



Success Stories from the AHRQ-Funded Health IT Portfolio (2009)



Agency for Healthcare Research and Quality

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Health IT



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Executive Summary

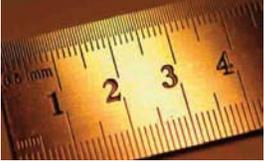
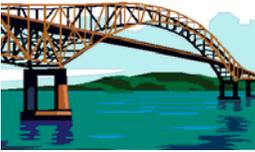
Since 2004, AHRQ has recognized the potential of health information technology (IT) to improve quality of care, patient safety, and health care efficiency and has invested millions of dollars in a variety of contracts and grants in more than 150 communities, hospitals, providers, and health care systems. 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: 1) improve health care decisionmaking; 2) support patient-centered care, the coordination of care across transitions, and the use of electronic exchange of health information; and 3) improve the quality and safety of medication management.

These investments are expected to enhance the usability of health IT, promote access to and adoption of evidence-based systems, and examine their impact on health care quality, safety, and outcomes. This report provides illustrative examples of various types of AHRQ Health IT Portfolio-funded projects that recently concluded (2009). Furthermore, these 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. The projects featured in this report include:

Project	Principal Investigator	Description	AHRQ Project Funding
 <p>SAFEHealth: A Health Information Exchange Improving Health Care Delivery in Central Massachusetts</p>	Lawrence Garber	This project, supported by a Transforming Quality Through Health IT Implementation grant, developed a sustainable and regional HIE that securely transfers patient health information in real time among various health care facilities where they seek care.	\$1,499,999 (4,059,648) provided in in-kind funding)
<p>Using Human Factors Research to Increase the Success of a Health Information Technology Implementation</p> 	Pascale Carayon	This project, supported by a Transforming Quality Through Health IT Value grant, successfully used human factors research to increase the success of a computerized provider order entry system.	\$1,455,066

The names of the project used later in this report are used here. The original titles of the grants/contracts appear in text boxes in each success story.



Project	Principal Investigator	Description	AHRQ Project Funding
 <p data-bbox="245 491 509 661">Measuring Quality in Physicians' Practices in Southwestern Missouri Using an Electronic Health Record</p>	Denni McColm	This project, supported by an Ambulatory Safety and Quality grant, successfully used pre-existing electronic health record technology to facilitate quality measurement reporting	\$889,681
 <p data-bbox="245 869 509 1050">Electronic Referrals Show Promise for Improving Quality of Care in Outpatient Settings</p>	Douglas Bell	This contract evaluated a Web-based electronic referral system to understand its impact on quality, efficiency, accessibility, and patient-centeredness of specialty care and to assess different implementation practices and explore their influence on the system's success or failure in other settings.	\$999,825
<p data-bbox="245 1068 509 1297">Electronic Standing Order in Primary Care Physician Offices Boost the Delivery of Adult Vaccinations and Other Health Maintenance Services</p>	Lynne Nemeth	This contract developed and implemented electronic standing orders to increase clinical services such as screening tests, adult immunizations, and diabetes care, and successfully demonstrated the positive impact on these services in multiple physician practices.	<p data-bbox="1122 1068 1386 1094">\$448,560</p> 
 <p data-bbox="245 1562 509 1732">Building Bridges Workshop: Healthcare Consumer Needs and the Design of Health Information Technology</p>	Anne Peterson	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.	\$342,898



Project	Principal Investigator	Description	AHRQ Project Funding
Health Care Consumers' Perspectives on the Design and Use of Health Information Technology	Jeffrey Kerwin	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.	\$251,114 
Strategies for Integrating Usability in Electronic Health Records	Cheryl McDonnell	A contract that was AHRQ's first initiative to guide innovation in EHR usability to benefit potential health IT users developed three separate reports that defined categories for usability and evaluation, recommended interface designs, and detailed vendor practices and perspectives on usability engineering processes and engagement of end users.	\$362,402 

The intent of these success stories is to provide a high-level summary of each project describing its accomplishments and its contribution to the field of health IT. To learn about each individual project, please see the National Resource Center for Health IT Web site (<http://healthit.ahrq.gov>). Users can search projects and review their final reports, 2009 project-specific summaries, and other outputs. For more information on the activities of the AHRQ Health IT portfolio, please see the National Resource Center for Health IT Web site (<http://healthit.ahrq.gov>) and the Health IT Portfolio's 2009 Annual Report (<http://healthit.ahrq.gov/HITCY2009Report>).





SAFEHealth: A Health Information Exchange Improving Health Care Delivery in Central Massachusetts



Depending on the severity and complexity of patients' health care problems, providing health care for a single patient can be complex. Care may involve multiple clinicians, services, and facilities, each with its own record of the patient's medical conditions, ordered tests, and prescribed medications. As a patient transitions from a primary care doctor to a specialist, hospital, or emergency department (ED), fragmentation in sharing health care data contributes to barriers in coordinating care. Health information exchanges (HIEs) seek to provide a timely, secure, electronic means of sharing a patient's relevant medical information acquired at various participating health care facilities.

SAFEHealth is a regional HIE that securely transfers patient health information in "real time" between providers. As such, patients' health information is included in the electronic health record (EHR)—an electronic version of a patient medical record—and is available at the various health care facilities where they seek care. The goals of SAFEHealth are to improve quality of care, cost-effectiveness, and health care efficiency, while at the same time protecting patient privacy.

Concept and infrastructure development began in 2004, and the HIE became fully operational in June 2009. Since then, the HIE has provided timely exchange of medical information across health care facilities for patients throughout Central Massachusetts. Patient data, such as medication lists, vital signs, and laboratory results, appear in the participating facilities' EHR.

*No more huge piles of paper.
I can set up a followup with
a Fallon Clinic specialist
based on the ER note. ...
Essentially, we have cut out
the middle man – talk
about GREEN and LEAN!
- Physician at Fallon Clinic*

Figure 1: Total number of documents transferred from Fallon Clinic to HealthAlliance

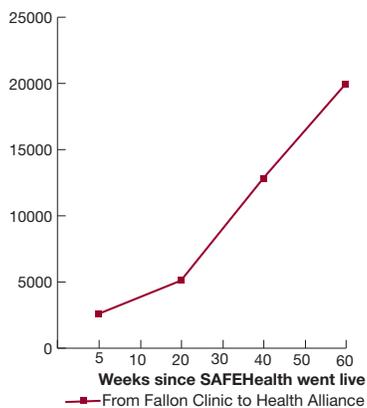
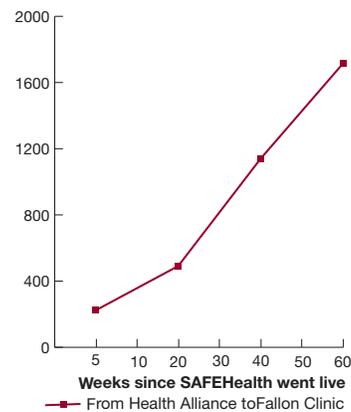


Figure 2: Total number of documents transferred from HealthAlliance to Fallon Clinic



In the first 8 months, 1,500 patients signed consents and 14,000 documents were shared. As shown above in Figures 1 and 2, the number of documents exchanged between Fallon Clinic and HealthAlliance has steadily increased over the first year. Physicians feel that SAFEHealth allows them to provide higher quality, more effective medical care, while patients feel that the benefits of SAFEHealth outweigh the risks of privacy and security concerns. Further, SAFEHealth is provided to participating organizations at an affordable price—around \$2,000 per year. Today, SAFEHealth continues to thrive, even after AHRQ funding ended in September 2009. Further information on SAFEHealth is available at www.SAFEHealth.org.



Health Information Exchange to Improve Care Coordination and Quality

In the past, a number of challenges have been associated with implementing HIEs. Some past models of HIE have experienced varied degrees of success in part because they were not financially sustainable. There can be large costs associated with the development of the HIE, and maintenance fees can be cost-prohibitive for participating organizations once the HIE goes live. Some past models have also stored patient data from all of the different organizations in one centralized location, which has been controversial for some as concerns regarding data ownership and patient privacy were raised. The Health Insurance Portability and Accountability Act (HIPAA) Privacy and Security regulations allow for the transfer of patient clinical data for the purpose of treatment, payment, and operations. Some States have additional protections for patients. For example, patients in Massachusetts need to sign separate consents to release HIV and mental health-related information to other clinicians with a need-to-know. A given HIE may choose to filter out HIV and mental health-related information, which may adversely impact patient safety, or they can have patients sign consents to opt-in and share all of their clinical information.

SAFEHealth is an active HIE that was developed from 2007 to 2009 to connect the variety of health care players and address the challenges posed above. Fallon Clinic partnered with UMass Memorial Health Care system and Fallon Community Health Plan to create SAFEHealth, which shares clinical data across providers but allows participating organizations to maintain control of their patient's clinical data using "edge proxy" servers. AHRQ awarded \$1.5 million of funding in 2004, and Fallon Clinic, Fallon Community Health Plan, HealthAlliance Hospital, and UMass Memorial Medical Center collectively donated \$4 million. During the AHRQ funding cycle, the research project had two phases: 1) using stakeholder feedback to define functional requirements and develop the software; and 2) implementing the HIE, assessing its financial sustainability, and evaluating its impact.

The Participants

- Fallon Clinic is a large, non-profit group practice with over 20 locations throughout Central Massachusetts, with over 1,700 employees and 250 physicians representing over 30 specialties.
- UMass Memorial Health Care's HealthAlliance Hospital is a non-profit, acute care hospital in North Central Massachusetts.
- Milford Regional Medical Center is a 121-bed non-profit, acute care facility in South Central Massachusetts.
- Patients served by these organizations were eligible for inclusion in the study and represent AHRQ's priority populations (women, children, elderly, minorities, disabled, etc.).

A literature review, stakeholder interviews, and focus groups were conducted early on to inform the development of SAFEHealth. Six focus groups were conducted with patients in the following groups: chronically ill, acutely ill, caregivers, and healthy adults. Two physician focus groups were also conducted—one with primary care physicians and a second with specialists. Approximately 6 months post-implementation of the HIE, physicians and staff were surveyed.



A number of key decisions in the development of SAFEHealth contribute to its success. SAFEHealth was made available through each of the physicians' different existing EHR systems (Fallon Clinic uses Epic, HealthAlliance uses Siemens, and Milford uses MEDITECH). Patients only need to opt in once during a medical encounter at a participating organization in order to share all of their clinical data via SAFEHealth for treatment, payment, and operations uses only. Patient opt-in consent for SAFEHealth was automated at the point of patient registration at the facility, so there was little impact on existing workflows to obtain patient consent. Further, patients can revoke access to any or all organizations at any time. Finally, according to the developers of SAFEHealth, decisions were made early on to establish the foundation for a financially sustainable HIE model. The HIE was created by Fallon Information Technology (IT) staff, and costs were shared by partners. It cost \$1 million and took 2 years to develop and implement SAFEHealth. Today, the HIE is thriving and costs organizations around \$2,000 per year to participate.

Key Results

Functional requirements for the HIE were explored in physician and patient focus groups, the literature review, and stakeholder interviews. Workgroups were created to define data standards and to develop policies and procedures regarding data ownership, use and privacy, and security. The workgroup decided on the following specifications to develop the software:

- One central demographic repository/enterprise master person index (EMPI)
- No central clinical data repository
- Patients opt-in only once at any location and can revoke access to any or all entities at any time
- All authorized organizations can access the entire patient record
- Clinical data flows from EHR to EHR (given that multiple EHRs are in use)
- Clinicians directly view clinical data within their EHRs
- Each connected entity performs user authentication and role-based access through their EHR
- Minimize duplicate data from multiple sources
- Scalable and high performance
- Leverage existing health IT systems with minimal modification
- Integrate seamlessly into physician and staff workflow

SAFEHealth was implemented using two approaches (opt-in publish/subscribe versus push of results) per the separate organization's preferences. First, SAFEHealth became fully operational in June 2009 using a federated edge-proxy server architecture with patient opt-in for clinical data exchange managed by a consent engine external to the EHR. HealthAlliance provided ED notes, and Fallon Clinic provided 2 years of historical patient notes. Second, a one-way interface (push of results) was established from Milford's EHR (MEDITECH) to Fallon's EHR (Epic) in July 2009.

In the 6 months post-introduction of SAFEHealth, results were generally positive. A central EMPI was pre-loaded with the demographic data (name, gender, date of birth, and zip code) for approximately one million patients. After 8 months, 1,500 patients (approximately 50 percent of ED visits) signed consents, 4 revoked their consents, 75 percent agreed to receive payer data in the future, and 14,000 documents were securely exchanged. Physicians were able to see and use clinical data via SAFEHealth as part of their normal workflows using their own EHRs. In a busy ED, registration clerks felt it was easy to obtain



consent from patients since an automated process was in place and the impact on their workflow was minimal. For Milford, approximately 10,000 clinical documents were transferred in the first 15 weeks, and the cost to maintain this interface is only a few hundred dollars per year.

A number of barriers and facilitators were encountered during the development and implementation phases of SAFEHealth.

- It was key to instill trust and provide value to each stakeholder, such that they could justify participating and paying for SAFEHealth. Originally, developers tried to create software to support the exchange of patient clinical information by hiring programmers, purchasing site licenses for software development tools, and creating a Regional Health Information Organization. However, this approach was determined to be cost prohibitive. It would have been difficult to provide enough savings to justify this great expense. Instead, they followed a different, more cost-effective path. Fallon Clinic's existing in-house IT staff created the software and hosted a central server in this trusted organization's data center, and participating organizations agreed to share in the associated costs.
- Integrating SAFEHealth into workflows of patients, registration clerks, and physicians was critical. Consent forms are automatically printed for registration clerks only when they are needed, and the Consent Web Portal makes it easy for registration clerks to enter the resulting consent information with one click.
- Point-to-point T31/XDR-like interfaces worked well to push clinical data to the ordering or referring physician (the Milford model), and a federated, edge proxy server containing a TP13/XDS.b-like Document Repository and Document Registry effectively synchronized clinical content between multiple health care organizations (the HealthAlliance model).
- Patient consent was not high (approximately 50 percent) because patients perceived their care as being provided by only one organization and not involving others. As a result, they did not see the need to participate in SAFEHealth, in part because only two organizations were participating. Patients will see greater value in SAFEHealth as more organizations participate.
- Providers were generally most satisfied when patient clinical data shared via SAFEHealth were filed directly into appropriate sections of the existing EHR. Sorting patient data by sections of the EHR (e.g., laboratory, imaging, etc.) makes it easier for providers to find relevant clinical information in a timely manner.

In the first year since AHRQ funding ended (September 2009), SAFEHealth continues to be an active HIE and a valuable resource to providers and patients alike in Central Massachusetts. There have not been any major disruptions or problems regarding its functionality or financial sustainability. Dr. Garber feels that SAFEHealth was a success because it followed, as he described, the three pillars for HIE success: establish trust among all stakeholders, provide value to all stakeholders, and fit efficiently into existing health care workflows.



Dr. Garber has disseminated his findings in over 30 presentations to national, State, and local groups and hopes to publish findings in the future. As of summer 2010, SAFEHealth has not been marketed or expanded to other organizations. Massachusetts is moving toward creating a statewide HIE with American Recovery and Reinvestment Act of 2009 funds. The developers of SAFEHealth plan to align with the forthcoming State system and are looking forward to the State's guidance on this matter.

Grant Title: SAFEHealth—Secure Architecture For Exchanging Health Information

Principal Investigator: Lawrence Garber, Worcester, Massachusetts

Grant Number: This project was supported by grant number 1 UC1-HS015220 from September 30, 2004, to September 29, 2009.

AHRQ Final Report: <http://healthit.ahrq.gov/UC1HS015220Garberfinalreport2009>

References

Garber LD. SAFEHealth – Architecture, workflows and policies. Massachusetts Health Data Consortium CIO Forum; 2009 Nov 18. Available at: [http://www.safehealth.org/about/SAFEHealth Presentation to MHDC CIO Forum - November 18, 2009.ppt](http://www.safehealth.org/about/SAFEHealth%20Presentation%20to%20MHDC%20CIO%20Forum%20-%20November%2018,%202009.ppt).

Garber LD. SAFEHealth - A public utility for electronically exchanging clinical information in central Massachusetts. HealthAlliance Hospital Grand Rounds; 2009 Mar 3. Available at: [http://www.safehealth.org/physicians/Health Alliance Hospital Grand Rounds - SAFEHealth.ppt](http://www.safehealth.org/physicians/Health%20Alliance%20Hospital%20Grand%20Rounds%20-%20SAFEHealth.ppt).



Using Human Factors Research to Increase the Success of a Health Information Technology Implementation



Medication errors—errors in prescribing, administering, or dispensing a medication—occur in nearly one out of five inpatient medication doses and account for 7,000 deaths per year. Many factors contribute to these errors, ranging from illegible handwriting to a lack of information about a patient’s drug allergies. Implementing systems and processes, such as computerized provider order entry (CPOE), where providers enter medical orders directly in a computer, has been shown to reduce medical errors.

The introduction of new technologies and systems has an impact on how health care providers work, thus the success of CPOE is in part based on how well the system is designed and integrated into the workflow of an existing health care system. Researchers from the University of Wisconsin-Madison and Geisinger Health System examined the effects of CPOE in four intensive care units (ICUs). The team collected and analyzed data to understand CPOE’s impact on 1) patient safety and the quality of care, 2) staff tasks and perceptions of the system, and 3) financial value. They also examined the effect of using human factors analysis tools (usability evaluation and proactive risk assessment) during the implementation of CPOE.

CPOE is an electronic application that allows clinicians to directly enter medical orders into a computer system. CPOE replaces traditional ordering methods such as paper, verbal, telephone, and fax.

With respect to patient safety and the quality of care, the research team found that although certain types of medication errors—particularly transcription errors (data entry errors that occur when information about a medication order is misread or miskeyed when entered into a computer)—were reduced with CPOE, new kinds of errors were introduced. CPOE was also associated with improvements in the timeliness of antibiotic medication delivery and the rate of ventilator-associated pneumonia.

The research team assessed the impact of CPOE on staff tasks and found that CPOE changes the work of physicians and midlevel providers, who are the primary intended users of this application. CPOE requires providers to specify many aspects of orders that were previously specified by nurses; therefore, nurses may be less burdened because they do not have to make assumptions about orders prescribed by the physicians or search for physicians to clarify their orders. While staff perceptions initially indicated short-term negative views of the impact of CPOE use on communication, timeliness, and quality and safety of care, these concerns dissipated after 12 months. CPOE appeared to have no significant impact on financial value; there were no noticeable changes in ICU costs or physician productivity during the study period.

By conducting human factors research—studying people and how they interact with products, devices, procedures, work spaces, and the environments encountered at work and in daily living—the team utilized methods for identifying issues and concerns with the user interface and workflow that could be addressed before the system went live to lessen the negative impact and increase effective use. Hospital staff found the human factors process valuable; they were able to identify potential problems with the system and potential negative impact on patients and providers before the system went live in the ICUs. These findings highlight the importance of continued research to identify how CPOE impacts safety of patient care and how to design and implement effective CPOE systems. As part of this research, Dr. Carayon and her team have developed a publicly available toolbox, including tools for usability evaluation; these are available at http://cqpi.engr.wisc.edu/cpoe_tools.



Health Information Technology Implementation to Address a Health Care Need

Research shows that nearly half of medication errors occurring in hospitals are preventable. There are many factors that contribute to medication errors, such as incomplete patient information at the time of ordering and illegible handwriting. CPOE can help decrease these errors by providing support for drug selection or dosing calculations, helping to avoid errors due to illegible handwriting, providing information to the prescriber about the patient as the order is written, and checking orders for problems such as drug allergies.

However, the success of CPOE depends on how well it is designed and integrated into the health care system's workflow. New technologies often change the way health care work is performed. As a result, while CPOE may reduce some medication errors, it may introduce new types of errors. In addition, if information is not presented clearly, it may be perceived as inappropriate or irrelevant, especially by physicians and other medical staff whose workload is already demanding and who work in complex care environments, such as ICUs.

The CPOE system examined in this study was part of a larger-scale, hospital-wide electronic health record implementation. EpicCare Inpatient Clinical System (version Spring 2006) was introduced in three phases.

- Phase I, June 2002 – Electronic availability of test results (laboratory, radiology, and cardiology results) and radiology images, as well as secure e-messaging among clinicians.
- Phase II, June 2005 – Electronic nursing documentation.
- Phase III, October 2007 – Order management (order entry by clinicians, pharmacist processing, and electronic medication administration documentation by nurses) and documentation by physicians and midlevel providers. This phase was the focus of the AHRQ-funded research.

Key Results

Principal investigator Dr. Carayon and her team used a variety of methods to evaluate the impact of the CPOE implementation and identified the following findings and outcomes.

To assess medication safety and quality of care, data on medication errors were collected through chart reviews. Quality-of-care data, including mortality rate, length of ICU stay, ventilator-associated pneumonia, and compliance with sepsis treatment guidelines are regularly compiled at Geisinger Medical Center (GMC) and were made available to the researchers. All measures were compared before and after CPOE implementation.

Overall, the number of medication errors did not change. There were, however, significant changes in the types of errors. For example, errors in transcription—the transfer of a medication order from a handwritten form into the electronic pharmacy system—were eliminated. However, duplicate orders occurred more frequently after the CPOE implementation. These findings indicate that new types of errors are emerging and highlight the importance of ongoing study to identify how and why CPOE impacts safety of patient care.

Study Participants:

Geisinger Medical Center in Danville, Pennsylvania, is a 403-bed teaching hospital with a Level 1 Trauma Center and serves as the main tertiary and quaternary care center for Central Pennsylvania. Four ICUs were studied:

- A 24-bed adult ICU
- An 18-bed cardiac ICU
- A 38-bed neonatal ICU
- An 11-bed pediatric ICU



Researchers did not find differences in the majority of quality-of-care indicators after the CPOE implementation. The two exceptions were that the rate of ventilator-associated pneumonia declined and the rate of compliance with the sepsis resuscitation “bundle” increased in the 6.5 months after CPOE implementation.

Because the timeliness of antibiotic medication administration has been identified as impacting mortality of ICU patients, data on antibiotic turnaround time were collected for the Adult ICU. Antibiotic turnaround time is defined as the time between ordering an IV antibiotic and administering the first dose of the medication. The researchers found that the overall turnaround time from medication ordering to administration declined significantly after the CPOE was implemented, from a median of 100 minutes to 64 minutes. This is primarily because there was a reduction in time, from 25 minutes to 5 minutes, between ordering and pharmacy processing.

To assess the impact on staff tasks and the workflow of ICU staff (including physicians, nurses, physician assistants, and nurse practitioners), the research team collected observation data and analyzed how ICU providers perform various tasks, as well as the frequency and duration of those tasks. Tasks were classified into four categories: 1) conversational, 2) review and documentation, 3) direct care, and 4) non-clinical.

The researchers found that CPOE changes the work of physicians and midlevel providers, who are the primary intended users of this application. One important change is that CPOE requires providers to specify many aspects of orders that were previously specified by nurses, pharmacists, and others. Therefore, nurses may be less burdened because they do not have to make assumptions about orders prescribed by the physicians or search for physicians to clarify their orders.

With respect to staff perceptions about CPOE, the team surveyed nurses, physicians, and midlevel providers about the usability of the system, defined as the degree to which a system is easy to use or user-friendly. The survey also addressed CPOE’s effect on communication, coordination, quality of working life, and perceptions of patient safety and quality of care. They found nurses felt less positively about the technology 3 months after implementation than did physicians and other ordering providers. However, nurses’ views improved over time, while physicians and other providers’ views became less positive over the next 9 months. In addition, declines in perceived communication timeliness, patient safety, and quality of care returned to pre-implementation levels 1 year after implementation. This finding suggests that the ICU staff were able to adapt to the new technology in a relatively short period of time.

To evaluate ICU costs, the researchers used GMC monthly financial data, including the total costs of laboratory work, pharmaceuticals, radiology, transfusions, and other treatment for patients in each ICU. These costs were compared before and after the implementation. There was no significant change in the financial data after the implementation.

The research team conducted a modified proactive risk assessment (PRA) to evaluate the CPOE system implementation as well as its potential impact on patients and

Why conduct human factors research?

Implementation of health IT, especially in complex care environments such as ICUs, can introduce change that may lead to increased workload for staff or generate other unintended outcomes. By performing usability testing and PRA to evaluate the technology and its consequences before implementation, problems can be identified and addressed to lessen the negative impact and increase effective use of the technology.



providers. As part of the PRA, a diverse team—including nurses, unit desk clerks, physicians, information technology staff, and hospital leadership—collectively reviewed the new system and identified the potential vulnerabilities inherent to the interface design and anticipated workflow. These issues pertained to a range of potentially negative consequences, including: patient safety and quality-of-care concerns, non-compliance with regulatory requirements, increases in cognitive burden on CPOE users, and worker inconvenience or distress.

After aggregating and prioritizing each vulnerability, they reviewed and addressed each through one or more ways: 1) a technology solution (e.g., modifying the system or the user interface), 2) process or workflow redesign, 3) pre-implementation and/or ongoing user training, or 4) “watchful waiting”—close consequence monitoring when researchers were unsure about a solution. For example, they found that staff were concerned that the order entry screen format may cause a clinician to not scroll through the entire page. Therefore, they used this feedback to alter the system, so that similar medication orders were grouped together, eliminating the need to scroll through the information. Dr. James Walker, Geisinger’s chief health information officer, reports that after the PRA and usability evaluation, everyone was in agreement that they have a much safer and more reliable process and tool.

I thought [the human factors approach] was a very useful process with different perspectives generating good discussion of potential issues.

Geisinger Employee

Findings from Dr. Carayon’s team indicate that new types of errors are emerging after CPOE implementation. This highlights the importance of ongoing studies to identify how CPOE impacts the safety of patient care and how to design and implement CPOE systems to avoid the introduction of new types of errors. Human factors research allowed the team to design and implement the technology more effectively at GMC, and to identify potential negative impacts on patients and providers before the system went live in the ICUs. These findings highlight the importance of continued research to identify how CPOE impacts safety of patient care and how to design and implement effective CPOE systems.

Based on positive staff evaluations and support and acceptance of the usability training and PRA, Geisinger continues to invest in technology optimization activities. Dr. Walker reports that each time Geisinger implements a new software or technology, they conduct usability evaluations. As part of this research, Dr. Carayon and her team have developed a publicly available toolbox, including tools for usability evaluation; these are available at http://cqpi.engr.wisc.edu/cpoe_tools.

Grant Title: CPOE Implementation in ICUs

Principal Investigator: Pascale Carayon, Madison, Wisconsin

Grant Number: This project was supported by grant number 1 R01 HS 015274 from September 1, 2004, to August 31, 2009.

AHRQ Final Report: <http://healthit.ahrq.gov/R01HS015274Carayonfinalreport2009>

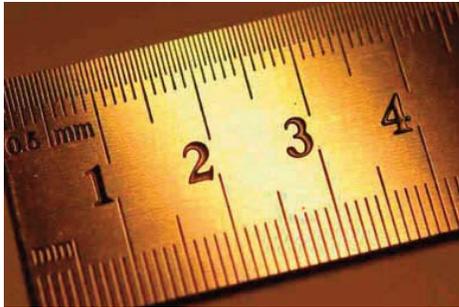


References

- 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: Sznclwar 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: Sznclwar F, Mascia L, Montedo U, editors. *Human factors in organizational design and management—IX*. Santa Monica, CA: IEA Press; 2008p. 369-75.



Measuring Quality in Physicians' Practices in Southwestern Missouri Using an Electronic Health Record



Current efforts to improve the efficiency and quality of medical care while decreasing costs involve improving the availability of patient's health care information. Electronic health records (EHRs) are patient medical records that health care providers can access via computers to review and record clinical information during patient encounters. EHRs capture such information as patient health histories, current medication lists, and test results. Quality measures that quantify the appropriateness and quality of care provided by a clinician or health care organization can be generated from

information contained across many records in an EHR system. Monitoring of quality measures as part of quality improvement process has been shown to improve clinicians' and organizations' compliance with clinical guidelines. While EHRs have great potential for assisting in the measurement of health care quality, data on quality of care are not automatically generated from these systems.

This project sought to establish the foundation for measuring quality of care using EHR technology in a group of ambulatory practices in southwestern Missouri. This was done by: 1) standardizing the EHR to collect the clinical patient data required for measuring quality of care and 2) evaluating the efficiency and accuracy of automated data coding (i.e., by EHR software) compared to manual coding (i.e., by an individual) of health data to measure quality of care.

The study involved 15 practices affiliated with Citizens Memorial Healthcare (CMH) in Bolivar, Missouri, with assistance from the Institute for Health Metrics and LSS Data Systems, Inc. These practices use the MEDITECH EHR system and deliver an average of 70,000 patient encounters per year combined. Demographically, CMH's patient population is older and poorer than the Nation's average.

In evaluating the project, automated EHR data extractions were found to be more complete (100 percent) compared to manual coding (less than 25 percent), better at identifying the eligible population, and more exact in reporting results from the EHR. One challenge was getting physicians to fully document all of the relevant information about a specific patient or visit in the EHR system that was necessary to measure quality. Based on findings from the project, incentives and performance feedback for physicians, further revisions to the EHR, targeted physician feedback, and training can be used to improve use of the EHR for quality measurement.

A toolkit was developed to help the CMH EHR vendor's other clients implement quality measures, and it will become publicly available in the near future. Findings from the project have been presented to stakeholders, including medical providers and clinical researchers.

The Challenge: False impression that implementing an EHR will cause quality measurement and reporting to happen by osmosis.
- Denni McColm, Principal Investigator



Using Electronic Health Records to Measure and Report on Quality of Clinical Care

A quality measure is a standardized assessment that quantifies the extent to which an individual unit within a population (person in a clinic, individual clinic among all clinics in a region) meets some criterion for quality of care. Quality measures use patient clinical data to quantify the appropriateness and quality of care provided by a physician or health care organization. Providing timely data to physicians on their performance on quality measures has been shown to improve their compliance with clinical guidelines. EHR systems have great potential for assisting in quality measurement by providing reliable, valid clinical data for quality measurements. Automating the extraction and reporting of measurement data through an EHR system should reduce staff and physician time and improve accuracy and timeliness of reporting quality performance data for external and internal purposes.

However, there are challenges to this. First, documentation occurs in many places within the EHR, complicating search algorithms and confusing results. For example, the result of a hemoglobin A1c laboratory test may be recorded in one place if completed in the clinic, another if completed by an outside laboratory that has an interface to the EHR, and another if received from a non-interfaced laboratory. In addition, clinical documentation is often not standardized or is unstructured (e.g., text).

The Centers for Medicare and Medicaid Services (CMS) administers a pay-for-reporting program called the Physician Quality Reporting Initiative (PQRI). This program offers incentive payments to eligible physicians and mid-level providers (nurse practitioners and physician assistants) who measure and report on the quality of care and services provided to Medicare patients. In 2009, physicians could choose from 153 PQRI quality measures in a variety of care settings and specialties. Reporting could be done through a PQRI-qualified registry, a qualified EHR system, or claims coding. In this study, automated data extraction of PQRI quality measures from the organization's EHR was developed and compared to claims coding.

The aim of this project was to use pre-existing EHR technology to facilitate quality measurement. All 15 physician practices were already using the ambulatory MEDITECH EHR, which was linked to a community-wide EHR called Infocare. More specifically, the objectives were to:

- Standardize the EHR to capture data elements needed to measure the quality of clinical care;
- Develop an automated data extraction system to provide feedback reports to physicians on their clinical quality performance;
- Demonstrate the efficiency and accuracy of automated data extraction and reporting; and
- Address technical, organizational, and workflow issues associated with measuring clinical quality.

Study Participants:

- Citizens Memorial Hospital is a public hospital district in southwestern Missouri.
- Institute for Health Metrics is a non-profit organization that assists health care facilities use their electronic data to improve quality.
- LSS Data Systems, Inc. is the Citizens Memorial Hospital EHR vendor that is certified by the Certification Commission for Health Information Technology.



The project was split into two phases. During Phase I (October 2007 through September 2008), the project team standardized the documentation systems and processes within the EHR (e.g., documentation templates, electronic prescribing, and documentation of allergies) so quality data could be extracted without interrupting physician workflow. Also, CMH established and implemented a manual claims-coding method for PQRI reporting to serve as a comparison. Since not all 62 PQRI quality measures selected for the purposes of this project could be manually coded, three quality measures related to diabetes care were coded for each physician. The three measures were blood pressure levels, hemoglobin A1C levels, and low-density lipoprotein levels. In Phase II (October 2008 through December 2009), the PQRI measures for ambulatory care were extracted from the EHR and reported using an automated data extraction tool. Automated coding from the EHR was compared to manual claims coding.

Data sources for the quality measures included patient demographics, billing data, medication lists, health maintenance items, immunization records, orders, vital signs, test results, and documentation queries from the EHRs. Documentation queries provided a large part of the data needed to evaluate PQRI compliance, such as tracking exclusions when patients refused the recommended therapy or tests.

Physicians, midlevel providers, and nurses were trained on the new documentation templates, tools, and queries using online learning, classroom training, and one-on-one training. Web-based reports were created to demonstrate CMH compliance with PQRI indicators at the organizational level using relevant clinical data.

Key Results

The automated data extraction of 62 PQRI quality measures from the EHR relied on documentation queries and existing data fields within the EHR to code results, exclusions, and additional requirements.

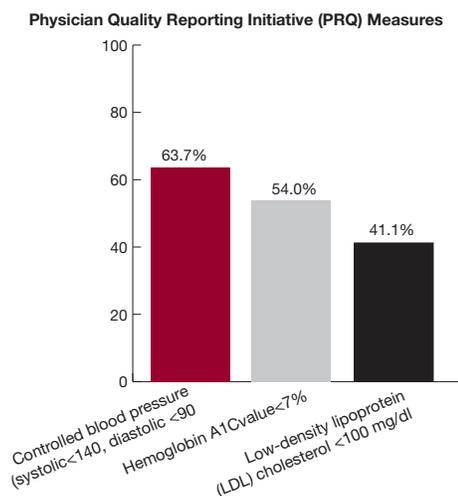
- For 50 measures, information to determine whether patients were eligible to be included in the PQRI measure (e.g., diabetic patients) was available in the demographic and diagnosis/procedure codes within the EHR.
- Twelve measures had additional eligibility requirements. For one measure, the additional requirement was found in the medication list; the other 11 measures required the development of documentation queries to determine eligibility.
- For eligible patients, half of the measurement results were found in existing fields of the EHR; queries were built to capture results for the other half of the measures.
- All of the quality measure exclusions were captured using queries.

Coding completeness was low for the manual coding; only 20 percent of the eligible cases for the diabetes measures were manually coded, and only 16 percent of the eligible codes were applied to those cases. Alternatively, automated data extraction achieved 100 percent coding completeness and did a better job identifying the eligible population. In addition, automated data extraction was more accurate in reporting results from the EHR than manual coding.

At this time, the PQRI program does not specify performance goals for controlling blood pressure, A1C, or LDL in diabetic patients. However, results from the current project demonstrated the following levels of performance at CMH using the automated data extraction.



FIGURE 1: REPORTING RESULTS FROM THE AUTOMATED CODING OF THREE DIABETES-RELATED PQRI MEASURES: PERCENTAGE OF DIABETIC PATIENTS WITH CONTROLLED BLOOD PRESSURE, PERCENTAGE OF DIABETIC PATIENTS WITH A HEMOGLOBIN A1C VALUE OF <7%, AND PERCENTAGE OF DIABETIC PATIENTS WITH LOW-DENSITY LIPOPROTEIN CHOLESTEROL <100 MG/DL.



Thus far, physicians at CMH-affiliated practices are not adequately documenting PQRI data elements, especially exclusions. By design, feedback was not provided to physicians during the project on their documentation in the EHR of PQRI data elements or on their performance on the 62 PQRI measures. Without incentives and feedback, physicians may not adequately document within the EHR all of the information that is needed to produce valid and reliable quality measures. Quality measurement can be done even without accurate documentation; however, it may not accurately reflect the quality of care that physicians are providing to their patients.

A number of strategies can be used to improve physicians' documentation within the EHR system. As part of the project, a Web-based report on aggregate organizational performance was developed for CMH. This report could be used to provide feedback on physician performance and thus increase compliance with quality reporting. Additional training could also be provided to physicians and their staff on quality measures and effective use of the EHR.

This project was specifically focused on standardizing and integrating data capture in an EHR system to automate coding of quality measures. In the future, feedback can be provided to clinicians on their performance on PQRI quality measures, which will ideally impact the quality of care they provide to their patients. A toolkit including the custom documentation queries was developed and will be made publicly available to other users of the EHR system in the future. The toolkit allows clients to use the queries with either manual coding or automated data extraction.

Grant Title: Standardization and Automatic Extraction of Quality Measures in an Ambulatory EMR

Principal Investigator: Denni McColm, Bolivar, Missouri

Grant Number: This project was supported by grant number R18 HS 017094 from September 7, 2007, to August 31, 2009.

AHRQ Final Report: <http://healthit.ahrq.gov/R18HS017094McColmfinalreport2009>



References

“Capturing PQRI Data: Lessons Learned from an AHRQ Grant.” Online presentation by Denni McColm of project findings on November 12, 2009, to an audience of 105 health care professionals and clinical researchers.

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.

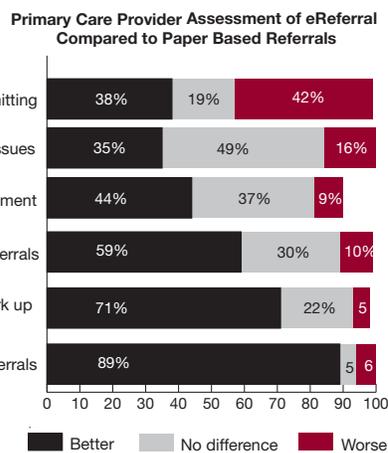


Electronic Referrals Show Promise for Improving Quality of Care in Outpatient Settings



This project evaluated a Web-based referral and consultation system (“eReferral”) developed by the University of California San Francisco (UCSF) at San Francisco General Hospital (SFGH). The eReferral system was designed to facilitate primary care practices’ consultative requests to specialty clinics and services (e.g., nephrology, radiology). This project demonstrated the success of the eReferral system and generated guidance on how electronic referral systems can be used to support improvements in health care processes and outcomes.

The primary care-specialty care referral process is often hampered by inadequate information exchange, a lack of critical information, and/or a clear reason for requesting specialist expertise. Safety net systems face additional challenges due to a shortage of specialists. Electronic referrals create an opportunity to improve information exchange, resulting in better allocation of specialty care visits, reduced wait times, increased efficiency, and improved clinical outcomes.



The eReferral system was designed to enable primary care physicians to submit a referral request to a specialist by completing an Internet-based form with a free-text reason for the request, taking the place of submitting requests by fax or telephone. On the receiving end of the electronic referrals, specialty clinics designate a clinical reviewer who can clarify the consultative question, request additional information, or triage the patients as needed. The primary care provider and specialty reviewer can communicate back and forth within the system until the issue has been addressed, with or without an appointment. By creating opportunities for increased clinical

review and communication, eReferral is designed to identify and expedite urgent cases, reduce premature referrals, and eliminate inappropriate referrals.

Among eReferral users, the system has been viewed as a success, showing promise for improving specialty access and the timely delivery of critical services. Having a relatively intuitive user interface and eliminating a paper alternative may also be contributing factors in the system's success. The success of the system was not without its challenges, as physicians also perceived increased administrative time to manage referrals as a negative consequence of the system.

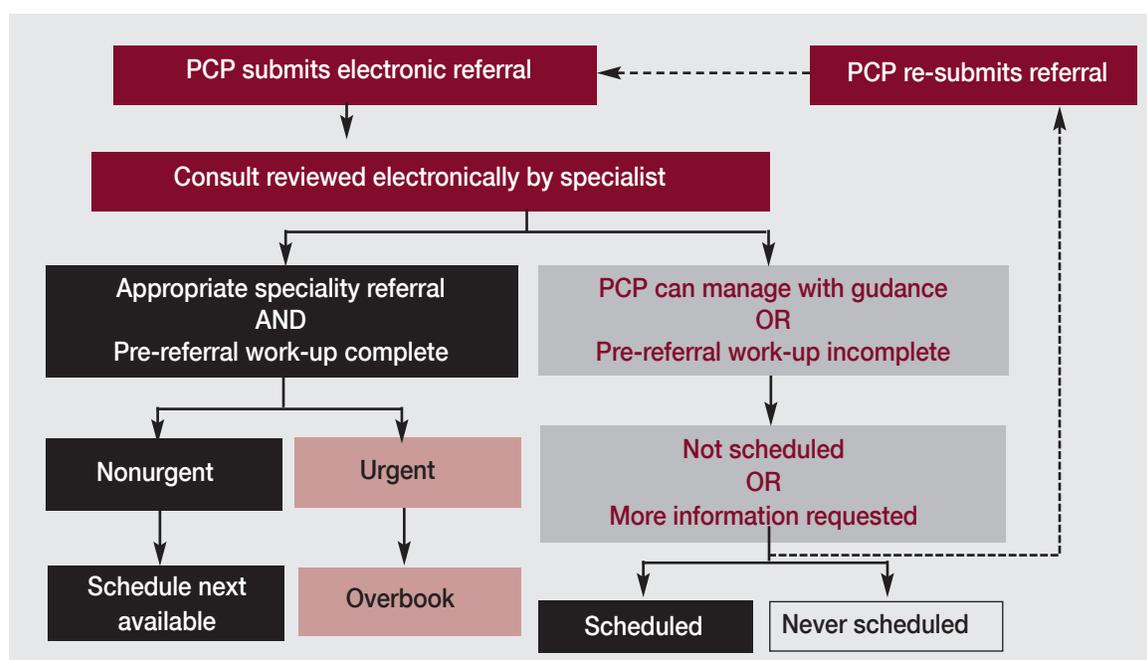
Based on this initial evidence, the eReferral system has been extended for wider use among SFGH specialty clinics and services. Similar systems modeled on eReferral have also been adopted by several safety net systems in California. The generalizability of these findings to other settings will depend on electronic health record infrastructure and financial incentives. While health IT can reduce waste and improve patient care, implementation processes need to account for changes in workflow and set realistic expectations for users.



Health IT Implementation to Improve Communication and Care Coordination between Primary Care and Specialty Care Physicians

The eReferral system was developed to streamline the referral process and improve access to specialty care. Prior to eReferral, the primary care provider (PCP) completed a handwritten paper referral form, which was then faxed to the specialty clinic, typically while the patient was still in the clinic. (In this study, PCPs were defined as either Family Medicine or Internal Medicine physicians or midlevel providers, such as nurse practitioners or physician assistants, who see adults and practice in primary care clinics.) Referrals were scheduled on a next-available basis, and there was no centralized method to track referrals. In contrast, in the eReferral process (illustrated below), relevant patient and physician information for each referral is automatically extracted from the electronic health record at SFGH and is linked to the electronic referral request for subsequent review. The role of the specialty clinician reviewer is to ensure the clarity of the consultative question, request additional evaluation when necessary, and triage appointment requests. The specialist reviewer and the referring physician can use the eReferral system to communicate back and forth until the clinical issue has been addressed, with or without an appointment. The reviewer's role is critical to the success of the system, as doctors felt that "the system is only as good as the reviewer."

THE eREFERRAL PROCESS



*Colors represent that process can go in two different directions.

This project consisted of three parts: 1) analyses of secondary data to compare indicators of the quality, efficiency, and accessibility before and after the use of eReferral; 2) semi-structured interviews to assess distinctive implementation practices and explore how these practices might influence the system's success or failure; and 3) work process modeling to estimate the net costs (versus savings).



The two-part intervention was one that 1) introduced the system in a new specialty clinic and 2) made improvements to enable greater use of the system by referring primary care physicians at affiliated community health centers. Evaluation of this system has shown promising results for improving specialty access and the timely delivery of critical services. Both specialty and referring-physician users perceived any differences in the time needed for the eReferral process as valuable contributions to patient care. Based on evidence that the eReferral system can increase efficiency and improve patient care, the system continues to be extended for wider use within SFGH and affiliated safety net provider organizations, and is under consideration by many other health care systems as well.

Key Results

Preliminary findings demonstrate the impact of eReferral on clinic efficiencies. Avoidance of unnecessary or premature specialty visits resulted in decreased wait times for routine appointments. This in turn decreased the use of overbooked appointments—those appointments scheduled in excess of available capacity in order to limit the impact of patient no-shows. When reviewers overbook patients, they are adding patients onto an already full schedule of patients and are forced to do so without taking into account staffing or space availability. The use of overbooked appointments results in unpredictable, overly busy clinics, with increased stress for clinicians, support staff, and patients. Decreasing the use of these appointment types can improve clinic flow and result in a more efficient and rational use of clinical resources.

I think the patient's visit is more productive because the specialists have already done some of the initial diagnostic work.

- Referring Physician

Analysis of the eReferral system logs demonstrated substantial initial decreases in wait times for routine new patient appointments. The only exception was in the Cardiology clinic, where wait times actually increased by 34 percent, from generally less than 40 days to the range of 40 to 60 days. This difference may be due in part to a relatively larger supply of cardiologists at the time when eReferral was launched, followed by a modest reduction in the number of specialists staffing the clinic. Cardiology wait times continue to be shorter than for most other clinics. The system logs also indicated that eReferral enabled acceleration of more urgent care, with some clinics having up to 37 percent of referrals expedited.

It's a lot of fun... Someone e-mails me and I give them advice... There's a fair number of times where I have to look something up. So I get to learn... to think... to educate. I don't have to deal with all the things that are why physicians don't like being physicians anymore.

- Specialty Reviewer

Results from a survey of specialist physicians found a significant improvement in their ability to identify the reason for and appropriateness of referrals. Results of a survey among PCPs indicated that eReferral improved quality of care for their patients but that IT connectivity posed significant problems for some clinics.

Semi-structured interviews were conducted with eReferral users in order to better understand the users' views about the benefits and drawbacks of eReferral. Results of these interviews indicate that the majority of users had favorable attitudes toward eReferral, despite several challenges such as increased workload for referring physicians, difficulty in notifying patients about their

appointments in specialty care, system design issues, and poor connectivity in some clinics. From the referring PCPs' perspective, the major benefits of eReferral over prior paper-based referral forms were



improved access to specialty care, enhanced opportunity for education, and the ability to track referral requests. The system was also credited with substantially improving communication between primary care and specialty care clinics and enhancing patient co-management. Uptake may have been enhanced by factors including mandatory use of the system (e.g., no paper alternative); the user-interface, which users perceived as intuitive and easy to learn; champions for the technology; and process adaptations implemented by some practices.

*It just keeps everything organized...It really helps me track everything a lot more easily than what we used to have...It's an electronic trail that is very logically set up.
- Specialty Reviewer*

In addition to studying the overall attitudes about using the eReferral system and the effects of eReferral on performance and quality of care, simulation modeling of the referral work processes was conducted. An estimate of labor costs and the net number of appointments associated with the referral process in eReferral was compared to the prior paper-based system. Simulation modeling was designed for both medical and surgical specialties based on a fixed referral base. Preliminary findings show that, while the “cost” of using eReferral was 6.1 minutes per referral, the number of

medical and surgical specialty appointments would decrease by 28 percent and 21 percent respectively. The net cost savings differed between medical and surgical specialties because in medical specialties, the reviewer role is filled by a physician, while in surgical clinics reviews are primarily conducted by nurse practitioners (rather than by surgeons).

In summary, eReferral is widely viewed as a success by specialists and referring physicians alike. The system has substantially improved access to specialty care and communication between specialists and referring physicians. It is important to consider that there is a learning curve for use of technologies. eReferral is a relatively new tool that people are learning to use and integrate into their daily work routines. While much of the data in this study was collected from practices that had been using eReferral for less than 1 year, it is possible that further benefits in both financial and quality outcomes will be realized as users gain more experience and technical features of the system are improved.

Contract Title: Use of Electronic Referral System to Improve the Outpatient Primary Care-Specialty Care Interface

Principal Investigator: Douglas Bell, Santa Monica, California

Contract Number: This project was supported by contract number 290-06-0018I-3 from August 1, 2008, to January 31, 2010.

AHRQ NRC Web Page: http://healthit.ahrq.gov/portal/server.pt/community/ahrq-funded_projects/654/projectdetails?pubURL=http://wciplibcontent/publish/communities/a_e/ahrq_funded_projects/projects/use_of_electronic_referral_system_to_improve_the_outpatient_primary_care_specialty_care_interface.html

References

Chen AH, Kushel MB, Grumbach K, Yee HF Jr. Practice profile. A safety-net system gains efficiencies through 'eReferrals' to specialists. *Health Aff (Millwood)*. 2010 May;29(5):969-71.

Kim Y, Chen AH, Keith E, Yee HF Jr, Kushel MB. Not perfect, but better: primary care providers' experiences with electronic referrals in a safety net health system. *J Gen Intern Med*. 2009 May;24(5):614-9.

Kim-Hwang JE, Chen AH, Bell DS, et al. Evaluating electronic referrals for specialty care at a public hospital. *J Gen Intern Med*. 2010 Oct;25(10):1123-8.



Electronic Standing Orders in Primary Care Offices Boost the Delivery of Adult Vaccinations and Other Health Maintenance Services



Patients make appointments with their primary care clinicians for a variety of reasons. Essential services such as screening tests, adult immunizations, and diabetes care may be overlooked if they are not the reason for the health care visit. By organizing and reviewing key information from a patient's electronic health record (EHR) at each visit and through careful review of the patient's medical record regardless of the reason for the current appointment, as-needed essential services can be identified and addressed.

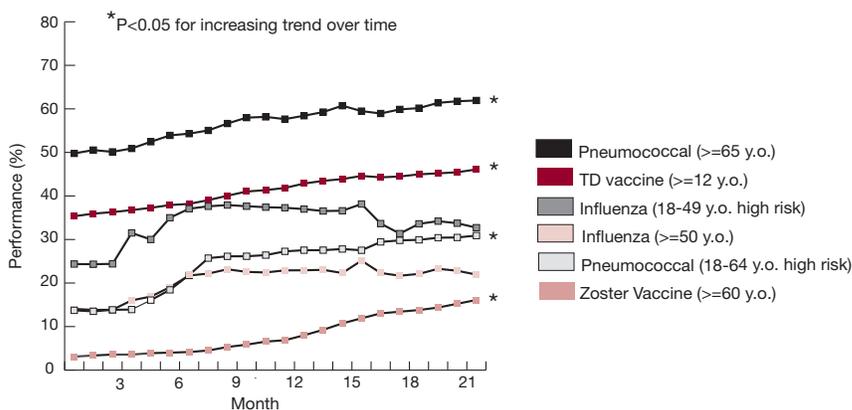
A standing order (SO) authorizes nurses and other appropriate medical staff to carry out services in the doctor's office or to prescribe essential health maintenance services, which can be scheduled elsewhere (e.g., bone density scan). While SOs are triggered by a patient visit to their clinician's office, SOs do not require that the patient be examined. This pilot project implemented and examined the effectiveness of an electronic SO process through the creation of a health maintenance report and other information technology functionalities. Study sites used a common commercial EHR, McKesson, which was customized to deliver appropriate health services at the right time for the patients.

Eight primary care practices implemented and evaluated electronic SOs for 15 measures in the areas of preventive screening, adult immunizations (Figure 1), and diabetes care. Participating practices reported 6 to 10 percent improvements in preventive care screenings, 8 to 17 percent improvements in adult immunizations, and up to 18 percent improvements in diabetes care measures. Interviews with practice staff revealed that the time commitment contributed to implementing standard orders was minimal and not a deterrent to participation. This pilot project demonstrated that by empowering staff to carry out SOs, practices can improve the efficiency and quality of care by facilitating the timely delivery of necessary preventive services to patients.

The project made us more aware that our patients were missing regular health maintenance....we did not realize that we missed this. We are now keeping up with their health maintenance issues, and patients realize that they are cared about.

- Participating Physician

Figure 1. immunization Performance Measures Over Time: Monthly Medians Across All 8 SO-TRIP Practices



Health IT Implementation to Address a Health Care Need

The Practice Partner Research Network (PPRNet), a member-driven, practice-based learning and research organization, was the lead agency for this project. Currently, PPRNet has 160 physician practices, representing over 850 health care providers, and approximately 1.8 million patients located in 41 States (<http://www.musc.edu/PPRNet/>). Its members consist of 73 percent family medicine physicians, 21 percent internal medicine physicians, and 6 percent specialty or other type practices. Although practice-based research networks have been in existence for many years, PPRNet is unique in that all of its members use the McKesson EHR system to capture their patient information. A total of eight PPRNet member practices from eight different States were selected for participation in this project. Two of the practices serve a rural population, and one practice serves a population with a high proportion of Hispanic patients.

Screening recommendations from 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 were used as the basis for creating the electronic SOs and the electronic SO quality-of-care measures. A customized EHR health maintenance (HM) template served as the electronic SO provider reminder. The HM template outlined the schedule of testing, screening, and immunizations that should be provided to each patient based on the patient’s disease, age, and gender. The HM table (Table 1), in contrast to the HM template, aggregates the recommended services from multiple HM templates into one location. The HM table indicates a patient’s need for a preventive service and can be used to track if the patient received these services. Overdue items appear highlighted in red in the HM table for easy viewing, serving as electronic reminders.

TABLE 1 - SAMPLE HEALTH MAINTENANCE TABLE*

Alcohol	50-64 YEAR OLD FEMALE	04/10/2011	X	
Aspirin Therapy	Multiple			
BP	Multiple	11/09/2009	X	
Cholesterol	50-64 YEAR OLD FEMALE	05/24/2002		
Colonoscopy	50-64 YEAR OLD FEMALE			
Creatinine	ACE INHIBITOR	09/11/2008		
Depression	50-64 YEAR OLD FEMALE	05/24/2002		
Diet Counseling	DIABETES MELLITUS	05/02/2010		X
Exercise Counsel	DIABETES MELLITUS	05/02/2010		X
Eye exam	DIABETES MELLITUS	11/09/2009		
F.O.B.	50-64 YEAR OLD FEMALE	04/30/2010		X
Flex Sig	50-64 YEAR OLD FEMALE			
Foot Exam	DIABETES MELLITUS	11/09/2009		
Glucose,Fasting	50-64 YEAR OLD FEMALE			
HDL Cholesterol	Multiple	05/24/2002		
Height	50-64 YEAR OLD FEMALE	05/02/2014		X



Hemoglobin A1C	DIABETES MELLITUS	11/09/2009		X
Influenza vaccine	Multiple	05/24/2002		
LDL Cholesterol	Multiple	05/24/2002		
Mammogram	50-64 YEAR OLD FEMALE	05/24/2002		
Microalbumin, Ur	DIABETES MELLITUS	11/09/2009		
Pap Smear	50-64 YEAR OLD FEMALE	04/10/2012	X	
Pneumococcal poly.	DIABETES MELLITUS	11/09/2009		
Potassium	ACE INHIBITOR	05/03/2009	X	X
Smoking Counseling	Multiple	11/09/2009		
Tdap	50-64 YEAR OLD FEMALE	05/24/2002		
Triglycerides	Multiple	05/24/2002		
Weight	50-64 YEAR OLD FEMALE	05/02/2011		X
Zoster	50-64 YEAR OLD FEMALE	05/24/2002		

*Light red shading indicates what is overdue for the patient.

PPRNet previously developed a quality improvement (QI) model called the “PPRNet-Translating Research into Practice (TRIP) QI model” (for more information, please see: <http://www.musc.edu/PPRNet/model.htm>). This model served as the basis for assisting practices in incorporating the electronic SO into their systems and workflow using a set of core concepts on how to lead practice development and what to focus on for practice QI. Following this model, the research team convened a meeting of participating practices during which all of the participants made plans to introduce the project within their practice, and to configure their patient records to assure that the relevant HM templates were available for use. A site visit was made by research team members within 2 months of the meeting to further reinforce the project goals and to help the practice with any implementation issues. Monthly correspondence with each practice helped the project staff to understand the practices’ experience using the SO interventions and to provide assistance. Correspondence with practice teams focused on learning the successful strategies that the practices had used to implement their electronic SO system.

A second site visit was made at the midpoint of the project to further understand how the project was implemented and help practices overcome any new or ongoing technical issues with the process. A second network meeting was held in September 2009 in Charleston, South Carolina, during which each practice presented their specific experiences in implementing electronic SOs. This meeting encouraged discussion, further reflection by practices, and reconsideration/revision of their own plans and strategies.

A final site visit or evaluation phone conference took place within the last quarter of the data collection period to elicit final perspectives related to the project and perceptions about sustainability. Three practices had only two site visits: one practice had successful adoption of the intervention, and no additional learning was expected; one practice did not have interim data to report at the midpoint of the project due to data extraction problems (which were eventually solved); and one practice had too many conflicting priorities and had not demonstrated adequate success to warrant a third visit.



Key Results

The electronic SO intervention was customized to each practice based on the unique characteristics of the participating practice. To evaluate the success of the intervention, practices submitted EHR data extracts on a quarterly basis. The research team used these extracts to measure the presence of HM templates, use of the templates, and performance on the study measures for each practice. The “presence” of the HM template was calculated as the number of patients that had the measure on their HM template divided by the number of patients eligible for the measure. The “use” of the template was calculated as the number of patients with an entry on the template divided by the number of patients with the measure on their template. Table 2 shows the percent change from the beginning of the study to study end, which increased in six practices, was relatively unchanged in one practice, and declined in another. Statistically significant changes over time were noted for osteoporosis screening, most immunizations, and urinary microalbumin testing.

TABLE 2: MEDIAN PERCENT OF ELIGIBLE PATIENTS WITH MEASURE ON HEALTH MAINTENANCE (HM) TEMPLATE AND MEDIAN PERCENT OF PATIENTS WITH HM TEMPLATE ENTRY AT STUDY BASELINE AND END

Measure	Eligible Patients with Measure on HM Template		Patients with HM Template Entry	
	July 1, 2008	April 1, 2010	July 1, 2008	April 1, 2010
Cholesterol (>=18 y.o.)	92%	97%	41%	56%
HDL-Cholesterol (>=18 y.o.)	21%	95%	16%	52%
Mammography (>= 40 y.o. F)	92%	99%	35%	60%
Osteoporosis (>=65 y.o. F)	94%	100%	9%	21%
Pneumococcal (>=65 y.o.)	91%	99%	40%	66%
Pneumococcal (18-64 y.o. high risk)	63%	79%	8%	35%
Influenza (>=50 y.o.)	51%	99%	8%	37%
Influenza (18-49 y.o. high risk)	52%	60%	4%	17%
Td Vaccine (>=12 y.o.)	96%	100%	26%	46%
Zoster Vaccine (>=60 y.o.)	0%	100%	0%	28%
Urine Microalbumin	68%	80%	9%	44%
Hemoglobin A1c	57%	80%	6%	54%
HDL-Cholesterol	85%	99%	37%	67%
LDL-Cholesterol	90%	97%	48%	76%
Triglycerides	85%	93%	37%	61%



Since receipt of a procedure (e.g., mammogram, any immunization) is in part assessed from data recorded on the HM table, increased use of the HM features rather than actual delivery of more services may have biased assessments of improvements for these measures. Also, since most practices ordered lipid measurements as panels (total-cholesterol, LDL-cholesterol, HDL-cholesterol, and triglycerides), improvements in one actual clinical procedure (obtaining a lipid panel) may exaggerate improvements in the summary measure which counted each lipid measure independently.

Qualitative methods were used to determine the barriers and facilitators to the adoption of and ability to sustain a new electronic SO system within each practice. The research team found that most successful practices had established policies and protocols, and educated their staff on their new roles. Staff in practices with significant improvement embraced the project with the support of leaders, and did not experience major time burdens. Technical competence and leadership were cited as important to optimally adapt and use EHR reminder tools and help staff adopt new roles and overcome barriers. Reinforcing the system was critical; successful practices followed up on the project with staff, soliciting staff input and posting quarterly performance reports to share successful approaches. Several practices provided trainings conducted by practice physicians to enhance staff knowledge regarding the system and implementation of the SO. Many of the practices took an incremental approach to implementing a set of measures at first and added others when success was demonstrated. Some practices focused on a more limited set of standing orders throughout the project and may have needed more time to demonstrate substantial improvements.

Two of the eight practices experienced more difficulty in demonstrating improvements. Difficulty incorporating the SO protocol in these two practices was related to larger practice size and diversity (multi-specialty and an internal medicine group) of clinicians.

As this research was designed as a pilot demonstration project using a small sample of practices to test the efficacy of this approach, future work should test the effectiveness in a larger sample of practices. Additional work is also needed to identify which clinical measures are best suited for inclusion in such SO protocols in the future.

Contract Title: Implementation and Evaluation of Standing Orders Using Health Information Technology

Principal Investigator: Lynne Nemeth, Charleston, South Carolina

Contract Number: This project was supported by contract number 290-07-10015-2 from June 1, 2008, to July 31, 2010.

AHRQ Background Report: http://healthit.ahrq.gov/portal/server.pt/community/ahrq-funded_projects/654/projectdetails?pubURL=http://wci-pubcontent/publish/communities/a_e/ahrq_funded_projects/projects/implementation_and_evaluation_of_standing_orders_using_health_information_technology.html



Building Bridges Workshop: Health Care Consumer Needs and the Design of Health Information Technology

Empowering health care consumers (i.e., patients) in their own health care is critically dependent on their ability to collect, store, and manage their “personal health information” (PHI) (e.g., medication information, health insurance, or information about a care provider). Effective management of PHI helps patients to better communicate with clinicians, which can lead to better health care decisions and better health care outcomes. Consumer health information technology (IT) refers to a wide range of hardware, software, and Web-based applications



that allow patients to participate in their own health care via electronic means. Effective consumer health IT systems are necessary to support the complex task of personal health information management (PHIM).

One of the most underused resources in health care in America is the consumer.

- Carolyn Clancy, Director, AHRQ

A 2-day AHRQ-sponsored workshop on PHIM brought together leaders from multiple disciplines and organizational perspectives to consider diverse consumer needs and how consumer health IT solutions should be designed to meet those needs (see Web site). Three key workshop themes that emerged are outlined below:

Defining PHIM:	Design Issues:	Steps for the Advancement of Consumer Health IT:
<ul style="list-style-type: none"> • PHI is managed in many ways, anywhere, anytime. • Factors such as health status, age, and attitudes about health and medical care influence PHIM. • An individual’s capacities, health, or family status, may change over time. • Systems need to be flexible and accessible to different types of users, across different settings. 	<ul style="list-style-type: none"> • Consumer health IT must account for the particular needs of the consumer. • Consumer health IT developers will also need to consider the particular needs, goals, preferences, and capacities of the people they are serving. • Tools should ensure that a patient decides who has access to his or her PHI. • Interactive tools should deliver information that is easily understood by the patient. 	<ul style="list-style-type: none"> • Additional research is needed on consumers’ PHIM practices and related design issues. • Collaboration within the industry should be encouraged, supported, and rewarded. • New technology requires a strong foundation to support use of tools on various types of systems.



Improving the Management of Personal Health Information

PHIM refers to the set of activities that support consumers' access, integration, organization, and use of their PHI. Ideally, PHIM involves successfully integrating diverse types and sources of information so that the consumer can effectively participate in his or her own health care. At the same time, PHIM involves a complex array of tasks that many consumers find challenging, such as tracking and integrating information from various sources, coordinating care across different providers, and making critical health care decisions.

The “Building Bridges” workshop was convened to develop a framework for characterizing PHIM that would inform the design of effective consumer health IT systems. In preparation for the workshop, two reports were developed to provide some context for the workshop and to facilitate discussion among the participants:

1) “Personal Health Information Management and the Design of Consumer Health Information Technology: Background Report,” which synthesized existing literature and evidence relating to:

- Consumers' personal information management (PIM) and PHIM needs and goals,
- Practices used for PIM and PHIM,
- Tools and technologies available to date, and
- Significant gaps in current understanding of PHIM.

2) “Personal Health Information Management and the Design of Consumer Health Information Technology: Secondary Analysis of Data from the Medical Expenditure Panel Survey,” which analyzed various recall techniques (e.g., relying on memory, recording information on a calendar or in a checkbook, or referring to consult documentation) as well as some influencing factors such as:

- Demographics.
- Socioeconomic characteristics.
- Volume of health information.
- Type of medical event.

The goals of the workshop and the final report were to promote the design of consumer health IT systems that are based on a solid understanding of consumers' PHIM practices. The patient's perspective was a central consideration in the discussions that addressed the following three objectives:

- Characterization of PHIM methods used by individuals and families.
- Establishment of an action agenda (for research and design, industry, and policy) for supporting consumers' PHIM practices through health IT.
- Development of recommendations for moving this agenda forward.

The success of the workshop was due in part to having a consultant from within the PHIM industry play a role in soliciting support for the meeting and helping to recruit participants. Throughout the 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 solutions. Participants were also asked to consider how well currently available tools meet consumer needs, and what changes or design innovations would be needed for systems to more fully consider the patient's perspective.



In a final report, the workshop participants developed recommendations and an action agenda for research, industry, and policy that consider the background information and rationale to support each recommendation. Participants noted that the field of health IT is so dominated by the physician perspective that the needs of the patient can often get lost. Currently, there are no existing systems, models, or classifications defining different PHIM user types, needs, practices, and goals.

Therefore, given that the field of PHIM itself is still in its infancy, there is an opportunity to incorporate consumers' needs into the PHIM framework by addressing the important question: "Who and what are we designing for?" To design systems in a way that realistically supports individuals, more information is still needed on what constitutes true user-centered design in this aspect of health IT. Therefore, the resulting recommendations from the workshop explain the need for future research and pertain to three main areas: 1) understanding user needs and context, 2) improving design of consumer health IT tools, and 3) evaluation research. Building a more robust consumer health IT infrastructure can support patient-centered care in several ways, such as empowering patients to become more knowledgeable partners in their health care, improving patient-doctor communication, and making tools and systems more widely available to all consumers.

We want to have personal health information tools that live with people.

*-Patricia Flatley Brennan,
Department Chair, School of Nursing and College of Engineering, University of Wisconsin-Madison*

Contract Title: Personal Health Information Management and Design of Consumer Health IT

Principal Investigator: Anne Peterson, Arlington, Virginia

Contract Number: This project was supported by contract number 290-2007-1007-2T-1M1 from July 14, 2008, to December 31, 2010.

AHRQ Background Report:

http://healthit.ahrq.gov/portal/server.pt/gateway/PTARGS_0_907458_0_0_18/09-0075-EF.pdf

References

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. HHS290200710072T). AHRQ Publication No. 09-0075-EF. Rockville, MD: Agency for Healthcare Research and Quality. June 2009.

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. HHS290200710072T). AHRQ Publication No. 09-0090-EF. Rockville, MD: Agency for Healthcare Research and Quality. July 2009.

Wilson C, Peterson A. Managing Personal Health Information: An Action Agenda. (Prepared by Insight Policy Research under Contract No. HHS290200710072T.) AHRQ Publication No. 10-0048-EF. Rockville, MD: Agency for Healthcare Research and Quality. March 2010.



Health Care Consumers' Perspectives on the Design and Use of Health Information Technology



Nationwide efforts to increase the engagement of consumers (i.e., patients) in their health care—known as patient-centered care—and the adoption of health information technology (IT) are transforming the U.S. health care system. Health IT involves the use of computer hardware and software to store, retrieve, and share health care information for communication and decisionmaking. Health IT systems, such as electronic health records (EHRs), are primarily being designed and marketed to meet clinicians' need for information about their patients, and to provide a means of evaluating the quality and efficiency of care provided. Health IT is expected to help patients participate in their own care by allowing greater access to health data (e.g., through personal health records [PHRs]) and an enhanced role in decisions about their health care.

The novel purpose of this project was to investigate health care consumers' awareness, beliefs, fears, and perceptions of health IT, and the potential role of health care consumers in the design and use of health IT. Twenty focus groups were conducted with everyday people from across the U.S., sampled from diverse backgrounds, including individuals from rural and urban areas, English and Spanish speakers, the insured and uninsured, and the healthy and chronically ill. Each focus group included two parts: 1) a 1-hour discussion about their awareness of health IT, as well as the capacities and issues associated with health IT, designed to “educate” participants about the topic; and 2) a half-hour discussion about the consumer role in the design and use of health IT. A copy of the discussion guide is available online in the final report. The results of these focus groups suggest that:

- More public education is needed about the relevancy of health IT to consumers and how consumers can influence its design, implementation, and use.
- Consumers expressed concern about the privacy and security of their medical information as records transition from paper to electronic media.
- Consumers also reported concern that use of health IT might make clinician encounters impersonal if clinicians focused more on the computer and less on the patients.
- There was disagreement over the extent to which patients should be involved in the design and use of health IT. A large number of participants said that health IT policy decisions should be left to experts in medicine and IT.
- Overall, focus group participants said that health IT would improve the quality and efficiency of health care they receive.

EHRs versus PHRs:

- EHRs are electronic versions of patient charts that clinicians and other health professionals access, review, and update with relevant medical information.
- PHRs are electronic personal health records that consumers maintain and access to review their health history.

That's your personal information. You should have every right to say how it's used.

- Focus Group Participant



Involving Patients in the Design and Use of Health Information Technology

Various surveys have explored public awareness and opinions about the value and benefit of health IT. Recent research suggests that there is some public awareness of current efforts to create a secure, nationwide health information network that will connect clinicians and allow patients' health information to follow them as they move through the health care system from primary, to specialty, to emergency, or to long-term care. Americans generally report that EHRs will improve health care quality in the U.S.; however, they also expressed the need for assurances about the privacy and security of their medical data. Some patients expressed concern that the transition to EHRs will increase the chance that unauthorized people beyond their clinicians' offices will gain access to their medical records. Furthermore, education about health IT is needed. Surveys have shown that the public is ill-informed about health IT, especially the distinctions between capabilities of EHRs and PHRs, and how clinicians use EHRs.

The goals of this project were to 1) better understand health care consumers' awareness, beliefs, perceptions, and fears of health IT; and 2) learn how and at what point patients want to be engaged in the development of health IT. Focus groups were conducted with members of the general population to explore issues identified by prior survey research. Four focus groups were conducted in each of the five Census Bureau regions of the United States (Mid-Atlantic, West, Midwest, South, and Northeast) for a total of 20 groups. Individuals who had at least one visit with a clinician in the prior 2 years—either for their own health care or for that of a close family member—were eligible to participate in the focus groups.

During the first hour of the focus groups, the moderator presented several questions for participants about the capacities of and issues related to health IT, including:

- The shift from paper-based systems to electronic systems like EHRs.
- The impact of health IT on patient-provider communication.
- The security of electronically-stored patient data.
- The use of patient data in research and for quality monitoring.
- The use of health IT by clinicians to manage prescriptions, order and receive medical test results, manage chronic diseases, and manage infectious disease outbreaks.
- The use of clinical decisionmaking applications (i.e., software that helps clinicians during patient visits with decisionmaking tasks related to diagnosis, disease management, and treatment) and sharing of patient data with other clinicians.
- The use of PHRs by patients.
- The use of telemedicine (i.e., transfer of medical information from provider-to-provider or provider-to-patient through the use of interactive audiovisual media for purposes of consulting or medical examination) in rural areas.
- The impact of health IT on health care costs for both clinicians and patients.

Focus Group Participants:

- Unprecedented gathering of diversified health care consumers.
- Diversity at consumer level: Efforts were made to recruit a diverse group of consumers with respect to age, gender, education, socio-economic status, racial/ethnic backgrounds, immigration status, linguistic capacity, and health insurance status (HMOs, Medicare, Medicaid, uninsured, etc.).
- Diversity at community level: Participants were recruited from both rural and urban geographic areas with varying levels of HMO penetration.



These questions and the resulting discussion served to educate the participants as to the potential benefits and risks of health IT. For the remainder of the discussion, the moderator explored participants' general awareness of health IT (e.g., whether and why their clinicians used computers, and patients' own use of health IT) and the extent to which patients and other health care stakeholders (e.g., clinicians, insurance companies, and the government) should be engaged in the design and use of health IT (including their respective roles, when to become engaged in decisionmaking, topic areas, and how patients should communicate with other stakeholders about their preferences).

Key Results

Although health care was important to the majority of the participants in the focus groups, most did not have strong opinions about health IT. A little over half of participants reported seeing clinicians use computers during patient visits, and most participants in the focus groups were unaware that

PHRs existed. Even though they had little personal experience, group participants overall said that health IT had both potential risks and benefits.

Many participants said that clinicians' ability to access patient medical history by computer and share patient information with other clinicians electronically was beneficial and would improve the quality of patient care. Conversely, participants were concerned about the impact of health IT on the security and privacy of patient data. These issues were especially important to participants due to their belief that medical data "was no one else's business" and should not be shared without the patient's permission.

I always have that fear of sending information into cyberspace and it getting hacked or getting intercepted in some way. I think it pays to be a little paranoid.

- Focus Group Participant

Everything else has been hacked. Government files have been hacked; banks have been hacked. My credit cards have been stolen. What else is left?

- Focus Group Participant

Participants said that health IT could potentially improve the efficiency of the health care system. For example, several participants described positive experiences with receiving xray examinations and having the images available moments later when they returned to their clinicians' offices. However, most expressed doubt that improvements in health care efficiency related to health IT would reduce their own medical expenses. In fact, some participants reported concern that the costs of implementing and adopting health IT would be shifted from medical practices to patients.

In discussions about patients' role in health care and the added benefit of health IT to them, focus group participants generally perceived their role as passive, meaning few participants—regardless of their health status at the time—saw the potential for health IT to empower patients and enhance their role in their own health care. Before learning more as part of the discussions, participants were not able to

When my doctor comes in ... she has, like, a big, thick [file] because I've been going to her for years ... But, if she had a laptop or something, she'd be able to go back to that date and time and just pull that up and it would pop right up. It would be easier for her, as far as being organized and being systematic.

- Focus Group Participant



describe how they could use health IT or how it could enhance the health care decisions they make with their providers.

A large proportion of participants expressed uncertainty about whether patients should be involved in the design and use of health IT. Reasons for this uncertainty included perceptions that: 1) patients may not have the expertise to make such decisions, 2) health IT was developed solely for clinicians, and 3) health IT was already in use so patients should only be concerned with data privacy issues.

In spite of the perceived passive nature of and uncertainty about patients' role in the design and use of health IT, there was almost complete agreement across groups that patients should have a say in how electronic medical data are shared and used, including being able to set limits on the use of their medical information. Many participants said that patients' consent should be required before medical records are released, even in emergency situations. Further, participants said that patients should be asked to consent to the storage of their medical records in an electronic system, and that the consent process should take place in their clinician's office, either directed by the clinician or his/her office staff.

Focus group participants were asked to consider when and how patients should be engaged in the design and use of health IT. Many participants said that if patients have a role, it should begin early in the process. Based on the focus group results, the following strategies for engaging patients in health IT design and use were identified:

- Health IT vendors, clinicians, and the Federal Government asking for patient opinions or perspectives through surveys and focus groups;
- Elections or referenda being held;
- Patients writing letters to elected officials;
- Patient advocacy organizations speaking on patients' behalf; and
- Patients serving on advisory committees of hospitals or health care networks.

Lastly, the focus group results suggest a need for public education about health IT, focused specifically on how health IT will affect the patients' experiences, and how and why their opinions matter in its design and use. In addition, because concerns about privacy were so prevalent among participants, there is a need for public education about how the security and privacy of electronic medical data can be assured. Future focus groups should be held after more widespread adoption of health IT to assess any changes in public understanding of the benefits of health IT and its impact on quality of care and patient experience.

Contract Title: Consumer Engagement in Developing Electronic Health Information Systems

Principal Investigator: Jeffrey Kerwin, Rockville, Maryland

Contract Number: This project was supported by contract number PSC T0#07R000131 from September 2008, to June 30, 2009

AHRQ Final Report:

http://healthit.ahrq.gov/portal/server.pt/gateway/PTARGS_0_1248_888520_0_0_18/09-0081-EF.pdf



Strategies for Integrating Usability in Electronic Health Records

An electronic health record (EHR) contains patient demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data, and radiology reports and is generated by one or more encounters at a health care delivery setting. EHR systems can reduce information burdens on clinicians and help them to improve the efficiency and efficacy of care. "EHR usability" refers to how easily health care practitioners learn to use an EHR and how satisfied they are with its ability to support efficient and effective patient care.

There is strong evidence (outside health care) that usability testing in the design and development phase is more effective and less expensive than after market release.

- Expert Panel Member

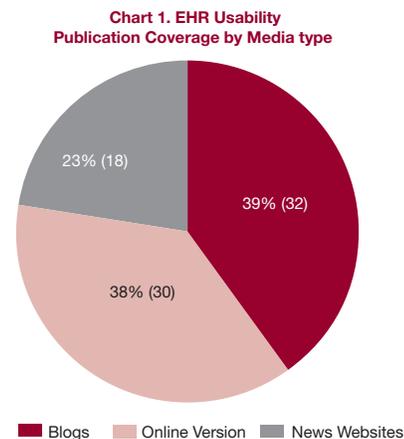
The development of software features, functions, and technical requirements have been researched thoroughly; however, there still remains a lack of information about the usability of EHRs in practice and the implications of their design. Significant investments in health information technology (IT) are being made across the country, and the influx of resources into the EHR market will stimulate innovative ideas. This project

represents AHRQ's first initiative to guide innovation in usability to benefit potential health IT users and increase the body of knowledge in this important area.

A group of eight EHR vendors participated in informal interviews to provide insight into current vendor-based practices for integrating usability across an EHR's entire development life cycle, and a multidisciplinary panel was convened to explore key issues related to usability evaluation and interface design considerations for EHR usability. Three resulting reports focus on key areas of interest to policymakers, researchers, and EHR developers and outline several important recommendations to assure EHRs better meet the needs of the changing health care environment:

- Interface Design Considerations identifies policy and research actions to improve usability.
- Evaluation and Use Case Framework reviews the evolving role of EHRs and the need for a practical, common usability evaluation framework.
- Vendor Practices and Perspectives provides insight into current vendor-based practices for integrating usability during the entire life cycle of the product.

An aggressive dissemination strategy was initiated, the results of which are represented in Chart 1. While the download of online versions of the reports was the second most frequent dissemination method, blogs and news Web sites have considerably larger viewer bases and facilitated wider exposure of the reports to the target audiences.



Increasing Usability of EHRs

The project team identified and convened a multidisciplinary panel to begin exploration of improving EHR usability through the application of information design principles. The panel was comprised of practicing clinicians, researchers, leadership of care delivery organizations, health IT vendors, other IT vendors, and health care member organizations. Many panel members serve or have served on the Certification Commission for Health Information Technology (CCHIT), the recognized organization that develops the comprehensive, practical definitions of what capabilities are needed in EHR systems. The interviewed EHR vendors were identified with support from the CCHIT and AHRQ, and represented small, medium, and large businesses. The number of clinician users per company varied from 1,000 to more than 7,000, and revenue ranged from \$1 million to more than \$10 billion per year.

Key Results

The three areas of exploration that marked the focus for this project are: Evaluation and Use Case Frameworks, Interface Design Considerations, and Vendor Practices and Perspectives. Each of these areas is discussed in the following sections.

EVALUATION AND USE CASE FRAMEWORKS

Many methods for evaluating the usability of EHRs are available. The panel summarized a usability evaluation framework that combines these methods into one table. The pertinent categories for usability evaluation and their descriptions are listed in Table 1. The panel also created several use cases—defined as a description of a system’s behavior and appearance as it responds to stimulus (e.g., commands, incoming information)—to improve the overall design of EHR-user interaction by illustrating key functionality, organization, and visualization principles of effective user interface design.

TABLE 1: EVALUATION FRAMEWORK

Usability Evaluation Criteria	Description
Software-User Interaction	Design characteristics that support the user-system interaction.
Usability and Design	The ability to provide necessary system information to the user when needed.
Learnability	Minimizing the learning curve associated with system.
Cognition Facilitation	Appropriate information should be displayed, graphics and visualizations used effectively, and clutter should be reduced or eliminated.
User Control and Software Flexibility	User control of the system and appropriate flexibility available to tailor the system to meet their needs.
System-Real World Match	System interfaces serve as representations of systems, processes, and items that exist in the real world.
Graphic Design	Color, layout, placement, readability, use of text, numbers, and symbols.



Consistency

Consistency across all screens and functions for reducing the effort required to navigate the system, locate necessary functions, and interpret information.

INTERFACE DESIGN CONSIDERATIONS

The expert panel recommended several actions to support the development of an objective usability evidence base, incorporate lessons learned from other industries, and systematically improve the usability of EHRs. The panel's recommendations were categorized into research-based activities and policy actions.

Research

- Document patterns of clinician information use in EHR systems.
- Develop and evaluate use cases and tools to evaluate EHR implementations for adherence to usability principles and best practices.
- Develop ways to measure the impact of usability and information design on ergonomic and cognitive workload, data awareness and comprehension, patient safety, clinician decisionmaking, and efficiency of care delivery.
- Maximize efficacy of adaptive displays, defined as data displays that change the nature or format of information presented for viewing 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 for EHRs to display complex information.
- 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

- Establish certification requirements for EHRs based on a practical and fair process of usability evaluation.
- Include usability/information design in the certification process.
- Require/strongly recommend that vendors establish and document their programs for testing the usability of their systems (people and processes), including evaluating potential impacts on quality and safety.
- Include EHR design and functionality in standards and guidelines.
- Develop a National EHR usability laboratory to support public-private collaboration and sharing of best practices.
- Develop tools and processes to support evaluation of products and implementation.
- Assist health IT vendors in product development and health care organizations in effective implementation of EHRs.



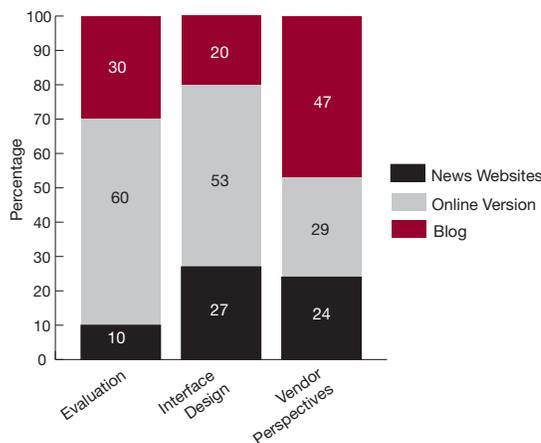
VENDOR PRACTICES AND PERSPECTIVES

During interviews, all vendors expressed a deep commitment to the development and provision of usable EHR products. Vendors described usability engineering processes and the engagement of end users throughout the product life cycle. However, practices such as formal usability testing, the application of user-centered design processes, and personnel with expertise in usability engineering were rare. Based on feedback from interviews, the project expert panel made the following recommendations:

- Encourage vendors to address key shortcomings in current processes and practices related to the usability of their products. Most critical among these are lack of adherence to formal user-design processes and a lack of diversity in end users involved in the testing and evaluation process.
- Include variety of end-users in the design and testing process, and collect feedback from them throughout the product life cycle. Potentially undersampled end users include people from nonacademic backgrounds with limited past experience with health IT, and people with disabilities.
- Support an independent body for vendor collaboration and standard development to overcome market forces that discourage collaboration, best practices, and harmonization.
- Develop standards and best practices in use of customization during EHR deployment.
- Encourage formal usability testing early in the design and development phase as a best practice, and discourage dependence on postdeployment review supporting usability assessments.
- Support research and development of qualitative and quantitative tools that evaluate and report EHR ease of learning, effectiveness, and satisfaction.
- Increase research and development of best practices supporting designing for patient safety.
- Design certification programs for EHR usability in a way that focuses on objective and important aspects of system usability.



Chart 2. EHR Usability: Publication Coverage by Media Type



Media dissemination of the project publications through select sources is depicted in Chart 2; the major media dissemination method varied for each publication.

The companion documents developed by this project provide important direction for the future of EHR usability. The three resulting documents assist in defining a foundation for the development of a common framework for the evaluation of EHR design; recommend actions to support the development of an objective EHR usability evidence base and formative policies; and make recommendations about the role of usability in the development, testing, and deployment of EHR systems.

Contract Title: Use of Dense Display of Data and Information Design Principles in Primary Care Healthcare Information Technology Systems

Principal Investigator: Cheryl J. McConnell, Arlington, Virginia

Contract Number: This project was supported by contract number 290-07-10073T from May 1, 2009, to May 31, 2009.

AHRQ Project Reports:

http://healthit.ahrq.gov/portal/server.pt/gateway/PTARGS_0_1248_907505_0_0_18/09%2810%29-0091-2-EF.pdf

http://healthit.ahrq.gov/portal/server.pt/gateway/PTARGS_0_1248_907504_0_0_18/09%2810%29-0091-1-EF.pdf

http://healthit.ahrq.gov/portal/server.pt/gateway/PTARGS_0_11699_911984_0_0_18/EHRVendorPractices&Perspectives.pdf





AHRQ Publication No. 10-00095-3-EF
November 2010