impact of this tool on accuracy of documenting pending tests in discharge summaries, (3) modify an existing clinical-messaging tool (DOCS4DOCS®) to automatically deliver results for pending tests to the followup providers, and (4) evaluate the impact of the modified messaging tool on providers' actions and attitudes. This work will be conducted at Wishard Memorial Hospital (WMH). WMH is a 353-bed urban public hospital on the campus of Indiana University School of Medicine that uses the Regenstrief Medical Record System (RMRS) integrated with the Regenstrief-developed Gopher computerized provider order entry (CPOE) system. All inpatient orders and discharge summaries must be entered electronically via Gopher. The newly developed tool will deliver pending results to providers through the Gopher CPOE system.

To evaluate the tools, Dr. Were and his team will use a combination of randomized controlled studies, and surveys to discern the specific effects of each technology on processes of care. Outcomes of interest include: (1) adequacy and accuracy of discharge summary documentation of tests with pending results, (2) usability of the tool to help incorporate pending tests into the discharge summary, (3) impact on providers' actions of automatically delivering results, and (4) attitudes of followup providers on automatic delivery of test results that return after hospital discharge.

**Specific Aims**

- Develop and implement a computerized tool which automatically identifies tests with pending results at hospital discharge and assist in the incorporation of these tests into the discharge summary. **(Ongoing)**
- Evaluate the impact of this tool on accuracy of documenting pending tests in discharge summaries **(Upcoming)**
- Modify an existing clinical-messaging program to enable automatic delivery of returning results for pending tests to the designated outpatient followup providers. **(Upcoming)**
- Evaluate how the automatic delivery of test results impacts followup providers' actions and attitudes. **(Upcoming)**

In addition to the specific research aims, Dr. Were, as part of the Mentored Clinical Scientist Research Career Development Award, will continue his long-term career goal of implementing and evaluating informatics-based interventions that improve quality of care and patient safety. Project funds will allow him to acquire advanced skills through structured coursework, regular seminars, and mentoring with leaders in medical informatics, health services research, biostatistics, and implementation research.

**2009 Activities:** The project team began Java-language programming of the processor, called the Pending Test Processor (PTP), that will incorporate pending tests into the electronically-prepared discharge summaries. This includes programming the Gopher CPOE system to send an HL7 trigger-message to the PTP when a discharging provider signs the electronic discharge summary. Upon receiving this trigger message, the PTP identifies tests with pending results by querying the RMRS database. The tests identified through the queries will be delivered via Gopher back to the discharging provider, who will select tests for inclusion on the discharge summary.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

| | |
|---|---|
| **Project Title:** | Context-Aware Knowledge Delivery into Electronic Health Records |
| **Principal Investigator:** | Del Fiol, Guilherme, M.D., M.S., Ph.D. |
| **Organization:** | Duke University |
| **Mechanism:** | PAR: HS09-087: Mentored Research Scientist Research Career Development Award (K01) |
| **Grant Number:** | K01 HS 018352 |
| **Project Period:** | 09/09 – 07/13 |
| **AHRQ Funded Amount:** | $575,729 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Adults

**Summary:** The Institute of Medicine (IOM) report, Crossing the Quality Chasm: A New Health System for the 2001 Century, called for an overhaul of the U.S. health care system, noting that new models of care should make health care more safe, effective, patient-centered, timely, efficient, and equitable. Aligned with the IOM aims, new models of care, such as the American Academy of Pediatrics Medical Home and the Future of Family Medicine project New Model, have been proposed.

One of the main causes of errors in the health care system is gaps in the information available to providers. The provision of just-in-time access to relevant knowledge is an essential requirement for the implementation of new models of care. Immediately available information helps patients and providers make better, more informed decisions. Information delivered in this manner facilitates the process through which providers explain patient care options and helps providers retrieve and manage the best, up-to-date knowledge available at the point of care.

The goal of the proposed research is to develop, implement, and evaluate a prototype for a scalable and widely deployable knowledge delivery service ("knowledge broker") capable of automatically delivering context-specific knowledge from online resources into electronic health record (EHR) systems via a "knowledge dashboard." This will help providers address their knowledge gaps, leading to better and more informed decisions.

A literature review in combination with focus groups will document provider knowledge needs. This information will inform the development of the knowledge dashboard. Once developed, the knowledge dashboard will be integrated into an EHR for use by providers. The project is using McKesson Horizon Ambulatory Care EHR, a Certification Commission for Health Information Technology-certified product.

Four core design requirements will drive the development of the knowledge broker to guarantee its scalability and wide deployability: 1) the architecture will be open, independent, standards-based, and services-oriented; 2) the knowledge base will be expandable to accommodate additional knowledge needs in various contexts; 3) the knowledge broker will be able to deliver knowledge through mechanisms other than a knowledge dashboard, such as infobuttons; and 4) the knowledge broker will be able to account for the needs of and deliver knowledge to both providers and patients. This will allow the dashboard to potentially serve as a national model for knowledge delivery at the point of need.

The project will investigate why, how, and when users interact with the knowledge dashboard as well as the effect of these interactions on the fulfillment of knowledge needs and decisionmaking. Finally, the

study will identify areas and opportunities for system enhancement and expansion. An exploratory data analysis will determine the feasibility and planning of a future large-scale quantitative investigation. It is anticipated that this project will ascertain the level to which provider-oriented knowledge will help providers address their knowledge gaps, leading to better and more informed decisions.

**Specific Aims**

- To build a knowledge base of patients' and providers' knowledge needs. **(Ongoing)**
- To design, develop, and evaluate the usability of a scalable, widely deployable knowledge delivery service in a laboratory setting. **(Ongoing)**
- To conduct a mixed-method assessment of a pilot implementation of the knowledge broker in a real-world medical home environment. **(Upcoming)**

In addition, as part of this Mentored Research Scientist Research Career Development Award (K01), Dr. Del Fiol is seeking additional training in clinical and health services research and leadership training through the Duke University School of Medicine Clinical Research Training Program.

**2009 Activities:** The project was in the startup phase, during which time the literature review to build a knowledge base and initial design of the knowledge delivery service were initiated.

**Selected Outputs**

The project does not have any outputs to date.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The project is in the startup phase.

**Milestones:** Progress is mostly on track.

**Budget:** Roughly on target.

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|---|---|
| **Project Title:** | Health Information Technology and Improving Medication Use |
| **Principal Investigator:** | Bates, David W., M.D., M.Sc. |
| **Organization:** | Brigham and Women's Hospital |
| **Mechanism:** | RFA: HS07-004: Centers for Education and Research on Therapeutics (CERTs) (U18) |
| **Grant Number:** | U18 HS 016970 |
| **Project Period:** | 09/07 – 08/11 |
| **AHRQ Funding Amount:** | $1,999,073 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health information technology (IT) evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Knowledge Creation

**Target Population:** General

**Summary:** The Centers for Education and Research on Therapeutics (CERTs) program is a national initiative to increase awareness of the benefits and risks of new, existing, or combined uses of therapeutics through education and research. Each CERT supports multiple research projects under the leadership of a lead principal investigator.

In 2007, recognizing that information technology (IT) has great potential to reduce medication errors and improve patient safety, the Agency for Healthcare Research and Quality funded the Brigham and Women's Hospital's Health IT CERT program. The Brigham and Women's Hospital CERT-Health IT team is organized into two "cores": The Methodology and Data Resources Core, and the Translation and Dissemination Core. These cross-disciplinary cores support their current CERT projects. The project topics span the areas of soliciting information from patients on adverse events related to medications, the use of clinical decision support, evaluation of new processes for medication reconciliation post-discharge, and the impact of regional health exchange on medication safety.

These results will break new ground and help assess how current health IT-related interventions can be rolled out broadly. In addition, the Brigham and Women's Hospital CERT-Health IT team will build and bolster educational tools and programs to assist with therapeutics and health IT.

**Specific Aims**

- Evaluate the impact of using telephony to ask outpatients prescribed specific medications (known from electronic health record [EHR] data) if they are experiencing adverse effects related to those medications. **(Ongoing)**
- Evaluate the impact of clinical decision support and automated telephone outreach on antihypertensive and lipid-lowering therapy in ambulatory care. **(Ongoing)**
- Evaluate any new errors created upon implementation of electronic prescribing. **(Ongoing)**
- Evaluate the impact of implementing a post-discharge ambulatory medication reconciliation intervention. **(Ongoing)**
- Evaluate effects of multiple vendor-based prescribing systems on medication safety among six Regional Health Information Organizations in New York and Massachusetts. **(Ongoing)**

**2009 Activities**

Project 1 – e-Pharmaco-vigilance: Integrating Patient Reports of Side Effects with Electronic Health Records for Surveillance of Recently Approved Drugs. This project uses interactive voice response that interoperates with a patient EHR to actively monitor patients taking recently Food and Drug Administration-approved drugs. The system calls patients to ask about their progress using a medication, and the system is programmed with electronic triggers to e-mail the physician. The project enrolled approximately 300 to 400 patients per month.

Project 2 – A Multi-Modal Intervention to Improve Antihypertensive and Lipid-Lowering Therapy. This project compares the impact of clinical decision support (CDS) to CDS plus automated telephone outreach to patients on their use of antihypertensive and lipid-lowering medications. The project completed the qualitative research of semi-structured interviews with providers to characterize the challenges of medication management, received institutional review board approval, and developed the automated telephone script that will support CDS in one arm of the evaluation.

Project 3 – Unintended Consequences of ePrescribing. This project is reviewing prescriptions from commercial pharmacies to identify e-prescription errors. The project will determine the frequency of errors and characterize them in order to develop recommendations for steps to prevent e-prescribing errors and other unintended consequences. The team reviewed 3,898 prescriptions and began to categorize the types of errors, and evaluate differences in types of errors and error rates between different ePrescribing systems.

Project 4 – Ambulatory Medication Reconciliation Following Hospital Discharge. In 2007, a post-discharge medication reconciliation module was created within the ambulatory EHR to reduce medication errors. When the trial began in 2008, use of the module was low, so the project team created an active reminder ("pop up") in the EHR medication screen and a passive reminder in the EHR summary screen. The team compared usage of the reconciliation module with reminders to usage before the reminders were developed.

Project 5 – Impact of Vendor Systems on Ambulatory Medication Safety. This project compares the impact of electronic prescribing by users in the short term (less than 6 months) to longer-term users (greater than 1 year). The project is enrolling providers in rural Hudson Valley, New York and New York City. Provider enrollment was completed in Hudson Valley, and five providers in New York City were recruited. The team met with the commercial electronic prescribing vendor to ensure that the prescription data can be captured for the two time periods of interest.

Project 6 – Identification of Decision Support Rules for Dissemination in EHRs. This project is developing medication-related clinical decision support rules for EHRs in inpatient and outpatient settings. The team reviewed a large data set of adverse drug events involving multiple drugs in community hospitals to build on previous research and enable developing recommendations to prevent adverse drug events. As the second component of the project, seven sites were visited to assess the EHR and computerized physician order entry system alerts for compliance with human factors principles. The human factors principles were developed by the research team and are established for use in other systems with visual alerts, but they have not yet been applied to clinical information systems.

**Preliminary Impact and Findings**

Project 1: The project is tracking the percentage of calls that trigger an e-mail response to the provider, and of those e-mails sent to a provider, the percentage that result in direct followup from the provider through a phone call, office visit, or discontinuation of the medication. A manuscript describing the system design, implementation, and challenges encountered has been submitted to Pharmacoepidemiology and Drug Safety.

Project 2: The project has no findings to date.

Project 3: The project has characterized the types of errors and the error rates across different e-prescribing systems. The preliminary results describe the differences in errors between systems and the range in error rates across systems in areas such as inappropriate abbreviations and omitted duration. Initial findings will be presented at a poster session and a manuscript has been submitted for publication.

Project 4: The project has no findings to date; a manuscript is in preparation for publication in 2010.

Project 5: The project has no findings to date; a manuscript is in preparation for publication in 2010.

Project 6: A manuscript is currently under review describing the key human factors principles for consideration in the design and implementation of medication-related decision support systems.

**Selected Outputs**

Achieving Benchmarks in Treating Hypertension and Hyperlipidemia: Barriers and Best Practices Physician Interview Guide.

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|---|---|
| **Project Title:** | Computer Automated Developmental Surveillance and Screening |
| **Principal Investigator:** | Carroll, Aaron, M.D. |
| **Organization:** | Indiana University- Purdue University at Indianapolis |
| **Mechanism:** | PA: HS07-243: AHRQ Health Services Research (R01) |
| **Grant Number:** | R01 HS 017939 |
| **Project Period:** | 06/09 – 05/12 |
| **AHRQ Funding Amount:** | $899,183 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Disabilities*, Pediatric*

**Summary:** Developmental disabilities affect between 12 and 16 percent of the pediatric population in the United States. "Best practices" guidelines require that children receive appropriate and timely screening and treatment for these disabilities. Electronic computer decision support strategies (CDSS) offer a promising aid for implementing a standardized approach to developmental surveillance and screening.

Researchers at Indiana University have developed an electronic CDSS for pediatric practices called CHICA (child health improvement through computer automation) to deliver appropriate guidelines to physicians during the patient visit. CHICA will be modified to incorporate developmental surveillance and screening within the existing practice workflow without requiring additional time of the physician or other office staff. The CHICA CDSS system includes the elements of: 1) pediatric guidelines encoded in Arden Syntax; 2) a dynamic, scannable paper user interface; and 3) an HL7-compliant interface to existing medical record systems.

The proposed work extends the CHICA software by incorporating the 2006 American Academy of Pediatrics (AAP) guidelines into the surveillance and screening algorithm, and evaluates the effect of the CHICA system on developmental surveillance, screening, referral, and early intervention/early childhood services. This evaluation follows a cohort of children with developmental disabilities to compare the proportion of children who undergo developmental screening at 9-, 18-, and 30-month visits at four practice sites, two of which have implemented the CDSS system and two of which have not. This will identify how implementation of the AAP recommendations into CHICA affects adherence to clinical guidelines. In addition, documentation of long-term outcomes will contribute to knowledge about the impact of early surveillance and screening on child health. Qualitative aspects of child screening surveillance will also be explored. These include elements of the child's management plan, such as family involvement in treatment decisions/planning, treatment that is based on the initial assessment versus treatment that is continuously modified using data-driven decisionmaking, and whether management strategies build on the strengths of the child.

**Specific Aims**

- Expand and modify an existing computer-based decision support system (CHICA) to include the 2006 AAP developmental surveillance and screening algorithm. **(Ongoing)**
- Evaluate the effect of the CHICA system on the developmental surveillance and screening practices of four pediatric clinics. **(Upcoming)**
- Evaluate the effect of the CHICA system on referrals for developmental and medical evaluations, as well as early developmental intervention/early childhood services. **(Upcoming)**

- Develop and follow a cohort of children with identified developmental disabilities to look at the end results/effects of developmental screening. **(Upcoming)**

**2009 Activities:** A primary focus of the first year of the grant was to incorporate the 2006 AAP developmental surveillance and screening algorithm and rules into the CHICA system. An expert team, including a general pediatrician and a clinical psychologist, was assembled to discuss and reflect on the generation of rules in CHICA following the AAP algorithm. Programming of the developmental screening algorithm was initiated to enable CHICA to generate the Ages and Stages Questionnaire (ASQ), which will be filled out by parents at their children's 9-, 18-, and 30-month visits. In addition to programming, further modifications were made to the CHICA to allow the system to receive and interpret images sent by fax and improve the ability of the software to verify data received in scanned forms.

In preparation for the evaluation, the project team identified and began installing CHICA software at four clinical sites. None of the sites previously operated the CHICA software, so initial training on the use of the software was conducted. All four clinics are participating in a learning collaborative focused on child developmental screening. Evaluation of the CHICA system will test the ability of the software to support teams focused on developmental screening.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

No outputs at this time.

**Grantee's Most Recent Self-Reported Quarterly Status (as of December 2009):** The team is working on implementing the screening tools, such as the Ages and Stages Questionnaire, as scannable documents that can be read by the Teleform document management program, which will produce a scored result. The technology has been applied to one document; the next task is modifying the other screening tools.

**Milestones:** Progress is mostly on track.

**Budget:** Spending is roughly on target.

**AHRQ Priority Population.*

## Table 14: Contract-Specific Summaries

| One-Time Requests for Proposals | | | | |
|---|---|---|---|---|
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Contract Number** | **Summary** |
| No | Davidson, Arthur, MD, MSPH | Colorado Connecting Communities—Health Information Collaborative | 290-04-0014 | Page 356 |
| No | Frisse, Mark, MD, MS, MBA | MidSouth eHealth Alliance | 290-04-0006 | Page 358 |
| No | Overhage, J. Marc, MD, PhD | An Evolving Statewide Indiana Information Infrastructure State and Regional Demonstration Project—Indiana Network for Patient Care | 290-04-0015 | Page 360 |
| No | Perez, Gina B., MPA | Delaware Health Information Network | 290-05-0012 | Page 362 |
| No | Root, Jan, PhD | Improving Communications Between Health Care Providers via a Statewide Infrastructure: Utah Health Information Network Clinical State and Regional Demonstration Project | 290-04-0002 | Page 364 |
| No | Zimmerman, Amy, MPH | Rhode Island Statewide Health Information Exchange—State and Regional Demonstration Project, current*care* | 290-04-0007 | Page 366 |
| No | Middleton, Blackford, MD, MPH, MSc | Clinical Decision Support Consortium | 290-08-10010 | Page 368 |
| No | Shiffman, Richard N., M.D., M.C.I.S. | Guidelines Into Decision Support | 290-08-10011 | Page 372 |
| **Active Health IT Portfolio Task Orders (TO)** | | | | |
| **Completed in 2009** | **Principal Investigator** | **Project Title** | **Contract Number** | **Summary** |
| Yes | Bell, Douglas, MD | Use of Electronic Referral System to Improve the Outpatient Primary Care-Specialty Care Interface | 290-06-0017-4 | Page 374 |
| No | Bell, Douglas, MD | Building an Implementation Toolset for E-Prescribing | 290-06-0017-3 | Page 377 |
| No | Berkowitz, Alicia , BA | Applying Lessons Learned in Community Collaboration to Health Information Technology | 290-07-10071-5 | Page 379 |
| No | Bhardwaj, Ajay, PhD | Learnings for Implementing Electronic Exchange of Health Information: A Synthesis of AHRQ's Health Information Exchange Projects | 290-07-10034-2 | Page 381 |
| No | Brennan, Patricia Flatley, RN, PhD | Industrial and Systems Engineering and Health Care: Critical Areas of Research Workshop | 290-09-00027U | Page 383 |
| Yes | Brottman, Gail, MD | Improving Ashtma Care in an Integrated Safety Net Through a Commercially Available Electronic Medical Record | 290-06-0020-5 | Page 385 |
| No | Brustrom, Jennifer, PhD | Quality Indicators Care Coordination Measures Project | 290-04-0020 | Page 387 |

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| No | Busch, Jon , PhD and Levit, Katherine | Design of a Toolkit to Add Electronic Clinical Data to Statewide Hospital Administrative Claims Data | 290-2006-0009C | Page 389 |
| No | Carayon, Pascale and Karsh, Ben-Tzion, PhD and PhD | Incorporating Health Information Technology Into Workflow Redesign | 290-08-10036 | Page 391 |
| No | Casale, Cecilia, PhD | Reducing Disparities in Health Care Quality for Priority Populations: An Approach Focused on Improving Care in Under-Resourced Settings Using Health Information Technology and Other Quality Improvement Strategies | 290-09-10014 and P330900421P | Page 393 |
| No | Dimitropoulos, Linda, PhD | Technical Assistance for Health Information Technology and Health Information Exchange in Medicaid and the Children's Health Insurance Program | 290-07-10079T | Page 395 |
| No | Doebbeling, Bradley, MD, MS | Implementing and Improving the Integration of Decision Support into Outpatient Clinical Workflow | 290-06-0013-3 | Page 398 |
| No | Felt-Lisk, Susan, MPA | Synthesis Reports for Grants and Cooperative Agreements for Transforming Health Care Quality Through Information Technology | 290-09-00019I-3 | Page 400 |
| No | Fiks, Alexander, MD, MSCE | The Give Teens Vaccines Study | 290-07-10013-4 | Page 402 |
| No | Finkelstein, Joseph, MA, MD, PhD | Enabling Patient-Centered Care through Health Information Technology | 290-07-10061-I7 | Page 404 |
| No | Fontaine, Patricia, MD, MS | Assessing the Impact of the Patient-Centered Medical Home | 290-07-10010-4 | Page 406 |
| Yes | Fontaine, Patricia, MD, MS | Participation by Primary Care Practices in Health Information Exchange in Minnesota | 290-07-10010-2 | Page 408 |
| No | Genevro, Janice, PhD | "First, Do No Harm": Using Health Information Technology to Reduce Use of Preventive Services with Potential Harms | 290-09-00032U | Page 410 |
| Yes | Gibbons, M. Chris, MD, MPH | Impact of Consumer Health Informatics Applications | 290-07-10061 | Page 411 |
| No | Grossman, Joy, PhD | Effective Use of e-Prescribing in Physician Practices and Pharmacies | 290-05-0007-3 | Page 413 |
| Yes | Hasnain-Wynia, Romana, PhD | Improving Quality through Health Information Technology: Testing the Feasibility and Assessing the Impact of Using Existing Health Information Technology Infrastructure for Better Care Delivery | 290-06-0022-3 | Page 415 |
| Yes | Hsiao, Allen L., MD | Secure Messaging in a Pediatric Respiratory Medicine Setting | 290-06-0015-2 | Page 417 |
| No | Hurd, Donna, MSN | Evaluation of AHRQ's On-Time Pressure Ulcer Program | 290-06-0011-8 | Page 419 |
| No | Jack, Brian, MD | Using Innovative Communication Technology to Improve the Health of Young African American Women | 290-06-0012-7 | Page 421 |
| Yes | Kerwin, Jeffrey, PhD | Consumer Engagement in Developing Electronic Health Information Systems | PSC TO#07R000131 | Page 424 |

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| No | Krist, Alexander, MD, MPH | Using Health Information Technology to Improve Health Care Quality in Primary Care Practices and in Transitions Between Care Settings | 290-07-10011-3 | Page 426 |
| No | LaBonte, Sheri, JD, PMP, CISSP | Patient Safety Metadata | 290-08-10005M | Page 428 |
| No | Lobach, David, MD, PhD, MS | Enabling Health Care Decisionmaking Through the Use of Health Information Technology | 290-07-10066-I | Page 430 |
| Yes | Longo, Daniel, ScD | Defining Barriers/Solutions for Collecting Quality Performance Measures | 290200710011I-2 | Page 432 |
| No | McDonnell, Cheryl J., PhD | Use of Dense Display of Data and Information Design Principles in Primary Care Healthcare Information Technology Systems | 290-07-10073T | Page 434 |
| No | McKibbon, Ann, MLS, PhD | Enabling Medication Management through Utilization of Health Information Technology | 290-07-100601-5 | Page 437 |
| No | Mold, James , MD, MPH | Using Health Information Technology to Improve Health Care Quality in Primary Care Practices and in Transitions between Care Setting | 290-07-10009-5 | Page 439 |
| No | Mullican, Charlotte, MPH | Health Information Technology and Mental Health: The Way Forward | 290-09-000027U | Page 441 |
| No | Nagykaldi, Zsolt, PhD | Stay-at-Home Influenza Toolkit | 290-07-10009-4 | Page 442 |
| No | Nemeth, Lynne, PhD, RN | Implementation and Evaluation of Standing Orders Using Health Information Technology | 290-07-10015-2 | Page 444 |
| No | O'Connell, Mary Ellen, MMHS | Human Factors in Home Health Care | AHR7128 | Page 447 |
| No | Osheroff, Jerry, MD | Structuring Care Recommendations for Clinical Decision Support | 290-09-00022I-2 | Page 449 |
| No | Peikes, Deborah, PhD, MPA | Establishing Federal Resources to Support Patient-Centered Medical Home Concept | 290-09-00019I-2 | Page 451 |
| Yes | Peterson, Anne, MS | Personal Health Information Management and Design of Consumer Health Information Technology | 290-2007-1007-2T-1M1 | Page 453 |
| No | Resnick, Helaine, PhD | Telemonitoring in Rural Elder Nutrition Centers: Demonstration Project of Hypertension Management | 290-06-0024-2 | Page 457 |
| No | Rosenthal, Daniel, MD | Health Information Technology Enablement of Quality Measurement: Health Information Technology Expert Panel | 290-07-10017-3 | Page 459 |
| No | Shiffman, Richard N., MD, MCIS | Improving Guideline Development and Implementation | 09-587F-07 | Page 461 |
| No | Simonaitis, Linas, MD, MS | Improving Lab Followup by Delivering an Enhanced Medication List to Outpatient Physician Practices | 290-06-0013-2 | Page 463 |
| Yes | Spranca, Mark D., PhD | Conducting Measurement Activities for Health Information Technology Initiative | 08R000112 | Page 465 |

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| No | Togias, Alkis , MD | Asthma Measurement Development – Asthma Outcomes Workshop | 09-655F-09 | Page 467 |
| No | Uhrig, Jennifer, PhD | Using Short Message System (SMS) to Improve Health Care Quality and Outcomes Among HIV-Positive Men | 290-06-0001-7 | Page 469 |
| Yes | West, David, PhD | Participation by Primary Care Practices in Health Information Exchange in Colorado | 290-07-10008-3 | Page 471 |
| No | West, David, PhD | Assessing the Impact of the Patient-Centered Medical Home | 290-07-10008-6 | Page 474 |
| No | Williams, Robert, MD | Evaluation of Computer-Generated After-Visit Summaries to Support Patient-Centered Care | 290-07-10007-2 | Page 476 |
| No | Wu, Shinyi and Koppel, Ross, PhD and PhD | Developing a Guide to Identifying and Remediating Unintended Consequences of Implementing Health Information Technology | 290-06-0017-5 | Page 478 |

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|---|---|
| **Project Title:** | Colorado Connecting Communities—Health Information Collaborative |
| **Principal Investigator:** | Davidson, Arthur, M.D., M.S.P.H. |
| **Organization:** | Colorado Regional Health Information Organization (CORHIO) and University of Colorado Health Sciences Center |
| **Contract Number:** | 290-04-0014 |
| **Project Period:** | 10/04 – 01/10 |
| **AHRQ Funding Amount:** | $5,000,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** General

**Summary:** This project built a prototype data exchange among four providers as a learning laboratory to identify architecture and policy issues the community needs to address to establish a sustainable business model. The four partners of the Colorado Regional Health Information Organization (CORHIO) project are Denver Health and Hospital Authority, Kaiser Permanente Colorado, The Children's Hospital, and University of Colorado Hospital.

The CORHIO project uses a robust electronic master patient index (eMPI) that allows records to be matched and shared at the point of care (POC). This system offers authorized emergency room practitioners at the four sites access to radiology reports, laboratory results, prescribed and dispensed medication information, EKG reports, registration information, and problem lists aggregated from all sites. All existing standards from the Healthcare Information Technology Standards Panel were incorporated into the architecture. CORHIO and its partners "went live" with the demonstration on December 1, 2008.

The project team was able to successfully develop a non-profit, independent entity to promote exchange of health information in Colorado. Policies, procedures, and the technical and legal infrastructure were developed and deployed to allow secure, federated exchange of information between the four large health care organizations over the Internet utilizing Federal standards and protocols to the extent that they existed. A robust eMPI for nearly 2,500,000 registrants (1,400,000 individuals) was developed and much experience gained around how to build and utilize an eMPI.

**Specific Aims**

- Facilitate the live exchange of clinical information across four sites. **(Achieved)**
- Evaluate clinical impact. **(Achieved)**
- Analyze role of the Medicaid program. **(Achieved)**
- Develop a sustainability model. **(Achieved)**

**2009 Activities:** In the early months of 2009, the CORHIO Board approved and adopted the business/sustainability plan, which outlined two main roles for CORHIO: 1) expand its role as a convener of stakeholders and an organizational resource for facilitating health information technology (IT) activity across the State and 2) provide health IT services, offering a central infrastructure that maximizes economies of scale to deliver or enable messaging functionality.

Activities throughout the year focused on improving and maintaining the system architecture across sites, providing a security and audit framework compliant with the Health Insurance Portability and Accountability Act that also met National Institute of Standards and Technology standards, implementing protocols and procedures at the four sites, and signing the master data-sharing agreement at the four sites. In January, CORHIO staff visited three of the four partners and implemented the POC service in their emergency departments. CORHIO completed ongoing work to enhance eMPI functionality, which helped partner organizations to identify duplicate records within and between organizations.

CORHIO decided not to implement a single system for the State, but rather to adopt appropriate standards and recognized software products that CORHIO will support and inter-connect. Although overall usage of the POC system was low, lessons learned from the demonstration project encouraged CORHIO to continue the eMPI work as it moved toward a sustainable clinical messaging model.

**Preliminary Impact and Findings:** Building a coalition of stakeholders into a non-profit corporate entity in Colorado was a slow and laborious process. The development of that entity has facilitated building a cogent business plan, taking advantage of new funding opportunities and capacity to take a leadership role within the State and region regarding health information exchange (HIE). This success is predicated on the shared involvement of both public and private sector health care leadership.

The eMPI is a core component of any HIE and provides the basis for a record locater service. The accuracy of linking patient identities across institutions will determine how the institutions and providers look at aggregated data. Partner participation is key to improving the accuracy of the data by getting it right at the source. Improving the eMPI is a multi-lateral process that can optimize care through all partners. This particular technology component is still in its infancy as a reliable resource.

With significant assistance from other Federally-funded efforts both public and private, legal and policy barriers, for the most part, can be addressed successfully through collaborative engagement and firm deadlines for completing the work. Narrowing the scope to focus on the products and services where a business case exists significantly improves chances of success in these areas.

Use of the POC system had limited usage during the production period. Factors that impacted limited usage included: 1) the end-user had to initiate a process of searching for records and 2) password management was cumbersome. Despite an intuitive and relatively fast interface for patient searches, busy emergency department clinicians would not spend the time to search. A self-searching, automated system that launched the eMPI and record locator service upon patient consent, found matching records, and then prompted the emergency department end-user with potential matches could have better integrated with emergency department workflow.

**Selected Outputs**

CORHIO POC demonstration system was in use for most of the calendar year with three hospital emergency rooms and one health plan call center accessing secure information.

CORHIO and the Governor's Office of Technology hosted a health IT summit dedicated to bringing public and private stakeholders together to collaborate on how to leverage American Recovery and Reinvestment Act funding opportunities to further advance the HIE adoption process across the State.

The CORHIO POC system included more than 2.5 million individual records with more than 250,000 linked pairs among the four partners.

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| **Project Title:** | MidSouth eHealth Alliance |
| **Principal Investigator:** | Frisse, Mark, M.D., M.S., M.B.A. |
| **Organization:** | Vanderbilt University/Midsouth South eHealth Alliance |
| **Contract Number:** | 290-04-0006 |
| **Project Period:** | 09/04 – 09/10 |
| **ARHQ Funding Amount:** | $5,000,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** To develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** General

**Summary:** Health care providers can make better care and treatment decisions when they have as much information (laboratory tests, medical history, medicines, etc.) as possible about a patient's health. The MidSouth eHealth Alliance (MSeHA or the Alliance) implements and evaluates a regional data-sharing and interoperability service for health care entities in the Greater Memphis area, including three counties in southwest Tennessee, northern portions of Mississippi, and northeastern Arkansas. The MSeHA is a nonprofit organization that works in conjunction with the Vanderbilt University Regional Informatics Team. Stakeholders include patients, primary care providers, specialty care providers, inpatient and emergency room care teams, health systems, safety net clinics, and State and local government. The Alliance enables providers to review medical information from several organizations quickly while restricting access to a patient's medical information to current and direct care providers.

MSeHA has gained State and National recognition for its approach to privacy, security, and confidentiality. Its data-sharing agreements, policies, and operating committee infrastructure have been adapted by more than 30 organizations and States. The Alliance began with a focus on improving the quality of patient care while maintaining or decreasing the cost of care delivery. This project expands the initial focus by evaluating use/adoption, usability, reduction of duplicate tests, impact on specific complaints (e.g. chest pain), workflow, and financial impact. The lessons learned and work products developed are to be applied across the State.

**Specific Aims**

- Exchange of clinical data elements among providers in a three-county region with a population of about 1 million. **(Achieved)**
- Leverage the Vanderbilt technical architecture to initiate the exchange and eventual transition to an independent platform. **(Ongoing)**
- Expand the number of participating organizations to remaining safety net providers and primary care ambulatory providers. **(Ongoing)**
- Develop a business model for sustainability. **(Ongoing)**

**2009 Activities:** MSeHA began exchanging data in 2006, and as of December 2009, data from 15 hospitals (inpatient, outpatient, and emergency departments), 14 primary care safety net clinics, and the UT Medical Group (the private practice arm of the University of Tennessee Health Science Center, representing more than 400 providers), were available to emergency rooms (including one in Southaven, Mississippi), 14 primary care clinics, and hospitals. The data include laboratory results, diagnostic imaging reports, cardiac study reports, discharge summaries, dictated emergency department notes,

operative notes, history and physicals, diagnostic codes, patient demographics and other identification, and encounter data. The MSeHA has also been working on a medication hub project to provide medication history from RxHub and SureScripts; the project initiated its first query of the medication hub in early 2009. Approximately 26 percent of inquiries into the medication claims-based database yielded patient medication histories.

During 2009, the project team piloted the concept of a single sign-on and a trusted network, which improved workflow for the individual user while maintaining security. With the conclusion of successful pilots in two areas, MSeHA will implement single sign-on and trusted networks concepts at additional sites.

Initially, Vanderbilt donated the use of its proprietary technology (software, hardware, etc.). During 2009, as part of the sustainability plan, the MSeHA system worked on converting from the Vanderbilt system to a commercially available system hosted by Informatics Corporation of America (ICA). The conversion will be completed in early 2010. Through a partnership and licensing agreement with Vanderbilt, ICA retains the exclusive right to sell a commercial version of the Vanderbilt system.

**Preliminary Impact and Findings:** The MSeHA is conducting usability surveys with incentives, and collecting qualitative data on workflow issues in emergency department and ambulatory settings as part of its evaluation. Overall, providers commented that the data were valuable and useful in caring for patients. Suggestions for improvement were forwarded to the development team. Duplicate testing analyses are also underway for head MRI, head CT, abdomen CT, HBA1C, and ankle x-rays. The MSeHA tracks the number of patients who are queried and whether patient data were found. All patients are "looked up" through an automated process. A more detailed query is made by the provider for as many as 13 percent of the initial queries. Approximately one-third to one-half of patients who were the subject of a detailed query had some information available for the clinician.

**Selected Outputs**

Frisse ME. Perspective: Health information technology: one step at a time. Health Affairs. 2009;28(2):w379–w84.

Frisse ME. Information technology platform requirements for a learning healthcare system. Washington Institute of Medicine; 2009.

Penfield SL, Anderson KM, Edmund M, et al. Toward health information liquidity: realization of better, more efficient care from the free flow of health information. Washington: Booz Allen Hamilton; 2009 January. (served as major contributor)

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| **Project Title:** | An Evolving Statewide Indiana Information Infrastructure State and Regional Demonstration Project—Indiana Network for Patient Care |
| **Principal Investigator:** | Overhage, J. Marc, M.D., Ph.D. |
| **Organization:** | Regenstrief Institute |
| **Contract Number:** | 290-04-0015 |
| **Project Period:** | 09/04 – 07/10 |
| **AHRQ Funding Amount:** | $5,000,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** To develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** General

**Summary:** Indiana is using established local and regional health information initiatives, including the Indiana Network for Patient Care (INPC), to develop the electronic health information infrastructure across the entire State. The INPC, an operational health information exchange (HIE) in central Indiana (Indianapolis), is one of six Agency for Healthcare Research and Quality (AHRQ)-sponsored State and Regional demonstration (SRD) projects begun in late 2004 and early 2005 to create State or regional HIE. The SRDs use a variety of approaches (e.g., technical, business, and governance models) to support data sharing and interoperability. Each is funded to analyze the role of the Medicaid program, evaluate their project, and develop a sustainability plan. The INPC HIE includes a broad array of participants and members: physicians, hospitals, ambulatory practices, laboratories, radiology centers, health plans, State and county health departments, and immunization registries. The Regenstrief Institute, acting on behalf of the participants, created and operates the exchange and helped create the Indiana Health Information Exchange (IHIE) to establish a sustainable business model to support the INPC.

The INPC has operated since 1995, providing population-based, longitudinal, structurally coded, and text patient data on citizens of Indiana. The INPC coverage is most complete for the Indianapolis Metropolitan Statistical Area (MSA), a 3,200-square-mile region in central Indiana with 1.7 million residents, but continues to expand to cover all 6.4 million residents of Indiana. The INPC currently stores data for 20 million unique patient registrations, representing more than 10 million unique individuals. The system contains clinical data for nearly the entire population of the Indianapolis MSA, patients throughout Indiana, and patients outside the State.

The INPC captures data from many sources, including hospitals, physician practices, public health departments, laboratories, radiology centers, pharmacies, pharmacy benefit managers (via SureScripts), and payers. Sources like hospitals and physician practices provide many types of data, including laboratory, radiology, and pulmonary function test results; cardiology diagnostic results; gastroenterology study results; procedures performed; diagnoses assigned; transcribed reports (admission, operative, discharge); and inpatient, outpatient, and emergency department encounters.

**Specific Aims**

- Assess the effects of HIE on productivity, service utilization, patient quality, safety, satisfaction, and ongoing marginal costs. **(Ongoing)**

- Create a sustainable business and funding model to assure the HIE's long-term survival by providing services built on top of the HIE, such as clinical messaging, quality improvement, and public health services. **(Achieved)**

**2009 Activities:** The INPC brought in new partners (laboratories, imaging centers, suburban health hospitals, emergency departments, long-term care facilities, and rehabilitation centers) and sought to resolve several challenges related to this expansion. The INPC became more active in areas surrounding Indianapolis, including Evansville, Terre Haute, and Northwest Indiana. In addition, they continued developing a new software platform to support the exchange, completed a database migration, moved to a new data center, and completed an extensive application software redevelopment.

Regenstrief Institute and the MidSouth eHealth Alliance (MSeHA) worked together to implement the medication hub pilot project. MseHA and INPC were contracted to interface with multiple sources of medication information, including SureScripts-RxHub, and hospital data systems. Early in 2009, MSeHA initiated its first queries to the existing Regenstrief medication hub. The overall "hit rate" for queries is around 30 percent.

Regenstrief worked with the Marion County Health Department and IHIE to alert to more than 3,000 physicians about the H1N1 virus via the DOCS4DOCS clinical messaging system. In early September 2009, IHIE started securely sending clinical test results, reports, and other medical information to HealthBridge HIE in Cincinnati, Ohio, and to HealthLINC HIE in Bloomington, Indiana. Future HIE-to-HIE exchange will focus on bi-directional exchange among these HIEs and others.

Regenstrief implemented a study of barriers to expanding HIE participation and used information from multiple HIE databases to study ambulatory-related factors leading to hospitalization of patients with community-associated methicillin-resistant Staphylococcus aureus (CA-MRSA). Work continued on implementing the IHIE sustainability plan and implementing the evaluation plan.

**Preliminary Impact and Findings:** Preliminary findings from the CA-MRSA work indicate that it is possible to identify Centers for Disease Control and Prevention-defined CA-MRSA patients using multiple data sources, such as insurance claims data, a MRSA patient registry, INPC data, and geocoded patient data.

**Selected Outputs**

In February and September 2009, project staff participated in two in-person meetings with fellow AHRQ-sponsored SRDs to share lessons learned, gather general information, and plan for upcoming project-specific deliverables, such as conducting evaluations and developing sustainability plans.

Please see the INPC Web site, available at: http://www.regenstrief.org/medinformatics/inpc, for more information.

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| **Project Title:** | Delaware Health Information Network |
| **Principle Investigator:** | Perez, Gina B., M.P.A. |
| **Organization:** | State of Delaware |
| **Contract Number:** | 290-05-0012 |
| **Project Period:** | 09/05 – 09/11 |
| **Project Budget:** | $4,700,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** To develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** General

**Summary:** The Delaware Health Information Network (DHIN), a public-private partnership that received Agency for Healthcare Research and Quality funding in October 2005, implemented a real-time electronic method for health care providers to obtain information about their patients. The DHIN exchanges data among hospitals, reference laboratories, physician practices, and public health agencies through the State. Partners include consumers, physicians, hospitals, businesses, payers, government agencies engaged in health care, and reference laboratories.

The DHIN's public-private board of directors is comprised of diverse organizations representing the primary stakeholders of health information exchange (HIE). They include consumers, doctors, hospitals, health plans, business, higher education, and State agencies responsible for population health, information technology, and the State budget.

As of late 2009, DHIN had enrolled 144 practices with 59 additional practices in various stages of pre-enrollment. The three hospitals systems participating in DHIN account for more than 80 percent of hospital admissions in the State; these three hospital systems as well as LabCorp, Quest, and Doctors Pathology Services contribute data on more than 90 percent of the laboratory tests in the State.

**Specific Aims**

- Improve care of patients served by Delaware's health care system, and reduce medical errors associated with inaccurate or incomplete information available to providers. **(Ongoing)**
- Reduce the time and financial costs of HIE by reducing the complexity of current distribution methods and increasing use of electronic means. **(Ongoing)**
- Improve communication between health care providers and patients to provide appropriate, timely care that is based on the best available information. **(Ongoing)**
- Reduce the number of duplicative tests, and expedite the reporting of consultant opinions and tests/treatments between specialists and the referring physicians. **(Ongoing)**
- Improve the efficiency and value of electronic health record (EHR) systems in physicians' offices, and assist physicians that do not have an EHR to better organize and retrieve test results. **(Ongoing)**

**2009 Activities:** The DHIN reached 100 percent interoperability among its core data senders and receivers, including 100 percent of its data elements in July 2009. In March 2009, DHIN went live with patient record inquiry functionality and is developing medication history functionality, which is scheduled to go live in early 2010 at several pilot sites, including emergency departments, Federally Qualified

Health Centers, long-term care, home health, pain management, and private practices. Pilots for transcribed reports, radiology images, and eOrders were also being developed in 2009. Project staff began to develop evaluation and sustainability plans and continued to certify EHR vendors and provide them with interfaces to DHIN.

**Preliminary Impact and Findings:** As of late 2009, DHIN had enrolled 144 practices with 59 additional practices in various stages of enrollment. The three hospital systems and LabCorp contribute data on more than 90 percent of the laboratory tests in the State. The three hospitals systems participating in DHIN account for more than 80 percent of hospital admissions in the State. Anecdotal information has been the basis for the current impact evaluation of DHIN. This information has established that DHIN saves time and creates efficiencies at the practice office (both automated and paper-based), improves patient outcomes, saves money in the emergency department, and supports transitions of care among inpatient and outpatient settings. Participating hospitals have determined that automated public health reporting through the DHIN saves time and infection control resources. A formal evaluation will begin in September 2010 to understand the value and benefit of the DHIN for each stakeholder group, including physician practices, hospitals, laboratories, payers, consumers, and State agencies. The evaluation will measure how the DHIN impacts efficiency, patient safety, and health care costs.

**Selected Outputs**

For more information about DHIN and their work visit http://www.dhin.org/

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| **Project Title:** | Improving Communications Between Health Care Providers via a Statewide Infrastructure: Utah Health Information Network Clinical State and Regional Demonstration Project |
| **Principal Investigator:** | Root, Jan, Ph.D. |
| **Organization:** | Utah Health Information Network |
| **Contract Number:** | 290-04-0002 |
| **Project Period:** | 09/04 – 09/11 |
| **ARHQ Funding Amount:** | $5,000,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** To develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** General

**Summary:** The Utah Health Information Network (UHIN) is a broad-based coalition of health care insurers, physicians, hospitals, laboratories, local health departments, health centers, State agencies, and other interested parties that have come together to reduce health care costs and improve the quality of care through the use of electronic data interchange. In 2008, the Utah legislature passed a law that gave the Department of Health (DOH) the authority to adopt standards for exchanging medical data. The Utah DOH decided to leverage UHIN's experience in developing and adopting administrative data exchange standards for the task of exchanging clinical data.

UHIN's goal is to implement statewide information and communication technologies to facilitate the exchange of clinical data among its members. In the early stages of the project, UHIN completed the initial implementation of a statewide clinical health information exchange built upon existing administrative exchange infrastructure and contracts. The first 4 years of UHIN's Agency for Healthcare Research and Quality contract were dedicated to building coalitions, developing infrastructure, identifying and engaging in dialogue amongst disparate UHIN partners, developing UHIN self-governance policies and procedures, and determining technological and administrative requirements needed to support the UHIN. The enhanced infrastructure that allows initial exchange of clinical information through UHIN is a utility for direct entry of claims, eligibility inquiries, and other health care transactions. In 2008, the community determined that a more comprehensive solution for clinical information exchange was necessary, so in 2009, UHIN contracted with the Axolotl Corporation, a provider of health information exchange (HIE) services, to provide the technical infrastructure for a clinical health information exchange (cHIE). UHIN will update its electronic commerce agreement and create a cHIE addendum that places the responsibility to comply with liability requirements for proper use of member's clinical data.

**Specific Aims**

- Develop a novel exchange of laboratory and prescription drug data among unrelated entities. **(Achieved)**
- Conduct analyses of the role of the Medicaid program. **(Achieved)**
- Provide for an evaluation of the project. **(Ongoing)**
- Implement sustainability model. **(Ongoing)**

- Community implementation of clinical data exchange utilizing the expanded cHIE infrastructure that includes an "Electronic Medical Record (EMR) Lite," a Master Patient Index (MPI), and virtual health records query functionality. **(Ongoing)**

**2009 Activities:** UHIN began to roll out the cHIE in two pilot communities. By the end of the year, the UHIN Board approved seven clinical standards and three clinical specifications and updated the pricing model for the cHIE to reflect the number of hospital admissions from the previous year. Two clinics in the pilot community began receiving laboratory results from one of the hospitals through the cHIE. UHIN finalized its evaluation plan and began to collect data related to the UHINt (baseline provider tool) Pilot Implementation and Adoption. This evaluation consisted of the existing UHIN network ([UHINet] gateway and baseline tools), which exchanged administrative (billing) transactions to be upgraded to also allow for the exchange of clinical messages. The evaluator, HealthInsight, completed interviews with UHIN staff on the adoption of UHINet and UHINt and began to analyze clinical logging data to determine the volume of clinical transactions exchanged over a period of time.

UHIN leveraged the work completed under this contract to establish a 2-year pilot project with Veterans Affairs (VA) to exchanging continuity of care documentation between the VA and rural hospitals in Utah by connecting UHIN to the National Health Information Network.

**Preliminary Impact and Findings:** In a State with relatively high (30 to 50 percent) EMR penetration, the cost—in the form of connection and clinical interface fees EMR vendors want to charge—is a significant challenge. EMR vendors are seeking between thousands and tens of thousands of dollars to create these connections and clinical interfaces.

In addition, Dr. Root's team has found that EMR systems are not currently designed to easily handle clinical, real-time information exchange. The majority do not have the functionality to: 1) query for a virtual health record, 2) identify and resolve multiple identities efficiently, 3) manage HIE patient consent parameters, 4) maintain the metadata that identifies the origins of imported HIE data, or 5) indicate which HIE data have been validated. In short, UHIN anticipates that most clinicians, whether they have an EMR or not, will be forced to use some or all of the cHIE tools—EMR-lite, virtual health records, and the registry and report tool—in tandem with their existing EMRs.

**Selected Outputs**

UHIN standards only apply to members of UHIN and do not become State rules. The UHIN standards for exchanging clinical information through the cHIE that were established in 2009 include:

- Chief Complaint Standard Version 2.0
- Clinical Acknowledgement and Error Status Standard Version 2.0
- Clinical Laboratory Results Standard Version 2.0
- Discharge Summary Standard Version 2.0
- History and Physical Standard Version 2.0
- Operative Report Standard Version 2.0
- Standardized Laboratory Test Result Identifiers Standard Version 2.0
- Master Patient Index and Physician Address Book Specification Version 2.0
- Admit/Discharge/Transfer Specification Version 2.0
- Clinical Header and Trailer Specification Version 1.0

Developing an approved list of EMR systems that have been successful in developing an interface with the cHIE.

cHIE addendum to accommodate clinical data exchange in the cHIE

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| **Project Title:** | Rhode Island Statewide Health Information Exchange—State and Regional Demonstration Project, current*care* |
| **Principal Investigator:** | Zimmerman, Amy, M.P.H. |
| **Organization:** | Rhode Island Department of Health |
| **Contract Number:** | 290-04-0007 |
| **Project Period:** | 09/04 – 06/11 |
| **AHRQ Funding Amount:** | $5,000,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** To develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** General

**Summary:** The Rhode Island Department of Health is collaborating with the Rhode Island Quality Institute (RIQI) and stakeholders across the State to develop, implement, and evaluate an interconnected statewide health information system with a master patient index (MPI). The aim of the system is to provide information to clinicians and patients when and where it is needed. The Rhode Island health information exchange (HIE) system, known as current*care*, is intended to evolve into an interconnected statewide health information network that will improve the quality, safety, and value of health care services and support critical public health needs for the broader Rhode Island population.

The project is intended to design, develop, test, deploy, and evaluate the initial phase of a secure and reliable HIE system governed by RIQI, the State-designated health information organization (HIO). Initial types of data to be shared as part of the HIE during the project period include laboratory results and medication history. Initial end users will be long-term care facilities, community health centers, private providers, and hospital emergency departments. Other data-sharing partners, end users, and data types, including interfaces with electronic health record (EHR) systems, will be added as quickly as possible.

Current*care* is being implemented in accordance with the Rhode Island HIE Act of 2008, which stipulates stricter privacy and confidentiality protections than other State and Federal health information privacy laws. The rationale, impact, and results of this law on HIE system implementation will be a major focus of the project evaluation. Current*care* is expected to go live in late 2010.

**Specific Aims**

- Improve the quality, safety, and value of health care in the State of Rhode Island through a sustainable statewide HIE system. **(Ongoing)**
- Incorporate an MPI into the HIE to locate longitudinal patient health information from numerous data-submitting partners statewide. Design the HIE so that consumers will be allowed to control access to their data. **(Achieved)**
- Implement the capability to present data from various sources in an integrated, patient-centric manner using a common user interface. **(Upcoming)**
- Transition all operating, management, and governance responsibility of the HIE to a community-based regional HIO. **(Upcoming)**

**2009 Activities:** Project stakeholders worked with the technical vendor team to finalize the first version of current*care* for testing and security audit. Technical development focused largely on implementing a

two-level patient authorization model and a scalable consumer enrollment methodology, prompted by privacy and security policy and legal developments. RIQI continued efforts to obtain consumer registration (enrollment) in current*care* using various strategies, including community outreach and education, training and development among providers, and paper-based and electronic marketing strategies. Enrollment efforts initially targeted Medicaid beneficiaries and were expanded to include patients at the site of care and in long-term care facilities.

In January 2009, the project team presented an update on current*care* implementation to the Rhode Island Chapter of the American Health Information Management Association. In February and September 2009, the project team participated in two in-person meetings with fellow Agency for Healthcare Research and Quality-sponsored State and Regional Demonstration projects to share lessons learned and general information, and to plan for upcoming project-specific deliverables, such as conducting evaluations and developing sustainability plans. By the end of the year, more than 33,500 patients had been enrolled in current*care*. Current*care* was in the user acceptance testing phase in late 2009 to be followed by a security audit before going live in a pilot implementation. Efforts continued to finalize the data-sharing agreement, which will be signed once the system is ready to go live.

**Preliminary Impact and Findings:** The impact of the RI HIE Act of 2008, which applies specifically to the statewide HIE system, has been notable during this period. While system-generated findings are not yet available due to implementation delays, in addition to laying the legal and operational foundation for the RI HIE authorization model, the project developed and gained governance committee approval of 10 distinct HIE policies and brought them into compliance with the Health Information Technology for Economic and Clinical Health Act of 2009.

**Selected Outputs**

Information about the current*care* system is available at www.currentcareri.com.

The project team contributed to the AHRQ-sponsored manuscript entitled, *Liability for Regional Health Information Organizations: Lessons from the AHRQ-Funded State and Regional Demonstration Projects and Other Community Efforts*, available at http://www.healthit.ahrq.gov/.

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| **Project Title:** | Clinical Decision Support Consortium |
| **Principal Investigator:** | Middleton, Blackford, M.D., M.P.H., M.Sc. |
| **Organization:** | Brigham and Women's Hospital |
| **Contract Number:** | 290-08-10010 |
| **Project Period:** | 03/08 – 07/10, Including No Cost Extension |
| **AHRQ Funding Amount:** | $5,000,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population**: Diabetes, Coronary Artery Disease, Hypertension

**Summary:** Despite the overwhelming evidence of clinical decision support's (CDS's) effectiveness, CDS adoption and use are limited; only a small number of academic medical centers and integrated delivery networks accounting for the bulk of CDS research and development. Wider CDS adoption has been held back by a variety of social, economic, and technical issues, including but not limited to: lack of widely adopted standards for representing and sharing clinical knowledge in a computable form; difficulty developing clinical practice guidelines that can be readily and unambiguously translated into a computable form; absence of a central repository or knowledge resource where computable guidelines can be stored and shared; challenges integrating CDS into the clinical workflow; and limited understanding of organizational and social issues relating to CDS.

These barriers are surmountable, as evidenced by sites where CDS is pervasive. The biggest challenge to fostering widespread CDS adoption is documenting, generalizing, and translating the experience from these advanced sites to broader community settings. To address this challenge, investigators from Brigham and Women's Hospital, Harvard Medical School, and Partners HealthCare Information Systems (PHIS) formed the Clinical Decision Support Consortium (CDSC) in collaboration with the Regenstrief Institute, the Veterans Health Administration, Kaiser Permanente Northwest Research Group, General Electric Healthcare, Siemens Medical Solutions, Mayo Clinic, NextGen, University of Texas School of Biomedical Informatics, Oregon Health and Science University, Mid-Valley Independent Physicians Association, and University of Medicine and Dentistry of New Jersey.

The goal of the CDSC is to assess, define, demonstrate, and evaluate best practices for knowledge management (KM) and CDS in health information technology (IT) at scale—across multiple ambulatory care settings and electronic health record (EHR) technology platforms—in pursuing the long-term goal of widespread CDS adoption. The CDSC will develop a series of service-oriented clinical decision support interventions focused on diabetes, coronary artery disease, and hypertension screening.

The project is organized into two base years and three option years. In the base years, the CDSC team developed the service-oriented CDS interventions and piloted them in ambulatory sites in Massachusetts. In the option years, the team will expand the interventions and continue to gather data and develop best practices for state-of-the-art service oriented CDS.

**Specific Aims**

- Assess and define best practices for knowledge management and CDS in ambulatory care. **(Ongoing)**
- Define a novel, practical knowledge representation scheme that allows users to access knowledge in a manner that facilitates the translation of knowledge into CDS within EMRs. **(Ongoing)**

- Build a prototype National knowledge repository to support access and use of knowledge artifacts and collaborative knowledge engineering. **(Achieved)**
- Build publicly available Web services to provide remote CDS. **(Acheived)**
- Build end-user CDS dashboards depicting user compliance with CDS and provide feedback to knowledge engineers building the CDS knowledge artifacts and Web services on the efficacy of the CDS. **(Achieved)**
- Coordinate overall CDSC evaluation activities. **(Ongoing)**
- Demonstrate the feasibility of a service oriented architecture (SOA)-based approach through multisite, multivendor demonstration projects. **(Ongoing)**
- Disseminate results through a variety of traditional channels. **(Ongoing)**

2009 Activities: Building on a successful first base year, in 2009 the CDSC team continued to pursue research and development through a number of project teams from institutions across the U.S. The KM lifecycle assessment team conducted site visits at leading hospitals and with clinical content and EHR vendors, assessing KM systems, terminology services, and data standards. Results of these assessments were disseminated in academic publications and at presentations and in recommendations to Certification Commission for Health Information Technology (CCHIT), Healthcare Information Technology Standards Panel (HITSP) and clinical practice guideline developers, knowledge vendors, and health IT vendors. Results were also used to define best practices for CDS development and maintenance, including refinement of the multilayered knowledge representation model. The CDS services team continued to develop and support a SOA-based CDS service which is currently running in the Partners Longitudinal Medical Record (LMR) system. The CDS Dashboard team developed a CDS measurement framework and performance measurement dashboards targeted at physicians and CDS developers. The CDSC KM Portal team brought a portal online which contains CDS knowledge artificats and the Knowledge Translation and Specification team continued work on mechanisms and tools for representing guideline-based clinical knowledge. Finally, the CDSC Evaluation team focused on creating detailed evaluation plans and designing statistical methods for analyzing CDS and service performance data.

In its first two years, the CDSC has:

- Conducted a broad and deep ethnographic study of CDS. This has led to a better understanding of technical and sociological issues related to decision support which has proved critical as the team develops CDS content and carries out demonstrations across a variety of CDSC member sites.
- Developed a cutting-edge four-layer knowledge representation stack which builds on the best of prior knowledge representation efforts and overcomes several challenges which prior efforts have faced. They are sharing the stack widely, and have seen significant interest in it.
- Constructed and tested novel CDS services. These services take, as input, the current lingua franca of interoperable health information exchange, the Continuity of Care Document (CCD), and apply actionable logic to the information to return a set of semantically-encoded, recommended clinical actions as well as explanation of the rationale for these actions, level of evidence, and alternatives.
- Integrated these decision support services into the LMR and initiated a trial. These services are now used thousands of times daily by practicing physicians taking care of real patients.
- Devised a novel measurement model for CDS which is used in CDS dashboards to deliver feedback on CDS performance to clinicians and developers. The model takes into account the myriad of ways that CDS can influence practice, as well as accounting for both the decision support process and ultimately clinical quality.
- Built a robust clinical content governance process and tackled difficult issues relating to provenance, standardization, localization, and versioning.
- Authored recommendations regarding decision support to a variety of audiences such as CCHIT, HITSP. and clinical practice guideline developers.

- Disseminated their findings widely by making more than a dozen presentations at National and international meetings, and publishing papers at conferences and in journals.

**Preliminary Impact and Findings:** The CDSC focuses on five principal research themes. Lessons learned in each theme from the various teams and projects are outlined below.

***CDS and KM Field Studies***

Field studies conducted by CDSC demonstrate that several leading health IT vendor systems and two home grown systems exhibit a wide range of capabilities to support CDS. Expertise regarding KM for CDS also varies widely, which is a critical factor in the successful implementation, effective use, and maintenance of CDS.

Health IT vendors, content vendors, and clinicians are the three key players in the CDS world. Health IT vendors generally appreciate the importance of CDS and build functionality into their EHR products to support basic CDS capabilities. Content vendors appreciate the value of CDS and aim to meet the market need for knowledge content in ready-made forms for implementation in CDS systems. However, none of the vendors appear to fully support all health IT users' potential knowledge content needs. Further, while the vendors recognize the relevance of increasing the dissemination of knowledge content in readily-accessible forms, they are fearful of how such dissemination will affect business. Clinicians generally appreciate the value of CDS in theory, but in practice find that current CDS systems obstruct clinical workflow, may not address their clinical questions, or provide CDS where there is no perceived need.

***Knowledge Representation***

Clinical knowledge constitutes the core of CDS and the CDSC has developed a four-layered approach to knowledge representation.

CDSC found that the human readable components of knowledge artifacts in Levels 2 and 3 are accessible to end users who are knowledge engineers and sophisticated clinicians. CDSC's evaluation of the approach found that it facilitated knowledge engineering and translation of artifacts from lower levels to higher levels of abstraction in several ways. Given the limited set of knowledge artifacts in use, however, CDSC has not been able to assess questions on the utility of the formalism for knowledge re-use—for example, reusing a Level 2-structured CDS statement in more than one Level 3 rule statement. Such re-use and repurposing of the knowledge representation is supported by the formalism but remains untested, since it requires dramatically increasing the study content.

In the Level 4 knowledge representation—executable knowledge in the form of standard Web services—the CDSC found that the standards it employs allow too much subjective interpretation and that consensus processes are still needed to address inconsistencies in C32 local interpretations and the use of local data types and coding schemas. However, CDSC will continue to refine and inform the Level 4 knowledge representation with the experience of its demonstrations and the efforts of others working in this area.

***Knowledge Aggregation and Collaboration***

The Partners KM portal has been in widespread use for more than 5 years. Using this as a model platform, the CDSC KM portal went further to adopt the multilayered knowledge representation formalism, define a metadata schema to characterize knowledge at the various levels of abstraction, and facilitate end user access to knowledge via the portal. The current implementation of the CDSC portal has a fairly limited feature set, but has proven useful to CDSC members. Secondary hypotheses of how well the four-layered representation formalism and the KM portal itself facilitate knowledge aggregation have not been addressed because of the CDS demonstration projects' limited scope. Governance policies which address content authorship, sharing via the KM portal, and ratification continue to be developed and refined by the CDSC's Content Governance Committee (CGC).

### *Knowledge Dissemination*

CDSC's experience with knowledge dissemination is limited because there are only enough resources to make the KM portal and eRooms available to CDSC participants. Nevertheless, early usage patterns suggest that knowledge content within the KM portal is being accessed by members across the Consortium and that eRooms have fostered collaborative knowledge engineering and insight sharing. The principal method of active knowledge dissemination under study has been the design and elaboration of Web-based CDS services for EHRs at CDSC sites. The PHS LMR was the first 'test subject' and has proven to be extremely useful and informative: many of the 'bugs' are being worked out at PHS, and hopefully will not be experienced by others. CDSC still plans to make both the KM portal and CDS Services broadly available to maximize the value of the knowledge content created within CDSC.

### *CDS Performance Assessment*

CDS, while demonstrated to be successful in a small number of settings, has not yet had broad impact. In order to fine-tune knowledge content for CDS, CDSC has focused on assessing CDS performance through 'CDS Dashboards' and different measures of CDS performance. These include the appropriateness of CDS triggers, the degree to which clinicians acknowledge and act upon CDS, and clinical outcomes resulting from CDS interventions. This research informs the development of the KM portal, knowledge artifacts, and implementation of CDS Web services. Secondary questions have also been posed about the value of feedback data on the use of CDS dashboards in remote settings for the knowledge engineers creating CDS services. As the evaluation projects proceeds, CDSC hopes that such feedback data from remote sites on CDS performance will facilitate both consensus development of refined knowledge content for CDS interventions and improved clinician performance from the refined CDS interventions.

## Selected Outputs


Sittig DF, Wright A, Simonaitis L, et al. The state of the art in clinical knowledge management: an inventory of tools and techniques. Int J Med Inform 2010 Jan;79(1):44-57.

Middleton B. Accelerating the translation of knowledge into clinical decision support: three National demonstration projects. Panel session presented at AMIA 2009 Annual Symposium; 2009 Nov 14-18; San Francisco, California.

Sittig D, Ash J, Wright A, et al. Key standards recommended for achieving a National repository of clinical decision support interventions. Paper presented at AMIA 2009 Annual Symposium; 2009 Nov 14-18; San Francisco, California.

Wright A. Governance for clinical decision support. Panel session presented at AMIA 2009 Annual Symposium; 2009 Nov 14-18; San Francisco, California.

Sittig D, Ash J, Wright A, et al. Key themes related to clinical decision support and knowledge management: results of a rapid assessment process. Paper presented at AHRQ Annual Conference; 2009 Sept 14-16; Bethesda, Maryland.

Wright A, Sittig DF, Ash JS, et al. Clinical decision support capabilities of commercially-available clinical information systems. J Am Med Inform Assoc; 2009 Jun 30.

Wright A, Bates DW, Middleton B, et al. Creating and sharing clinical decision support content with Web 2.0: issues and examples. J Biomed Inform 2009 Apr; 42(2):334-46

Middleton B. The clinical decision support consortium. Stud Health Technol Inform 2009;150:26-30.

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| **Project Title:** | Guidelines Into Decision Support |
| **Principal Investigator:** | Shiffman, Richard N., M.D., M.C.I.S. |
| **Organization:** | Yale University |
| **Contract Number:** | 290-08-10011 |
| **Project Period:** | 03/08 – 02/10 |
| **AHRQ Funding Amount:** | $2,500,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** General

**Summary:** The Guidelines Into Decision Support (GLIDES) project supports the development, implementation, and evaluation of demonstrations that advance understanding of how best to incorporate computerized clinical decision support (CDS) into health care delivery at ambulatory care sites. The project's main focus is knowledge management and implementation. The principal goals are to define a systematic and replicable approach to transforming knowledge derived from clinical practice guidelines into actionable decision support systems; identify and implement preferred methods for integrating CDS tools into electronic health record (EHR) systems; improve CDS tools for measuring and improving quality of care and providing performance feedback; and evaluate the benefits and weaknesses of creating, storing, and replicating CDS across multiple clinical sites.

The GLIDES project is led by staff from the Yale School of Medicine's Department of Pediatrics and the Center for Medical Informatics and is assisted by clinical and information technology (IT) staff from Nemours and Yale New Haven Hospital. GLIDES CDS demonstration tools have been integrated into GE's Centricity and Epic's EpicCare at select primary and specialty clinics within the Yale-New Haven and Nemours health systems. These two EHR systems are certified by the Certification Commission for Health Information Technology. A combination of quantitative and qualitative evaluation methods are being used to determine the project's results and major findings. The overall goal of the project is to recommend methods to assist clinical organizations across the country with the efficient and effective implementation of CDS.

**Specific Aims**

- Implement evidence-based guideline recommendations that address prevention of pediatric obesity and chronic management of asthma from the Diagnosis and Management of Asthma from The National Heart, Lung, and Blood Institute guidelines and the Screening and Intervention for Overweight in Children and Adolescents from the Expert Committee on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity guidelines. **(Ongoing)**
- Apply the Guideline Elements Model (GEM) and associated tools that facilitate the development of executable code to systematically and replicably transform the knowledge contained in these guidelines into a computable format. **(Ongoing)**
- Deliver the knowledge via CDS at ambulatory sites that employ Centricity EHR at Yale and EpicCare at Nemours. **(Ongoing)**
- Evaluate the fulfillment of these goals and the effectiveness of the decision support tools in improving the quality of health care. **(Ongoing)**
- Disseminate the findings. **(Upcoming)**

**2009 Activities:** The focus of activity was on the transformation of knowledge contained in narrative clinical guidelines into CDS. A centralized project team performed analysis and decomposition of the targeted clinical guidelines for asthma and obesity prevention. Local implementation teams were responsible for CDS design, system development, and implementation of the guidelines at multiple clinical sites operated by Yale and Nemours for both specialists and primary care physicians. Each EHR platform (Centricity and EpicCare) presented unique technical challenges, including inherent product limitations relating to access to data, time stamping, and interface design that required local technical expertise and knowledge to resolve. The intent of this complex implementation is to identify and propose solutions to the challenges of implementing common guidelines in varied practice locations. A thorough and rigorous evaluation program is underway, addressing transformation of text guidelines into decision support, CDS development and evaluation, clinician use and usability of CDS, the effect of CDS on guideline-directed care, and patient outcomes.

The project has identified a number of opportunities to work "upstream" in the guideline development process to improve the way guidelines are written to facilitate their implementation. In addition, GLIDES deployed and refined a series of documentation tools and templates to address such challenges and assist with transformation of the guidelines into implementable knowledge.

**Preliminary Impact and Findings:** The technical limitations of the EHR platforms and the reliance on local technical expertise and knowledge to solve them reinforced the GLIDES view that implementation success requires a great degree of local site knowledge and engagement of clinicians and IT personnel in CDS implementation for all but the simplest guidelines and CDS interventions. For example, clinical policies, terminology, workflow, and EHR screen structures tend to work differently across clinical locations. To integrate effectively with these policies, terminologies, workflows, and structures, the CDS architecture must be highly customizable to reflect these local factors. This shifts the knowledge transformation and implementation activity away from work that can be performed "centrally" (by guideline developers and those implementers who are organizing and sponsoring the guideline implementation) to work that must be performed "locally" (by the clinicians, IT, and support staff that will be responsible for implementing the automated CDS and using it in the clinical location).

By using GEM, the guideline translation process worked effectively for the GLIDES project and was one of the most straightforward of GLIDES project activities. GEM is not intended to produce executable code but rather to facilitate the development of executable code within the site-specific EHR. With a structured data model and toolkit, knowledge transformation and implementation is made substantially easier.

**Selected Outputs**

Shiffman R. GLIDES Evaluation Plan: Overview of Key Elements, Clinical Decision Support. Technical Expert Panel Meeting; 2009 May 1: Agency for Healthcare Research and Quality.

GLIDES Web site. Available from http://GEM.med.yale.edu/glides.

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| **Project Title:** | Use of Electronic Referral System to Improve the Outpatient Primary Care–Specialty Care Interface |
| **Principal Investigator:** | Bell, Douglas, M.D. |
| **Organization:** | RAND Corporation |
| **Contract Number:** | 290-06-0017-3 |
| **Project Period:** | 09/07 – 09/09 |
| **AHRQ Funding Amount:** | $396,536 |
| **Summary Status as of:** | September 2009, Completion of Contract |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** General

**Summary:** Poor communication and coordination of care between primary care and specialty care providers leads to major inefficiencies in health care delivery. In resource-constrained settings, these inefficiencies exacerbate mismatches between the supply and demand for specialist services. This project evaluated the implementation of a Web-based electronic referral system (eReferral) developed by the University of California San Francisco (UCSF) and San Francisco General Hospital (SFGH). The eReferral system is staffed by specialist reviewers to allow clarification of the consultative question, requests for additional evaluation, and triaging of appointment requests. The study included a multimethod evaluation of a two-part intervention of extending the use of eReferral and making improvements designed to support primary care providers' (PCPs') use of the system.

The evaluation of the eReferral system consisted of three components:

- Secondary analyses of quantitative data from SFGH administrative systems, eReferral system usage logs, and data from two quality improvement surveys previously conducted among SFGH providers comparing indicators of accessibility, efficiency, and quality of specialty care before and after the use of eReferral.
- Semi-structured interviews with eReferral users in primary care and in specialty clinics to better understand users' views about the benefits and drawbacks of eReferral and to identify best practices in implementing the system.
- Simulation modeling to document the business case for implementing eReferral for specialty and primary care sites and to project the system's implications for health care costs and utilization of services.

The evaluation of this system centered on changes in the quality, efficiency, accessibility, and patient-centeredness of outpatient specialty care. Both specialty and referring physician users viewed eReferral as a success, reported improved communication between each other, and increased access to specialty care. They also perceived any increases in the time needed for the eReferral process as valuable contributions to patient care; however, further validation may be needed to ensure the work process models adequately reflect the time and cost tradeoffs. Establishing valid simulation models that can predict the costs and benefits of electronic referral system designs will be important for creating successful electronic referral systems in other settings of care.

**Specific Aims**

- Compare changes among specialty clinics on indicators of the quality, efficiency, accessibility, and patient-centeredness of outpatient specialty care before and after use of eReferral. **(Achieved)**
- Assess distinctive eReferral implementation practices among specialty and primary care sites and explore how these practices might influence the system's success or failure in achieving business and health care goals. **(Achieved)**
- Estimate the net costs (versus savings) of implementing eReferral for specialty and primary care sites and document the business case for the system's adoption and use. **(Achieved)**

**2009 Activities:** The focus of activity was on defining the primary care side intervention and making improvements to the eReferral user interface, including the following additions.

- Added a Scheduling Considerations Box: This new function allows referring providers to let clinic reviewers/schedulers know about scheduling constraints the patient may have (e.g., is out of the country during the summer, can only come for afternoon appointments, etc.) with the goal of improving show rates.
- Added a Worklist Reorganization/Display: This new function allows for the following worklists to be accessible: 1) referred patients worklist, 2) a PCP's own worklist, 3) other providers' worklists, 4) referring location worklist, and 5) primary care clinic's worklist.
- Added a Nonclinical Note: This new function allows the user to enter notes about logistical/scheduling/contact issues that gets attached to the eReferral—used most by primary care clinics that are tracking their referrals.
- Added the ability to remove eReferrals (and restore them) from provider worklists.
- Added the ability to save a draft eReferral for completion within 14 days.

Additional activities completed throughout the year included the drafting of the UCSF-SFGH eReferral Implementation Handbook and the completion of post-intervention interviews. The project team completed a total of 28 interviews, which provided rich data on the implementation and outcomes of the intervention. When it became evident that the team was approaching theoretical saturation, the team shifted resources from interviewing to focusing on qualitative coding and analysis of the interview transcripts.

Throughout the implementation, the development team was responsive in addressing system issues as well as organizational issues that arose, such as onerous requirements for scheduling appointments that were imposed by one specialty clinic, and they conducted a relatively slow pace of rollout across the available specialty clinics. The project team also worked on a manuscript reporting results from the SFGH specialist survey and made plans for three additional manuscripts.

**Impact and Findings:** Analysis of the eReferral system logs demonstrated substantial initial decreases in wait times for routine new patient appointments for seven of eight medical specialty clinics. The changes in wait times resulted from increased appointment availability due to appointments "not initially scheduled" so that initial workup could be completed by PCPs and from referrals that never resulted in an appointment with PCP advice being delivered through eReferral instead. The eReferral system also enabled acceleration of more urgent care, indicated by an estimated 37 percent increase in expedited referrals.

Survey results showed that specialists reported significant improvements in their ability to identify the consultative question and in appropriateness of referrals. PCPs reported that eReferral improved quality of care for their patients but that information technology connectivity posed significant problems for some clinics.

User interviews revealed that most PCPs and specialists were satisfied or very satisfied with eReferral, despite a variety of challenges. A major driver of the system's acceptance was the perception that the system substantially improved access to specialty care, quality of care, and administrative efficiency in submitting and managing referral requests. Numerous interview participants reported that by using a specialist reviewer to review and triage referral requests, eReferral prevents premature and inappropriate referrals, for example those where the patient should have further diagnostic testing before being seen by the specialist or where the patient should be referred to a different specialty service. This was viewed as a major benefit by specialists but was also seen positively by referring providers. These benefits were mediated largely by improved communication between primary care and specialty care providers. Uptake may have been enhanced by factors including mandatory use of the system (no paper alternative), the user-interface, which users perceived as intuitive and easy to learn, and process adaptations implemented by some practices.

Simulation of typical referral work processes was built for average referral volumes in the medical and surgical departments of SFGH (selected departments, 854 and 1,212 annual referral requests, respectively). Simulation results predicted that the system would reduce the number of specialist appointments needed to care for the fixed referral base by 29 percent for medical specialties and 33 percent for surgical specialties. To achieve this access gain in the medical specialties, a specialist reviewer spent an estimated 9.4 minutes per referral request (133.9 hours for 854 reviews). The net amount of time needed for eReferral reviews exceeded the 29 percent estimated reduction in specialist time spent on visits (75.6 hours per 854 referrals), and resulted in 9.5 percent additional referral processing labor costs. However, in surgical clinics, eReferral reviews were conducted by lower-cost nurse practitioners. Thus, the reviewer time needed (8.1 minutes per referral, 163.9 hours for 1,212 referrals) costs substantially less than the surgeon time saved on visits (100.7 hours for 1,212 referrals), yielding a 22.5 percent cost reduction using eReferral. PCPs spent 2.7 more time submitting, responding, and revising referrals compared to the system of paper-based referral requests. There were substantial savings in staff time in both specialty clinics and PCP offices. Overall, the labor costs were projected to be modestly higher for eReferral to medical subspecialty clinics and lower for eReferral to surgical clinics.

**Selected Outputs**

The study yielded an implementation handbook, cost tool, and summaries of findings for dissemination to other care settings.

The final report is forthcoming in 2010.

| | |
|---|---|
| **Project Title:** | Building an Implementation Toolset for E-Prescribing |
| **Principal Investigator:** | Bell, Douglas, M.D. |
| **Organization:** | RAND Corporation |
| **Contract Number:** | 290-06-0017-4 |
| **Project Period:** | 08/08 – 01/10 |
| **AHRQ Funding Amount:** | $999,825 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Implementation and Use

**Target Population:** Not Applicable

**Summary:** This project is developing and testing an e-prescribing toolset that will act as a "how-to" guide for implementing e-prescribing across various ambulatory care settings and pharmacies. The project includes: 1) an environmental scan of current National and international e-prescribing implementation programs; 2) detailed analysis of successful e-prescribing implementations in several organizational configurations, including large and small practices and safety net settings; 3) development of an implementation toolset based on these findings; and 4) pilot testing of e-prescribing implementation using the toolset. The toolset will include guidance on the complete life cycle of activities expected to contribute to successful implementation, covering technology requirements, workflow analysis tools, and governance agreement templates. The focus of the pilot implementation is on the completeness and usability of the toolset.

The environmental scan will serve to catalogue publicly announced, ongoing e-prescribing initiatives in the United States and abroad and describe their major features, including the participating organizations, the range of practice sizes and settings involved, the e-prescribing technologies used, the degree of successful adoption and use, and the degree to which stated goals have been achieved. Several successful e-prescribing initiatives will be analyzed to assess the extent to which successful implementation is attributable to key practices or features, such as governance agreements, organizational characteristics, individual attitudes and motivations, prescription-related work processes, specific e-prescribing technologies and standards used, distinctive implementation practices, and estimated costs (versus savings) for each participating organization. The findings from the analysis will guide the creation of a draft e-prescribing implementation toolset that provides organizations with guidance and customizable aids to help them follow the practices or develop characteristics that contribute to implementation success. The guidance will include sample governance agreements, workflow patterns and feasible work process transitions, and direction on other key organizational factors that support adoption of innovations such as leadership, organizational culture, employee involvement, training, and performance evaluation and incentives.

The draft toolset will then be evaluated on its usability and usefulness in helping provider organizations that represent a broad range of practices to implement e-prescribing. A final e-prescribing implementation toolset will be created based on findings from the pilot evaluation. Organizations and communities will use the toolset to guide decisionmaking about and implementation of e-prescribing and will disseminate this toolset Nationally on the Agency for Healthcare Research and Quality's National Resource Center for Health Information Technology Web site at live and online presentations and conferences and in peer-reviewed publications.

**Specific Aims**

- Catalogue publicly-announced, ongoing e-prescribing initiatives. **(Achieved)**
- Assess contributors to successful implementation of e-prescribing initiatives. **(Ongoing)**
- Create two draft e-prescribing implementation toolsets. **(Ongoing)**
- Evaluate the draft toolset's usability and usefulness in helping provider organizations implement e-prescribing. **(Upcoming)**
- Create a final e-prescribing implementation toolset based on findings from the pilot evaluation. **(Upcoming)**

**2009 Activities:** The scope of this project has been expanded from one to two toolsets: one geared to physicians, the other designed for pharmacies. Activities focused on conducting an environmental scan of existing pharmacy systems to mirror the environmental scan that was conducted in 2008. Successful e-prescribing initiatives were identified and through the process of site visits, field researchers conducted an assessment of the extent to which implementation success is attributable to key practices or features. Site visit data were analyzed for possible inclusion in the pilot toolsets, and this information served to inform the final implementation and assessment plans for both the provider and pharmacy toolsets. The final implementation is still in progress. In the meantime, the project team is continuing the process of identifying potential physician sites that plan to implement e-prescribing early in 2010. The California Medical Association included an announcement about the study in their December newsletter, asking interested physicians to respond.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The project has no outputs to date.

| | |
|---|---|
| **Project Title:** | Applying Lessons Learned in Community Collaboration to Health Information Technology |
| **Principal Investigator:** | Berkowitz, Alicia, B.A. |
| **Organization:** | IMPAQ International, LLC |
| **Contract Number:** | 290-07-10071-5 |
| **Project Period:** | 08/09 – 09/10 |
| **AHRQ Funded Amount:** | $298,905 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** Establishing systems for electronic data exchange presents technical and financial challenges and challenges stakeholder collaboration. Approaches that create mutual benefits, meet competing needs, and generate operating efficiencies need to be identified. This project focuses on how models of community planning and development in health care and other industries can be used to establish sustainable Regional Health Information Organizations (RHIOs) and health information exchanges (HIEs). It seeks to identify characteristics that distinguish successful and unsuccessful collaborations to guide future RHIO and HIE development.

The project team will convene an innovation meeting of stakeholders to obtain input on best practices for collaboration. In preparation for the meeting, the project team will create a background report that will include a literature review and dissemination plan. Based on the literature review and outcomes from the meeting, the team will draft a summary of best practices and recommendations for establishing and sustaining RHIOs/HIEs. The team will prepare a final report that will synthesize the results from the background report and the innovation meeting. The final report will describe applicable best practices from the field of community development in the form of illustrative models and narrative case studies and make recommendations for ongoing research, implementation, and policy work in this field.

**Specific Aims**

- Conduct a comprehensive literature review on community planning and development and RHIO and HIE initiatives. **(Ongoing)**
- Convene an innovation meeting comprised of RHIO and HIE leaders and National and international community planning experts to assess the applicability of community collaboration models to sustainable RHIOs and HIE, and to identify best practices, illustrative models, and case studies. **(Ongoing)**
- Prepare a final report synthesizing results and findings from the literature review and meeting and make recommendations for ongoing research, implementation, and policy work in the RHIO and HIE fields. **(Upcoming)**
- Develop, execute, and evaluate a communication and dissemination plan to drive awareness and integration of project findings and recommendations into practice at National, State, and local levels. **(Upcoming)**

**2009 Activities:** Study staff began activities to support the literature review and drafted and finalized project work plans.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The project has no outputs to date.

| | |
|---|---|
| **Project Title:** | Learnings for Implementing Electronic Exchange of Health Information: A Synthesis of AHRQ's Health Information Exchange Projects |
| **Principal Investigator:** | Bhardwaj, Ajay, Ph.D. |
| **Organization:** | AFYA, Inc. |
| **Contract Number:** | 290-07-10034-2 |
| **Project Period:** | 06/09 – 06/10 |
| **AHRQ Funded Amount:** | $294,757 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** General

**Summary:** Over the past few years, extensive peer-reviewed and grey literature has indicated that implementing health information exchange (HIE) requires special organization-specific considerations and may pose challenges similar to the challenges associated with the implementation of electronic health records (EHRs). This project focuses on understanding key lessons learned by the six Agency for Healthcare Research and Quality (AHRQ)-funded State and Regional Demonstrations in Health Information Technology (SRDs) and creating a catalog of resources for HIE stakeholders.

This project collaborates with the SRD projects to synthesize information on the challenges and success factors for developing sustainable community, statewide, or regional exchange of health information. A comprehensive literature review and environmental scan will be done among peer-reviewed publications, evaluation reports, industry publications, and HIE support tools. During this process, publicly available toolsets will be identified and organized by potential use. The review and scan will inform indepth conversations with the SRD project teams to develop a detailed HIE synthesis report and repository of HIE tools and resources. The report will include case studies of each SRD project and a summary of lessons learned across the projects. The relevant tools and documents received from SRD contractors will be prioritized and ranked by market need, quality, and usefulness. This effort to collect and synthesize lessons and tools will contribute significantly to existing and future HIE efforts.

**Specific Aims**

- Conduct a comprehensive literature review and environmental scan of projects, progress, lessons learned, and available resources in the HIE field. **(Achieved)**
- Develop and implement a scientifically rigorous approach to working collaboratively with AHRQ SRDs in health information technology. **(Achieved)**
- Develop a detailed HIE synthesis report with recommendations for the adoption of processes that will promote HIE. **(Ongoing)**
- Develop a toolkit or resource repository that can be easily accessed and used to accelerate HIE in other communities. **(Upcoming)**

**2009 Activities:** Activities focused on conducting an environmental scan and literature review, selecting a framework for case study development and data collection, developing data collection tools, collecting HIE tools and resources, and completing the SRD case studies. A detailed literature review and a brief summary of the environmental context that emphasizes current information gaps have been completed to

inform a background report with the proposed framework. Steps toward completing the SRD case studies include: 1) collection and analysis of the content of documents with relevant data, such as project meeting notes and progress reports to AHRQ, 2) conducting preliminary phone interviews to confirm data extracted from documents and discuss processes and lessons learned during project implementation, 3) synthesis and summarization of document and interview data to draft an initial narrative description and identify gaps, and 4) followup phone interviews to discuss details of decision rationales, mechanisms of implementation, and lessons learned. The project team is recording data about SRD tools during phone interviews and will request them after completing all of the interviews.

**Preliminary Impact and Findings:** Data are collected and summarized on an ongoing basis. Findings were submitted to the Federal Project Officer for review and not yet available for publication.

**Selected Outputs**

Draft environmental scans and a background report were submitted to the Federal Project Officer for review.

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|---|---|
| **Project Title:** | Industrial & Systems Engineering and Health Care: Critical Areas of Research Workshop |
| **Principal Investigator:** | Brennan, Patricia Flatley, R.N., Ph.D. |
| **Organization:** | Professional and Scientific Associates |
| **Contract Number:** | 290-09-00027U |
| **Project Period:** | 06/09 – 11/10 |
| **AHRQ Funded Amount:** | $86,140 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** Since the 1970s, the concept of better integrating engineering principles and practices into health care system design has held great allure and promise. Although there have been instances of successful collaboration, it has been challenging to bridge the conceptual and practical divides between disciplines. A 2005 report from the Institute of Medicine and the National Academy of Engineering titled Building a Better Delivery System: A New Engineering/Health Care Partnership outlined broad research activities needed to improve health care delivery.

The purpose of this project is to develop and propose a research agenda for how industrial and systems engineering may support health services research and health care delivery redesign, with a focus on health information technology (IT). The Health IT Portfolio at the Agency for Healthcare Research and Quality (AHRQ) and the Service Enterprise Systems (SES) Program at the National Science Foundation (NSF) seek to strengthen partnerships between the health services community and the industrial and systems engineering community to achieve the portfolio and program goals set for AHRQ and SES. To that end, AHRQ and NSF cofunded a workshop to identify potential projects or topics of mutual benefit.

**Specific Aims**

- Develop and propose a research agenda for how industrial and systems engineering may support health services research and health care delivery redesign, with a focus on health IT. **(Ongoing)**

**2009 Activities:** A meeting of experts and leaders in the fields of industrial and systems engineering, health informatics, health services research, health care delivery, and other relevant areas was convened on September 21 and 22, 2009, in Washington, DC, with the goal of developing an actionable research agenda. Deliverables from this project include a background report that summarizes and critiques past meetings to guide the current effort, a research agenda including a prioritized list of critical areas of research to be addressed along with a list of suggested workshop topics to move the health services and industrial and systems research communities toward meeting the research objectives, and the dissemination of materials and products developed at this workshop.

**Preliminary Impact and Findings:**

Common themes identified from the review of documents for the Background Report include:

1. The current health care delivery system is both unsustainable in terms of cost and suboptimal in terms of value.

2. The current health care delivery system cannot adequately respond to changes in the larger environment and within the medical sciences.
3. Solving the problems of the health care delivery system is complex and will require approaches that are multidimensional, multileveled, and inclusive of multiple stakeholders.
4. Information technology will play a key role in the future health care delivery system.
5. Incentives are needed to promote change, including the use of systems engineering tools, information technology, and evidence-based medicine.
6. Opportunities are needed for cross-education and collaboration between health care professionals and scientific and technical professionals such as engineers and computer scientists.
7. Research funding is needed to explore the intersections between health care and the use of systems engineering tools, computer science methodologies, and information technology.

In addition the following action items for the workshop were identified:

1. Define a vision of an ideal health care system.
2. Critically examine the reasons for which fundamental change to the health care delivery system, including through the use of industrial and systems engineering tools, remains intractable.
3. Develop a prioritized list of new industrial and systems engineering tools that must be developed to realize the vision of an ideal future.

**Selected Outputs**

Agency for Healthcare Research and Quality. Industrial and Systems Engineering and Health Care: Critical Areas of Research Workshop. 2009 Available from: http://healthit.ahrq.gov/engineeringhealth

Valdez RS, Brennan PF. Industrial and Systems Engineering and Health Care: Critical Areas of Research: Background Report. (Prepared by the University of Wisconsin-Madison, Madison, WI under Contract No. 290-09-00027U). AHRQ Publication Number 09-0094-EF. Rockville, MD: Agency for Healthcare Research and Quality. September 2009. Available from: http://healthit.ahrq.gov/engineeringhealthbackgroundreport.

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|---|---|
| **Project Title:** | Improving Asthma Care in an Integrated Safety Net Through a Commercially Available Electronic Medical Record |
| **Principal Investigator:** | Brottman, Gail, M.D. |
| **Organization:** | Denver Health |
| **Contract Number:** | 290-06-0020-5 |
| **Project Period:** | 09/07–12/09 |
| **AHRQ Funding Amount:** | $484,760 |
| **Summary Status as of:** | December 2009, Conclusion of Contract |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Implementation and Use

**Target Population:** Asthma, Chronic Care*, Safety Net

**Summary:** The goal of the Health Information Technology and Asthma project is to bring the 2007 National Asthma Education and Prevention Program (NAEPP) asthma guidelines to the point of patient care by incorporating a computerized decision support application into the EpicSystems electronic medical record (EMR). The system meets certification criteria established by the Certification Commission for Health Information Technology; it is the system in use at Hennepin County Medical Center (HCMC) and eight related primary care clinics, the project implementation sites. The application runs on a Java platform within HCMC's intranet and is integrated into the Epic EMR. "Integration into the Epic EMR" means that 1) the user can invoke it through a routine Epic workflow, and 2) EMR data required for application functioning and for future reporting and analysis automatically are transferred from Epic into the application. The user is not required to either log in again, or to perform double data entry. Once the user has invoked the application, the system guides the user through a typical ambulatory encounter for asthma that follows the evidence-based recommendations expressed in the 2007 NAEPP guidelines for asthma. These recommendations deal with assessments of the level of asthma severity or control based on responses to specific questions about asthma symptoms and lung function, determining the appropriate level of therapeutic aggressiveness, and fulfilling the intended treatment plan through choices of commercially available medications that meet the 2007 NAEPP guideline dosing recommendations for patients of different ages. The application incorporates all provider choices into a one-page, patient-friendly Asthma Action Plan, which the user can print in either English or Spanish. The application also produces an asthma "trigger sheet" (also in English or Spanish), as well as a physician-specific progress note which the user can copy and paste into the appropriate documentation section in Epic.

**Specific Aims**

- Develop the electronic decision support tool based on recommendation presented in the NAEPP 2007 Guidelines for the Diagnosis and Management of Asthma. **(Achieved)**
- Create a mechanism that enables a user to call up the e-AAP while logged into a patient's EMR. **(Achieved)**
- Introduce the e-AAP to providers at eight HCMC primary care clinics, emphasizing how the e-AAP supports quality asthma care. **(Achieved)**
- Create an asthma registry populated by data generated from the e-AAP merged with asthma-relevant data generated by patient EMRs and use the registry as the data source for regular reports showing clinic-by-clinic measures of asthma care quality. **(Achieved)**

**2009 Activities:** After more than a year of development, the e-AAP became technically available at HCMC on June 15, 2009. Creating the technical functionality was the first component of implementation; remaining components involved introduction, orientation, and staff training. These were the dominant activities of 2009. Activities included group trainings and one-on-one instruction on launching and completing the e-AAP during a patient visit. The implementation activities are continuing in the clinics as an ongoing asthma quality improvement project through the HCMC Ambulatory Care Quality Committee and the hospitals' ongoing participation in the Institute for Clinical Systems Improvement. Feedback from providers who have used the application has been mixed. The most negative responses have generally been from older staff physicians who do not feel comfortable navigating the EMR and are generally technology averse. There has also been more pushback from staff physicians in internal medicine who struggle to cover all requirements in a 15-minute appointment with patients who have multiple active problems, including asthma. Conversely, younger providers (including residents) have found the application to be user friendly and easy to launch during patient visits. They find assessment questions and treatment recommendations valuable and time saving. Providers have gotten positive feedback from their patients when using the e-AAP interactively during the visit. Patients have also been enthusiastic about the written asthma action plans they receive generated from the e-AAP.

**Impact and Findings:** The project illustrated the challenges to helping physicians deliver evidence-based medicine in simple, intuitive ways. Challenges are cognitive, technical, administrative, and financial. Cognitive challenges emerge when scrutinizing evidence-based guidelines to determine how they can be operationalized during the delivery of medical care. The project found that guidelines often failed to provide the kind of support that physicians need when they are performing clinical work. The team recommends developing new criteria for guideline quality that include the ability to operationalize recommendations while performing medical work.

Technical challenges that are not associated with converting narrative guidelines into clinical decision support have less to do with creating the support than making the support intuitively available during care delivery. The project did succeed at establishing an Epic-supported mechanism through which clinicians could invoke the electronic decision support tool while engaging in a patient encounter. However, the team did not anticipate all the contexts in which clinicians might invoke the tool and the absence of context information made it challenging to interpret some data. However, because contexts evolve with technology, it may never be possible to anticipate all potential contexts for the purposes of data capture mechanisms.

The team was reminded that software is a product with a very short shelf life and only remains useful to the extent that it is maintained. For clinical decision support software, maintenance needs are of two basic types. One type is technical, modifying the software in response to user feedback about functioning, screen displays, etc; the other is content. When providing clinical decision support, underlying content must reflect current clinical conditions or it will be less than useful at best and harmful at worst. Resources are required to perform these ongoing maintenance activities.

**Selected Outputs**

Brottman GA, Computerized asthma decision support tool integrated into an EHR. Demonstration presented at AHRQ Annual Health IT Grantee and Contractor Meeting; 2010 June 2-4; Washington, DC.

Electronic Asthma Action Plan Application Website. Available at: http://e-aap.net/

**AHRQ Priority Population*

| | |
|---|---|
| **Project Title:** | Quality Indicators Care Coordination Measures Project |
| **Principal Investigator:** | Brustrom, Jennifer, Ph.D. |
| **Organization:** | Battelle Memorial Institute |
| **Contract Number:** | 290-04-0020 |
| **Project Period:** | 09/09 – 09/10 |
| **AHRQ Funded Amount:** | $400,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** Care coordination is the deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient's care to facilitate the appropriate delivery of health care services. Organizing care involves marshalling personnel and other resources to carry out all required patient care activities and is often managed by the exchange of information among participants responsible for different aspects of care.

The health care community is struggling to determine how to measure when and if this vital activity is occurring. The National Quality Forum recently concluded that adequate measures of care coordination do not exist and are urgently needed. Especially pressing is the need to evaluate the effectiveness of care coordination within the primary care patient-centered medical home.

Initial investigation into current care coordination measurement approaches will be based on multiple data sources (electronic health record systems, consumer surveys, and databases of administrative claims); information on National organizations' care coordination measurement activities; review of applicable Agency for Healthcare Research and Quality (AHRQ) publications; and a comprehensive search of peer-reviewed literature. The project will include insights on patient and caregiver experiences with care coordination, as well as clinician and researcher perspectives. In addition, the project will identify potential data sources for assessing care coordination that simultaneously support patient care and measurement objectives. Ideally, routinely monitored care coordination measures should not increase the burden of providing high-quality patient care, but should support better management of patients. By the end of the project a care coordination measurement summary report, measurement plan, and evaluative tool will be developed.

**Specific Aims**

- Identify and assess ambulatory care coordination measures and develop an initial list of candidates for evaluation by the AHRQ Quality Indicator development process, with a particular focus on measuring ways that care coordination might prevent emergency room visits and unnecessary hospital readmissions. **(Ongoing)**
- Develop a tool to assess care coordination interventions in studies and demonstration projects in the short term while measurement development activity proceeds. **(Ongoing)**

**2009 Activities:** The study team completed a preliminary title and abstract review of measures-specific literature search results, began full-text review of updated care coordination background literature search, and received feedback from AHRQ on a preliminary set of ideas for the evaluation tool frameworks.

Bi-weekly calls were held with AHRQ to review progress. A revised project timeline and a work plan were submitted and approved by AHRQ. Several potential experts and stakeholders were contacted regarding evaluative methods or ongoing measure development. The study team worked on identifying domains assessed by care coordination measures and developing a framework for examining care coordination-specific measures.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The project has no outputs to date.

| | |
|---|---|
| **Project Title:** | Design of a Toolkit to Add Electronic Clinical Data to Statewide Hospital Administrative Claims Data |
| **Principal Investigator:** | Busch, Jon, Ph.D. and Levit, Katharine |
| **Organization:** | Thomson Reuters Healthcare, Inc. |
| **Contract Number:** | 290-2006-0009C |
| **Project Period:** | 09/09 – 07/10 |
| **AHRQ Funded Amount:** | $50,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** As health care reform efforts take center stage, the importance of reliable and structured data streams increases for hospitals targeting quality improvements and consumers making health care decisions. Adding clinical data, especially "present on admission" (POA) codes and laboratory results, to existing administrative datasets is seen as a practical, effective, and cost-efficient method to improve the accuracy and content of hospital quality assessments and to provide quality improvement evidence.

Based on pilot projects sponsored by the Agency for Healthcare Research and Quality in four Healthcare Cost and Utilization Project (HCUP) partner States (Florida, Minnesota, Virginia, and Washington), this project will design a toolkit that will allow statewide data organizations to enhance their administrative data's clinical content. This is part of the near-term plan for building on the combined potential of administrative data and electronic health records to improve measurement for public reporting and quality improvement.

As part of this project, HCUP statewide data organizations will be surveyed on potential components of a toolkit, issues surrounding building the business case for adding clinical data, technical assistance needs, and optimal toolkit dissemination strategies. Additional input will be sought at the Annual HCUP Partners meeting. Two Webinars with statewide data organizations will provide opportunities to discuss findings from the pilot activities and the partner survey. A set of recommendations will then be developed for the toolkit content and dissemination strategy, with a focus on adding electronic laboratory data and improved collection of POA codes. Additional information about this project is available at http://www.hcup-us.ahrq.gov/reports/clinicaldata.jsp.

**Specific Aims**

- Catalogue tools that help data organizations increase effectiveness and efficiency when adding laboratory values or POA codes to administrative discharge records **(Achieved)**
- Solicit input from partner organizations and statewide data organizations on ways an electronic toolkit can enhance the clinical content of statewide electronic hospital discharge abstracts. **(Ongoing)**
- Develop content recommendations for an "Adding Clinical Data" toolkit. **(Upcoming)**
- Develop a toolkit dissemination strategy. **(Upcoming)**

**2009 Activities:** The project began in September with an initial focus on cataloguing the tools available to help data organizations increase their effectiveness and efficiency in adding laboratory values or POA codes to administrative discharge records. HCUP partners in Florida, Minnesota, Virginia, and Washington developed a number of such tools, which were organized into categories based on their sequential need within the data collection process, which is as follows: project initiation; planning; communication; training; data standardization/collection/transmission; and feedback and reporting. At the Annual Partners meeting in November, the project team assessed interest in enhancing clinical content of administrative data. Preliminary planning for the first of two Webinars is underway.

**Preliminary Impact and Findings:** This project has no findings as of December 2009.

**Selected Outputs**

This project has no outputs as of December 2009.

| | |
|---|---|
| **Project Title:** | Incorporating Health Information Technology Into Workflow Redesign |
| **Principal Investigator:** | Carayon, Pascale, Ph.D., and Karsh, Ben-Tzion, Ph.D. |
| **Organization:** | University of Wisconsin |
| **Contract Number:** | 290-08-10036 |
| **Project Period:** | 01/09 – 12/10 |
| **AHRQ Funded Amount:** | $494,028 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** Health information technologies (ITs) provide computerized clinical information to clinicians and/or patients and are seen as beneficial to health care quality and patient safety. However, evaluations of the impact of health IT on quality and safety show mixed results. The main reason for unfavorable results seems to be related to difficulty integrating health IT in ways that support clinical workflows across organizations (e.g., between a clinic and community pharmacy), within a clinic, during a visit, or into the cognitive work of the clinician. It is clear that health IT must be designed to fit specific contexts if it is to work.

The University of Wisconsin's Center for Quality and Productivity Improvement is developing a toolkit that small and medium-sized outpatient health care organizations can use to assess workflow and determine how health IT may be used in this context. The work is being conducted by a multidisciplinary team of researchers in human factors and ergonomics, industrial and systems engineering, sociology, psychology, health informatics, and medicine.

**Specific Aims**

- Assess existing research and evidence in the area of the impact of health IT on workflow in outpatient settings and how health IT can be used to assess workflow in these settings. **(Ongoing)**
- Identify resources for workflow assessment in health care as well as proven workflow analysis methods and instruments used in the field of human factors and ergonomics that could be applied in health care settings. **(Ongoing)**
- Synthesize information in a toolkit that explains the importance of analyzing workflow when implementing and using health IT, summarizes commonly used methods for workflow assessment, explains the purpose of each method, describes how to implement them, explains the advantages and disadvantages of each approach, cites available resources for more in-depth information on each tool, and provides examples drawn from the literature and other sources that illustrate the experience of small and medium-sized practices in implementing health IT. **(Ongoing)**

**2009 Activities:** The project team conducted a literature search and environmental scan: current practice redesign efforts that use health IT as a tool; health IT's impact on clinical workflow; and available workflow analysis and redesign methods and tools. In addition, they issued a Federal request for information on and how health IT can support workflow redesign.

**Preliminary Impact and Findings:** Findings will be reported in the forthcoming toolkit and summary report.

**Selected Outputs**

Carayon P, Karsh B. Workflow Toolkit and Lessons in User Centered Design. Presentation at the Agency for Healthcare Research and Quality Health IT Grantee and Contractor Meeting; 2010 June 2; Washington, DC.

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|---|---|
| **Project Title:** | Reducing Disparities in Health Care Quality for Priority Populations: An Approach Focused on Improving Care in Under-Resourced Settings Using Health Information Technology and Other Quality Improvement Strategies |
| **Point of Contact:** | Casale, Cecilia, Ph.D. |
| **Organization:** | Professional and Scientific Associates and Medical Care Research and Review |
| **Contract Number:** | 290-09-10014 |
| **Project Period:** | 03/09 – 12/10 |
| **AHRQ Funding Amount:** | $160,748 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Asthma, Chronic Care*, Diabetes, Elderly*, Low SES/Low Income*, Pediatric*, Racial/Ethnic Minorities*, Women*

**Summary:** The Agency for Healthcare Research and Quality (AHRQ) seeks to build a research and action agenda for reducing disparities in health care quality among the AHRQ priority populations. In October of 2009, AHRQ convened a meeting that provided recommendations to advance this effort. Five papers were commissioned. An introductory paper focused on how underresourced settings could overcome health information technology (IT) implementation challenges and provided insight in how health IT might improve care and reduce disparities. The remaining four papers were case studies of large and persistent disparities in quality of care as identified by the United States Department of Health and Human Services/AHRQ National Healthcare Disparities and Quality Reports. The papers will be published in a journal supplement with an introduction authored by AHRQ staff.

The case studies addressed the reduction of differences between: 1) Black and White children in asthma hospitalization rates, 2) Black, Hispanic, and White diabetic adults in lower-extremity amputation hospitalizations, 3) Black, Hispanic, and White women in receiving early prenatal care, and, 4) low-income and higher-income Asian and White children and adults in receiving good provider-patient or family communication. The case studies combined literature reviews and creative thinking to produce recommendations for a research and action agenda for further use of health IT and other strategies to reduce disparities in quality of care.

**Specific Aims**

- Build a research and action agenda for reducing disparities in health care quality among priority populations. **(Ongoing)**

**2009 Activities:** The project team made arrangements for all meeting logistics including location, audiovisual equipment, food and beverage services, hotel and travel for participants, securing a facilitator and speakers, and conference calls for development of workshop agenda, topics, and participant list. They also arranged for development of workshop materials including registration and conference materials, agenda, participant list, development of a workshop Web site, an audiotape of the entire workshop, and a

written summary of the workshop proceedings. The meeting was held, and a final report was prepared and is posted on the AHRQ Web site.

**Preliminary Impact and Findings:** As summary is included in the final meeting report.

**Selected Outputs**

*Reducing Disparities in Health Care Quality in Underresourced Settings Using Health IT Strategies: Expert Meeting Summary*. April 2010. Agency for Healthcare Research and Quality, Rockville, MD. http://www.ahrq.gov/research/dispmtgsum09.htm

**AHRQ Priority Population*

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|---|---|
| **Project Title:** | Technical Assistance for Health Information Technology and Health Information Exchange in Medicaid and the Children's Health Insurance Program |
| **Principal Investigator:** | Dimitropoulos, Linda, Ph.D. |
| **Organization:** | RTI International |
| **Contract Number:** | 290-07-10079T |
| **Project Period:** | 09/07 – 02/11 |
| **AHRQ Funded Amount:** | $2,990,592 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Low Income/Low SES*, Medicaid, Pediatric*

**Summary:** As the largest purchaser of health care for low-income and vulnerable populations in the United States, Medicaid and the State Children's Health Insurance Program (CHIP) have significant power that can be leveraged to support the adoption and implementation of health information technology (IT) and health information exchange (HIE) to improve services for this population. Medicaid and CHIP agencies, aided by projects such as this, have gradually been working toward increased involvement in the planning and implementation of health IT systems. The goal of this project is to improve the coordination and quality of care by providing technical assistance (TA) to agency personnel to plan and implement health IT and HIE.

RTI International (RTI) will develop and implement a program of TA based on multiple sources of information including a needs assessment and a multistate collaborative, as well as ongoing communication and interaction with Medicaid/CHIP agencies. The project team will use the information to develop a three year program of TA for Medicaid and CHIP agencies. The information collected includes: current and planned health IT and HIE projects and implementation plans of the Medicaid/CHIP agencies; TA needs for accomplishing the agency health IT and HIE plans and/or projects; cost and value data to develop the business case for technology adoption; program evaluation planning; barriers or challenges to current or planned health IT/HIE plans; and preferences for how TA should be provided (Webinar, workshop, etc.).

In addition, RTI developed and maintains a repository of health IT and HIE related information that is specific to Medicaid and CHIP; developed and maintains a Medicaid/CHIP-specific section of the Agency for Healthcare Research and Quality (AHRQ) National Resource Center (NRC) Web site; systematically reviews and synthesizes the literature on costs and value of health IT and HIE to Medicaid and CHIP programs established; supports a set of ongoing health IT and HIE Communities of Practice for Medicaid and CHIP agency staff; and set up a hotline with a toll-free number where personnel at agencies can speak to a member of the RTI team.

**Specific Aims**

- Complete a nationwide assessment of Medicaid/CHIP health IT and HIE plans. **(Achieved)**
- Develop a three year technical assistance plan based upon findings of nationwide assessment. **(Ongoing)**

- Establish a menu of additional tools and strategies to support Medicaid/CHIP health IT and HIE development. **(Ongoing)**

**2009 Activities:** RTI worked continuously with both Federal and State-level partners to monitor the factors that affect the health IT and HIE needs of Medicaid and CHIP agencies. Project staff listened to Centers for Medicare and Medicaid Services-sponsored sessions to stay abreast of the developments at the Federal level that impact Medicaid and CHIP programs. As part of this ongoing assessment, project staff made a concerted effort to update information about Medicaid and CHIP agencies' initiatives, plans to respond to American Recovery and Reinvestment Act regulations through 2009, needs for TA using existing opportunities, and updated TA plans for 2009 and 2010 accordingly.

Project staff developed and delivered a comprehensive series of free Webinars, Web-based workshops, and in-person workshops on a wide range of health IT and HIE topics featuring national experts and leaders. Topics were identified and selected based on information gathered from the nationwide Medicaid/CHIP needs assessment.

A guide to evaluating the costs and value of e-prescribing was developed and is under final review by AHRQ. The guide specifically discusses the three primary timeframes for evaluating e-prescribing system adoption and implementation: prospective, early implementation, and retrospective. The final report provides a separate step-by-step guide to evaluating the costs and value of e-prescribing for each of the timeframes described.

Project staff developed three peer learning networks for Medicaid and CHIP agencies that will serve as open, collegial platforms for staff to access and exchange up-to-date information on health IT issues that are most relevant to Medicaid and CHIP agency staff.

RTI maintains a section of the NRC Web site devoted to this project and the resources available to Medicaid and CHIP agencies. The project Web site contains static information about the project, a calendar of all scheduled upcoming TA sessions, links to 508-compliant materials from all Webinars, and Web-based workshops provided since the outset of the project, and links to all publicly-released reports created under the project.

**Preliminary Impact and Findings:** The Year 1 needs assessment analysis revealed the following: 1) most agencies have at least one health IT initiative and more than half had at least two, 2) many States and territories have plans to evaluate the value of their health IT initiatives but few could provide any details, 3) the main challenges for agencies are costs, infrastructure, and other resources, provider adoption, sustainability, and system technicalities, 4) best practices and lessons learned involved planning/budgeting, increasing communication and coordination, early and frequent stakeholder engagement, and acquiring appropriate staff and expertise, 5) the primary challenges to HIE initiatives are infrastructure and resource issues, 6) quality improvement and increased communication/interoperability were reported most frequently as the primary goals and objectives of the HIE initiatives, and 7) half of the reporting agencies had limited or no plans to evaluate the HIE efforts.

**Selected Outputs**

Project staff developed and delivered a comprehensive series of free Webinars, Web-based workshops, in-person workshops, and TA documents many of which can be found at:

http://healthit.ahrq.gov/portal/server.pt?open=514&objID=14728&mode=2

http://healthit.ahrq.gov/portal/server.pt?open=514&objID=14729&mode=2

In addition, other project products can be found in the AHRQ Medicaid and CHIP Repository at:

http://healthit.ahrq.gov/portal/server.pt?open=514&objID=16286&mode=2

**AHRQ Priority Population*

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| **Project Title:** | Implementing and Improving the Integration of Decision Support into Outpatient Clinical Workflow |
| **Principal Investigator:** | Doebbeling, Bradley, M.D., M.S. |
| **Organization:** | Indiana University |
| **Contract Number:** | 290-06-0013-3 |
| **Project Period:** | 09/07 – 03/10 |
| **AHRQ Funding Amount:** | $394,622 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Cancer

**Summary:** Computerized clinical decision support (CDS) and the use of electronic medical records (EMRs) can improve clinical decisions, adherence with evidence-based guidelines, and quality of care. However, the integration of CDS into clinical workflow is not well understood, and poor integration can hinder its use and minimize its benefits. Common barriers to implementation include poor interface design, usability problems, and the lack of integration into the workflow of a clinical environment.

This project conducts a field study and controlled simulation analysis to integrate CDS for colorectal cancer screening into outpatient clinical workflow. The project includes key informant interviews on site-specific best practices; direct observation of colorectal cancer screening CDS to identify barriers and facilitators to workflow integration; rapid prototyping of design alternatives based on those findings; controlled simulation to test the impact of design on efficiency, usability, and workload; and implementation of the refined CDS in local clinics to assess usability and impact. The three study participants—the Regenstrief Institute, the Department of Veterans Affairs (VA), and Partners Healthcare System—use different EMRs but are all institutions that have improved quality and efficiency using CDS.

The first phase of the project uses qualitative methods on site visit data to understand the various factors for effective integration of CDS into clinical workflow in different EMRs. Measurable attributes from this work for the second project phase include efficiency, usability, and workload to demonstrate improved clinical workflow integration in both a simulated setting and actual implementation into clinical practice.

**Specific Aims**

- Identify key approaches to CDS development for colorectal cancer screening at two VA Medical Center sites and two Nationally recognized non-VA sites for effective CDS integration into clinical workflow. **(Unknown)**
- Develop and test CDS design alternatives for improved integration into clinical workflow through a controlled simulation study and subsequent implementation. **(Unknown)**

**2009 Activities:** No reported 2009 activities.

**Preliminary Impact and Findings:** All three project sites experienced similar implementation issues including

- Organization and presentation of data
- Education of providers and patients

- Navigation
- Technological enhancements
- Form of decision support and how to connect it to quality reporting
- Workflow/role assignments
- Organizational issues
- Coordination between gastrointestinal and primary care

**Selected Outputs**

Haggstrom DA, Saleem JJ, Militello LM, et al. Examining the relationship between clinical decision support and performance measurement. AMIA Annu Symp Proc. 2009 Nov 14;2009:223-7.

Saleem JJ, Militello LM, Arbuckle N, et al. Clinical decision support at three benchmark health IT systems: barriers to colorectal cancer screening reminder use. AMIA Annu Symp Proc. 2009 Nov 14;2009: 558–562.

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|---|---|
| **Project Title:** | Synthesis Reports for Grants and Cooperative Agreements for Transforming Health Care Quality Through Information Technology |
| **Principal Investigator:** | Felt-Lisk, Susan, M.P.A. |
| **Organization:** | Mathematica Policy Research, Inc. |
| **Contract Number:** | 290-09-00019I-3 |
| **Project Period:** | 09/09 – 12/11 |
| **AHRQ Funded Amount:** | $699,870 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** The goal of this project is to generate reports which synthesize the experiences of the nearly 120 grants which comprise the Agency for Healthcare Research and Quality's (AHRQ's) Transforming Healthcare Quality Through Information Technology (THQIT) initiative. The THQIT initiative is composed of grants funded through four one-time requests for funding announcements (RFAs) including:

- THQIT Planning Grant (HS-04-010)
- THQIT Implementation (HS-04-011)
- Limited Competition for AHRQ THQIT– Implementation Grants (HS-05-013)
- Demonstrating the Value of Health Information Technology (HS-04-012)

THQIT grants were active for varying durations from 2004 through 2009 and were funded to support different aspects of organizational and community-wide activities in health information technology (IT) implementation, to elucidate various stakeholders' perspectives, and to demonstrate the value of health IT implementation and use.

This project will synthesize and report on the experiences of the THQIT grantees. This will be done by collecting data from the original grant applications, peer-reviewed literature, and reports from the THQIT initiative. A Web-based survey that is tailored by the type of grant will be designed and administered to all THQIT grantees to obtain standardized sets of key information across and within the four RFA groups of grantees. Semi-structured interviews with approximately 40 grantee sites will be conducted.

The framework for the data collection and analysis in this project include the following questions:

- What features of planning and health IT partnerships were associated with effective planning, implementation and use, and improved health care processes and outcomes?
- What was the role of the grant and associated requirements in shaping the experience and outcomes of the projects, and how might the grant process be improved?
- What financial, organizational, technical, personnel, procedural, and other barriers were encountered, and what strategies have grantees found to overcome them?
- Where and to what extent have the implementation projects documented improvements or decrements to patient safety, quality of care, or efficiency associated with their health IT implementations, with strong or suggestive evidence? Are certain project features or characteristics associated with better outcomes?

- What benefits do grantees report and what, if any, potential hazards, care process compromises, and safety incidents have been identified?

Findings and outputs from this project will broaden the knowledge base on how to accelerate health IT implementation, on meaningful use, and on criteria for future funding and policy decisions.

**Specific Aims**

- The goal of this project is to generate reports that synthesize the experiences of the nearly 120 grants which comprise AHRQ's THQIT program. **(Ongoing)**

**2009 Activities:** The first four months of this project were devoted to project planning, identifying and reviewing grantee outputs (peer-reviewed and grey literature and final reports to AHRQ), and convening a Technical Expert Panel (TEP). The TEP members represented stakeholder perspectives affected by the THQIT projects. Specifically, they included the perspectives of the following areas: health IT professional, physician, nursing, rural health, community health center, hospital, ambulatory care management, and social scientist. At a one-day meeting in Washington, DC, they provided guidance on (1) the framework and methodologies for collecting and synthesizing information from the implementation and planning THQIT grantees, (2) data collection content and timing, (3) analysis, and (4) summary of findings.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The project has no outputs to date.

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| **Project Title:** | The Give Teens Vaccines Study |
| **Principal Investigator:** | Fiks, Alexander, M.D., M.S.C.E. |
| **Organization:** | The Children's Hospital of Philadelphia Pediatric Research Consortium |
| **Contract Number:** | 290-07-10013-4 |
| **Project Period:** | 09/09 – 09/11 |
| **AHRQ Funding Amount:** | $500,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Teenagers

**Summary:** Immunization rates have been designated as one of the leading health indicators for the Nation by Healthy People 2010. They are particularly useful as measures of the quality of pediatric care because immunization schedules are clearly delineated, standardized Nationally, and structured to protect children and adolescents from life-threatening illness. While much attention has historically been focused on the immunization of infants and young children, recent licensing of new vaccines for adolescents has broadened the population requiring timely vaccination. Effectively delivering adolescent vaccines, especially the quadrivalent human papillomavirus (HPV) vaccine, has been challenging. According to the most recent National Immunization Survey, rates of HPV vaccination are the lowest for all adolescent vaccines.

The Children's Hospital of Philadelphia (CHOP) Pediatric Research Consortium (PeRC) is evaluating the impact of clinician-focused and patient/family-focused health information interventions on HPV vaccination rates among adolescents. The PeRC network serves as an integrated pediatric care delivery system, with shared administrative structure and a shared state-of-the-art electronic health record (EHR), EpicCare, which is certified by the Certification Commission for Health Information Technology. This study will compare the effectiveness of targeting immunization decision support at families and/or clinicians by conducting two parallel trials: a cluster-randomized trial aimed at clinicians and a family-level randomized trial. The planned intervention will employ multiple evidence-based strategies to influence HPV vaccine delivery and receipt in primary care. For clinicians, these include education, clinical decision support, audit, and feedback on vaccination success (measured as the proportion of eligible patients seen by a clinician and given the vaccine during each month of the study). Family-focused decision support will remind parents and their adolescent child that the vaccine is due through phone calls that provide educational information regarding the vaccine, and offer links to additional information on a Web site designed for this project that combines content available through the CHOP Vaccine Education Center.

The evaluation of these two distinct approaches will provide information on the impact of these alternate strategies, alone or in combination, on HPV vaccination rates. The study will advance understanding of how to use health information technology (IT) to engage children and families with clinicians in health decisions and will inform future interventions aimed at improving health for children and adolescents.

**Specific Aims**

- Determine the impact of clinician-focused, EHR-based decision support at the point of care on the receipt of HPV vaccine among adolescents. **(Ongoing)**

- Determine the impact of family-focused, health IT-based decision support on HPV vaccine receipt (main outcome) and families' uncertainty regarding HPV vaccination (exploratory) **(Ongoing)**

**2009 Activities:** The first few months of the project were spent confirming the data analysis plan for the main study and cohort sub-study, defining the data model/database design, and beginning baseline data collection. The data model was designed to allow the project team to capture the main outcomes of the study. The required data fields were identified within the EHR database. The interview guide for interviews with clinicians, parents, and adolescents was completed. To finalize institutional review board (IRB)-approval, the project team is completing power calculations for the cohort study and finalizing consent forms for the project. While awaiting IRB approval, the project team has been meeting regularly to address study details so that once approval is granted, the team can quickly establish baseline vaccination rates. A functioning prototype of the teen vaccine clinical decision support system is expected in early 2010.

**Preliminary Impact and Findings:** This project has no findings to date.

**Selected Outputs**

This project has no outputs to date.

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| **Project Title:** | Enabling Patient-Centered Care through Health Information Technology |
| **Principal Investigator:** | Finkelstein, Joseph, M.A., M.D., Ph.D. |
| **Organization:** | Johns Hopkins University |
| **Contract Number:** | 290-07-10061-I7 |
| **Project Period:** | 12/08 - 06/10 |
| **AHRQ Funding Amount:** | $330,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** General

**Summary:** The use of health information technology (IT) has been promoted as having tremendous promise in improving the efficiency, cost-effectiveness, quality, and safety of medical care delivery in our Nation's health care system. Health IT can support patient care-related activities such as order communications, results reporting, care planning, and clinical or health documentation. Customized integration of patients' information in a health IT application delivered in an accessible, user-friendly format empowers patients and their family members to be active participants in care decisions and in the daily management of their health and illnesses. These are key components of patient-centered care, which the Institute of Medicine has identified as important to ensuring health care quality and patient safety.

Researchers at Johns Hopkins University are developing an evidence report that is part of a three-report series, all focusing on the Agency for Healthcare Research and Quality (AHRQ) Health IT Portfolio's strategic goals. This report will focus on the Portfolio's goal of developing and disseminating evidence on the impact of health IT that enables patient-centered care (PCC). Because of the diversity of IT applications being developed, as well as the different ways in which impact can be measured, the review includes peer reviewed scientific literature (e.g., randomized controlled trials, implementation research, descriptive-qualitative studies, technology assessments) as well as conference proceedings. PCC areas of interest to AHRQ for this evidence report are:

- Shared decisionmaking between the patient and/or family (or caregiver) and clinician.
- Patient-clinician and/or family (or caregiver)-clinician communication.
- Providing access to medical information.

The review will focus on these outcomes as well as care delivery process outcomes that impact systems, care providers and patients, and clinical outcomes. The prospective of clinicians, developers, consumers, and their families will be addressed in the review of the barriers and facilitators of health IT PCC implementation. The review will be guided by a conceptual framework based on current models of patient-centered care.

**Specific Aims:**

- Conduct a comprehensive literature review regarding the impact of health IT that enables PCC. **(Achieved)**
- Develop a final report on the impact of health IT that enables PCC. **(Ongoing)**

**2009 Activities:** The focus of activity throughout the year was on reviewing and synthesizing the evidence in over 300 articles regarding the proposed questions, focusing on the effectiveness of health IT applications enabling PCC in improving care processes, clinical outcomes, and intermediate outcomes such as patient/provider satisfaction, health knowledge and behaviors, cost, and physiologic measures. The data were entered into a master database for analysis and classification mapping. Upon feedback from AHRQ, there was also additional research into the impact of health IT on PCC on specific technological capabilities and their technical implementation. The initial drafting of the report is underway, and the initial findings were also submitted to a technical expert panel for critique. A no-cost extension of the project has been granted through June 2010 to allow time for responding to the critique and finalizing the report.

**Preliminary Impact and Findings:** This project has no findings to date.

**Selected Outputs**

This project has no outputs to date.

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| **Project Title:** | Assessing the Impact of the Patient-Centered Medical Home |
| **Principal Investigator:** | Fontaine, Patricia, M.D., M.S. |
| **Organization:** | University of Minnesota |
| **Contract Number:** | 290-07-10010-4 |
| **Project Period:** | 07/09 - 12/10 |
| **AHRQ Funding Amount:** | $249,990 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Not Applicable

**Summary:** The Primary Care Medical Home (PCMH) model is a vehicle for addressing operational characteristics of health care practices to maximize accessible, comprehensive, family-centered, coordinated, compassionate, and culturally effective care. However, many unanswered questions about potential benefits, drawbacks, and requirements for transforming and maintaining practices point to the need to evaluate the model. Some of the challenges to evaluating the PCMH model include the constantly changing environment of health care, the varying definitions for the term "medical home," and the lack of valid measures for many of the features included in those varying definitions.

HealthPartners Research Foundation is striving to inform policy by evaluating the economic and quality outcomes of mature PCMH clinics in the HealthPartners Medical Group (HPMG) system. HPMG is a multispecialty group in the metropolitan region of Minneapolis and St. Paul, Minnesota, that includes approximately 700 physicians, 40 percent of whom practice primary care in 21 clinics throughout the region. HPMG has been implementing elements of the PCMH concept since 2000, and since 2005 its clinics have been functioning at PCMH Level 3, as defined by the National Committee for Quality Assurance. The central hypothesis of the study is that a clinic's level of PCMH is significantly associated with higher quality, increased patient satisfaction, and reduced resource use. The specific aims of the project are to: determine the associations between PCMH measures and the quality and patient satisfaction with care provided by HPMG clinics; determine medical resource use by constructing a series of multivariate regression models that investigate the relationship between clinical practice systems and resource use within HPMG clinics; identify trends in quality, satisfaction, and resource use occurring within HPMG clinics between 2004 and 2008; and determine whether the trends estimated in support of the third specific aim are unique to HPMG or reflect the overall secular trend occurring among Minnesota-based medical groups.

The data that will support this analysis will come from HealthPartners administrative databases. These databases will provide quality and resource use data corresponding to HealthPartners members receiving care at any contracted Minnesota-based medical group. As such, they will comprise a retrospective cross-section. All patients treated in HPMG clinics will be eligible for the analysis; however, the quality outcome variable will determine the data used in support of each model. For instance, childhood immunizations will be limited to a pediatric population, while diabetes quality indicators will be limited to a diabetes population.

This study has the potential to impact the current understanding of the potential benefits of the PCMH, aid in identifying PCMH domains most strongly related to those benefits, provide policymakers with

valuable information regarding what to expect from widespread PCMH adoption, and provide medical leaders with insights into the PCMH systems of most importance.

**Specific Aims**

- Determine the associations between PCMH measures and the quality and patient satisfaction with care provided by HPMG clinics. **(Ongoing)**
- Determine medical resource use within HPMG clinics. **(Ongoing)**
- Identify trends in quality, satisfaction, and resource use occurring within HPMG clinics. **(Upcoming)**
- Determine whether any identified trends differ significantly from the general secular trend occurring across Minnesota-based medical groups. **(Upcoming)**

**2009 Activities:** Overall progress included performing initial analysis as well as additional complex analyses that had been suggested by the initial analyses and ongoing refinement of the patient attribution algorithm and cost data sets. Specifically, patient-level covariate data were merged with two quality data sources, the Care Innovation and Clinical Indicators datasets, so that multilevel analyses could be performed. These multilevel models predict individual quality data elements (Care Innovation and Clinical Indicators data sources) from patient-level covariates, Physicians Practice Connection® (PPC) scores at the clinic level (from Picker patient satisfaction data), and a random intercept for the clinic. Additionally, clinic-level variation in all quality measures was summarized for the 6-month report draft. The project team proposed a preliminary analysis report that would include early stage drafts of three manuscripts based on the cross-sectional analysis of data completed during the first 6 months of the project.

**Preliminary Impact and Findings:** Preliminary analysis indicates that people who receive consistent primary care at a single PCMH clinic have significantly fewer primary care visits and total visits compared to those who fragment their care across clinics or across health systems. This is reflected in lower utilization relative value units in those areas. Cost data show significance among subgroups. No support has been found to demonstrate much relationship between the use of the medical home model, as measured by PPC-PCMH scores, and quality indicators or patient satisfaction. This could be due to several factors, one being that completion of the PPC-Readiness Survey (RS) by a single knowledgeable observer does not provide enough accuracy for summary scores to demonstrate actual relationships. It is also possible that any relationship between PPC-RS scores and performance measures disappears when the clinics are at a relatively similar level of utilizing a medical home model, despite the apparent variations in both scores and performance measures. No strong relationship has been demonstrated between the presence and function of practice systems and these measures of performance, despite the extensive literature suggesting that there is.

**Selected Outputs**

None available at this time. The project team, in a preliminary analysis report, has proposed three manuscripts based on the cross-sectional analysis of data completed during the first 6 months of the project. These manuscripts would be forthcoming in 2010.

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| **Project Title:** | Participation by Primary Care Practices in Health Information Exchange in Minnesota |
| **Principal Investigator:** | Fontaine, Patricia, M.D., M.S. |
| **Organization:** | University of Minnesota |
| **Contract Number:** | 290-07-10010-2 |
| **Project Period:** | 08/08 – 07/09 |
| **AHRQ Funding Amount:** | $254,423 |
| **Summary Status as of:** | July 2009, Conclusion of Contract |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** The American Recovery and Reinvestment Act of 2009 provides billions of dollars for the promotion of electronic health records (EHRs) and the formation of regional centers to foster community-wide electronic health information exchange (HIE) with the ultimate goal of a nationwide health information network. Minnesota's e-Health Law, passed in 2007, mandates EHR and HIE participation by all clinics and hospitals, including small primary care practices. This contract assesses factors that influence the participation of small- and medium-sized primary care practices in Minnesota in community-wide electronic HIE, defined as the electronic exchange of information among multiple stakeholders such as hospitals, laboratories, ambulatory practices, and quality assurance organizations. Assessments focus on both the perceived benefits and barriers to HIE participation.

**Specific Aims**

- Conduct a systematic literature review of HIE, with emphasis on application to primary care practices. **(Achieved)**
- Determine the motivation and barriers to primary care practice participation in HIE. **(Achieved)**
- Create a report that integrates the factors that affect participation in a community-based electronic HIE. **(Achieved)**

**2009 Activities:** Data were collected through questionnaires and interviews at nine primary care practices in Minnesota that had fewer than 20 physicians and varying degrees of EHR and HIE involvement. Information was collected on characteristics of the practice, EHR capacity, and the degree of HIE. Responses were compiled, cross-checked, and updated from interview transcripts. Results were then analyzed using simple descriptive statistics. Site visits were also conducted by the project team and included a tour of the facilities, a demonstration of the EHR, and interviews with key informants using a semistructured script with questions about EHR and HIE planning and implementation. The practice contact person from each site identified at least three informants from among those knowledgeable and responsible for the practice's information technology (IT) system, including administrators, medical directors, IT staff, physicians, and nurse managers.

**Impact and Findings**

*Extent of EHR and HIE Implementation*

Of the nine practices, eight were using EHRs. In HIE, all nine practices shared data with the Minnesota Department of Health through the successful and widely disseminated Minnesota Immunization

Information Connection, a secure and comprehensive Web-based immunization registry supported by State and Federal funding that is accessible to health care clinics, schools, and child care workers. Laboratory information was the next most commonly shared type of information, reported by eight practices. Several practices were receiving information from nonhospital-based commercial laboratories through direct electronic imports to the EHR. One practice had programmed an interface between their EHR system and the hospital laboratory information system. Other HIE functions were present in seven or fewer practices, and none reported electronic data sharing with nonaffiliated practices (e.g., competing primary care groups or independent consultants).

*Benefits*

Key informants described the motivation for and anticipated benefits of their practices' decision to adopt an EHR. Most practices cited Minnesota's e-Health Law, which requires interoperable EHRs by 2015, as a motivating factor. For some, e-prescribing was the first step toward broader electronic data sharing. More than half the sites were involved in quality reporting initiatives, which were a frequently mentioned motivation for establishing HIE. Replacing labor-intensive medical record reviews with an electronic process in meeting quality reporting requirements had significant cost implications. Immediate access to outside records improved the quality and safety of patient care and saved time that would have been spent requesting records, waiting for them to arrive, and scanning them into the EHR system.

*Barriers*

Lack of interoperability was a barrier for all practices. Informants with IT backgrounds observed that while interoperability was not technically difficult, there was limited political willpower to bring appropriate resources to that goal. Cost was a formidable and overlapping barrier to HIE adoption. Funding EHRs was usually the first cost hurdle, but ongoing license fees and IT support also limited implementation, especially in settings where resources were scarce. Eight of the nine practices did not meet their goal of exchanging clinical data with their associated hospitals. Even among practices that were part of larger systems that also owned local hospitals, only one could access patient information throughout the system; another had recently purchased a compatible EHR. Hospitals and practices did not typically envision community-wide HIE when they planned for and purchased their EHR systems. Overall, data security and privacy were acknowledged as challenging issues that warranted Federal guidelines. Faced with barriers to HIE, practices responded with varying degrees of success. As an important incremental step toward HIE, practices in the northeast region of the State worked with a regional health information organization to create a patient record locator service. While strong leadership, a strategic plan, and physician involvement from the beginning of the EHR selection process seemed to promote success, none of the practices were engaged in the community-wide HIE envisioned as the foundation for the National health information network.

**Selected Outputs**

Fontaine P, Zink T, Boyle R, et al. Health information exchange: participation by Minnesota primary care practices. Arch Intern Med 2010;170 (7):622-9.

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|---|---|
| **Project Title:** | "First, Do No Harm": Using Health Information Technology to Reduce Use of Preventive Services with Potential Harms |
| **Principal Investigator:** | Genevro, Janice, Ph.D. |
| **Organization:** | Professional and Scientific Associates |
| **Contract Number:** | 290-09-00032U |
| **Project Period:** | 09/09 – 09/10 |
| **AHRQ Funded Amount:** | $64,937 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** Working toward the provision of high quality health care and good health outcomes means that information about health care services that should not be provided—whether preventive services or treatment—is also important to protect patients from harm within the health care system. However, formative research and feedback from practicing clinicians indicates that it is extremely difficult to communicate "don't do" recommendations effectively. As providers move to digitized health records, they expect that decision support systems will effectively communicate "don't do" recommendations as well as other types of health care information. This discrepancy between expectation and reality creates an opportunity to explore the best ways to achieve the desired state.

This project is facilitating an Agency for Healthcare Research and Quality meeting in March 2010, at which approximately 20 experts in evidence-based recommendations and guidelines, health information technology, bioinformatics, cognitive psychology, and health communications will discuss ways to improve clinical decision support for preventive services with potential harms. The purpose of this 1-day meeting is to identify a research agenda and potential next steps in this area.

**Specific Aims**

- Convene an expert meeting of approximately 20 participants to discuss methods of communicating "don't do" recommendations. **(Upcoming)**
- Identify a research agenda and potential next steps in developing "don't do" recommendations effectively. **(Upcoming)**

**2009 Activities:** Activities included the identification of a steering committee that is helping design the meeting, identifying participants, and developing the agenda. Logistical considerations for hosting the meeting are also underway. In addition, the steering committee is developing a plan to disseminate reports and other products developed for or as a result of the meeting.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

Two white papers are being developed to prompt discussions at the meeting. A meeting summary will follow the meeting.

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| **Project Title:** | Impact of Consumer Health Informatics Applications |
| **Principal Investigator:** | Gibbons, M. Chris M.D., M.P.H. |
| **Organization:** | Johns Hopkins University |
| **Contract Number:** | 290-07-10061 |
| **Project Period:** | 08/08 – 10/09 |
| **AHRQ Funded Amount:** | $278,850 |
| **Summary Status as of:** | October 2009, Conclusion of Contract |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** General

**Summary:** Many people are excited about the potential of health information technology (IT) and consumer oriented electronic health solutions to improve public health. This field is commonly referred to as consumer health informatics (CHI). Despite the interest, however, there has not been a rigorous review of the effects of CHI on health and health process outcomes. This project is a comprehensive review of current literature on CHI, defined as "any electronic tool, technology, or electronic application that is designed to interact directly with consumers, with or without the presence of a health care professional, that provides or uses individualized (personal) information and provides the consumer with individualized assistance to help the patient better manage his or her health or health care." The literature review focuses on four key areas: (1) the impact of CHI on a variety of health outcomes (including process, intermediate, clinical, and economic outcomes), (2) barriers to implementation of CHI, (3) estimates of the cost and net value of CHI, and (4) evidence needed for broader CHI adoption. Literature is identified through a structured search of several databases, references in review articles, recommendations by experts, and grey literature, such as conference proceedings.

**Specific Aims**

- Review the literature on influence of currently developed consumer health informatics. **(Achieved)**
- Identify gaps in consumer health informatics literature. **(Achieved)**
- Make recommendations for future consumer health informatics research. **(Achieved)**

**2009 Activities:** The project team reviewed literature databases using a search strategy based on a definition of "consumer" and framed by the key research questions. An emphasis of the search was to find randomized clinical trials on CHI's impact on outcomes. Identified literature was reviewed for inclusion based on several criteria, including results from a quality scoring system for the randomized clinical trials. After data was abstracted, a second reviewer verified the quality and consistency of the data. At the completion of the review, the evidence for each type of outcome in each clinical area was graded for quantity, quality, and consistency. Throughout the project, the core team sought feedback from external experts in systematic reviews and sent them a draft report for comments and revisions prior to submitting the final evidence report.

Impact and Findings: The review of the available literature suggests that some CHI applications can effectively engage consumers, enhance traditional clinical interventions, and improve both intermediate and clinical health outcomes. One hundred and forty-six articles were included in the CHI review, the majority of which studied educational Web sites (55 percent). A smaller proportion of published CHI

research focused on computer-generated tailored feedback applications (15 percent), personal monitoring devices (8 percent), and interactive computer programs (8 percent). The majority (58 percent) of CHI applications were designed for use in the patient's home. The studies were varied in the health conditions of interest, ranging from chronic disease and cancer to mental health and Alzheimer's disease. The review suggests that CHI can have a positive impact on intermediate health and clinical outcomes. The majority of studies found evidence of significant positive effect on clinical outcomes. None of the studies found evidence of harm. Studies evaluated in the review suggested three critical elements often found in CHI applications that exert a significant effect on health outcomes. These three elements are: (1) individual tailoring – i.e., the intervention uses information on the specific characteristics of an individual; (2) personalization – i.e., the method of delivery is specified to the individual; and, (3) behavioral feedback.

No conclusions could be made regarding the impact of CHI on economic outcomes, as only three studies reviewed economic outcomes, and each used different economic metrics and methodologies. Thirty-one studies addressed CHI barriers, including systems-level barriers (e.g., hardware and internet access), individual-level barriers (e.g., patient literacy), and challenges of incorporating CHI for the clinic staff. Gaps in CHI research identified by the review include the need to study differences in patient preferences for CHI based on knowledge, attitudes, beliefs, needs, utilization, gender, age, and race/ethnicity as well as the need to evaluate the role of CHI for different patient populations (children, seniors, racial and ethnic minorities, disabled).

**Selected Outputs:**

Gibbons MC, Wilson RF, Samal L, et al. Impact of consumer health informatics applications. Rockville (MD): Agency for Healthcare Research and Quality; October 2009. Evidence Report/Technology Assessment No. 188. (Prepared by Johns Hopkins University Evidence-based Practice Center under contract No. HHSA 290-2007-10061-I). AHRQ Publication No. 09(10)-E019.

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| **Project Title:** | Effective Use of e-Prescribing in Physician Practices and Pharmacies |
| **Principal Investigator:** | Grossman, Joy, Ph.D. |
| **Organization:** | Center for Studying Health System Change |
| **Contract Number:** | 290-05-0007-3 |
| **Project Period:** | 02/09 – 02/11 |
| **AHRQ Funding Amount:** | $374,635 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Knowledge Creation

**Target Population:** Not Applicable

**Summary:** This project addresses the need for qualitative research about the effects of electronic prescribing (e-prescribing) on physician and pharmacy practice and communication. The potential gains from e-prescribing assume that prescribers and pharmacists have access to and make use of the required features. Limited research on the topic suggests that not all e-prescribing systems have the full range of features required by the Medicare Improvements for Patients and Providers Act of 2008. Further, even when the features are available, physician practices face barriers to implementing them effectively, and even when they are implemented at the practice level, physicians may not use them. Similarly, to gain the benefits from electronic transmission of prescriptions, both physician practices and pharmacies must routinely use systems enabled for two-way electronic communications. However, several studies have identified that information technology system limitations, workflow and training issues, and real or perceived regulatory barriers are obstacles to e-prescribing in both the physician and pharmacy settings.

The Center for Studying Health System Change (HSC), a non-partisan health policy research organization in Washington, DC, is conducting research in 12 Nationally representative communities that have been studied longitudinally since the mid-1990s as part of HSC's Community Tracking Study. The researchers will conduct approximately 115 interviews with representatives of physician practices and pharmacies located in these communities and with other local and National stakeholder organizations to explore the effects of e-prescribing among users who electronically send or receive prescriptions directly from or to their e-prescribing system, rather than by stand-alone or computer-generated fax.

Interviews will collect information on how communication between physician practices and pharmacies is affected by e-prescribing. The study will also explore physician use of third-party information (medication histories, formularies, generic medication alternatives) at the point of prescribing. Information collected by the study will inform strategies for governmental and private health care organizations to promote adoption and effective use of e-prescribing capabilities, including Medicare and Medicaid financial incentives and penalties.

**Specific Aims**

- Explore how e-prescribing features are implemented and used by physicians and pharmacies with a focus on selected features that have the potential to yield health care quality and cost benefits but that prior research has shown not to be available or used routinely by significant proportions of e-prescribers. **(Ongoing)**

**2009 Activities:** The study design was finalized, and semi-structured interview protocols were developed. Clearance to begin research was requested from the Office of Management and Budget (OMB). HSC received comments from five stakeholders and organizations and submitted responses to OMB in December 2009.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The project has no outputs to date.

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| **Project Title:** | Improving Quality through Health Information Technology: Testing the Feasibility and Assessing the Impact of Using Existing Health Information Technology Infrastructure for Better Care Delivery |
| **Principal Investigator:** | Hasnain-Wynia, Romana, Ph.D. |
| **Organization:** | Health Research and Educational Trust; Northwestern University, Feinberg School of Medicine |
| **Contract Number:** | 290-06-0022-3 |
| **Project Period:** | 09/07 – 07/09 |
| **AHRQ Funding Amount:** | $393,457 |
| **Summary Status as of:** | July 2009, Conclusion of Contract |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Cancer, HIV/AIDS, Safety Net

**Summary:** This study assessed the use of health information technology (IT) to improve care delivery and outcomes for patients with HIV and/or who need cervical cancer screening by documenting and facilitating clinicians' use of laboratory orders and test results in community health centers (CHCs). The project examines how health IT tools can improve compliance, efficiency, and quality of care by reducing duplicate tests and lost results and increasing adherence to treatment followup guidelines.

The project includes two CHCs in Chicago, IL, that use the Centricity electronic health record (EHR), which is certified by the Certification Commission for Health Information Technology. The EHR has the capability for clinical decision support, evidence-based protocols, and automated feedback reports documenting organizational and provider-level performance on laboratory indicators. Semistructured interviews were conducted with IT, laboratory, clinical, and administrative staff to document the implementation process, perceived benefits and utilization of the EHR in laboratory ordering and results communication at the point of care, and any resulting workflow changes.

**Specific Aims**

- Understand how health IT can improve access to and management of laboratory information for patients with HIV and patients in need of cervical cancer screening. **(Achieved)**
- Illustrate how health IT tools can improve compliance with evidence-based laboratory test guidelines and improve both the efficiency and quality of care by reducing the numbers of duplicate laboratory tests, "lost" results, and laboratory results without followup. **(Achieved)**
- Identify how health IT can aid various types of health care practitioners in laboratory-related tasks. **(Achieved)**
- Develop a set of best practices focused on how a specific set of health IT tools can be used to improve both treatment and screening (i.e., HIV treatment and cervical cancer screening and followup) that can be disseminated to other CHCs and physician practices. **(Achieved)**

**2009 Activities:** The project data analysis was completed, and several reports were developed, including the effects on adherence to treatment followup and a guide on best practices for implementation of EHRs in CHCs.

**Impact and Findings:**

*Adherence to guidelines*

Implementation of the EHR had limited measurable short-term impact on laboratory followup and duplicate tests. Post-implementation data showed that the rate of followup for abnormal Pap smears was very low at both centers (less than 10 percent). One reason may be that some patients receive followup care at other clinical sites, and this is not documented in their record. This finding identifies the need for better tracking of followup care at the clinical sites and tracking of patients who receive followup elsewhere. An insufficient number of records were available to compare rates of pap smears before and after EHR implementation. However, the persistently low rate of followup for abnormal Pap smears is an important finding. The EHR provides data for monitoring the low followup rate for use in quality improvement, which may indicate the need for further modification of decision support at the point of care.

The rate of duplicate viral load tests for HIV at each center was low both pre- and post-implementation of the EHR (less than 1 percent). Patients in the study who were seeking HIV care at the CHCs tended to be aware of their status and knew when laboratory tests were last performed or due, potentially reducing duplicate test ordering. Overall, these results highlight the importance of prioritizing use of health IT tools for those clinical areas that have relatively low rates of clinical adherence. Guideline compliance for HIV laboratory measures did not show statistically significant improvement at 6 or 12 months post-implementation. However, an improvement in compliance at 20 months post-implementation was evident on several measures, including CD4, lipid profile, and liver function tests. This finding indicates that the time period for improvement after implementation can be as long as 2 years.

*Cost-effectiveness*

The lack of statistical improvement in the two quantitative outcomes of interest did not allow for a calculation of an incremental cost-effectiveness ratio. As a result, the analysis focused on the cost of implementation. The cost of implementation ranged from $143,360 to $168,340 for hardware, software, and personnel. Additional infrastructure and training costs were estimated between $23,000 and $35,000. Ongoing operational costs were estimated between $30,000 and $45,000 a year.

*Qualitative component*

Qualitative interviews with staff identified the benefits of the EHR, areas needing improvement in the use of the EHR, and the impact of EHR implementation on workflow. Laboratory interface issues, such as delays in logging onto the system and printing, have a notable impact on providers' satisfaction with the system. Despite staff members' frustration, no one reported that he or she would prefer to go back to paper charts. The key benefits of the EHR reported by the staff included ease in finding charts, improved communication between different providers through "flagging," and improved communication with patients.

**Selected Outputs**

Yonek J. Improving health IT infrastructure for better care. Hospitals and Health Networks Digital Magazine. 2009 Dec 14.

Implementation Handbook. Improving quality through health IT: Testing the feasibility and assessing the impact of using existing health IT infrastructure for better care delivery. August 2009. Health Research and Educational Trust.

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| **Project Title:** | Secure Messaging in a Pediatric Respiratory Medicine Setting |
| **Principal Investigator:** | Hsiao, Allen L., M.D. |
| **Organization:** | Yale New Haven Health Services Corporation |
| **Contract Number:** | 290-20-060015 |
| **Project Period:** | 09/07 – 09/09 |
| **AHRQ Funding Amount:** | $399,970 |
| **Summary Status as of:** | September 2009, Conclusion of Contract |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Pediatrics*, Teenagers

**Summary:** Although e-mail may be an efficient clinician-patient communication tool, standard e-mail is not secure enough to meet Health Information Portability and Accountability Act guidelines. Firewall-secured electronic messaging systems have been developed for use in health care, but the impact and usability of these secure systems has not been broadly assessed.

This project evaluated how the implementation of a secure e-mail messaging (e-messaging) system between clinicians and patients and/or guardians affects provider efficiency, utilization of emergency department (ED) for medication refills, and patients' qualitative satisfaction with care in a pediatric respiratory medicine setting. The project was completed at the Yale Pediatric Respiratory Medicine Clinic, a subspecialty clinic in a tertiary care hospital that serves a diverse patient population. Study methods included: 1) pre-implementation survey of patients regarding Internet use, 2) tracking of messages, 3) open-ended qualitative interviews of users and non-users to describe the impact of the system, and 4) description of the implementation process.

Prior to enrollment of patients, a time-motion study was conducted on clinic providers' daily telephone use for scheduling, refills, and answering questions. Study results were compared with post-implementation provider time utilization to determine whether providing care (refills, answering questions, etc.) required similar or different amounts of provider time when conducted electronically.

This research contributes to understanding of use of secure messaging from the patient's perspective and increases implementation process information that other providers can use.

**Specific Aims**

- Understand the content of what children, adolescents, and their parents will send as a secure message to their providers. **(Achieved)**
- Evaluate the impact of secure messaging with regard to provider-time spent, ED-utilization for medication refills, and qualitative satisfaction by the patients and clinicians. **(Achieved)**

**2009 Activities:** The team completed a pre-implementation survey of 127 patient/families on their Internet use. Medical providers, nurses, patients, and their guardians were trained in the use of the messaging system. Audits of the secure messages and content analysis of both telephone calls and secure messages were conducted for a period of 8 months. Open-ended, qualitative interviews were conducted with 28 patients and their guardians to assess their attitudes toward electronic messaging. The interviews explored possible reasons for not signing up for secure messaging or for signing up but not using the system, as well as other barriers to adoption. Interviews with patients and guardians who did use the secure messaging system were conducted to learn about their experience and satisfaction. All collected

data were analyzed, and an electronic messaging implementation handbook was developed from notes captured during the implementation process. A manuscript was developed and submitted to Pediatrics for publication.

**Impact and Findings:** The pre-implementation survey determined that patients have access to and interest in using the Internet to communicate with health care providers. During the first 6 months after implementation, 127 patients enrolled in the system but sent only 5 messages. There was no change in the volume of telephone calls. Qualitative interviews with parents after implementation of secure messaging identified three themes: barriers to use of the system, promoters to its use, and ideas for potential uses.

While barriers for some patients were anticipated (lack of access to computers, literacy, discomfort with new technology), several unexpected barriers were identified in qualitative interviews with patients. Although families may have access to the Internet and strong interest in e-mailing, secure messaging was ultimately utilized only by a handful of patients because it was less convenient than phoning, too technically cumbersome, and lacked a personal touch.

The few users who initially used the system appeared to be patients/families who are newer to the practice. The project continued to enroll patients, targeting new patients, as more established patients were prone to resort to "tried and true" methods of communicating with the clinic.

While every indication was given that this new technology was desired, patients preferred more traditional methods of contact at the clinic. In order for secure messaging systems to be used to improve communication with providers and be part of a patient-centric model of care, they must be integrated into more readily-usable messaging portals and accompanied by content that is of interest to patients and their families.

**Selected Outputs**

Hsiao AL, Tolomeo T, Edmonds D, et al. Secure e-messaging: quality communication? Slow take-off of 'kids' airmail' in a pediatric respiratory medicine clinic. Poster presented at the Institute for Healthcare Improvement 21st Annual National Forum on Quality Improvement in Health Care; 2009 Dec 6-9; Orlando, Florida.

Electronic Messaging Implementation Handbook.

**AHRQ Priority Population*

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| **Project Title:** | Evaluation of AHRQ's On-Time Pressure Ulcer Program |
| **Principal Investigator:** | Hurd, Donna, M.S.N. |
| **Organization:** | Abt Associates, Inc. |
| **Contract Number:** | 290-06-0011-8 |
| **Project Period:** | 06/09 – 05/10 |
| **AHRQ Funding Amount:** | $480,790 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** Elderly*

**Summary:** Pressure ulcers and injurious falls have serious health and economic consequences for elderly residents in nursing homes. Substantial research has documented that prevention of both types of adverse events is possible, yet problems persist across health care settings. Many initiatives to improve quality of pressure ulcer care in nursing homes have been undertaken in the last decade, including the Agency for Healthcare Research and Quality-funded On-Time Pressure Ulcer (PrU) Healing Project which helps nursing homes implement best practice guidelines in PrU care through workflow redesign and process improvements. While the On-Time program has unique characteristics, it has not yet been formally evaluated and thus is not ready for wide dissemination. The goals of this project are two-fold: 1) evaluate the effectiveness of the On-Time PrU program, and 2) design the tools and foundation for a falls prevention implementation effort using an approach similar to On-Time PrU.

Falls are the most frequently reported adverse events among frail nursing home residents and are a critical resident safety issue. There is an urgent need for model programs to effectively identify and manage fall risk in nursing homes. To disseminate the results of the proposed module and sustain improvements, a new implementation approach is needed. A yearlong process of workgroup meetings will inform the standardization of fall documentation and the development of tools to guide clinical decisionmaking for fall prevention. In addition, six to eight facilities will participate in a series of teleconference calls to develop health information technology specifications based on the final set of fall prevention tools. For the On-Time fall prevention module, documentation data elements, actionable reports, and tracking tools on risk factors will be developed using lessons learned from the On-Time PrU program. These resources will allow nursing home staff to intervene in a timely manner with at-risk residents to reduce the incidence of injurious falls. The project team will work with facilities to develop a feasible implementation plan to integrate these tools into daily practice.

**Specific Aims**

- Evaluate the effect of the On-Time PrU by comparing 15 New York nursing homes that have implemented the program with 12 to 15 control nursing homes. Information on pressure ulcer incidence provided by the facilities for a 12-month period and adjusted for resident risk factors using minimum data set data will provide the data needed to assess the effectiveness of the On-Time program for reducing pressure ulcers. **(Ongoing)**
- Design the tools and establish the foundation for a fall prevention implementation effort using an approach similar to the On-Time PrU prevention, including standardized documentation data elements that can be integrated into everyday practice, actionable reports of resident fall risk factors, and tracking tools. **(Ongoing)**

**2009 Activities:** The focus of activities has been on completing a literature review on preventing falls in nursing homes and on finalizing plans for program evaluation, data collection, and instruments. A series of teleconference calls was begun to facilitate discussion among the participants on standardizing fall documentation and developing tools and reports to guide clinical decision for fall prevention.

Facilities have been provided with detailed information on the data to be acquired and the data collection instruments they can use. Participating nursing homes remain free to use other formats for documenting PrU incidence and census data, as long as the required data can be ascertained. Recruitment materials that describe the data submission requirements in detail have been developed and include a study fact sheet, frequently asked questions, and a memorandum of understanding. At year's end, recruitment was slower and data collection more complex than expected. The project team is planning to send some of their own staff members to the control sites to assist with data collection. This will reduce the burden on facilities, increase efficiency, and reduce delays.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

Fall Prevention & Fall Education Discussion Outline. Includes: 1) fall management programs, 2) fall-related characteristics of residents and their environments, 3) ECF fall management approaches, and 4) information management.

Fall Prevention Final Literature Review. Literature review, list of references, and summary.

Fall Prevention Project Launch Checklist. Checklist to identify fall prevention and management practices.

Pressure Ulcer Evaluation Final Data Collection Plan and Tools Document. Explains the proposed data collection instruments and processes that will be used in the intervention and control nursing homes.

Pressure Ulcer Final Evaluation Plan. Overview of the evaluation design and guiding research questions; criteria for facility selection, including some rationale for these criteria, and how the information has been or will be obtained from intervention and control sites; strategy for facility recruitment; key measures to be used in quantitative analyses for the evaluation; analytic strategy; and power calculations to justify planned sample size.

**AHRQ Priority Population*

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| **Project Title:** | Using Innovative Communication Technology to Improve the Health of Young African-American Women |
| **Principal Investigator:** | Jack, Brian, M.D. |
| **Organization:** | Boston University |
| **Contract Number:** | 290-06-0012-7 |
| **Project Period:** | 07/09 – 04/11 |
| **AHRQ Funded Amount:** | $399,504 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Racial or Ethnic Minorities*: African American, Teenagers, Women*

**Summary:** Clinical health care for young women has been the focus of National attention since the 1980s, when research revealed significant racial disparities in pregnancy outcomes. National programs to improve poor pregnancy outcomes were initiated that centered largely on providing care for women during pregnancy and helping women enter prenatal care early. The proposed contract is part of an emerging effort to engage young adults and improve their health before they are pregnant.

This project includes the development of an intervention to promote the health of African-American women aged 15 to 21 years old. It uses theory-based behavioral change techniques and an existing clinical patient education system—the Virtual Patient Advocate (VPA)—to deliver the behavior change intervention. The VPA is an innovative communication channel that features an animated computer character that talks to patients over the Internet via simulated face-to-face conversation. Aspects of this technology have been previously applied by the researchers to provide patient education at hospital discharge. This VPA system will feature novel social networking capabilities to increase the reach and efficacy of the new intervention.

Study staff will conduct focus groups to solicit participants' recommendations to maximize the target population's uptake of the system, building relevant behavioral messages, and ensuring that the VPA system is convenient and easy-to-use. The system will be adapted from the VPA originally designed for the ReEngineered Discharge program (also called Project RED) to provide: 1) a personalized and comprehensive assessment of preconception risks; 2) culturally appropriate health promotion messages; 3) an individually tailored behavior change discussion for each risk identified. This integration of social networking technologies will increase the reach of the intervention while increasing adherence to its recommendations.

**Specific Aims**

- Design a new VPA for a Web-based behavior change and patient activation system that is informed by qualitative research with the target audience. **(Ongoing)**
- Develop VPA dialogue for African-American women (15 to 21 years old). **(Ongoing)**
- Develop a social networking interface that allows users to recommend other people who could benefit from the intervention and perform a proof-of-concept test of this new system to improve the health of African-American women. **(Ongoing)**
- Analyze the impact of the newly designed system. **(Upcoming)**
- Disseminate this new technology to at least two other academic medical centers. **(Upcoming)**

**2009 Activities:** Efforts were focused on developing the VPA and included: designing the Web-based tool; developing an intake questionnaire to screen participants for individual health risks related to preconception care; and writing the VPA scripts to address health risks and other components of the patient-VPA interaction.

The intake questionnaire, which identifies individual health risks related to preconception health, and the VPA scripts, which deliver health messages, were based upon the work of the clinical workgroup of the Centers for Disease Control and Prevention's Select Panel of Preconception Care, which was recently published as a supplement to the American Journal of Obstetrics and Gynecology (AJOG). The supplement identifies the following 13 health domains: immunizations, infectious disease, chronic medical conditions, psychiatric conditions, parental exposures, genetics and genomics, nutrition and dietary supplements, environmental exposures, psychosocial stressors, medications and supplements, reproductive history, special populations, and preconception care for men. The study team used these domains as a framework for developing the intake questionnaire and VPA scripts.

In addition to the clinical information from the AJOG Supplement and the National Advisory Committee, qualitative data from focus groups informed initial development of the intake questionnaire and VPA scripts. Two focus groups were held in 2009. Participants were recruited at community organizations, in a free public newspaper advertisement, job posting sites, and Craigslist. The focus group moderator presented program components and facilitated the following structured discussions:

- **VPA Scripts:** Participants listened to examples of VPA scripts about selected health topics and shared their opinions about the information and how it was presented. Their feedback provided insight into how to construct relevant health messages that would be well-received by the target audience.
- **Patient-Provider Interactions:** The focus group moderator went through the list of health risks from the 13 health domains and asked participants how their doctor or other health care providers address those subjects at appointments. Participants gave examples of both effective and ineffective approaches.
- **VPA Agents:** The focus group moderator introduced participants to eight potential VPA "agents." The participants discussed which agents were most effective and relatable, then chose one "agent" to deliver the preconception health messages.
- **Stories:** The project hired a professional storyteller to read example stories to participants, who then shared their reactions to the stories. Participants preferred stories written in the first person, suggested using images to enhance their connection to the story and comprehension of the material, and suggested that participants be able to rate the stories by clicking on a "thumbs up" or "thumbs down" button. The team will determine what stories will populate the system based on this feedback.
- **Reproductive Life Plan:** The focus group moderator led a discussion about participants' thoughts and preferences for a Reproductive Life Plan, which is an individualized list of health risks and planned actions to address those risks. Participants preferred to have the Reproductive Life Plan available electronically instead of in paper form, because they were afraid of losing the paper and compromising their confidentiality.
- **Existing Web sites:** Participants looked at a number of existing Web sites (www.mariatalks.com, www.sexreally.com, www.goaskalice.com) and shared their opinions about the positive and negative features of each. From this feedback the team learned about topics ranging from color and font preferences, to thoughts about specific features, such as quizzes and polls. This information will be incorporated into the design of the VPA system and other program materials.

Future focus group participants will decide on a name for the VPA agent. As the team writes the VPA scripts, the study team will start to input them into the system, will test the VPA's speech and continue to refine the system throughout development.

The team has also begun developing a platform to give participants story-authoring capabilities so that they can share their stories about overcoming individual health risks. Security of the participants' identity will be a priority of the story-authoring platform. Future focus groups will help determine the most effective way for participants to create their stories and how they should be presented to other participants. By sharing their stories, participants will contribute to a database of stories that will be integrated in to the VPA program. Subsequent participants will be able to hear stories relevant to their personal health risks and learn from the lessons and information shared by their peers.

A social networking interface that allows participants to invite friends to use the system is being developed. This interface could be integrated into existing social networking Web sites to appeal to the target audience, thereby reaching more young women who are at high risk of negative pregnancy outcomes.

**Preliminary Impact and Findings:** This project has no findings to date.

**Selected Outputs**

This project has no outputs to date.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Consumer Engagement in Developing Electronic Health Information Systems |
| **Principal Investigator:** | Kerwin, Jeffrey, Ph.D. |
| **Organization:** | Westat |
| **Contract Number:** | PSC TO#07R000131 |
| **Project Period:** | 09/07 – 06/09 |
| **AHRQ Funding Amount:** | $251,114 |
| **Summary Status as of:** | June 2009, Conclusion of Contract |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** General

**Summary:** The value of health information technology (IT) investment in improving quality and safety depends on participation by the ultimate beneficiary: the patient/consumer. Health IT has the potential to reduce health care disparities, increase consumer self-care, and provide a coordinated patient-centered experience. But consumers have expressed a distrust of some health IT efforts. The utility of any health IT or health information exchange (HIE) system will be greatly enhanced if patients are involved in its planning, development, and implementation; thus it is important to understand the best way to engage patients and consumers. This research study is designed to gain insight into consumers' understanding, fears, and concerns related to health IT and HIE to devise strategies to engage them in the development of electronic health information systems.

Twenty focus groups with health care consumers were conducted in selected cities around the United States, including four conducted with Spanish-speaking patients. Groups were divided by heavy users, defined as having a chronic disease or visiting three different health providers in the last year, and light users, individuals with at least one health visit in the last 2 years. Consumers with a relatively heavy dependence on health care might be expected to have a different frame of reference in considering health IT than people with a lighter use of health care. The potential benefits and risks of health IT are expected to be more immediately clear to those who are most dependent on health care.

Groups were also constructed by whether participants were covered by a Health Maintenance Organization (HMO). Approximately two-thirds of physicians who practice within an HMO use electronic medical records (at least partially), compared to only about one-fifth of those in practices owned by the physicians. Consumers who avoid HMOs often do so at least partly because they want maximum choice and independence in the health care providers they visit. This characteristic may be related to their perceptions of certain aspects of health IT (e.g., sharing of information among providers).

**Specific Aims**

- Gain in-depth understanding of health care consumers' awareness, beliefs, perceptions, and fears concerning health IT. **(Achieved)**
- Learn how/if consumers wish to be engaged in the development of health IT and at what point they should be engaged. **(Achieved)**

**2009 Activities:** A total of 20 focus groups were conducted to discuss consumer viewpoints, with groups located in the Northeast, Mid-Atlantic, South, Midwest, and Western regions of the United States to

capture differences in regional attitudes. Participants were required to have visited a health care provider at least once in the last 2 years for themselves or a family member.

Focus groups were conducted in two-part segments. The first hour of the discussion provided an opportunity for the moderator to educate the group to ensure everyone had a basic understanding of the capabilities of health IT. In the second part of the focus group, they discussed the role of consumers in influencing the design of health IT.

**Impact and Findings:** Focus group results provided insight from consumers on a number of topics including privacy, perception of benefits of use of health IT, and the consumer role in developing health IT. Overall, participants expressed optimism toward the use of technology and identified several benefits they had already experienced through the use of health IT. Privacy was a consistent concern across the groups, and there was support for the idea that health care consumers be asked for their consent before health data are stored electronically. Further, some participants suggested that access to electronic health data should be customizable based on patient preferences, for example, allowing the consumer to decide which other providers' data may be shared electronically. There was less agreement among focus group participants on the topic of using data for medical research and more concern for the use of data for pharmaceutical or market research.

The consumer role in designing and using health IT was not immediately identifiable for many participants. They believed that this work should fall to medical and technological experts and that consumers would not have knowledge to contribute. The one area consumers felt they would have a role is in the areas of data security and privacy of information. Other findings involve perceptions of the role of the market, health plans, and government in the development of health IT and perceptions on the venues available for consumers to support health IT development. The focus groups suggest that public education about health IT is needed.

**Selected Outputs**

Schneider S, Kerwin J, Robins C, Dean D. Consumer engagement in developing electronic health information systems: Final report. (Prepared by Westat, Rockville, Maryland, under Contract No. 233-02-0087). AHRQ Publication Number 09-0081-EF. Rockville, MD: Agency for Healthcare Research and Quality. July 2009.

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|---|---|
| **Project Title:** | Using Health Information Technology to Improve Health Care Quality in Primary Care Practices and in Transitions Between Care Settings |
| **Principal Investigator:** | Krist, Alexander H., M.D., M.P.H. |
| **Organization:** | Virginia Commonwealth University |
| **Contract Number:** | 290-07-10011-3 |
| **Project Period:** | 09/09 – 09/11 |
| **AHRQ Funding Amount:** | $499,982 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Adults

**Summary:** There is a major discrepancy between the American public's perceived value of personal health records (PHRs) and the use of PHRs. Only 2.7 percent of Americans have an electronic PHR, despite 79 percent reporting that they believe an online PHR would "provide major benefits to managing their health." Similarly, there are low rates of electronic medical record (EMR) use among clinicians. Only 17 to 24 percent of outpatient clinicians have an EMR, only 4 percent of which are considered fully functional. This low use of health information technology (IT) occurs at a time when the Nation is looking at health IT as an essential tool to reform health care, improve quality of care, coordinate care delivery, and reduce costs. For small- to medium-sized primary care practices implementing health IT, financial and technical resource limitations often require the adaptation of technology that is already available.

This project will assess methods of creating PHRs from existing EMR systems at small- to medium-sized primary care practices. For this project, a PHR is defined as a nonproprietary, prevention-focused record. When integrated with a clinician's EMR, it is termed an "interactive preventive health care record" (IPHR). The IPHR incorporates clinical decision support software, a reminder system, tailored educational materials, and decision aids into one actionable package for both patients and clinicians. IPHRs were shown to enhance clinician-patient communication and increase the delivery of recommended preventive services by three to 12 percent in a previous study. The proposed study builds on those findings to evaluate whether the IPHR can be applied to different health care settings that use different EMRs.

The study is being conducted in six practices that use Certification Commission for Health Information Technology-certified products (Epic EMR or A4 EMR), and cover a range of service areas (rural, suburban, and urban), and size (from two to 10 clinicians). Through a series of learning collaboratives, study staff will guide practices in creating a shared vision for implementing the IPHR. Separate learning collaboratives will be conducted at each practice before and after they implement the IPHR. In order to successfully engage practices and create change, the study team will work toward eight components: 1) securing leadership buy-in and support, 2) creating a culture that is conducive to change, 3) establishing a sense of priority, 4) forming a guiding coalition, 5) developing and communicating a shared vision, 6) empowering members to act on the vision, 7) planning for short-term wins, and 8) consolidating improvements and institutionalizing success.

**Specific Aims**

- Determine whether the study sites can begin implementing the IPHR. **(Ongoing)**
- Measure the utilization and effectiveness of the IPHR. **(Ongoing)**
- Determine the necessary steps and procedures that practices need to follow or avoid in order to implement the IPHR successfully. **(Ongoing)**

**2009 Activities:** The project began in the last quarter of 2009, during which the programming team was engaged to discuss a more generalizable mechanism to create interfaces. They are currently considering the use of either a continuity of care record or continuity of care document to transfer data. After institutional review board approval, outreach to recruit primary care practices was initiated and efforts to recruit study sites included presentations and maintained contact with organizations that were initially approached. An employee work profile for the collaborative practice coordinator who will lead the learning collaboratives was developed in preparation for posting to hire for the position. A public summary of the contract purpose, specific aims, and reportable milestones was submitted for posting to the Agency for Healthcare Research and Quality National Resource Center Web site. An electronic project plan, a hierarchical project organizational chart, and a final research plan were also completed.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The project has no outputs to date.

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| **Project Title:** | Patient Safety Metadata |
| **Principal Investigator:** | LaBonte, Sheri, J.D., P.M.P., C.I.S.S.P. |
| **Organization:** | Data Consulting Group |
| **Contract Number:** | 290-08-10005M |
| **Project Period:** | 01/08 – 12/10 |
| **AHRQ Funded Amount:** | $1,012,814 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Not Applicable

**Summary:** A common data classification registry streamlines the processes associated with information exchange, both within the Federal Government and between the Government and external stakeholders. Streamlined processes allow for the identification of and concentration on key improvement areas, and produce clearly identified, measurable results. The United States Health Information Knowledgebase (USHIK) is a metadata registry of health care-related data standards. This registry, which meets the requirements of the International Organization for Standardization and the International Electrotechnical Commission, has been a collaborative effort among several health information organizations and Federal agencies (the Centers for Medicare and Medicaid Services, the Department of Defense Military Health System, the Agency for Healthcare Research and Quality [AHRQ], and the National Cancer Institute), that recognize the need to maintain an Internet-based registry of data standards to be maintained long term. USHIK supports metadata registry for these various health care data initiatives and for 10 years has provided a single axis of continuity for various approved standards, elements, code sets, references, and additional artifacts at the Federal level. The USHIK registry supports these initiatives and participating Federal Government health care agencies by cataloging and providing a platform for maintaining and harmonizing standardized, approved data artifacts across multiple organizations, agencies, and entities.

The USHIK project complies with the e-Government Act of 2002 and the President's Management Agenda to use Internet-based information technology to enhance access to Government information and resources. As reusable components are identified and agencies begin to collaborate, USHIK is the single point of continuity among initiatives, agencies, and projects. AHRQ is responsible for the metadata repository, and USHIK will provide the mechanism for storing, maintaining, and sharing these metadata components.

USHIK project staff will facilitate implementation and usage of these components and component-based architectures across the health enterprise. USHIK will describe the types of interactions and information exchanges that occur between the Federal health communities and various customers, constituencies, and business partners. USHIK has the capacity to categorize and display the Government's information along with specific information exchange requirements and content areas and can deconstruct those content areas into greater levels of detail, e.g., basic data components that are common to many health-related processes and activities. USHIK facilitates the sharing of information exchange requirements through standards-based, reusable, secure, portable, and interoperable technology standards. Project efforts will further establish commonly understood classifications for health data elements, identify duplicative data resources, and enable information sharing among agencies. AHRQ will oversee the focused data efforts to ensure that all appropriate points of integration are identified.

**Specific Aims**

- Maintain the metadata registry. **(Ongoing)**
- Support the Healthcare Information Technology Standards Panel. **(Ongoing)**
- Support AHRQ's Center for Quality Improvement and Patient Safety (CQuIPS). **(Ongoing)**
- Provide support for external agencies. **(Ongoing)**

**2009 Activities:** The AHRQ USHIK project led the collaboration with the Iowa Foundation for Medical Care and CQuIPs in formulating the developmental requirements for the design and implementation of a portal within USHIK's architecture which supports "Common Formats." "Common Formats" specify the definitions and reports health care providers need to adopt to collect and submit standardized information on patient safety events such as incidents, near misses, or close calls, and/or unsafe conditions.

The prototype was completed. AHRQ USHIK hosted several live demonstrations for the stakeholders at various stages of completion and presented the vision and the Version 0.1 data prototype at the AHRQ Patient Safety Convention.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The AHRQ USHIK digitized the following 12 forms, which are currently used to collect/report data to the Patient Safety Organizations:

- Administrative
- Blood or Blood Product
- Devise or Medical/Surgical Supply
- Fall
- Health Care Event Reporting Form (HERF)
- Health Care-associated Infection
- Medication or Other Substance
- Patient Information Form (PIF)
- Perinatal
- Pressure Ulcer
- Summary of Initial Reports (SIR)
- Surgery or Anesthesia

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| **Project Title:** | Enabling Health Care Decisionmaking Through the Use of Health Information Technology |
| **Principal Investigator:** | Lobach, David, M.D., Ph.D., M.S. |
| **Organization:** | Duke University |
| **Contract Number:** | 290-07-10066-I |
| **Project Period:** | 09/09 – 12/10 |
| **AHRQ Funded Amount:** | $405,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** Access to and utilization of knowledge, information, and clinical data via health information technology (IT) can facilitate clinical decisionmaking and communication. While the use of clinical decision support systems (CDSS) has the potential to make evidence-based practice guidelines available to clinicians at the point of care, there is uncertainty and concern about workflow disruption, usability in practice, and utility of the content. In 2009, Duke University's Evidence-based Practice Center (EPC) was awarded a contract to develop a synthesis report summarizing the evidence on the use and effectiveness of CDSS across clinical settings. The report is part of a three-report series on the Agency for Healthcare Research and Quality's Health IT Portfolio's strategic goals. The report is focused on the portfolio's goal of facilitating health care decisionmaking with health IT. As part of the work, the EPC will convene a technical expert panel (TEP) to conduct a comprehensive systematic literature search, review and analyze the existing evidence, and identify gaps in knowledge. The final product will be a report that synthesizes key knowledge gaps and existing peer-reviewed research to provide critical information on developing and using electronic knowledge management and CDSS.

**Specific Aims**

- Identity what evidence-based study designs can be used to determine the effectiveness of CDSS. **(Ongoing)**
- Identify what contextual factors and features influence the implementation and use of electronic knowledge management and CDSS. **(Ongoing)**
- Identify the impact of introducing electronic knowledge management and CDSS. **(Ongoing)**
- Identify what generalizable knowledge can be integrated into electronic knowledge management and CDSS to improve health care quality. **(Ongoing)**

**2009 Activities:** The initial project startup included the development of the draft protocol for the review and synthesis of the existing peer-reviewed research and the kick-off call with the TEP to discuss project objectives, scoping of key questions, search strategy, and timeline. Based on the TEP feedback, the project team finalized the protocol for the literature search and review process (including sources, search strategies, and abstract and full-text screening criteria), the criteria for evaluating the quality of the studies, and the process of rating the strength of the existing evidence.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

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| **Project Title:** | Defining Barriers/Solutions for Collecting Quality Performance Measures |
| **Principal Investigator:** | Longo, Daniel, Sc.D. |
| **Organization:** | The Virginia Ambulatory Care Outcomes Research Network (ACORN) |
| **Contract Number:** | 290-2007-1001 |
| **Project Period:** | 09/07 – 03/09 |
| **AHRQ Funding Amount:** | $150,000 |
| **Summary Status as of:** | March 2009, Conclusion of Contract |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** General

**Summary:** Primary care practices are aware of the reimbursement incentives for monitoring patient outcomes to improve care management. However, inexperience with comparative data analysis, unfamiliarity with or limited access to information technology resources, and inadequate reimbursement for related activities limits progress in this area. Clinicians have competing demands for their time that limit their ability to become fully engaged in quality performance monitoring data collection and reporting (QPMDCR).

Primary care practices in the Virginia Ambulatory Care Outcomes Research Network (ACORN) were invited to conduct QPMDCR projects of their choosing to identify and document barriers to performance monitoring. Participating practices covered a range of practice size, patient population, resources, medical record systems (electronic or paper-based), and experience with quality improvement activities. Project participants reviewed relevant literature from 1989 to the present to supplement the research of practice experience. The objective was to comprehensively describe the issues involved in supporting primary care practices to collect and report quality measure data and document effective strategies that practices have used.

**Specific Aims**

- Implement QPMDCR projects at selected primary care practices. **(Achieved)**
- Develop a process model outlining a series of steps practices need to consider as they move toward implementation of performance monitoring. **(Achieved)**
- Develop an interactive Web tool for practices' self-assessment of strengths and weaknesses relative to conducting performance monitoring. **(Achieved)**
- Synthesize relevant literature of quality performance monitoring and reporting in ambulatory care settings, especially primary care offices. **(Achieved)**

**2009 Activities:** Five of six practices implemented and completed a QPMDCR project in 2008. Three focus groups were held with each of the implementing practice teams over the study period. The final report was prepared in 2009.

**Impact and Findings:** All five practices that completed implementations achieved some degree of success in selecting and planning a project, gathering data, and generating comparative reports. Some practices relied heavily (or exclusively) on physician involvement, while others involved nurses and other

practice staff. Two practices utilized automated queries of data; the remaining practices utilized manual data collection methods or some combination of the two approaches.

All of the study practices experienced multiple and common barriers. Many obstacles were beyond practices' control and significant enough to hinder progress. As a result, most practices were able to gather and analyze data and spend time brainstorming ways to make improvements to care delivery, but ultimately were unable to establish mechanisms for ongoing quality improvement in their practices as an outcome of this project. It is important to note that study practices did not have the necessary expertise in systematic collection and analysis of performance data and needed assistance to identify, set up, and learn the systems that provide this function. They also needed financial support to compensate for the time involved in performance monitoring, including time for physician champions to lead initiatives, time for data collection tasks, and time for interpretation of data. One practice that implemented their project experienced significant difficulty and was likely to discontinue performance monitoring efforts. The remaining practices planned to continue with some form of performance monitoring.

**Selected Outputs**

Longo DR, Rothemich SF, Krist AH, et al. Report of Experiences from Primary Care Practices in the Virginia Ambulatory Care Outcomes Network (ACORN): The Virginia Ambulatory Care Outcomes Research Network (ACORN); 2009 Mar. Prepared for Agency for Healthcare Research and Quality.

Interactive Web tool for practices' self-assessment of strengths and weaknesses relative to conducting performance monitoring. Available at: http://www.pubapps.vcu.edu/brads/qpm/.

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|---|---|
| **Project Title:** | Use of Dense Display of Data and Information Design Principles in Primary Care Healthcare Information Technology Systems |
| **Principal Investigator:** | McDonnell, Cheryl J., Ph.D. |
| **Organization:** | James Bell Associates |
| **Contract Number:** | 290-07-10073-1 |
| **Project Period:** | 05/08 – 05/10 |
| **AHRQ Funding Amount:** | $249,955 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** Health information technology (IT) holds great promise in supporting the transformation and improvement of health care in America, but deficiencies in the "usability" or more broadly, information design, of electronic health records (EHRs) are often cited as factors limiting the use of health IT. Information design is the art and science of preparing and conveying information for efficient, effective use. Recent articles in peer-reviewed and popular literature have identified shortcomings in usability and information design as contributing to the poor uptake of EHRs in the market and creating new categories of errors in care delivery. The usability of EHR systems, while recognized as critical for successful adoption and meaningful use, has not historically received the same level of attention as software features, functions, and technical requirements (e.g., interoperability specifications). Recognizing the importance of usability, the Certification Commission for Health Information Technology (CCHIT) recently formed a Usability Workgroup; however, current CCHIT criteria do not assess EHR product usability. Very little systematic evidence has been gathered on the usability of EHRs in practice and how their design affects cognitive task flow, continuity of care, and efficiency of workflows. Further, the role of EHRs in patient care is evolving significantly as adoption is incentivized, health information exchanges are activated, and new forms of comparative evaluations are codified and made available for clinical decision support. Given the significant Federal investment in EHR adoption, promoting improvements in EHR usability through deliberations, an action-based research agenda, and policy recommendations are timely activities for the Agency for Healthcare Research and Quality (AHRQ).

The goal of the project is to establish a foundation and action agenda for the use of dense data display and other innovative information design principles in primary care health IT applications. Project activities include reviewing existing research and evidence; identifying and convening a multi-disciplinary expert panel to establish design principles and evaluation criteria; and synthesizing this information into a final report, use cases, and recommendations for ongoing research, implementation, and policy work. In 2009 a project objective was added to conduct a series of structured discussions with selected certified EHR vendors and use these discussions to solicit recommendations from a panel of multidisciplinary experts on assessing and improving the usability of EHR systems.

**Specific Aims**

- Establish a foundation and an action agenda in the area of dense display of data and information design to provide insights into designing better primary care electronic EHRs. (Achieved)
- Complete a detailed background report, which contains a comprehensive summary of the literature and will serve as the basis for the final report. (Achieved)

- Conduct an innovation meeting comprising a group of experts in diverse areas related to the EHR and its design. The innovation group will be able to define what would be ideal user interfaces, primarily from the point of view of a primary care physician. This involves indicating how EHRs are and are not being used optimally. Additional considerations include patient safety and risk, efficiency, and the impact of having scattered information. (Achieved)
- Compile a set of recommendations on principles and policy and a research agenda. (Achieved)
- Compile a set of "use cases". (Achieved)
- Complete a final report that integrates the background report and the output from the innovation meeting. (Achieved)
- Interview a wide array of providers of ambulatory EHR products and develop recommendations to assess and improve the state of usability in EHR systems. (Ongoing)

**2009 Activities:** Project staff identified and convened a multidisciplinary panel at AHRQ offices on February 26-27, 2009. Members of the expert panel included practicing clinicians, researchers, academicians, health IT vendors, and leaders of care delivery organizations and health care member organizations (many serve or have served on CCHIT). The panel discussed design principles and evaluation criteria, using its many perspectives and disciplines to develop a coordinated and comprehensive policy strategy and set of recommended actions for AHRQ to support the development of an objective usability evidence-base, incorporate lessons learned from other industries, and systematically improve the usability of EHRs for practicing physicians and their staff.

A wide range of EHR product vendors was interviewed to assess and improve the state of usability in EHR systems. Small (less than 100 employees), medium (100-500 employees), and large (greater than 500 employees) vendors were represented. The number of clinician users per company varied from 1,000 to over 7,000; revenue ranged from $1 million to over $10 billion per year. The EHR products discussed came on the market in some form between the mid-1990s and 2007.

**Preliminary Impact and Findings:**

The Technical Expert Panel resulted in several recommendations including:

*Research-related recommendations*

- Document patterns of clinician information use in EHR systems.
- Develop and evaluate use cases and tools for evaluating EHR implementations for adherence to usability principles and best practices.
- Develop an understanding of and ways to measure the impact of usability and information design on ergonomic (navigating, documenting) and cognitive (reading, thinking, deciding) workload, data awareness and comprehension, patient safety, clinician decisionmaking, and efficiency of care delivery.
- Understand the effectiveness of adaptive displays, defined as those data displays that change the nature or format of information presented for viewing in light of specific patient characteristics or physician preferences.
- Assess current vendor and health care organization practices with regard to information design in EHR product development lifecycle and implementation.
- Identify and evaluate existing evidence-based style sheets and guidelines for EHRs.
- Identify and evaluate innovative ways to display complex information in EHRs.
- Identify best practices in the use of shared (patient-clinician) EHR views, including applicable privacy and confidentiality issues.
- Promote fellowships in the area of EHR usability and information design.

*Policy-related recommendations*

- Establish certification requirements for EHRs based on a practical and fair process of usability evaluation.
- Develop a National EHR usability laboratory to: 1) support public-private collaboration and sharing of best practices in this area, 2) develop tools and processes to support evaluation of products and implementations, and 3) assist health IT vendors in product development and health care organizations in effective implementation of EHRs.

In addition, the panel characterized the evolving role of the EHR in supporting clinical practice in terms of four primary functions. These functions include:

- Memory aid: Reduces the need to rely on memory alone for information required to complete a task.
- Computational aid: Reduces the need to mentally group, compare, or analyze information.
- Decision Support aid: Enhances the ability to integrate information from multiple sources to make evidence-based decisions.
- Collaboration aid: Enhances the ability to communicate information and findings to other providers and patients.

The final report characterized existing efforts to evaluate EHR systems as insufficient for broad discovery of best practices in information design, improvements in EHR evaluation, and dissemination of results to EHR researchers, developers, and purchasers. According to the report the critical categories of usability and design include: software user interaction, learnability, cognition facilitation, user control and software flexibility, system real-world match, graphic design, navigation and exiting, consistency, and EHR-specific design principles.

**Selected Outputs**

Armijo D, McDonnell C, Werner K. Electronic Health Record Usability: Evaluation and Use Case Framework. Rockville (MD): Agency for Healthcare Research and Quality; 2009 Oct. AHRQ Publication No. 09(10)-0091-1-EF.

Armijo D, McDonnell C, Werner K. Electronic Health Record Usability: Interface Design Considerations. Rockville (MD): Agency for Healthcare Research and Quality; 2009 Oct. AHRQ Publication No. 09(10)-0091-2-EF.

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| **Project Title:** | Enabling Medication Management through Utilization of Health Information Technology |
| **Principal Investigator:** | McKibbon, Ann, M.L.S., Ph.D. |
| **Organization:** | McMaster University |
| **Contract Number:** | 290-07-100601-5 |
| **Project Period:** | 06/09 – 09/10 |
| **AHRQ Funding Amount:** | $415,975 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** McMaster University is developing an evidence report that is part of a three-report series, all focusing on the Agency for Healthcare Research and Quality's health information technology (IT) portfolio's strategic goals. McMaster's report will focus on the portfolio's goal of improving the quality of various phases of the medication management continuum via the integration and utilization of health IT applications. Because of the diversity of health IT applications being developed and the different ways in which impact can be measured, the review will include peer-reviewed scientific literature as well as conference proceedings and grey literature (e.g. trade publications). A variety of health IT applications will be considered, including e-prescribing applications, computerized provider order entry, bar-coded medication administration, pharmacy-based health IT applications, electronic medication administration records, and IT-based medication management tools.

The medication management continuum can involve numerous actors and interactions starting with clinicians prescribing a medication, interaction between the prescribing clinicians and pharmacists to perfect the pharmacists' dispensing of the medication, administration of medication, and the extent to which patients take the medication as prescribed. The evidence report will focus on the quality and safety of various phases of the medication management continuum via the integration and utilization of health IT applications based on a comprehensive and systematic review of the scientific literature, other appropriate analyses, and extensive peer review of the draft report. The need is growing to synthesize the evidence generated by health IT use overall to understand the impact to date and set future direction for the field. Studying the integration and utilization of medication management and IT systems will lead to a better understanding of how health IT improves, or could improve, the quality and safety of medication management.

**Specific Aims:**

- Summarize evidence on the extent to which health IT enables improved quality and safety in its various phases along the continuum, which include but are not limited to: 1) accurate and timely prescribing of medication in response to a specific patient, 2) correct first-fill and refill dispensing of medications, 3) appropriate administering of medication, and 4) patients' taking of the pharmaceutical treatment regimen as prescribed. **(Ongoing)**

**2009 Activities:** The focus of activity has been on developing the work plan and project plan, convening the first technical expert panel meeting, and embarking on a comprehensive and systematic review of the scientific literature, which included screening over 30,000 articles. The current literature review process

entails a systematic search, abstract, review, and analysis of the scientific evidence for each question and the variance, if any, of the evidence according to age, sex, and race/ethnicity. Data collection forms were developed to facilitate the review process, and the applicable search databases included MEDLINE, Cochrane Database of Systematic Reviews, Excerpta Medica Database/EMBASE, Cumulative Index to Nursing and Allied Health Literature, PsychInfo, and other relevant databases. The abstracts are being reviewed against pre-established inclusion/exclusion criteria to determine potential eligibility for inclusion in the evidence synthesis. Summary evidence tables are being developed to include key data and important findings.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

| | |
|---|---|
| **Project Title:** | Using Health Information Technology to Improve Health Care Quality in Primary Care Practices and in Transitions between Care Settings |
| **Principal Investigator:** | Mold, James, M.D., M.P.H. |
| **Organization:** | University of Oklahoma Health Science Center |
| **Contract Number:** | 290-07-10009-5 |
| **Project Period:** | 09/09 – 09/11 |
| **AHRQ Funded Amount:** | $332,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Not Applicable

**Summary:** A fundamental part of a National health care network is the ability to share electronic health records (EHRs) from local health information exchange (HIE) hubs through regional health information organizations (RHIOs). A major barrier to RHIO-use, however, is the lack of a convincing value proposition for providers. While there appears to be a net societal benefit from investments in sharing information among health care organizations, the return on investment for individual medical practices is less certain. Medical practices incur most of the costs of adopting new information sharing technology, while health insurers and patients receive most of the benefits. Apart from capital expenses and fees, medical practices must adapt their workflow to benefit from RHIO technology. Many medical practices lack managers with the necessary implementation skills and experience. Implementation costs, including the loss of productivity, come directly from practices' income. Adoption is risky for small medical practices in particular. Little research has been done to determine the specific features of existing RHIOs that are most useful in primary care, what new features are needed, and how these features can be incorporated into primary care work flow and care processes.

This project documents, studies, and reports on the engagement of six primary care practices that currently use EHRs and are linked through a local HIE hub in a RHIO called Secure Medical Records Transfer Network, or SMRTNET. SMRTNET provides access to a broad range of information—including hospital records, laboratory tests, pharmacy records, and a statewide immunization registry—from a variety of sources. As part of this project, SMRTNET will be enhanced with the Web-based Preventive Services Reminder System (PSRS), a comprehensive clinical tool for improving the delivery of patient-centered preventive services through a patient registry, prompt/reminder functionality, clinical decision support, and quality improvement (audit) functions that are accessible through a simple, secure Web interface.

The project tests the usefulness and acceptability of a RHIO's ability to promote HIE across both local and statewide health care systems as a single point of attachment (i.e., a single interface rather than separate interfaces for multiple EHR systems) for a software application (PSRS). While many aspects of this HIE infrastructure development are specific to the two systems being studied, the research team believes that this type of connection between HIE systems and RHIOs is likely to be implemented around the United States. Analysis of the results of this implementation will yield generalizable and useful knowledge about best practices for HIE facilitation of patient-centered care in primary care provider settings. Furthermore, the research team anticipates that Federal incentives, funding, penalties, and requirements under the American Recovery and Reinvestment Act of 2009's "meaningful use" standards

will accelerate the combined use of EHRs and RHIOs. The results and the guide provided by this study will be timely and useful.

Based on observations and data analysis, the study team will produce an implementation guide to disseminate this type of health information technology system to other practices, at least one published manuscript reporting their findings, and a final report. The plan for disseminating the technology to primary care practices will be developed in collaboration with the Agency for Healthcare Research and Quality.

**Specific Aims**

- Enhance the current features of SMRTNET by including the PSRS software program. **(Achieved)**
- Test the usefulness and acceptability of the technology intervention. **(Ongoing)**
- Develop an implementation guide that provides the principles and steps required to implement connections between such systems, and the potential benefits from and barriers to implementation. **(Upcoming)**

**2009 Activities:** The study staff distributed the practice quality improvement assessment tool and a description of the project to 11 eligible primary care practices. The assessment tool is being collected on an ongoing basis to compare the readiness for change between participating and nonparticipating practices. In November, physicians and office managers from six practices met with study staff to review the project, and six physicians agreed to participate in the study. Study staff visited participating practices during the month of December to interview staff and administer the practice workflow/observation instrument. The final research, data collection, and analysis plan was submitted to the task order officer for approval.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The project has no outputs to date.

| | |
|---|---|
| **Project Title:** | Health Information Technology and Mental Health: The Way Forward |
| **Principal Investigator:** | Mullican, Charlotte, M.P.H. |
| **Organization:** | Professional and Scientific Associates |
| **Contract Number:** | 290-09-000027U |
| **Project Period:** | 06/09 – 10/10 |
| **AHRQ Funded Amount:** | $168,699 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** This contract will convene a workshop to develop an agenda to guide future research in mental health and health information technology (IT), as well as facilitate partnerships between the mental health and health IT communities. The Agency for Healthcare Research and Quality's (AHRQ's) Center for Primary Care, Prevention, and Clinical Partnerships will partner with the National Institute of Mental Health (NIMH) to develop an agenda-setting workshop that will guide future efforts in research related to mental health and health IT; the meeting will also facilitate partnerships between existing health IT expertise in these two areas. The goals are to establish what is known about the impact of health IT on improvements in mental health care interventions, coordination, fairness, and cost-effectiveness; identify gaps in knowledge; and determine infrastructure needs for underresourced settings.

Deliverables include a white paper created by an outside technical expert panel (TEP) to inform the content of the workshop. The TEP will convene at a meeting facilitated by AHRQ in October or November 2010 with followup conference calls. The draft white paper will be revised and finalized based on input from workshop participants. The contractor will help disseminate the paper upon its completion, working closely with AHRQ and NIMH to establish a detailed marketing plan.

**Specific Aims**

- Establish what is known about the impact of health IT on improvements in mental health care interventions, coordination, fairness, and cost-effectiveness; identify gaps in knowledge; and determine infrastructure needs for underresourced settings. **(Ongoing)**

**2009 Activities:** The TEP planned for a meeting in 2010 to begin work on the white paper.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The project has no outputs to date.

| | |
|---|---|
| **Project Title:** | Stay-at-Home Influenza Toolkit |
| **Principal Investigator:** | Nagykaldi, Zsolt, Ph.D. |
| **Organization:** | University of Oklahoma |
| **Contract Number:** | 290-07-10009-4 |
| **Project Period:** | 08/09 – 07/10 |
| **AHRQ Funded Amount:** | $100,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, coordination of care across transitions, and electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** General

**Summary:** Seasonal influenza is unpredictable. To achieve preparedness in primary care practices, management of patient surges, especially related to influenza, must be thoroughly studied so that models and technologies to improve surge capacity can be identified, tested, and disseminated. This project developed and is implementing a pilot Web-based Influenza Self-Management toolkit that can be delivered as a downloadable package to stakeholders. The package will contain an implementation guide with step-by-step instructions for Web administrators to customize and deploy the toolkit.

Building on past developments and findings from the Influenza Self-Management Web site previously designed by researchers at the University of Oklahoma Health Sciences Center, this project is focused on redesigning the toolkit into a downloadable Web package. Enhancements include eliminating proprietary content, ensuring 508-compliance, increasing organizations' capability to customize the package, modularizing the code to allow periodic content updates over the Internet, and developing the implementation guide PDF document. Customizable features will include page title, organization name, contact information, automatic location on an interactive map, an "About Us" page, and a list of updatable links to various influenza resources. Web administrators may customize the toolkit through an HTML file (Web form) that edits the appropriate Web pages of the package locally and according to user preferences. Administrators can upload the tailored package to their organization's Web servers and connect the home page of the toolkit to their Web sites.

**Specific Aims**

- Refine the Stay-At-Home Influenza toolkit to mitigate the characterization of product endorsement by eliminating references to specific products. **(Achieved)**
- Redesign the toolkit into a downloadable Web package. **(Ongoing)**
- Provide evidence that developed materials meet the standards for Section 508 compliance. **(Ongoing)**
- Write a "how-to" manual to facilitate the effective incorporation of Stay-at-Home modules into primary care physicians' Web sites. **(Ongoing)**

**2009 Activities:** The project focused on refining and enhancing the design of the Stay-at-Home Influenza toolkit as a downloadable Web package. Refinement was necessary to eliminate references to specific products that suggest product endorsement in case the Federal Government chose to disseminate and recommend use of the toolkit. Specific improvements include eliminating proprietary content, making the Web site 508-compliant, incorporating customization functionality for practices, and compiling a detailed

implementation guide for site administrators. The resulting Web package was alpha-tested in several primary care practices in Oklahoma and Texas.

Two customization options will be available to Web administrators. A Web-based (automated) version that uses an HTML form with an embedded ActiveX FileSystemObject control invoked by JavaScript is being designed for less experienced Web administrators. The advantages of this approach include simplicity of design, capability to access local file systems to modify the Web package, and a less significant technological learning curve. The second option, for more experienced Web administrators, is to manually edit a configuration text file to achieve the same result as the automated option.

**Preliminary Impact and Findings:** The project has no findings to date.

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**Selected Outputs:** The project has no outputs to date.

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|---|---|
| **Project Title:** | Implementation and Evaluation of Standing Orders Using Health Information Technology |
| **Principal Investigator:** | Nemeth, Lynne, Ph.D., R.N. |
| **Organization:** | Medical University of South Carolina |
| **Contract Number:** | 290-07-10015-2 |
| **Project Period:** | 06/08 – 07/10 |
| **AHRQ Funding Amount:** | $500,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Adults, Chronic Care*

**Summary:** Preventive health maintenance services (e.g., testing for cholesterol and lipids) can slow, halt, or monitor the progression of chronic diseases such as diabetes. These services also have the potential to reduce related disability and premature deaths. Similarly, vaccinations play a central role in preventing the development of diseases in adults and children. The promotion of health maintenance services and timely, appropriate vaccination is an ongoing focus of the health care system.

Standing orders (SOs) authorize nurses and other appropriate medical staff to provide services in the doctor's office or to order essential services (e.g., bone density scan) that may be scheduled elsewhere. This project implements and examines the effectiveness of an electronic standing order process to deliver appropriate services at the right time to the right patients. This is done through the use of a health maintenance template within the McKesson Practice Partner Patient Records electronic medical record (EMR), which is certified by the Certification Commission for Health Information Technology. Previous research shows that SOs increase immunizations in practices that do not use EMRs. The potential advantage of reminder systems in practices that do use EMRs may provide an opportunity to improve preventive and chronic care measures.

The electronic SOs and the electronic SO quality of care measures are based on the screening recommendations of the U.S. Preventive Services Task Force, adult immunization recommendations from the Centers for Disease Control and Prevention's Advisory Committee on Immunization Practices, and disease monitoring recommendations for persons with diabetes from the American Diabetes Association.

The lead group for this project is the Practice Partner Research Network (PPRNet), a member-driven practice-based learning and research organization. PPRNet has developed a quality improvement (QI) model called the "PPRNet-TRIP QI model." This model assists practices in incorporating electronic standing orders into their systems and workflow using a set of core concepts to lead practice development efforts and where to focus for practice QI. Using this model, the research team convenes a meeting of participating practices at which they develop plans to introduce standing orders into their practices.

The outcome measures for this study include:

- Four screening measures (cholesterol, HDL-cholesterol, mammograms, osteoporosis).
- Six adult immunization measures (tetanus, zoster, and two measures each for influenza and pneumonia).
- Five diabetes measures (HgA1C, urinary microalbumin, HDL, LDL-cholesterol, triglycerides).

The study uses a mixed-methods intervention for QI. Quantitative data measures are calculated from quarterly extracts from the EMR. Qualitative data are obtained through observation and interviews at practice site visits, network meetings, e-mails, and phone correspondence. The sample includes 8 PPRNet primary care practices that have between 2 and 25 providers who have no prior involvement with PPRNet interventions and who do not use SOs.

**Specific Aims**

- Facilitate the initiation of an electronic SO system and its incorporation into daily workflow in eight primary care practices, identifying best methods and strategies. **(Achieved)**
- Determine barriers and facilitators to the uptake and sustained use of electronic SOs in these practices. **(Achieved)**
- Document changes in quality of care indicators and practice time management resulting from the use of electronic SOs. **(Achieved)**
- Disseminate findings to the rest of the research network and publish results in a peer-reviewed medical journal. **(Ongoing)**

**2009 Activities:** Site visits were made at the midpoint of the project (June-September) to learn how the project was implemented at practices and help practices overcome technical issues or uncertainty about the process. A network meeting was held in September in Charleston, SC, and was attended by all practices, the research team, and the three consultant physicians. Each practice presented its experience implementing electronic SOs, which facilitated discussion, further reflection, and reconsideration/revision of plans and strategies.

Site visits and network meetings encouraged participation and discussion about the use of standing orders, including what about them is helpful, difficult, if new related activities are being undertaken, and if they are working. The study team recorded many of the discussions for later transcription and qualitative analyses, which was done by constant comparative method, comparing data to generate new insights into practices' perspectives on implementing the electronic SO system.

The research team used quarterly EMR data extracts to measure the presence of health maintenance templates, use of the templates, and performance on the study measures for each practice. For the final analyses of the 15 quality indicators, the median across practices was calculated at baseline and for each month of the study. Practice-level repeated measures analyses (using a mixed-model approach) were used to look for significant increases in these measures over time.

A manuscript summarizing the SO-TRIP project is in preparation.

**Preliminary Impact and Findings:** One year after implementation improvements in template presence, use, and performance were found within all fifteen measures across all practices. Median performance improvements in screening measures ranged from 3 to 6 percent, immunization measures increased from 7 to 12 percent, and diabetes measures increased from 2 to 11 percent. There were large variations among the eight practices in terms of improvement. Qualitative data revealed practice facilitators to the improvements included: establishing practice protocols and policies to embed clear expectations, good relationships to promote communication and patient flow, use of nursing note templates, and electronic patient update forms to update records. Barriers to implementing SOs included: staff perceptions, spread (consistent adoption of SOs among staff), limited staff education and followup, technical issues within the EMR, reimbursement for some services, and patient refusal.

Preliminary evidence from SO-TRIP suggests implementing electronic SOs within primary care practices can increase the delivery of preventive services and diabetes care. By developing the health care workforce to provide services indicated by a health maintenance reminder, staff can contribute to improving patient receipt of preventive services and diabetes laboratory tests within primary care practices.

**Selected Outputs**

Nemeth L. Implementation and evaluation of standing orders using health information technology. Poster session presented at North American Primary Care Research Group, November 2009, Montreal, Canada.

**AHRQ Priority Population.*

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|---|---|
| **Project Title:** | Human Factors in Home Health Care |
| **Principal Investigator:** | O'Connell, Mary Ellen, M.M.H.S. |
| **Organization:** | National Research Council |
| **Contract Number:** | AHR7128 |
| **Project Period:** | 09/09 – 06/10 |
| **AHRQ Funding Amount:** | $750,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** The National Research Council Committee on Human-Systems Integration has formed a multidisciplinary consensus panel of recognized experts, the Committee on the Role of Human Factors in Home Health Care. The goal of the expert panel was to examine a diverse range of behavioral and human factors issues resulting from recent trends and challenges associated with the increasing migration of medical devices, technologies, and care practices into the home. Relatively little has been established empirically about these challenges; however, it is recognized that homes have not been designed for the delivery of health care, that considerable variation exists as to what constitutes a home, and that patients and their caregivers—whether professional or lay providers—may be vulnerable when it comes to administering care in a safe and reliable manner. How humans interact in challenging environments is the province of human factors engineering. It is the purpose of this effort to gain a better and fuller understanding of:

- The human factors challenges that take into account the relevant sensory, behavioral, and cognitive capabilities of patients and caregivers.
- The nature of the care processes, procedures, and therapies increasingly occurring in the home.
- The steady migration and use of medical equipment and technologies in the home environment.
- How the design of the physical home environment can facilitate or impede the delivery of care.
- The impact of social and community environments on further enabling healthy lifestyles, among other challenges.

The work for this project is being conducted in two phases. Phase One included a workshop with authors of nine invited papers on various human factors aspects of home health care from which the committee plans to publish a Workshop Summary Report in summer 2010. In Phase Two, the committee will continue its work using the workshop papers, along with other inputs and research, to produce a consensus report identifying and discussing major human factors issues in home health care, with findings and recommendations for action and future research programs. The committee will also produce a brief companion designer's guide for home health care information technology (IT), intended to assist IT designers to incorporate good human factors principles, methods, and knowledge as they design products and systems intended for use outside the formal health care environment. These publications should be released in early summer 2011.

**Specific Aims:**

- Produce a consensus report identifying and discussing major human factor issues in home health care. **(Ongoing)**

- Produce a brief companion designer's guide for home health care IT. **(Ongoing)**

**2009 Activities:** The Phase One workshop took place on October 1-2, 2009, with nine invited papers on various human factors aspects of home health care. Using the workshop papers, along with other inputs and research, the development of the consensus report has begun. The project team focused on developing the work plan for completing Phase Two of this project, including all the major tasks such as convening committee meetings and developing both the consensus report and the companion product that will serve as a precise design guide for health IT developers. The first Phase Two committee meeting took place, and a second meeting has been scheduled.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The project has no outputs to date. The consensus report and companion designer's guide are anticipated in summer 2011.

| | |
|---|---|
| **Project Title:** | Structuring Care Recommendations for Clinical Decision Support |
| **Principal Investigator:** | Osheroff, Jerry, M.D. |
| **Organization:** | Thomson Reuters Healthcare Inc. |
| **Contract Number:** | 290-09-00022I-2 |
| **Project Period:** | 09/09 – 09/10 |
| **AHRQ Funded Amount:** | $500,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Implementation and Use

**Target Population:** Not Applicable

**Summary:** Incorporation of widely-accepted, evidence-based clinical care recommendations, also known as clinical guideline narratives, into clinical decision support (CDS) systems is a key method for improving health care and health outcomes. However, the process of translating care recommendations into CDS systems is slow, inconsistent, and inefficient, with CDS developers independently translating text-based care recommendations into computer-executable code. Structured, coded clinical logic statements that can be electronically processed can increase the speed, consistency, and efficiency of care guideline implementation. Such logic statements will reduce redundancy related to extracting and structuring decision logic by assigning computer-interpretable codes to the recommendation elements and actions. Also standardized logic statements and formats will help organizations that develop guidelines write recommendations in a way that can be more easily adapted for use as automated clinical reminders.

This project is developing structured, coded logic statements (called "eRecommendations") for all 45 A- and B-graded recommendations of the U.S. Preventive Services Task Force and two clinical recommendations underlying the Stage 1 "meaningful use" requirements for clinical performance measure reporting. To identify patients for whom each clinical recommendation applies and actions that should be taken, these eRecommendations will leverage standard data elements, coding systems, and value sets being developed for performance reporting under "meaningful use." The eRecommendations will be publicly available on the Internet for health information technology (IT) application developers, care providers, and others to access and further process into locally useful CDS rules.

The project will help fill the need for actionable clinical knowledge that can be further adapted for use in a variety of applications to support care decisions and outcomes. It is part of a series of steps toward the Agency for Healthcare Research and Quality's (AHRQ's) broader goal of ensuring that CDS optimally supports health decisionmaking and improvements in care quality, safety, and efficiency. In order to ensure that the eRecommendation template and contents will be widely used and useful, the project team is working with a wide variety of stakeholders. These include information system developers and implementers in the public and private sectors, guideline developers, the National Quality Forum, and others.

**Specific Aims**

- Develop a standardized approach to structuring the logic statements to ensure widespread usefulness and uptake by information system suppliers and implementers. **(Ongoing)**
- Develop widely accepted clinical recommendations expressed as logic statements freely available via the Internet. **(Ongoing)**

**2009 Activities:** A kickoff meeting was held with the Task Order Officer (TOO) and technical subcontractors. Project planning tools were prepared (schedule, timeline, and project plan). A quality control plan was completed and described within the project plan. A 508 Compliance Plan for Web dissemination of information from this project was drafted and submitted to the TOO and AHRQ IT staff.

Significant effort was focused on the engagement of stakeholders necessary for the success of the project. A guide for discussing the project with stakeholders was developed, and the principal investigator and project team delivered presentations and held calls with stakeholders.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The project has no outputs to date.

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|---|---|
| **Project Title:** | Establishing Federal Resources to Support the Patient-Centered Medical Home Concept |
| **Principal Investigator:** | Peikes, Deborah, Ph.D., M.P.A. |
| **Organization:** | Mathematica Policy Research, Inc. |
| **Contract Number:** | 290-09-00019I-2 |
| **Project Period:** | 09/09 – 03/11 |
| **AHRQ Funding Amount:** | $1,249,206 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** This project supports the efforts of the Agency for Healthcare Research and Quality (AHRQ) and the Federal government to develop the evidence base on the patient-centered medical home (PCMH) for researchers and policymakers. The development of white papers and issue briefs is providing vital information on key areas of the PCMH such as the use of health information technology, integrating mental and behavioral health into primary care, and how to engage patients. In addition, this project is developing an effective communication infrastructure and strategic leadership team to coordinate Federal efforts to build and reinforce emerging PCMH initiatives and use them to reconfigure health care delivery and improve the performance of the health system in the United States.

The project has undertaken an environmental scan to provide information and analysis on emerging work to improve primary care. The scan includes:

- A key tag-searchable database of literature on the medical home that is updated quarterly.
- A review of studies of the effects of the PCMH model.
- An overview of the information contained on Web sites that cover the medical home.
- A series of 5 white papers and accompanying policy briefs to fill critical gaps in the PCMH knowledge base. The first round of three white papers on health information technology, patient engagement, and mental and behavioral health integration are complete. National experts provided key insight into the development of these papers through several expert panel meetings held in Washington, DC. The second round of white papers will be on accountable care organizations and evidence on outcomes of the PCMH.
- A list of key outcomes articles on the PCMH for the AHRQ PCMH Web site.
- A list of foundational articles on the PCMH for the AHRQ PCMH Web site. This list provides key sources of information from the published and gray literature on the development and implementation of the PCMH concept.
- Text for AHRQ's public and private (Federal only) portals on the PCMH.

AHRQ has reconvened the Federal Collaborative on the PCMH to help improve coordination and collaboration among Federal agencies working on PCMH-related projects. A steering committee with representatives from seven Federal agencies provides input and guidance on the collaborative activities. The collaborative is being convened via face-to-face meetings, using a Federal portal designed for this project that allows electronic interchange and document sharing for the Collaborative, and a listserv. Four meetings have been held to date with presentations on: the Centers for Medicare and Medicaid Services

(CMS) PCMH demonstration, the integration of mental health services into the PCMH, the PCMH within the Veterans Affairs system and the Department of Defense PCMH Projects, and accountable care organizations and the PCMH. A meeting is scheduled for October 6th on Evidence of PCMH Outcomes. A listserv allows members of the collaborative to share information and ideas on the PCMH. Bi-weekly news updates including information on interesting new articles related to the PCMH and announcements of conferences and seminars will be distributed via this listserv.

A catalogue of Federal agency activities and research related to the patient centered medical home is currently under development. This resource will include a wide variety of information on agency efforts including implementation work, research being conducted, and partnerships with other agencies. This guide will assist agencies in forming new cross-agency partnerships and serve as a reference guide on where to find Federal peers with PCMH knowledge on specific topics. This guide will be available only to Federal collaborative members via the Federal portal.

This project also developed a PCMH Web site for the general public but aimed at policymakers and researchers where the foundational papers and background information developed through this project are posted. The project will develop a strategic plan based on the environmental scan, white papers, and Federal Collaborative to help improve primary care through practice transformation and health information technology.

**Specific Aims**

- Conduct an environmental scan to synthesize the knowledge and issues emerging in primary care and other health policies that may affect PCMH in order to help policymakers understand emerging PCMH initiatives. **(Ongoing)**
- Develop white papers that will help fill gaps in knowledge of PCMH-related topics. **(Ongoing)**
- Convene the Federal Collaborative for the Patient-Centered Medical Home to identify Federal relevant medical home activities and how they relate to each other and emerging private sector initiatives. **(Ongoing)**
- Develop a strategic plan that identifies how Federal leadership and activity might be leveraged to contribute to developing public and private sector work on PCMHs. **(Ongoing)**

**2009 Activities:** Expert panels were formed for the first three white papers, and conference calls with each expert panel yielded valuable feedback. The format for the in-person expert panel meetings was agreed upon and the initial drafts for each paper were completed. Work on the environmental scan included an initial scan of research articles and the narrowing of the list to key articles only. A scan was also conducted among relevant Web sites to evaluate content on medical homes. Work on the Federal Collaborative included initial development of the listserv, creating a steering committee to give input to the work of the collaborative and hosting a steering committee kick-off meeting, and the first Federal collaborative meeting. Planning was completed for the first Federal Collaborative meeting where Linda Magno from CMS presented on the CMS PCMH demonstration.

**Preliminary Impact and Findings:** The project has provided information for stakeholders on the medical home including Federal and State agencies, payers, patients, providers, and the media.

**Selected Outputs**

Outputs from 2009 include an environmental scan of foundational articles on the topic of Patient-Centered Medical Home and a Web site scan of information and resources related to the medical home on 38 Web sites. The list of foundational articles and Web site scan are available from http://pcmh.ahrq.gov/portal/server.pt/community/pcmh__home/1483.

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|---|---|
| **Project Title:** | Personal Health Information Management and Design of Consumer Health Information Technology |
| **Principal Investigator:** | Peterson, Anne, M.S. |
| **Organization:** | Insight Policy Research |
| **Contract Number:** | 290-2007-1007-2T-1M1 |
| **Project Period:** | 07/08 – 09/09 |
| **AHRQ Funding Amount:** | $342,898 |
| **Summary Status as of:** | September 2009, Completion of Contract |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** General

**Summary:** The purpose of this contract was to establish a foundation and propose an action agenda for the integration of patients' personal health information management into the design of consumer health information technology (IT). These aims were achieved through a 2-day workshop convened by the Agency for Healthcare Research and Quality on July 27 and 28, 2009, titled "Building Bridges: Consumer Needs and the Design of Health Information Technology," and subsequent final report, titled "Managing Personal Health Information: An Action Agenda." The report presents key recommendations and an action agenda developed during the workshop.

The goal of the workshop was to assist in the framework development for characterizing personal health information management (PHIM) that would inform the design of effective consumer health IT systems. The workshop brought together leaders from multiple disciplines, including health sciences, health informatics, information science, consumer health IT, and human factors research, with specific expertise in the fields of PHIM and/or health IT. Through small-group discussions and presentations, the participants considered the diverse needs of different consumer groups with respect to managing their personal health information and how consumer health IT solutions can be designed to better meet those needs. Based on these discussions and presentations, the participants were asked to set an agenda for advancing the field of consumer health IT that would include specific recommendations for research, industry, and policy. The goal of the workshop was to promote the design of consumer health IT systems that are based on a solid understanding of consumers' PHIM practices. Workshop discussions addressed three objectives: 1) characterize the methods that individuals and families use to manage their personal health information, 2) establish an action agenda (for research and design, industry, and policy) for supporting consumers' PHIM practices through health IT, and 3) develop recommendations for moving this agenda forward.

**Specific Aims**

- Assess and synthesize existing research and evidence regarding patients' PHIM practices and their linkages to effective development and use of consumer health IT. **(Achieved)**
- Conduct secondary analysis of the Medical Expenditure Panel Survey (MEPS) data regarding what records respondents use to retrieve information about a medical service to understand the degree to which the household received various medical services in the past year are associated with the manner in which the household kept records of those medical services. **(Achieved)**
- Identify and convene a multi-disciplinary expert workshop to establish a research agenda around PHIM and health IT. **(Achieved)**

- Synthesize the information gained into a final report to include a preliminary framework for studying this topic and recommendations for ongoing research, implementation, and policy work in this field. **(Achieved)**

**2009 Activities:** The following key tasks and deliverables were completed:

- A comprehensive background report that synthesizes existing research and evidence regarding patients' PHIM practices and the linkages between those practices and the effective development and use of consumer health IT.
- A secondary MEPS-Household Component analysis to identify variables that affect the techniques people use to recall information about past medical events.
- A multidisciplinary expert workshop to facilitate the design of health IT systems that are based on a solid understanding of individuals' and families' health information management practices.
- A final report including recommendations for ongoing research, industry, and policy work in this field.

The data analysis included utilizing both SAS and SUDAAN statistical software and the findings were presented in one of the following two reports that were developed to provide some context for the workshop and to facilitate discussion among the participants. The first report synthesized existing literature and evidence relating to PHIM needs, goals, tools, and significant gaps in current understanding of PHIM. The second report analyzed the most recent data from the Household Component of the MEPS relevant to PHIM. Multivariate analysis was used to identify variables that affect the techniques people use to recall information about past medical events and any patterns among those variables.

The workshop took place on July 27 and 28, 2009, with 22 expert participants, including leaders in health informatics, information science, consumer health IT, and human factors research. They represented a wide spectrum of perspectives, including academic institutions, technology, health care, and the Federal Government. Presentations and discussions were transcribed following the meeting, and the break-out group sessions were summarized by their facilitators. The final report incorporated the "action items" into a narrative that would support each explicit recommendation, somewhat similar to the position paper published in the *Journal of the American Medical Informatics Association*, titled "A Consensus Action Agenda for Achieving the National Health Information Infrastructure."

**Impact and Findings:** The background report synthesized existing literature and evidence relating to PHIM needs, goals, tools, and significant gaps in current understanding of PHIM. The report indicated that researchers have yet to establish a comprehensive understanding of what individuals do when they manage their personal health information, and the inherent challenges associated with effectively performing that work. The report also identified areas where future research is needed to address incomplete knowledge about the different goals and motivations for consumers to engage in PHIM, incomplete knowledge of the health information management needs of subpopulations, and a lack of detailed descriptions of the functional requirements and design elements for consumer health IT tools.

The data analysis from the MEPS indicated that many factors seem to influence an individual's choice of recall methods, including demographic and socioeconomic characteristics of the individual or family, the volume of health information managed, and the type of medical event (e.g., dental care, home health care).

Workshop participants were asked to share their understanding of consumers' current PHIM practices and to identify what else needs to be known about those practices in order to design better consumer health IT solutions. Participants were also asked to consider the extent to which currently available tools meet consumer needs and what changes or design innovations would be needed to produce more patient-centered health IT systems. The following points highlight the main themes that emerged from the workshop.

*Defining PHIM*

Health care consumers manage their personal health information in countless ways, and many factors influence the methods they use to perform the tasks and activities that characterize PHIM, such as health status, age, and attitudes about health and medical care. Moreover, a consumer's health information management practices can change over time as his or her capacities, health status, family status, and needs change. PHIM can occur anywhere, anytime; in other words, it is not restricted to a single, isolated location or event like a doctor's office or a medical appointment. All of these considerations have important implications for the design of consumer health IT systems. For example, they point to the need for systems that are flexible and accessible to different types of users and across different settings.

*Design Issues*

Consumer health IT solutions can play an important role in enabling patient-centered care, which the Institute of Medicine defines as "providing care that is respectful of and responsive to individual patient preferences, needs, and values, and ensuring that patient values guide all clinical decisions." In order to truly benefit consumers in this way, however, consumer health IT solutions must first and foremost take into account the particular needs of the consumer rather than the needs of the physician, the insurance company, or some other entity that has a stake in the patient's health care.

To ensure broad access to these solutions, developers will also need to consider the particular needs, goals, preferences, and capacities of subpopulations like the elderly, the chronically ill, the disabled, and the underserved, which typically face one or more barriers that interfere with their ability or willingness to use consumer health IT systems. Specific barriers may include access to, and comfort with, technology; cognitive and physical impairments; health literacy; and cost. Until the needs of these subpopulations, who likely pose the most challenging design considerations, are taken into account, the IT solutions that developers create will likely fall short of promoting patient-centered care.

Consistent with the principles of patient-centered care, these tools must also reflect respect for the patient. Specifically, these tools should, among other things, ensure that the patient decides who has access to his or her personal health information, and for those tools that are interactive, they should communicate information to the patient in a way that the patient can easily understand. In order to ensure that consumers will actually use consumer health IT solutions, it will also be important to design those solutions to fit seamlessly into the user's life.

*Important Steps for the Advancement of Consumer Health IT*

Workshop participants identified several steps that can be taken to promote innovation in consumer health IT. Key points included:

- Build a knowledge base about consumers' PHIM needs and practices and related design principles. Additional research is needed on consumers' PHIM practices and related design issues in order to develop consumer health interventions that can best support consumers in effectively managing their health and health-related information.
- Support more interdisciplinary efforts to drive innovation. Collaboration between academic institutions and the technology industry could lead to significant advances in consumer health IT, but various factors can often prevent the two types of entities from working together. To facilitate more partnerships across and within academia and industry, mechanisms will need to be established that reward collaboration and protect the rights and investments of all stakeholders.
- Build a more robust health IT infrastructure to ensure access to all health care consumers that can support the dissemination of new solutions across different platforms. This infrastructure will need to ensure that consumers have access to the technology regardless of their age, income, literacy level, or other potential barriers.

In addition, the workshop participants developed a research agenda proposing recommendations pertaining to three main areas: 1) understanding user needs and context, 2) improving design of consumer health IT tools, and 3) evaluation research. The detail behind these recommendations can be found in the final report.

**Selected Outputs**

Peterson A. Managing Personal Health Information: An Action Agenda (Prepared by Insight Policy Research, under Contract No. HHSA290200710072T). Rockville (MD): Agency for Healthcare Research and Quality; March 2010. AHRQ Publication No. 10-0048-EF.

Schneider SJ. Personal Health Information and the Design of Consumer Health Information Technology: Secondary Analysis of Data from the Medical Expenditure Panel Survey. (Prepared by Insight Policy Research, under Contract No. HHSA290200710072T). Rockville (MD): Agency for Healthcare Research and Quality; July 2009. AHRQ Publication No. 09-0090-EF.

Agarwal R, Khuntia J. Personal Health Information and the Design of Consumer Health Information Technology: Background Report. (Prepared by Insight Policy Research under Contract No. HHSA290200710072T). Rockville (MD): Agency for Healthcare Research and Quality; June 2009. AHRQ Publication No. 09-0075-EF.

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| **Project Title:** | Telemonitoring in Rural Elder Nutrition Centers: Demonstration Project of Hypertension Management |
| **Principal Investigator:** | Resnick, Helaine, Ph.D. |
| **Organization:** | American Association of Homes and Services for the Aged |
| **Contract Number:** | 290-06-0024-2 |
| **Project Period:** | 07/09 - 04/11 |
| **AHRQ Funding Amount:** | $399,919 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Elderly*, Condition-Specific (Hypertension), Low SES/Low Income*, Rural Health*

**Summary:** A vast network of organizations provides nutrition, health promotion, disease prevention, and social services to low-income elders, many of whom live in rural areas. This project seeks to put findings from successful clinical and home-based studies into practice and provide support for telehealth technology in the community.

The study is being conducted among hypertensive adults who receive nutrition assistance at one of four senior centers in Ohio. Two of the centers have installed telehealth kiosks that allow participants to self-monitor blood pressure (BP) any time they use the center; two sites that do not have kiosks serve as the control facilities. Data will be collected on baseline hypertension and hypertension endpoints such as physician visits and medication titrations, with a focus on comparisons between participants at intervention and control facilities. This study will help determine whether integrating the networks and infrastructures of both Federally and privately-funded senior centers is an efficient way to reach vulnerable elders.

**Specific Aims**

- Determine proof-of-concept for a system in which telehealth monitors can be utilized to manage BP in a community setting that targets high risk elders. **(Ongoing)**
- Compare BP control in a telehealth group to BP control in a control (non-telehealth) group. **(Ongoing)**

**2009 Activities:** Study staff conducted a literature review, developed implementation and assessment plans, trained project staff and nutrition center staff on data collection and study procedures, implemented the intervention, and began enrollment and data collection. The literature review used information gathered from PubMed, Cumulative Index to Nursing and Allied Health Literature, PsycINFO, Embase, and ProQuest databases and yielded a context summary report that identified literature relevant to implementing telehealth BP stations in nutrition centers. This product was subsequently modified to comply with the specifications of the Journal of Telemedicine and e-Health, where it was submitted in 2009 and ultimately accepted for publication.

Study staff went to the two intervention sites for onsite training, which included learning proper use of the BP monitoring kiosks, use of the data entry tool, and study procedures (consenting, filling out forms, and data collection schedule). In October, 2 months ahead of schedule, recruitment and enrollment of

participants began at all four study sites; data collection began soon thereafter. Some gaps in training of research nurses were noted, particularly in taking baseline BPs. Nurse researchers were retrained in the correct study procedures. Study staff has bi-weekly phone calls during which enrollment, all study procedures, challenges, and strategic planning are discussed.

**Preliminary Impact and Findings:** During initial enrollment, it became apparent that recruiting intervention participants was more difficult than anticipated. A lower-than-expected number of participants identified themselves as having hypertension, a finding that posed challenges to enrollment efforts. Nonetheless, during the last quarter of 2009, extensive enrollment activities were conducted at both the intervention and control centers with the aim of meeting recruitment targets. By the end of 2009, 23 of 72 targeted participants were enrolled in the intervention group, and 66 were enrolled in the control group. Recruitment efforts will continue into 2010. If intervention group enrollment targets are not met, quantification of the impact of the intervention may not be as precise. However, since this is a pilot study and not aimed at formal hypothesis testing, no statistical issues dealing with power are anticipated as these methodological issues are not inherent to the study design. Additional observations that were made in the early months of the study involved unreliable Internet connectivity at one of the intervention sites, a finding that has important implications for broader application of this work in the future.

Several preliminary findings have been identified in the early phase of the study, including:

- Because of challenges in obtaining service and maintaining continuity from local Internet services providers, Internet connectivity at senior centers is not always ideal. Because telehealth is predicated on reliable Internet connectivity, this issue is one that will need to be examined very carefully in the evaluation of this project.
- Proper selection of BP cuff size and proper placement of BP cuff may require extra instruction to ensure correctness and consistency. Participants may benefit from being given a reminder card with easy-to-follow instructions. This important consideration has a direct impact on BP measurement, which in turn, has implications for how individuals' BP will be managed.
- Participants may have increased BP scores when starting to use the machine due to anxiety over use of the kiosk. Evidence that "white coat hypertension" is present in telehealth is important to consider when reviewing initial/preliminary readings from seniors who are new to this technology.
- Participants have more experience with automatic BP machines at baseline than expected, (i.e., more than 99 prior uses). Even in relatively rural areas, exposure to automated BP devices (at home, in pharmacies, and supermarkets) is relatively high, a factor that may help ease the transition into use of this technology in the setting of telehealth.

**Selected Outputs**

By the end of 2009, study staff had completed the literature review, begun modifying this work for publication (submitted to and accepted by the Journal of Telemedicine and e-Health for publication in 2010), and began planning presentations of preliminary findings at several National meetings in 2010.

**AHRQ Priority Population*

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| **Project Title:** | Health Information Technology Enablement of Quality Measurement: Health Information Technology Expert Panel |
| **Principal Investigator:** | Rosenthal, Daniel, M.D. |
| **Organization:** | National Quality Forum |
| **Contract Number:** | 290-07-10017-3 |
| **Project Period:** | 06/08 – 11/09 |
| **AHRQ Funding Amount:** | $526,927 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** The project built on prior work at the National Quality Forum (NQF) completed under direction of the Health Information Technology Expert Panel (HITEP). The earlier HITEP-I report recommended 11 data categories and 39 data types, for a set of 84 high-priority performance measures to enhance capabilities for the electronic capture of data for quality measurement. The NQF reconvened the panel (HITEP-II) to gather, synthesize, and refine clinical workflow maps, focusing on care processes related to the previously prioritized set of measures. The project consisted of two primary workgroups:

- The Quality Data Set Workgroup helped guide the development of recommendations to further quality measurement using health IT and used the panel's expertise to develop materials concerning health IT standards, capabilities, and quality measurement.
- The Workflow Workgroup defined the workflow to manage electronic health information to enable expected patient care while decreasing the information seeking and documentation burden for individual clinicians. The work product defines the qualitative and quantitative aspects of data by examining quality data flow maps. Such quality data management addresses three requirements for data: the authoritative source, the methods for attribution of accountability at the source of the data, and the method of transit.

**Specific Aims**

- Represent quality data requirements (concepts, data types, data elements, code sets) unambiguously and specifically. **(Achieved)**
- Determine mechanisms and opportunities within quality data management workflows for identifying patients who are eligible for inclusion in measure populations, gathering performance measurement data, and providing clinical decision support to optimize performance in targeted areas. **(Achieved)**

**2009 Activities:** The NQF worked with the panel to complete an environmental scan; draft a set of quality measures that are automated, patient-centered, and longitudinal; and develop data standard recommendations to the HITSP. With the goal of quality measurement standardization, the panel was charged with the following tasks:

- Establish a priority order for the current sets of Ambulatory Care Quality Alliance (AQA) and Hospital Quality Alliance (HQA) approved measures;

- Identify common data types from the subset of highest priority measures to be standardized for automation in electronic health records and health information exchanges; and
- Develop an overarching quality measure development framework to facilitate developing, using, and reporting on quality measures from electronic health record (EHR) systems.

**Preliminary Impact and Findings:** A draft "quality data set" (QDS) was developed that could be used nationwide to support automated quality measurement. The QDS framework contains three levels of information: standard elements, quality data elements, and data flow attributes. The QDS as conceived by the NQF HITEP is a classification system by which measure developers can offer and refine definitions. Once fully developed, the QDS would be a centralized repository of quality data requirements (such as concepts, data types, data elements, and code lists) and data definitions used by multiple stakeholders to develop, specify, and use quality measures. The QDS aims to provide direction to measure developers, EHR vendors, and other stakeholders on how to define quality terminology without ambiguity.

**Selected Outputs**

National Quality Forum (NQF). Issue Brief No.17: HITEP II. October 2009.

National Quality Forum (NQF). Health Information Technology Automation of Quality Measurement: Quality Data Set and Data Flow. Washington, DC: NQF; 2009.

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| **Project Title:** | Improving Guideline Development and Implementation |
| **Principal Investigator:** | Shiffman, Richard N., M.D., M.C.I.S. |
| **Organization:** | Yale University |
| **Contract Number:** | 09-587F-07 |
| **Project Period:** | 09/06 – 09/10 |
| **AHRQ Funding Amount:** | $133,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Knowledge Creation

**Target Population:** General

**Summary:** Over the past 15 years, a major global initiative has been undertaken to develop, disseminate, and implement clinical practice guidelines; however, in a process as complex as translation of medical knowledge into systems that influence clinical behavior, a number of shortcomings have been identified, including problems in the authoring process, quality defects in the production of guidelines, and obstacles to effective implementation. Although systematic reviews have demonstrated that computerized systems can be effective in implementing guidelines in clinical practice, creating computer-mediated guideline implementation systems has also proven to be onerous and not uniformly successful.

Yale University has designed a research program, co-funded by the National Library of Medicine and the Agency for Healthcare Research and Quality (AHRQ), on the Effective Representation of Guidelines using Ontology (ERGO). This study is intended to reduce guideline ambiguities, improve efficiency, and create and evaluate tools that promote authoring of comprehensive and implementable guidelines. Overall, this research program will help researchers gain an understanding of how to improve knowledge acquisition, as well as assist guideline authors to state the recommendations precisely and comprehensively in a manner that facilitates implementation and remediates ambiguity.

**Specific Aims**

- Create a library of representative guideline recommendation statements that will be used to better understand and characterize the current corpus of guideline statements and to serve as a resource for modeling and evaluation activities. **(Achieved)**
- Delineate the range of ambiguous, vague, and underspecified language (AVUL) in recommendation statements and devise targeted remedies. **(Achieved)**
- Analyze the terminology of obligation (deontic components) used in guideline recommendation statements to understand how this concept can be applied most effectively. **(Achieved)**
- Create ontology of recommendations. **(Ongoing)**
- Develop and evaluate a controlled language editor for use by domain experts to facilitate authoring of recommendations that can be translated into decision support tools. **(Ongoing)**

**2009 Activities:** For the first aim, the project team continued to make use of the library of representative guideline recommendation statements, The Yale Guidelines Recommendation Corpus (YGRC), to provide a broad, representative source of recommendation statements for the project team's investigations. The team has also analyzed the YGRC using natural language processing tools and conducted a focus group of informaticians to examine the use of action-types as a basis for categorization, development, and implementation of guideline recommendations. In the efforts to delineate the range of AVUL in recommendation statements and devise targeted remedies (aim two), the team explored the use

of "controlled natural language" to diminish the widespread use of AVUL. Controlled natural languages are subsets of natural languages, obtained by restricting the grammar and vocabulary in order to reduce or eliminate ambiguity and complexity. The team continues to work with guideline developers to identify and eliminate AVUL. To analyze the terminology of obligation (deontic components) used in guideline recommendation statements and better understand how this concept can be applied most effectively (aim three), the project team analyzed the survey results from the 2009 AHRQ Annual Meeting to determine how expressions of obligation (e.g., "clinicians should…") that are commonly used in clinical practice guidelines are interpreted. Those results were incorporated in a paper that has been accepted for publication.

Aim four is ongoing and the team has achieved the first step in making the Guideline Elements Model (GEM) a guideline recommendation ontology by translating the GEM into a Web Ontology Language (OWL). An OWL representation makes GEM more applicable in systems that rely on Semantic Web. Such ontology should have broad utility as efforts at harmonization of the multiple guideline knowledge representations are undertaken. Developing a controlled language editor with a "What You See Is What You Mean" interface to facilitate authoring of recommendations that can be translated into decision support tools (aim five) will enhance the accuracy of translation and ease of implementation of new knowledge contained in guidelines. To that end, the project team has created the first generation of Building Recommendations in a Developer's Guideline Editor (BRIDGEWiz). BRIDGEWiz formalizes and systematizes a process for creating implementable guideline recommendation statements. It offers limited verb choices based on proposed action types and incorporates checks on decidability and executability, limits use of the verb "consider," limits Boolean connectors, and constrains selection of deontic terminology to that which is appropriate based on evidence quality and assessment of anticipated benefits and harms. Several groups have expressed interest in trialing BRIDGEWiz and the project team intends to design and execute an appropriate evaluation of the tool.

**Preliminary Impact and Findings:** Working with collaborators in Zurich, Switzerland, the project team translated a set of guideline recommendation statements into Attempto Controlled English (ACE). ACE texts are computer processable and can be unambiguously translated into discourse representation structures, a syntactic variant of first-order logic. The team found that ACE can be used to adequately express clinical practice guideline recommendations. ACE statements were judged to be acceptably "natural" sounding. Principles identified can be used to improve the quality, clarity, and implementability of clinical practice guidelines. This represents some of the first work with controlled natural language in health care.

**Selected Outputs**

Rosenfeld RM, Shiffman RN. Clinical practice guideline development manual: a quality-driven approach for translating evidence into action. Otolaryngol Head Neck Surg 2009; 140:S1-S43.

Shiffman RN. Clinical practice guidelines: supporting decisions, optimizing care. In: Lehmann CU, Kim GR, Johnson KB, editors. Pediatric informatics: computer applications in child health. New York; Springer: 2009. p. 149-60.

Shiffman, RN, Michel G, Krauthammer M, et al. Controlled natural language for clinical practice guidelines. Proceeding from the Workshop on Controlled Natural Language; 2009 June 8-10; Available at: http://sunsite.informatik.rwth-aachen.de/Publications/CEUR-WS/Vol-448/paper5.pdf.

Tran N, Michel G, Krauthammer M, Shiffman RN. Embedding the guideline elements model in web ontology language. AMIA Annu Symp Proc. 2009 Nov 14;2009:645-9.

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| **Project Title:** | Improving Lab Followup by Delivering an Enhanced Medication List to Outpatient Physician Practices |
| **Principal Investigator:** | Simonaitis, Linas, M.D., M.S. |
| **Organization:** | Indiana University |
| **Contract Number:** | 290-06-0013-2 |
| **Project Period:** | 09/07 – 04/10 |
| **AHRQ Funding Amount:** | $400,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

**Business Goal:** Knowledge Creation

**Target** Population: General

**Summary:** Medication errors and Adverse Drug Events (ADEs) are a major problem across the United States and have serious clinical and economic consequences. Although outpatient providers could detect and prevent many of these errors, their limited time with patients, their high workloads, and the challenge of managing a large volume of dynamic information can affect their ability to do so. Providers need to know what medications their patients take now or have previously taken if they are to improve medication management. However, primary care providers often do not know which medications have been prescribed by other providers or which non-prescription medications the patient takes. An accurate and complete medication list, facilitated by technology, can be an effective tool to promote the quality and safety of health care.

The goal of this project is to design, develop, and evaluate a method of providing medication data from the Indiana Network for Patient Care (INPC) to ambulatory primary care practices to enhance health care quality and safety. The project team at Indiana University and Regenstrief Institute developed the Enhanced Medication History (EMH), a medication history based on pharmacy dispensing records from three sources: RxHub commercial pharmacy benefit managers, Medicaid, and the Wishard County health services outpatient pharmacy. The EMH is supplemented by laboratory data from INPC and includes clinical decision support reminders specifically related to the patient on drug-drug interactions, drug-lab interactions, and drugs to be avoided in the elderly.

The project team modified the clinic registration system to create a trigger message when a patient registers. The trigger message is sent to the INPC to collect patient data and automatically produce a patient-specific EMH report. The report is delivered to the correct printer at the correct clinic within a minute or two of the patient's registration. When the report is printed, nurses or clinic staff place the document in the patient chart for the physician-patient visit.

The project team evaluated the EMH in a randomized, controlled trial, examining its impact on patient quality and safety indicators compared to usual care, as well as provider satisfaction with the EMH. Over a 46-week time period, the EMHs were successfully delivered to health care providers at 2 sites of a community health organization for 4,449 patients. Based on their written and verbal evaluations, the physicians considered the medication histories to be a useful tool even though the medication histories were incomplete summaries. The EMHs complemented information from chart notes and patients and helped discover previously unknown medication usage.

**Specific Aims**

- Aggregate medication histories from multiple sources into a single document. **(Achieved)**
- Add decision support rules to medication history documents in selected areas, such as inadequate lab monitoring, drugs with abnormal labs, or drugs to avoid in the elderly. **(Achieved)**
- Deliver enhanced medication history documents to clinics. **(Achieved)**
- Examine instances of decision support rule use. **(Achieved)**
- Examine quality and safety improvements. **(Achieved)**

**2009 Activities:** The EMHs became operational at a community health clinic in Indianapolis in December 2008; a second site for the same community health clinic network was added in March 2009. Although the original evaluation period was 1 year (52 weeks), after 46 weeks (October 2009) the project had to be stopped because the community health clinic switched to a different electronic registration system that was not able to send registration messages to the INPC to trigger the creation of medication histories. Although it may be possible to modify the new registration system to send registration messages in the future, implementing such a change required development work that could not be completed for several months. Therefore, the project team considered the research study completed at the time the registration messages stopped. Analysis of data and dissemination were ongoing at the end of 2009.

**Preliminary Impact and Findings:** Nine physicians were surveyed, and reported usefulness of the medication histories; however there was less agreement on the completeness of the medication histories. Strong agreement was reported in the following areas: medication histories helped to discover drugs, which were previously unknown, and helped to identify overuse of controlled substances. The entire process, from the initial arrival of the patient to the final delivery of the printed report, required less than 2 minutes, with minimal disruption to clinic workflow. The process was triggered automatically as a by-product of the normal activities of registering a patient. The printed documents were easily integrated into the paper-based process of assembling a clinic chart.

The project team reported several lessons for others developing similar interventions: keep disruptions in clinic workflow to a minimum; have a clinic liaison to identify potential problems; essential data sharing organizational agreements need to be in place; develop a linkage algorithm to connect patient identifiers from multiple data sources; the arrival of a patient to an outpatient clinic is a useful trigger for creating patient information documents such as medication histories; test and fine-tune the information in the patient arrival messages with the clinic management; a clinically usable coding system is needed to identify drugs; representing drug strength information is a complex task that may require improvements in external data sources and message standards; it is important to deliver the EMHs quickly; and until full electronic health record adoption, solutions must be flexible enough to support paper-based clinics.

**Selected Outputs**

Cravens G, Simonaitis L, Overhage M. Medication Categories in Pharmacy Dispensing Histories Delivered to an Ambulatory Clinic. AMIA Annu Symp Proc. 2009; 2009: 803.

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| **Project Title:** | Conducting Measurement Activities for Health Information Technology Initiative |
| **Principal Investigator:** | Spranca, Mark D., Ph.D. |
| **Organization:** | Abt Associates, Inc. |
| **Contract Number:** | PSC 23302008, TO#HHSP23300700008T |
| **Project Period:** | 09/07 – 08/10 |
| **AHRQ Funding Amount:** | $710,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** General

**Summary:** Over the past 35 years, the Agency for Healthcare Research and Quality (AHRQ) and its predecessor agencies have made development of informatics an agency priority. In addition, AHRQ-supported research has played a central role in identifying the need for improvements where health information technology (IT) was applicable. Given the significant investment by this initiative, there is a growing need to assess the adoption, use, and outcomes of health IT.

The purpose of this project is to identify the most appropriate and most feasible methods of collecting data on national performance related to adoption, use, and outcomes of health IT in four areas: reduction in medication errors due to adoption of computerized provider order entry (CPOE) systems, the number of patients who can access information electronically on medication therapy, the number of clinicians who can access evidence-based (EB) prevention or treatment information electronically, and the number of clinician organization who have adopted EB decision support technologies.

Following a construct clarification exercise and assessment of data availability and quality, measures have been operationalized as follows:

- Reduction in medication errors due to adoption of electronic prescribing (e-prescribing) systems in U.S. hospitals
- Consumer access to their medication information online
- Adoption and use of clinical decision support (CDS) in ambulatory care settings
- Adoption by hospitals of EB decision support technologies

These measures may be used to inform the activities of AHRQ's health IT portfolio and to gauge national progress toward health IT adoption goals. Additionally, based on the lessons learned from this effort, Abt Associates proposed a flexible new framework that AHRQ, The Office of the National Coordinator (ONC) for Health IT, and foundations may use to monitor the adoption, use, and outcomes of health IT in the new landscape created by the Health Information Technology for Economic and Clinical Health Act of 2009 (HITECH).

**Specific Aims:**

Develop reliable, valid, useful, timely, and cost-efficient measures and national estimates for four key measures of health IT progress:

- Reduction in medication errors due to adoption of CPOE systems. **(Achieved)**

- The number of patients who can electronically access information on medication therapy. **(Ongoing)**
- The number of clinicians who can electronically access EB prevention or treatment information. **(Achieved)**
- The number of clinician organizations who have adopted EB decision support technologies. **(Achieved)**

**2009 Activities:** The focus of activity has been on data analysis. The project team has completed data analysis for three of four measures, including the reduction in medication errors, the adoption and use of CDS in ambulatory care settings, and the adoption by hospitals of EB decision support technologies. The study team has also analyzed the implications of the HITECH Act of 2009 on future measurements in the health IT field, as well as the implications of new measures proposed by the ONC and Centers for Medicare & Medicaid Services to assess the "meaningful use" of health IT.

**Preliminary Impact and Findings:** *Reduction of medication errors due to the adoption of electronic prescribing systems.* Based on data from the American Society of Health System Pharmacists (ASHP) and the 2007 American Hospital Association (AHA) Electronic Health Record (EHR) Adoption Database – a Supplement to the AHA Annual Survey, it was estimated that approximately 26 percent of all in-hospital prescription drug orders were processed by an e-prescribing system in 2008. This estimate was combined with data from peer-reviewed studies and medication order volume data from the ASHP to estimate that the use of e-prescribing systems averted approximately 14.3 million medication errors in 2008. Further, it was estimated that as many as 65 million medication errors could have been averted in 2008 with greater adoption and use of e-prescribing.

*Adoption and Use of CDS in Ambulatory Settings.* Based on data from the 2008 National Survey of Health Record Keeping among Physicians and Group Practices in the United States, it was estimated that 68.6 percent of physicians practicing in ambulatory settings have any one of three types of CDS available to them (i.e., reminders for guideline-based interventions and/or screening tests, warnings of drug interactions or contraindications, or highlighting out-of-range laboratory results). Of those physicians, 94.4 percent use at least one type of CDS system at least some of the time. Fifty-seven percent of physicians have available a computerized system that highlights out-of-range laboratory results, of whom 95.8 percent use this feature at least some of the time; 28.8 percent have available a computerized system that provides warnings of drug interactions or contraindications, of whom 91.9 percent use this feature at least some of the time; and 23.1 percent have available a computerized system for reminders for guideline-based interventions or screening tests, of whom 85.3 percent use this feature at least some of the time. Generally speaking, CDS use is high in ambulatory settings once the technology is adopted. Adoption and use of CDS technologies is higher for physicians working in ambulatory care practices that are larger, multi-specialty, and/or located within a hospital medical center.

*Adoption of CDS in Hospitals.* Based on data from the 2007 EHR Adoption Supplement to the AHA Annual Survey, it was estimated that in 2008, 3,054 of the 4,701 hospitals in the study population (65 percent) had adopted at least one of six types of CDS (clinical guidelines, clinical reminders, drug allergy alerts, drug-drug interaction alerts, drug-laboratory interaction alerts, or drug dosing support). CDS technologies used to inform courses of action (clinical guidelines, clinical reminders, and drug dosing support) were adopted at a lower rate compared to CDS technologies used to correct courses of action (drug-allergy alerts, drug-drug interaction alerts, and drug-lab interaction alerts). Further, adoption was higher among hospitals that were larger, members of hospital systems, major teaching hospitals, urban, and/or not classified as public hospitals.

**Selected Outputs**

This project has no outputs to date.

| | |
|---|---|
| **Project Title:** | Asthma Measurement Development—Asthma Outcomes Workshop |
| **Principal Investigator:** | Togias, Alkis, M.D. |
| **Organization:** | National Institute of Allergy and Infectious Disease |
| **Contract Number:** | 09-655F-09 |
| **Project Period:** | 06/09 – 09/10 |
| **AHRQ Funded Amount:** | $50,000 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Asthma, Chronic Care*

**Summary:** The Asthma Outcomes Workshop is organized by a consortium of governmental and nongovernmental organizations including the National Institute of Allergy and Infectious Diseases (NIAID), the National Heart, Lung, and Blood Institute (NHLBI), the National Institute of Child Health and Human Development, the National Institute of Environmental Health Sciences, the National Center on Minority Health Disparities, the Agency for Healthcare Research and Quality (AHRQ), and the Merck Childhood Asthma Network. Representatives of the above organizations have formed a planning committee that has the overall responsibility for the workshop. The workshop is supported by these organizations and by a grant from the Robert Wood Johnson Foundation.

Seven subcommittees will meet in advance of the workshop to prepare recommendations on outcomes for their respective domains. The subcommittees are:

- Asthma Symptoms
- Asthma Exacerbations
- Airway Physiology
- Asthma Biomarkers
- Asthma Quality-of-Life
- Asthma Composite Scores
- Asthma Health Care Utilization and Costs

Each subcommittee will be asked to identify outcomes in its domain and classify them as core, supplemental, or emerging based on their clinical importance and on their level of validation and standardization.

After the workshop, participating National Institutes of Health (NIH) Institutes and Centers will consider endorsing a selective set of core outcomes as required outcome measures in NIH-initiated asthma clinical research programs. It is anticipated that these required outcome measures will accelerate the widespread use of the data produced by clinical trials, genetic studies, and other asthma studies, by allowing meaningful comparative analyses and enhancing the level of confidence in the findings of asthma clinical research.

**Specific Aims**

- Establish standard definitions and data collection methodologies for validated outcome measures in asthma clinical research. **(Ongoing)**

- Identify promising outcome measures for asthma clinical research and comment on their status and further validation needs. **(Ongoing)**

**2009 Activities:** Each subcommittee was asked to identify outcomes in its domain and classify them into core, supplemental, and emerging outcomes based on clinical importance and level of validation and standardization. Subcommittees worked in advance of the workshop to prepare recommendations on outcomes utilizing the work of the American Thoracic Society/European Respiratory Society Task Force and conducted additional reviews of their domain as needed. Limited contractor resources for literature reviews and evaluation of the level of validation of some outcomes were made available. The NHLBI and NIAID will also provide some staff support to retrieve articles identified by the subcommittees and to coordinate subcommittee meetings. Subcommittees operated through conference calls monthly or bimonthly as needed.

**Preliminary Impact and Findings:** The project does not have any finding to date.

**Selected Outputs**

The project does not have any outputs to date.

**AHRQ Priority Population*

| | |
|---|---|
| **Project Title:** | Using Short Message System (SMS) to Improve Health Care Quality and Outcomes Among HIV-Positive Men |
| **Principal Investigator:** | Jennifer Uhrig, Ph.D. |
| **Organization:** | Research Triangle Institute |
| **Contract Number:** | 290-06-0001-7 |
| **Project Period:** | 05/09 – 03/11 |
| **AHRQ Funding Amount:** | $399,950 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, coordination of care across transitions in care settings, and use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Men*, HIV/AIDS

**Summary:** More than 230 million cell phones were used in the United States in 2006. Younger adults, socioeconomically disadvantaged populations, less-educated young adults, and people who rent or move frequently have high rates of cell phone use. Higher levels of use have also been associated with lower levels of self-reported health status and higher levels of participation in health-compromising behaviors. Given the pervasiveness, low cost, and convenience of cell phone technology, short message system (SMS) messages (i.e., text messaging) may be particularly well suited to frequent communication with patients and health-related message delivery where and when these messages can be most effective.

This project studies the potential of SMS to support the adoption and maintenance of healthy behavior among people living with HIV who are treated in an ambulatory care setting. The research entails a thorough review of existing literature and the development and implementation of an SMS-based intervention that provides health communication messages tailored to the individual's: 1) medication and appointment adherence, 2) risk-taking behaviors, 3) social support, 4) general health and wellness, and 5) involvement in health care. The clinical and systemic goals are to develop an intervention that is straightforward, relatively inexpensive, and easily implemented in ambulatory HIV care settings. The intervention must also be viewed as acceptable and useful by patients living with HIV and have a positive influence on health care quality and outcomes.

Both the implementation process and outcomes will be evaluated for the project. The implementation evaluation will document the process used and determine the feasibility and potential for implementing the intervention in other ambulatory care settings. The outcome evaluation will focus on patient satisfaction with the intervention and the impact of the intervention on knowledge, attitudes, beliefs, intentions, behaviors, and health care quality and outcome measures.

**Specific Aims:**

- Conduct a thorough review of existing literature, paying close attention to work that has been completed on innovative uses of text messaging in health communication strategies. **(Achieved)**
- Develop and implement an SMS-based intervention to improve health care quality and outcomes by providing tailored health communication messages to HIV-positive patients who are treated in ambulatory care settings. **(Ongoing)**
- Conduct a process evaluation on implementation and determine the feasibility and potential for implementing the intervention in other ambulatory care settings. **(Ongoing)**

- Conduct an outcome evaluation that focuses on patient satisfaction and the impact of the intervention on targeted knowledge, attitudes, beliefs, intentions and behaviors, health care quality, and outcomes measures. **(Upcoming)**

**2009 Activities:** The comprehensive literature review for this project was completed and informed the design of the text-message intervention. Messages developed for this project were reviewed by three experts and pre-tested with nine individuals from the target audience prior to being finalized for implementation. The implementation and evaluation plan was developed, institutional review board approval was received from both RTI and Howard Brown Health Center, and a clinical exemption from Office of Management and Budget review was granted.

**Preliminary Impact and Findings:** The project does not have any findings to date.

**Selected Outputs**

The project does not have any outputs to date.

**AHRQ Priority Population.*

| | |
|---|---|
| **Project Title:** | Participation by Primary Care Practices in Health Information Exchange in Colorado |
| **Principal Investigator:** | West, David, Ph.D. |
| **Organization:** | University of Colorado, Denver |
| **Contract Number:** | 290-07-10008-3 |
| **Project Period:** | 08/08 – 07/09 |
| **AHRQ Funding Amount:** | $249,992 |
| **Summary Status as of:** | July 2009, Completion of Contract |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Synthesis and Dissemination

**Target Population:** General

**Summary:** Widespread participation in health information exchange (HIE) is needed to optimize the value of health information technology (IT). While smaller ambulatory practices provide much of the Nation's care, they are underrepresented in HIE projects. To increase adoption, HIE's value proposition in these settings must be thoroughly understood. Using a case study approach, this study evaluated the motivators, barriers, and potential facilitators of HIE in nine smaller primary care practices across a spectrum of health IT adoption levels. Through a mixture of telephone and on-site interviews, qualitative and quantitative data were collected to evaluate current methods of HIE, motivations for adopting HIE-related functions, barriers to adoption, and the appeal of potential incentives. Workflow processes related to health information were also mapped during site visits. Three of the practice sites had no electronic medical records (EMRs), two sites had only EMRs, and four sites were involved in a community-wide HIE program. For this project, a community-wide electronic HIE (CW HIE) initiative was defined as the exchange of electronic health information that includes more than one type of clinical data among multiple stakeholders in a community. A small- to medium-sized primary care practice was defined as a community-based medical practice that provides a full range of primary care services and involves 20 or fewer full-time clinicians. The analysis informed a set of recommendations on the structure and functions of HIE that smaller practices desire and methods that may promote their adoption of HIE.

**Specific Aims**

- Develop a report using published research and commentary on factors influencing stakeholder participation in community-wide HIE. **(Achieved)**
- Collect and analyze qualitative and quantitative data from nine primary care practices in three categories ("NO-EMR," "EMR-ONLY," and "CW HIE") to assess perceived benefits of, readiness to engage in, and barriers to HIE participation. **(Achieved)**
- Based on this analysis, determine the relative strengths and weaknesses of different strategies for encouraging small- to medium-sized practices to participate in HIE. **(Achieved)**

**2009 Activities:** The activities in the final year of the project focused on on-site data collection and analysis. In-person interviews among key informants took place during half-day site visits, conducted by at least two members of the research team. The interviews were organized into the topic categories: 1) practice ownership and decisionmaking; 2) current use of charts and IT; 3) current electronic and non-electronic exchange of health information; 4) scenarios of community HIE; 5) motivators, barriers, and incentives for adoption of community HIE; and 6) governance of community HIE. Workflow processes related to health information were also mapped during the site visits. The sources of laboratory and

radiographic test results were catalogued. For each source, the methods of ordering tests, tracking and receiving results, presenting them to clinicians for review, acting on physician orders, and charting were determined. The same methods were used to map processes for obtaining clinical notes (e.g., from hospitals and consulting physicians).

Data from the telephone interviews completed in 2008 were consolidated with data from the site visit interviews into case reports for each practice. These were then reviewed by the research team to identify key themes and findings and questions needing further exploration regarding the motivators, facilitators, and potential incentives for the adoption of HIE by smaller primary care practices. Followup telephone calls were conducted with each practice to allow participants to validate, contradict, and elaborate on the preliminary analysis. Based on these discussions, any necessary refinements were made to the final analysis.

**Impact and Findings:** The participating primary care practices varied in their IT resources and their experiences with HIE but had similar perspectives on the value HIE would provide and functionality they desired.

*Desired Functions of HIE*

In general, improving the ability to receive and review clinical information from an HIE is much more valued than the ability to send or make available clinical information from the practice. In prioritizing the data elements to be made accessible, test results are considered most important, followed by discharge summaries and clinic notes. Participating practices place the following value on specific functions of the HIE:

- The most valued function overall is the ability to look up clinical information (test results, clinic notes, and discharge summaries) from their own practice, other practices, or hospitals as needed.
- Highly valued (nearly as much as the ability to look up information) is the delivery of all results of tests ordered by the practice, regardless of the entity performing the test (hospitals, radiology centers, independent laboratories), to the practice in a consistent, consolidated manner.
- Electronic prescribing is also highly valued overall, whether it is a standalone electronic prescribing function or prescribing functions integrated in EMRs.
- The ability to place non-prescription orders (e.g., laboratory tests, radiographic studies, and referrals) is considerably less valued. Some value is seen in consolidating various processes for placing orders or making referrals.
- Creating reports is the least valued function.

*Motivators for Adopting HIE*

Across functions, all practices saw the potential for HIE to improve efficiency (less effort needed to obtain clinical information), uniformity of workflows (reducing training costs), and quality of care (through better-informed decisionmaking), all of which are considered to be equally important. In particular, practices consistently identify two specific benefits as major motivators for adoption: improving the coordination of care (reducing fragmentation of care when patients were hospitalized or seen by multiple practices) and anywhere/anytime access to clinical information.

*Barriers to Adopting HIE*

There is great variability in the reported barriers to joining HIE networks. Technical barriers focus on the need to integrate HIE with practice management systems and (where employed) EMRs. Some practices also consider capital costs to adopt HIE as major barriers. These might entail installing and supporting new computers and upgraded networking in the practice.

*Other Important Considerations*

Practices also identified important attributes of HIE that could either enhance or inhibit adoption of HIE. Reliability is clearly an important attribute, particularly for delivery of results. The governance of HIE networks is another important consideration for practices. It is important for leaders in HIE networks to have clinical experience, IT savvy, and respect in the community. Practices strongly want governance to include representation of hospitals and ambulatory practices. Social networks also appear to play a strong role in fostering HIE participation. All practices felt that a sense of community facilitated the cooperation necessary to establish their Regional Health Information Organization. Apart from governance, legal and regulatory issues are considered to be important but unlikely to pose major barriers to adoption.

*Facilitators and Incentives for Adopting HIE*

The most important facilitators identified for joining an HIE network are technical assistance (for both implementation and maintenance) and training. Especially helpful for the HIE is assistance in creating electronic interfaces between the HIE network and the practice's management system and (if present) EMR. Financial incentives for adoption are felt to be helpful but not as important as ongoing technical and training assistance. In general, there is no consensus on whether it is best for existing practices to join HIE networks before, during, or after EMR implementation.

**Selected Outputs**

Ross SE, Schilling LM, Fernald DH, et al. Health information exchange in small-to-medium sized family medicine practices: motivators, barriers, and potential facilitators of adoption. Int J Med Inform. 2010 Feb;79(2):123-9.

| | |
|---|---|
| **Project Title:** | Assessing the Impact of the Patient-Centered Medical Home |
| **Principal Investigator:** | West, David, Ph.D. |
| **Organization:** | University of Colorado Health Science Center |
| **Contract Number:** | 290-07-10008-6 |
| **Project Period:** | 07/09 – 12/10 |
| **AHRQ Funding Amount:** | $249,876 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Chronic Care*, Chronic Obstructive Pulmonary Disease, Diabetes, Heart Disease

**Summary:** The University of Colorado Health Sciences Center and The Robert Graham Center are conducting an evaluation of clinical outcomes, financial and economic impact, and patient and provider satisfaction for a medium-sized primary care health system that has implemented a long-term patient-centered medical home (PCMH) model. For 18 years, the WellMed Medical Group has provided care that matches the National Committee for Quality Assurance definition of a PCMH. The study examines outcomes and cost-effectiveness of the PCMH model implemented in WellMed's 22-practice, 80-provider health system. The evaluation is on overall care; care for coronary artery disease, diabetes mellitus (DM), and chronic obstructive pulmonary disease (COPD); and preventive care, including adult immunizations.

Key informant interviews and participant observations will help the study team understand how WellMed developed its model of care over time, the critical organizational milestones on the road to becoming a PCMH, and what it means to be a PCMH for WellMed. These qualitative data will provide a narrative foundation that complements and informs the quantitative findings. Data collection will focus on the strategic changes made to improve health outcomes for at least three different conditions; ischemic heart disease (IHD), DM, and COPD. Health outcome measures will include clinical outcome test values, hospitalization, and mortality. Particular attention will be given to the associated effects of specific elements of the medical home, including care management, team-based care characteristics, and health information technology (IT) functions.

A trend analysis to assess the impact of the WellMed model on patient and provider satisfaction will examine PCMH-related interventions associated with changes in satisfaction. In addition, a detailed analysis of data will assess the impact of the WellMed PCMH on patient care and health outcomes over a period of 10 years (1997-2006), comparing the full claims data available during various blocks of time with similar patient panels. Purposeful implementation of a comprehensive patient data management system allows internal and external cohort analyses. This study will provide ample opportunity for a well-functioning PCMH to demonstrate any improved outcomes.

**Specific Aims**

- Determine how WellMed developed their level-3 PCMH model (facilitators, barriers, key components, history, and leadership) using a qualitative methods approach. **(Achieved)**
- Determine if implementation of the WellMed model impacted patient/provider satisfaction. **(Ongoing)**
- Determine if implementation of the WellMed level-3 PCMH improved care and health outcomes for patients. **(Ongoing)**

- Determine the incremental in-practice expenses per patient per month required to operate the WellMed PCMH, and the key components of the program. **(Upcoming)**

**2009 Activities:** Activities were focused on finalizing the research plan. Electronic medical record data were transferred from WellMed to the Robert Graham Center and was used to inform a draft report of the findings. In addition, all the interviews from WellMed were transcribed. A meeting was scheduled to begin preliminary analysis on qualitative data in early 2010.

**Preliminary Impact and Findings:** The first report found that the clinic network functions as a group of medical homes in a primary care-based accountable care organization. WellMed built integrated health IT, patient transport, inpatient management, and supportive functions that go beyond the medical home. The result is demonstrable preventive care improvement and reduced premature mortality without evidence of strategic patient selection. These outcomes are comparable or exceed local Medicare Advantage plans, suggesting that the systematic medical home implementation may be responsible.

**Selected Outputs**

The WellMed Data Collection report was submitted to the Agency for Healthcare Research and Quality on December 28, 2009 and is under review.

**AHRQ Priority Population*

| | |
|---|---|
| **Project Title:** | Evaluation of Computer-Generated After-Visit Summaries to Support Patient-Centered Care |
| **Principal Investigator:** | Williams, Robert, M.D. |
| **Organization:** | University of New Mexico |
| **Contract Number:** | 290-07-10007-2 |
| **Project Period:** | 09/09 – 09/11 |
| **AHRQ Funding Amount:** | $496,788 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

**Business Goal:** Knowledge Creation

**Target Population:** Adults

**Summary:** The office visit remains a cornerstone of primary care delivery and is the major venue where health care information is transferred from provider to patient. Yet studies have shown that by the time the patient leaves a facility, he or she may forget as much as 50 percent of the information relayed during the visit. This can negatively affect a patient's care.

The electronic medical record (EMR) offers a new method of providing patients with information about their clinical visits through personalized, patient-specific handouts that summarize the topics and recommendations covered during the visit. These after-visit summaries (AVSs) have the potential to improve a patient's retention of information that is needed for adherence to treatment plans and followup instructions. AVS can also facilitate the transfer of information between health settings; however, the content and formatting of the AVS that will optimize patients' information retention and satisfaction is not known.

This project will employ qualitative data collection methods, including interviews and focus groups, to gather patient and physician input into AVS development. It will be take place in four clinics that use the Certification Commission for Health Information Technology-certified EpicCare EMR and that serve an ethnically and socioeconomically diverse patient population. The investigating team includes experts in study design and analysis, medical informatics, bilingual and bi-cultural patient information transfer, qualitative analysis, and clinical practice-based research.

By the end of the project, the study team plans to:

- Develop a prototype of the implementation document and guide, which will be evaluated by at least two practice sites that are interested in health information technology (IT) applications but not involved in the study. These sites will provide comment on the potential usefulness of the document in an implementation effort, and the study team will revise the document as warranted.
- Draft and submit a manuscript about the research effort to a peer-reviewed journal.
- Propose processes for active dissemination, including publicity through primary care organizations, academic primary care departments, practice associations, and various organizations active in health IT development.
- Post downloadable technical findings and after-visit summary-related products on the Internet for incorporation by other primary care providers.
- Prepare a final report that includes all study deliverables (e.g., copies of all research instruments), results, conclusions, suggestions for additional research, and actionable lessons learned.

**Specific Aims**

- Ascertain patient attitudes, preferences, and needs regarding the delivery of information at a visit with a primary care physician. **(Ongoing)**
- Identify primary physicians' attitudes about the utility, content, and value of the AVS. **(Ongoing)**
- Develop and test three different versions of an AVS. **(Upcoming)**
- Disseminate the programming instructions needed to deploy an AVS for health care organizations that use the Epic EMR system. **(Upcoming)**

**2009 Activities** The study team obtained institutional review board approval from Baylor College of Medicine, Harris County Hospital District, and the University of New Mexico. The physician interview guide was developed. Two research assistants were trained and participated in research team meetings. Documents were submitted, reviewed, and approved by the Office of Management and Budget.

**Preliminary Impact and Findings:** The project has no findings to date.

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**Selected Outputs:** The project has no outputs to date.

| | |
|---|---|
| **Project Title:** | Developing a Guide to Identifying and Remediating Unintended Consequences of Implementing Health Information Technology |
| **Principal Investigator:** | Wu, Shinyi, Ph.D., and Koppel, Ross, Ph.D. |
| **Organization:** | RAND Corporation |
| **Contract Number:** | 290-06-0017-5 |
| **Project Period:** | 05/09 – 06/11 |
| **AHRQ Funding Amount:** | $399,894 |
| **Summary Status as of:** | December 2009 |

**Strategic Goal:** Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

**Business Goal:** Synthesis and Dissemination

**Target Population:** Not Applicable

**Summary:** The use of new health information (IT) has been shown to enhance the quality, safety, and effectiveness of medical care. However, there are also unanticipated and undesired effects, often called unintended consequences, of health IT implementation, which can be difficult to identify during a technical analysis or pilot test of the new technology. The RAND Corporation, in partnership with Kaiser Permanente of Colorado and the American Health Information Management Association, is developing, user testing, and disseminating an empirically grounded, practical, Web-accessible Guide to Identifying and Remediating Unintended Consequences of Implementing Health IT. The guide will synthesize the existing knowledge on types and causes of unintended consequences and strategies to avoid or address them.

The project is a collaboration of six major health care settings/groups representing a geographically diverse group of provider organizations that includes inpatient and outpatient care delivered in academic and community settings. These organizations are either in the process of implementing a variety of health IT components from various vendors or are planning to do so in the near future. Depending on health IT implementation status and preferences, participants will serve either as laboratory sites to help develop the guide or as pilot sites to test the guide. Since these organizations include large numbers of locations and practices, they represent a wide range of perspectives and will facilitate pre-post comparisons of the guide's pilot-test assessment.

The guide will help organization leaders understand sociotechnical sources of unintended consequences and may help them avoid undesirable effects in health IT implementations. This knowledge will allow organizations to develop a process to diagnose and cope with emergent consequences. This process may even help prevent undesirable outcomes and provide opportunities for learning about and improving health care delivery. Examples of the target audience for the guide include chief information officers, directors of clinical informatics, practitioners serving as champions of health IT, hospital/clinic administrators, and implementation oversight teams. The front-line health IT users, including physicians and nurses, should also find the guide useful.

**Specific Aims**

- Synthesize the existing knowledge on types and causes of unintended consequences and strategies to avoid or address undesired consequences. **(Achieved)**
- Develop the draft version of the guide, instructions for its use, and material for training sessions. **(Achieved)**

- Pilot test the guide at three additional sites to assess its usability and usefulness. **(Upcoming)**
- Revise the guide and disseminate final version in a Web-accessible format through several methods. **(Upcoming)**

**2009 Activities:** The project focused on completing a comprehensive literature review and environmental scan and developing the draft and final guide development plan. The study team originally planned on pilot testing the guide at three collaborating laboratory sites but added a fourth site. The team is also considering submitting a publication to the Journal of the American Medical Informatics Association on the environmental scan but has not determined whether this fits in the contract's scope.

**Preliminary Impact and Findings:** The project has no findings to date.

**Selected Outputs**

The project has no outputs to date.

# Appendix A – Process for Preparing Project Summary

*Project Summaries Content Development Guidelines*

The following guidelines support the objective to provide consistent writing of the project summaries. In following these guidelines, it is expected that there will be some reasonable differences in content based on project status and the information that the PI/PD has shared in their progress reports and phone calls.

The following categories of the project specific summaries were developed by the summary writer from abstracting data from multiple sources.

- Target Population
- Project Summary
- Specific Aims
- 2009 Activities (or the year the project ended)
- Preliminary Impact and Findings
- Selected Outputs
- For Grant Projects: Grantee's Most Recent Self-Reported Quarterly Status. For grantees that have funding classified as "Other" (U18, R01, R13), "Training" (K08, K01), or "Dissertation" (R36), these sections are not included in the project summaries.

*Guidelines and examples for each section include:*

- **Target Population:** Each grant and contractor was assigned a target population as part of the development of profiles for new grants and contracts. For the majority of projects, this information was exported from JSI's internally developed database and entered into the project-specific summary. For those grants or contracts that did have not had a target population assigned, this was done at the time of summary development by JSI.

- **Summary** (2-5 paragraphs)**:** The information included in the summary section is similar to and consistent with the information included in the profiles available on the NRC Web site, but with more detailed information on methodology.
  - Statement of problem (e.g., research need)
  - Technology/application; EHR/EMR, CCHIT status (if applicable)
  - Intervention—description of the intervention (if applicable)
  - Methodology—description of methodology and phases of research to be completed in each year of the project (i.e., second year of grant qualitative data will be analyzed, and in year three the randomized clinical trial data will be analyzed)
  - Statement of how research impacts building on current knowledge (similar to profile)

- **Specific Aims**
  - Write specific aims using the main verb (e.g., Implement, Improve, Introduce) with the status of the aim in parenthesis, and bolded. For example: (**Achieved**)
  - In some cases, grantees may have some aims that are ongoing and are noted as (**Ongoing***) with the following text beneath the full list of Aims: **This aim was*

*not completed prior to scheduled conclusion of the grant (Month, Year); however, research will continue through other funding sources.*

- **2009 Activities** (1-3 paragraphs)
  - Progress as reported in the progress reports, quarterly calls from calendar year 2009.

- **Preliminary Impact and Findings** (1 paragraph)
  - Broad overview of findings to date; timing of expected findings if none to date may be included.

- **Selected Outputs**
  - Outputs were selected from the full list of outputs for the entire grant period (not exclusive to the year 2009). The full list of outputs was available in an Excel report from the JSI Access Database.
  - JSI reviewed all outputs, with the following priority for inclusion:
    - Peer-reviewed journal publications
    - Accepted presentations/manuscripts to conferences
    - Surveys that are part of the Survey Compendium
    - Other tools, surveys, and outputs
  - Order of outputs are chronological (newest publication first), and if output has no date, these are included at the end of the list alphabetically.

- **Grantees' most recent self-reported quarterly status** (1 paragraph) (Grants only)
  - This information was extracted from the last available grantee progress report of 2009 with supplementary or explanatory information from the call with the grantee.

*Tracking Project Summary Development*

A tracking Spreadsheet was developed to track the development, distribution, review, approval, and posting of each grantee and contractor project summary. The tracking spreadsheet is an interactive tool that was updated by JSI team members as tasks were completed. The process tracking spreadsheet was reviewed at weekly team meetings to monitor project progress, identify activities that are lagging, and address issues that could stall the development of the project summaries and sections of the annual report development.

AHRQ Publication No. 10-0095-EF
November 2010