



# A National Web Conference on the Use of Health IT in Practice-Based Research Networks (PBRNs) to Improve Patient Care

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2:30pm – 4:00pm ET



# Moderator and Presenters Disclosures

Moderator:

Rebecca Roper, MS, MPH\*

Agency for Healthcare Research and Quality

Presenters:

Alexander Fiks, MD, MSCE†

Zsolt Nagykaldi, PhD\*

Brian Yeaman, MD‡

Valory Pavlik, PhD\*

\*Have no financial, personal, or professional conflicts of interest to disclose.

† Dr. Fiks would like to disclose that he is a co-inventor of the “Care Assistant” that was used to provide clinical decision support in this study. He holds no patent on the software and to date has earned no money from this invention.

‡ Dr. Yeaman would like to disclose that he has a financial relationship with Yeaman and Associates and a professional and financial relationship with Cerner Corporation.



# Effectiveness of Automated Decision Support for Families, Clinicians, or Both on HPV Vaccination Rates for Girls

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Alexander G. Fiks, MD, MSCE

The Children's Hospital of Philadelphia  
(CHOP) Pediatric Research Consortium



# HPV Vaccination for Girls: The Problem

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- Rates of initiation and completion for the HPV vaccine are far lower than for other adolescent vaccines, such as Tdap or MCV4.
- Barriers to HPV vaccine receipt include:
  - high level of parental resistance to vaccination,
  - clinicians' delay of the initiation of the vaccine series beyond the recommended starting age, and
  - declining rates of adolescent preventive care with increasing age.
- Electronic health record (EHR)–based decision support offers the opportunity to influence families and clinicians to support vaccine receipt.



# Study Objective

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- To test the relative benefit of clinician-versus family-focused decision support to improve HPV vaccination rates for adolescent girls.



# Methods

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- **Design:**
  - This was a 1-year cluster-randomized trial of clinician-focused decision support (22 practices total).
  - Girls within each practice were randomized to receive family-focused decision support or none.
- **Study population:**
  - Adolescent girls aged 11–17 years due for HPV dose 1, 2, or 3 at any time during the 1-year study period were included.
  - Adolescents receiving any dose in family planning were excluded.



# Clinician-Focused Intervention

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- Clinicians were given education on adolescent vaccines, so that the alerts were meaningful.
- The training provided site-specific data derived from EHR-presented information on vaccine safety, vaccine efficacy, and overcoming barriers to receipt.

# Clinical Alerts

- Alerts were delivered through the EHR at the point of care.
- Decision support made clinicians aware of eligible patients in the office, initiating conversation and recommendations.
- Alerts included a list of what vaccines were due, when next doses were due, and what resources were available for assistance with ordering.

|                | Vaccines Due Now  | Order Today                         | Next Doses |          |
|---|---|-------------------------------------|------------|----------|
|   |  HPV | <input checked="" type="checkbox"/> | 5/1/2010   | 9/1/2010 |
|  Tdap          | <input checked="" type="checkbox"/>   |                                     |            |          |
|  Meningococcal | <input checked="" type="checkbox"/>   |                                     |            |          |
|  Varicella     | <input checked="" type="checkbox"/>   | 6/1/2010                            |            |          |
| <b>Upcoming Vaccines</b>  |   |                                     |            |          |
|  Influenza     |   | 10/1/2010                           |            |          |
| <b>Resources</b>  | <a href="#">ACIP schedule</a> <a href="#">VIS-multiple languages</a>                    |                                     |            |          |



# Feedback Reports

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- Made physicians aware of their own rates and how they compare to others in their practice and care network.
- Were generated from EHR data.
- Were hand-delivered quarterly.
- Included the number of visits at which the HPV vaccine was due, as well as the number and proportion of visits at which the vaccine was given.
- Included sick and well visits.



# Family-Focused Intervention

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- Educational calls were made when vaccines were due, with repeat calls made if no appointment was scheduled.
- Call scripts were created with input from practicing clinicians.
- Calls were delivered by an outside vendor, based on EHR-generated patient lists.
- Families were referred to an educational website that linked to the CHOP Vaccine Education Center.



# Sample Call

“Hello. This is the [practice name] calling from The Children’s Hospital of Philadelphia regarding [patient first name]. Our records show that the following vaccines are due and **recommended by your doctor: Human Papillomavirus, or HPV. Getting the full set of vaccines is an important part of protecting (patient name’s) health.** If you would like to learn more about the vaccines, go to <http://www.givetoteens.com>. Please call our office at [phone number] to schedule your child’s immunization visit. We look forward to seeing you.”



# Methods

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- **Outcomes:**
  - Vaccination rates among unvaccinated girls for each HPV dose
  - Time to vaccination for each HPV dose
- **Exposures:**
  - No decision support
  - Clinician-focused decision support
  - Family-focused decision support
  - Both clinician- and family-focused decision support
- **Covariates:**
  - Race, age group (11–13, 14–17), insurance status, practice setting (urban teaching vs. suburban nonteaching), oral contraceptive use, vaccine refusal

# Methods

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- **Statistical analysis:**
  - Kaplan Meier survival curves were generated for each vaccine dose, showing overall vaccination rate and time to vaccine receipt.
  - Standardized Cox proportional hazard regression models were implemented to adjust for covariates.
  - Bias-corrected bootstrap confidence intervals (999 samples) were reported for vaccination rates and time to vaccine receipt.

# Results

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- In the overall study population, N=22,478.
  - Combined intervention: 5,559
  - Clinician-focused only: 5,552
  - Family-focused only: 5,679
  - No intervention: 5,688
- 55% were white, 31% were African American, 2% were Asian, and 12% were other races.
- 67% were aged 11–13.
- 80% had private insurance.
- 20% received care at an urban teaching practice.
- No significant differences between study arms were found.



# Results

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- 194 clinicians (168 pediatricians and 26 nurse practitioners) participated.
- Clinician education results:
  - 60% attended the live session.
  - 14% viewed the recorded session.
  - 26% did not participate.

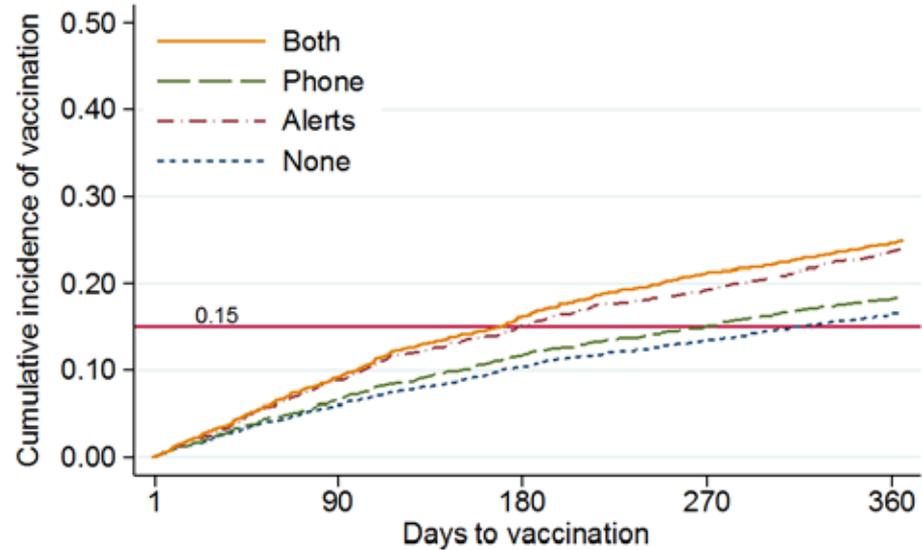


# Results

- Number of reminder phone calls made:
  - 14,534 for HPV1
  - 4,608 for HPV2
  - 4,622 for HPV3
- Response:
  - 47% listened to message in entirety.
  - 46% received a voicemail.
  - 3% hung up.
  - 4% of calls were not answered.
- Website usage:
  - Only 154 website hits over 1 year

# HPV Dose 1

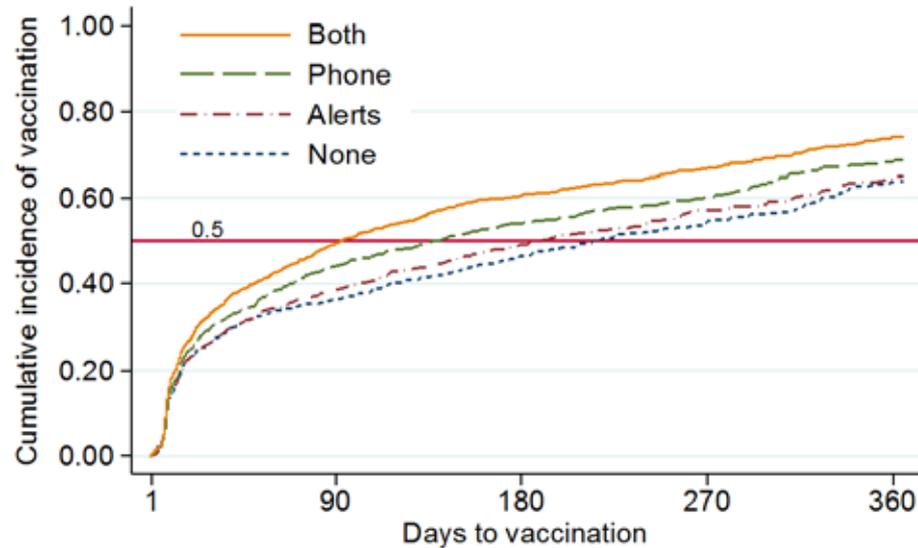
A HPV1 n=17,658



| Number at risk |      |      |      |      |      |
|----------------|------|------|------|------|------|
|                | 1    | 90   | 180  | 270  | 360  |
| Both           | 4369 | 3708 | 3193 | 2731 | 2274 |
| Phone Only     | 4440 | 3877 | 3440 | 2974 | 2476 |
| Alerts Only    | 4413 | 3746 | 3221 | 2765 | 2268 |
| None           | 4436 | 3898 | 3442 | 2983 | 2489 |

# HPV Dose 2

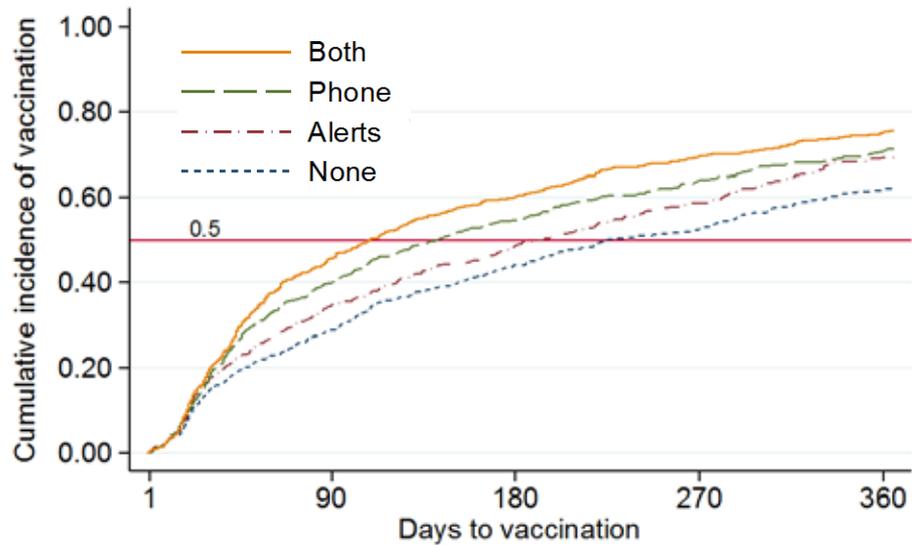
B HPV2 n=5142



| Number at risk |      |     |     |     |     |
|----------------|------|-----|-----|-----|-----|
|                | 1    | 90  | 180 | 270 | 360 |
| Both           | 1446 | 664 | 435 | 286 | 170 |
| Phone Only     | 1220 | 607 | 429 | 312 | 191 |
| Alerts Only    | 1346 | 744 | 504 | 322 | 208 |
| None           | 1130 | 658 | 468 | 330 | 211 |

# HPV Dose 3

C HPV3 n=4788



| Number at risk |      |     |     |     |     |
|----------------|------|-----|-----|-----|-----|
|                | 1    | 90  | 180 | 270 | 360 |
| Both           | 1307 | 586 | 323 | 190 | 118 |
| Phone Only     | 1204 | 623 | 387 | 259 | 159 |
| Alerts Only    | 1134 | 617 | 366 | 231 | 134 |
| None           | 1143 | 718 | 464 | 327 | 191 |

# Results

- Combined intervention was most effective for each dose ( $P=0.001$ ,  $0.008$ , and  $<0.0001$ ), with the highest final vaccination rates and shortest time to vaccination
- Clinician-focused intervention was more effective than family-focused intervention for HPV1 ( $P=0.007$ )
- Family-focused intervention was more effective for HPV2 and HPV3 ( $P=0.02$ ,  $0.03$ )

# Results

- Cost-effectiveness of family-focused decision support intervention:
  - Calculated the incremental cost of each additional girl vaccinated for the more effective single intervention for each dose compared to no intervention:
    - HPV1: \$3 (clinician-focused decision support)
    - HPV2: \$7 (family-focused decision support)
    - HPV3: \$4 (family-focused decision support)
- Assumptions: all costs except feedback delivery were spread across 10 years. Fixed costs were shared by the three doses.



# Limitations

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- This study was conducted at a single health care network in one region of the country.
- It was beyond the scope of this 12-month trial to follow subjects over time and evaluate the effect of intervention on HPV infection.



# Study Conclusions

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- To most effectively deliver HPV vaccine, both clinician- and family-focused decision support are needed.
- The cost of the decision support is low.
- The potential benefit of decision support for both families and clinicians should be considered in other clinical contexts.



# Lessons Learned

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- Both clinician- and family-focused support are needed to most effectively deliver HPV vaccine.
- This combined approach should be studied in other health settings and may be far more effective than focusing on only the clinician or only the family.
- Telephone referral to a website was not effective. Delivering website addresses in an electronic format (e-mail, text message, patient portal) may be more effective.



# Suggested Strategies for Similar Research

- Consider the family/patient, the health system, and the intersection of the two and how an intervention can best improve outcomes by focusing on one or more of these targets.
- In studies like this, it can be very helpful to deliver the intervention as an enhancement of usual care, which can waive the need for individual consent and allow for testing in real-world settings.
- The relative merits of using automated clinician vs. family decision support need to be studied in varied settings.



# Acknowledgments

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- We would like to thank the network of primary care clinicians, patients and families for contributing to this clinical research.
- This research was conducted by the Children's Hospital of Philadelphia under contract to the Agency for Healthcare Research and Quality, contract number HHSA 290-07-10013, Task Order 4, Rockville, MD.



# Contact Info

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Alexander G. Fiks

[fiks@email.chop.edu](mailto:fiks@email.chop.edu)

The Children's Hospital of Philadelphia  
Pediatric Research Consortium



# Q & A

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Please submit your questions by using the Q&A box to the right of the screen.



# Health Information Exchange With Intelligence (HIE-*i*)

## Connecting Clinical Decision Support (CDS) to a State-Wide HIE

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Zsolt Nagykalai, PhD, Brian Yeaman, MD, CMIO,  
Dewey Scheid, MD, MPH, Mark Jones, & James Mold, MD, MPH

University of Oklahoma HSC Department of Family & Preventive  
Medicine

Oklahoma Physicians Resource/Research Network (OKPRN)

Secure Medical Records Transfer Network (SMRTNet)

Norman Physician Hospital Organization (NPHO)



# Objective

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- Since the inception of health information exchange (HIE) in the early 1990s, formulating a convincing value proposition for end users has been a major barrier to sustainability in many HIEs.
- In this presentation, we demonstrate the development of a novel HIE architecture and describe a pilot study that provides a roadmap for building health information exchange with intelligence (HIE-*i*) by connecting clinical decision support (CDS) to the top level of a statewide HIE in Oklahoma.



# Context & Approach

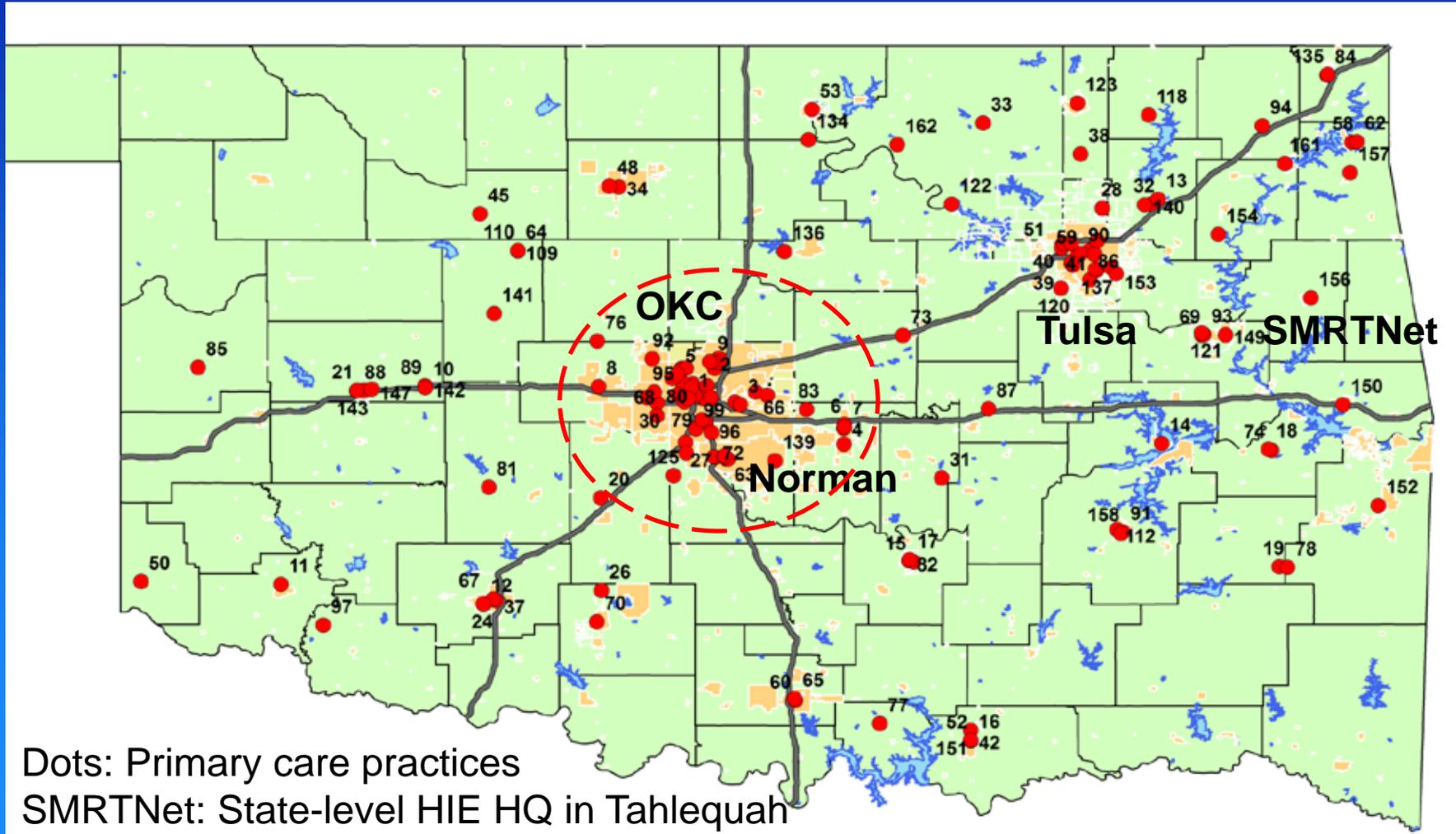
- A broad coalition of HIE stakeholders received an AHRQ Task Order Award (TO#17) in 2009 to design, build, and pilot test a novel information exchange infrastructure in Central Oklahoma.
- The demonstration project aimed at linking an existing regional data network in Norman (eHX Hub), including over 30 primary care practices, specialty practices, and the Norman Physician Hospital Organization (NPHO) to an array of Oklahoma City Metro area providers.
- We captured specialty referrals, hospital admissions, prescriptions, laboratory/imaging results, and emergency care from the HIE and leveraged this information at the HIE level to provide enhanced clinical recommendations for preventive services at the point of care.



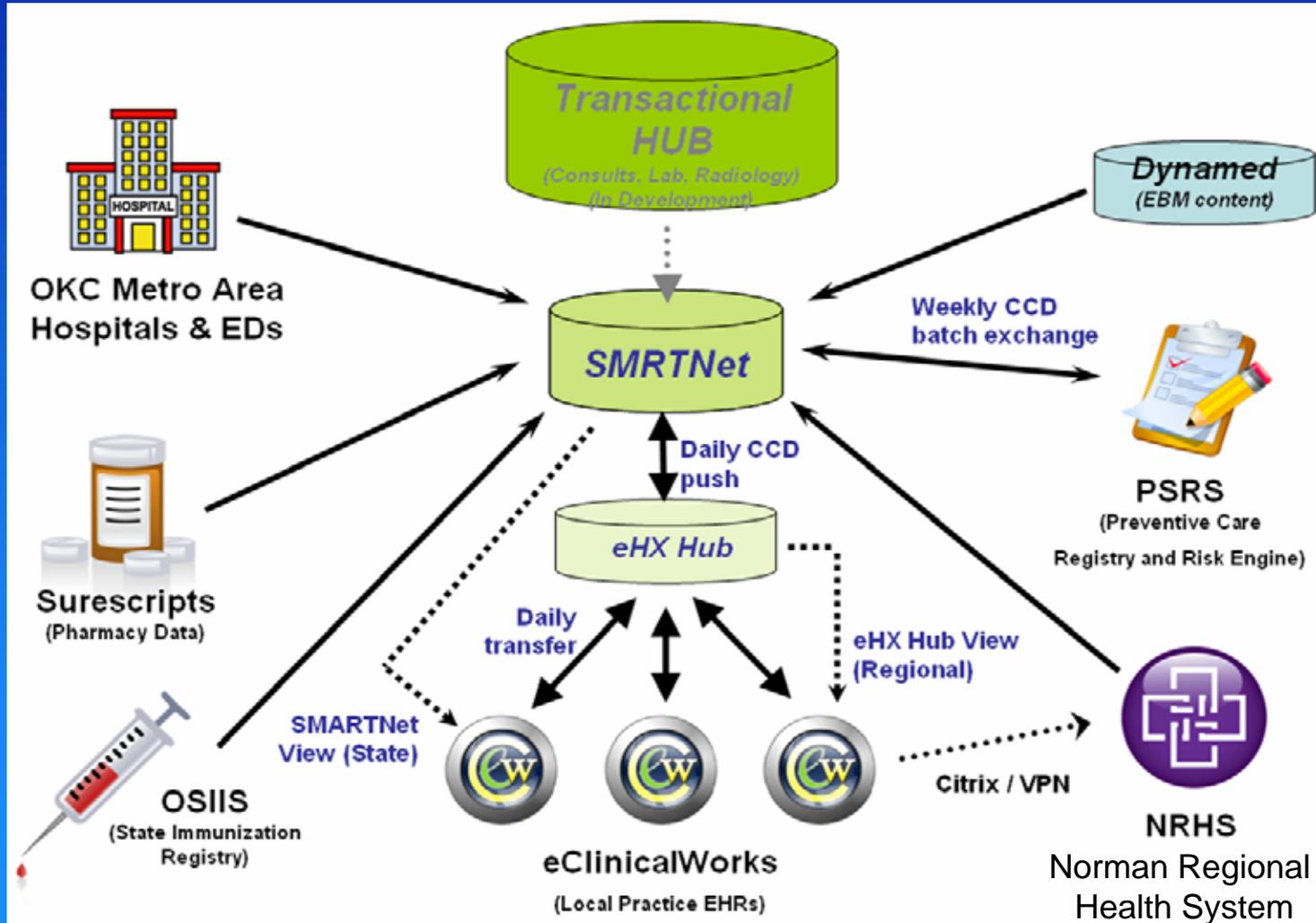
# Implementation Components

- Practice facilitation: We deployed a Practice Enhancement Assistant (PEA), another Oklahoma invention, to implement a strategic process of workflow assessment and redesign to integrate enriched continuity of care documents (CCD-*i*) into the clinical decision-support process at the point of care.
- Local Learning Collaboratives (LLCs): LLC team members from each practice met multiple times throughout the project to share and learn about successful approaches to adopting the new HIE technology.
- Pre- and postintervention data collection: At the beginning of, during, and at the end of the project, process and outcomes data were collected through the NPHO, SMRTNet eHX Hub, and practice-level patient records.
- Impact on practice workflow: Project staff conducted time-motion studies in each practice before and after the implementation of the HIE-*i* intervention.

# Implementation Locations



# HIE-*i* Architecture: CDS Brings Added Value





# HIE-*i* Architecture: Point-of-Care Decision Support Through the HIE

[Patient search](#) | [Patient register](#) | [Messaging](#)

[Return to search page](#)

**Disclaimer: [Hide]**

This record is an aggregate summary of medical information obtained from multiple participating healthcare providers. This clinical summary is intended to support optimal patient care. It is not intended to replace the patient's medical record nor is it guaranteed to encompass all historical information on this patient. It is provided to you in conformation with patient privacy requirements.

[REDACTED] Female 44 Years DOB: [REDACTED] HIE ID: [REDACTED] PCP: Home Phone: --

Page Search:

**Conditions(Problems) - [Default: All Historical]** [Details](#) [Print](#) [-/+](#)

| Problem                              | Code              | Status | Onset Date | Source      |
|--------------------------------------|-------------------|--------|------------|-------------|
| Other and unspecified hyperlipidemia | 272.4 (ICD-9 CM)  | Active |            | NPHO        |
| Other and unspecified hyperlipidemia | 272.4 (ICD-9 CM)  | Active |            | Browsersoft |
| Osteopenia                           | 733.90 (ICD-9 CM) | Active |            | NPHO        |
| Osteopenia                           | 733.90 (ICD-9 CM) | Active |            | Browsersoft |
| Depression                           | 311 (ICD-9 CM)    | Active |            | Browsersoft |
| Anorexia                             | 783.0 (ICD-9 CM)  | Active |            | Browsersoft |

Search:

**DIAGNOSIS - [Default: All Historical]** [Details](#) [Print](#) [-/+](#)

| Diagnosis                | Code        | Status | Date       | Source      |
|--------------------------|-------------|--------|------------|-------------|
| URIN TRACT INFECTION NOS | 599.0 (I9)  | Active | 10/24/2011 | Browsersoft |
| Datatype(DG1.4)-         | 780.79 (I9) | Active | 10/24/2011 | Browsersoft |
| TOBACCO USE DISORDER     | 305.1 (I9)  | Active | 10/24/2011 | Browsersoft |

Search:

**PROCEDURES - [Default: All Historical]** [Details](#) [Print](#) [-/+](#)

| Procedure          | Code          | Date       | PerformerSource |
|--------------------|---------------|------------|-----------------|
| Medicare F/U 99214 | 99214 (CPT-4) | 11/14/2011 | Browsersoft     |
| Medicare F/U 99214 | 99214 (CPT-4) | 10/26/2011 | Browsersoft     |

**VITAL SIGNS / CLINICAL RESULTS (Last 4 Results) - [Default: All Historical]- [No Results]**

**Radiology - [Default: All Historical]- [No Results]**

**History & Physical - [Default: All Historical]- [No Results]**

**Discharge Summary - [Default: All Historical]- [No Results]**

**Recommendations - [Default: All Historical]** [Details](#) [Print](#) [-/+](#)

The following recommendations are for preventive services needed for this patient based upon clinical information PSRS received from the HIE. These recommendations are suggestions only since patients may receive care at locations that do not currently contribute clinical data to SMRTNET.

| Recommendation               | Date       | Source |
|------------------------------|------------|--------|
| VZV1                         | 01/23/2012 | PSRS   |
| Tdap1                        | 01/23/2012 | PSRS   |
| Smoking status documentation | 01/23/2012 | PSRS   |
| Seatbelt use                 | 01/23/2012 | PSRS   |
| PAP smear                    | 01/23/2012 | PSRS   |
| MMR 1                        | 01/23/2012 | PSRS   |
| Meningococcal 1              | 01/23/2012 | PSRS   |
| Mammography                  | 01/23/2012 | PSRS   |

Search:

**Provider Reports - [Default: All Historical]- [No Results]**



# HIE Study: Population Characteristics

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- Patient population: 346 patient records in six primary care practices
- Intervention time frame: 2-year period (from March 2010 to June 2012)
- Average age: 66.3 years
- Gender distribution: 67.1% female
- Socioeconomics: typical metro-belt population including a range of socioeconomic statuses and 20% ethnic minorities
- Clinical diversity: a variety of multiple health conditions



# Organizational Impact: Continuing Practice Improvement

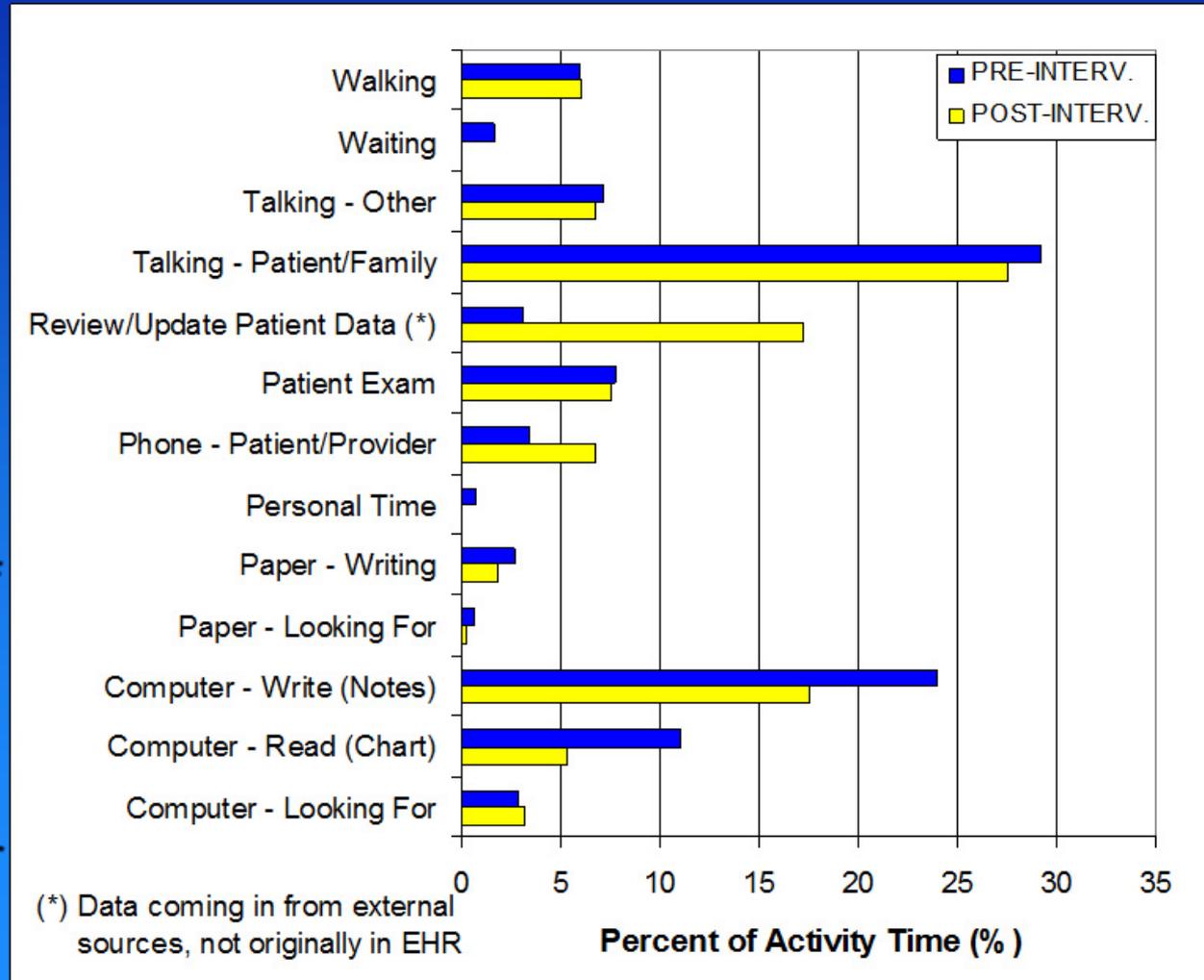
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- Two of the six practices improved their decision-support via better prompt and reminder systems.
- Another two practices expanded counseling options to include more behavioral and developmental services.
- Three of the six offices enhanced their operations with more staff involvement in the coordination of preventive care and provision of patient education.
- All but one practice indicated that they strengthened their organizational ability to support practicewide change and clinician-staff collaboration.

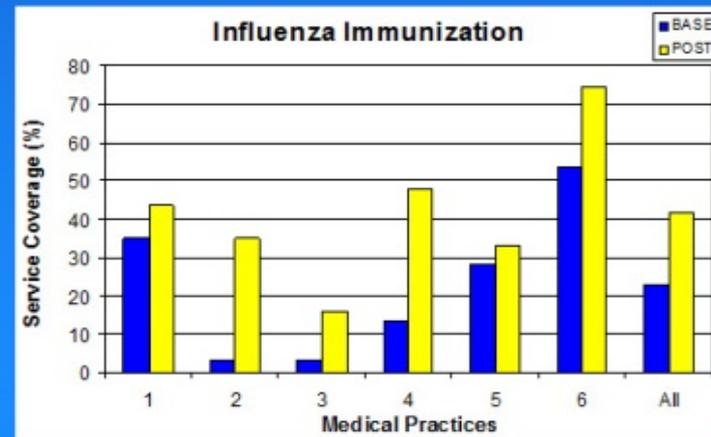
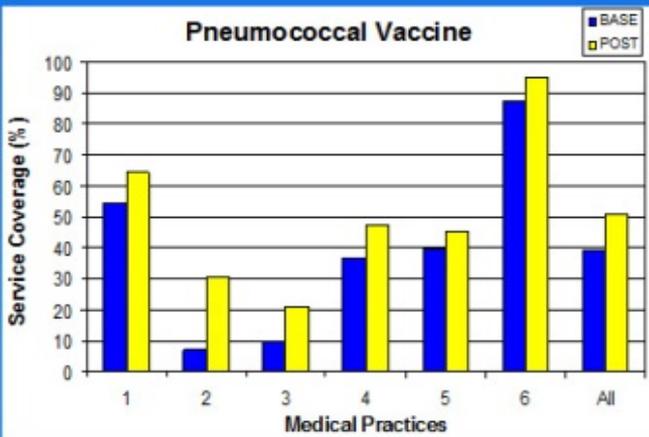
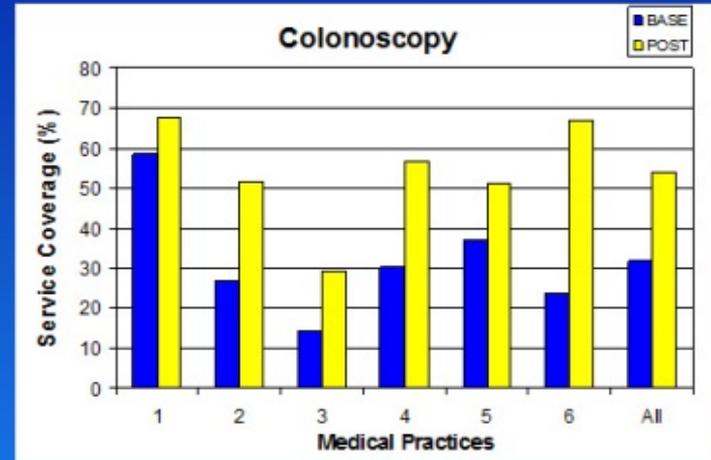
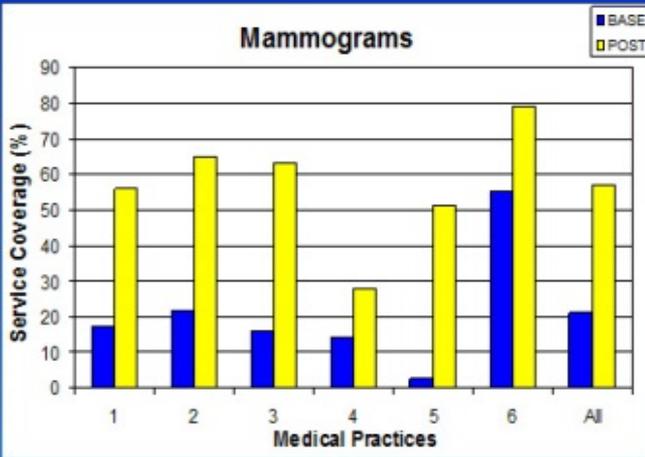


# System-Level Impact: Workflow Efficiency

- About 17% of the time clinicians and staff spent was redistributed from administration and information seeking to activities more directly related to care.
- Average workload of a clinician practice increased by about 30 minutes per day postimplementation (about 5 minutes per person per day).



# Clinical Impact: Preventive Services





# Practical Insight

- *Regional Health eDecisions: A Guide to Connecting Health Information Exchange in Primary Care:*
  - Developed by AHRQ and outlines a framework for primary care practices to connect to regional HIEs.
  - Is a blueprint for assessing organizational readiness for connecting an electronic health record to a Regional Health Information Organization (RHIO).
  - <http://www.healthit.ahrq.gov/sites/default/files/docs/citation/eDecisionsReport.pdf>



# Lessons Learned

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- Deliver added value to end users to drive HIE expansion.
- Implement a “network of networks” governance structure through strategic planning that involves all partners.
- Designate and grant effective project liaisons in each participating organization access to the leadership.
- Achieve a genuine understanding/ownership of the project in all stakeholder organizations (include decision makers).
- Identify specific consequences in written agreements for organizational lapses and not meeting project deadlines.
- Establish effective communication methods.
- Focus on collective problem solving and organizational learning in a goal-oriented environment.



# Acknowledgments

- Our team appreciates the work and dedication of participating clinician practices and all HIE partners, including SMRTNet, technology vendors, NPHO, the Norman Regional Health System, and the University of Oklahoma primary care research & development team.
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# Contact Info

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Zsolt Nagykaladi

[Zsolt-Nagykaladi@ouhsc.edu](mailto:Zsolt-Nagykaladi@ouhsc.edu)

University of Oklahoma HSC Department  
of Family & Preventive Medicine



# Q & A

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Please submit your questions by using the Q&A box to the right of the screen.



# EHR to HIE and PSRS

Dr. Brian Yeaman, MD, CMIO at NRHS, Zsolt Nagykaldi PhD, Dewey Scheid, MD, MPH, Mark Jones, & James Mold MD, MPH

University of Oklahoma HSC Department of Family & Preventive Medicine

Oklahoma Physicians Resource/Research Network (OKPRN)

Secure Medical Records Transfer Network (SMRTNET)

Norman Physician Hospital Organization (NPHO)



# About me....

- **Full disclosure: I am....**
  - Practicing family medicine physician
  - Chief medical information officer (CMIO), Norman Regional Health System (NRHS)
  - Rounding hospitalist
  - CMIO, Norman Physician Hospital Organization (NPHO)
  - Medical director, Greater Oklahoma City Hospital Council
  - Principal investigator, Long-Term Care (LTC) Office of the National Coordinator for Health IT (ONC) Challenge Grant
  - Oklahoma Bureau of Narcotics and Dangerous Drugs (OBNDD) Pilot Coordinator
  - Chief executive officer (CEO) and president, Yeaman and Associates Consulting
  - Minority owner, Axis Practice billing company

# EHR to HIE





# Structured Data Details

- Discrete data elements that can be exchanged across care settings and technology platforms via HIE
  - LOINC/SNOMED/ICD9/ICD10 etc.
  - Current ONC efforts via Meaningful Use to create standards
- Who owns the data?
  - Patient?
  - Doctor?
  - Payer?
  - Centers for Medicare & Medicaid Services (CMS)?

# EHR Pros and Cons



*"My data system isn't speaking to  
your data system."*



# Structured Data Barriers to Adoption

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- Traditionally, vendors have given 2–3 options for documentation of data.
- Not all fields are structured.
- Free text boxes
- Option overload for providers, CDS, order sets, structured data, demographics, quality measures, formulary checks, drug and allergy checking, HIE



# Structured Data and HIE

- HIE SMRTNet Example
  - Crosswalk for structured data
  - Enterprise Master Patient Index (eMPI)
  - Direct and Health Information Service Provider (HISP) services
  - Record Locator Service (RLS)
- Governance and trust
- Legal
- Sustainability
- Use case: quality/safety, duplication, transitions of care eligibility checking?



# Barriers to HIE Data Collection

- EHR variability
  - Many locations to enter the same data points
  - Clicks
  - Different elements of prevention and CDS in different areas
  - inconsistency across vendors
  - Standardization of the Continuity of Care Document (CCD)
- Provider variability
  - Workflow
  - Data entry
  - Ease of use
  - Embedded HIE and CDS
- Patient contributions through Personal Health Record (PHR)



# Clinical Decision Support

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- HIE the enabler for meaningful CDS
  - Evidence-based medicine and content vendors
  - Clinical rules
  - Order sets, next logical step is CDS embedded in computerized physician order entry (CPOE) and in HIE data consumption
  - Quality improvement tools at HIE level
  - Disease and case management
  - Personal health record tools and record portability



# Clinical Decision Support

- EHR-level obstacles
  - Workflow to access HIE
  - Workflow to document critical data elements
    - Too many options
    - Not always intuitive
    - Hard stops vs. soft stops
  - CDS limitations at the EHR level
  - HIE CCD import and utilization of structured data



# AHRQ Project

- Embed clinical decision support in ambulatory clinics
  - Primary care
  - Primary prevention services
    - Pneumovax
    - Influenza
    - Mammogram
    - Colonoscopy
  - Frequency of testing
    - LDL, CMP, TSH
  - Efficiency of prevention documentation
    - Pre- and postimplementation of HIE and CDS
  - Learning cycles





# Implementation of the PSRS

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- Patient registry
- Prompts/reminders
- Patient recalls
- Patient education
- Wellness plan
- Task manager
- Interoperable continuity of care record



# PSRS Risk Engine

- Layer 1: evidence-based guidelines
  - US Preventive Services Task Force (USPSTF) mammography recommendations
- Layer 2: clinical tailoring
  - Allergies and personal risks: patient is allergic to eggs (remove flu shot).
  - Mammography: recent Breast Imaging-Reporting and Data System (BI-RADS) 1-3 (modify regimen to 6-12 mos.)
- Layer 3: patient preferences
  - Colorectal cancer screening: patient prefers Fecal Occult Blood Test (FOBT) over colonoscopy (shift to annual stool cards evaluation schedule)
- Layer 4: patient constraints
  - Consider seasonality of services: do not recommend sun exposure advice during winter months, do not offer flu shots during summer months
  - Functional status: worsening balance and gait (prompt for home alterations and assessment of safe physical activity)



$$\ln \left( \frac{h(t)}{h_0(t)} \right) = b_1 X_1 + b_2 X_2 + \dots + b_k X_k$$

# Novelty of PSRS: Set Theory and Goal-Directed Care

**Q1: What are we trying to prevent from happening?**

**Q2: What is the best way to achieve that (individual)?**

- Include clinical conditions based on age.
- Extend conditions based on risk factors.
- Add immunization regimens based on conditions.
- Eliminate regimens based on age range.
- Eliminate regimens based on contraindications.
- Eliminate doses based on age.
- Eliminate doses based on history.
- Select from remaining doses based on maximum coverage for conditions.



# Some Results of HIE and PSRS Integration

- Improved delivery of preventive services
- Increased documentation of breast cancer screening using mammography (from 27 to 51 percent)
- Increased documentation of colorectal cancer screening using colonoscopy (from 32 to 54 percent)
- Increased documentation of pneumococcal vaccination (from 39 to 51 percent)
- Increased documentation of influenza vaccination (from 23 to 42 percent)
- Improvements in other medical services:
  - Increased documentation of hemoglobin A1cs of diabetic patients (from 68 to 83 percent)
  - Increased medication reconciliation accuracy (from 35 to 45 percent)



# Practical Insight

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# Contact Info

---

Brian Yeaman

[BYeaman@Yeamanandassociates.com](mailto:BYeaman@Yeamanandassociates.com)

Norman Regional Health System



# Q & A

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Please submit your questions by using the Q&A box to the right of the screen.



# Evaluation of Computer-Generated After-Visit Summaries to Support Patient-Centered Care

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Valory N. Pavlik, PhD

Department of Family and Community  
Medicine

Baylor College of Medicine



# Background

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- Supplying patients with instructions and educational information when leaving an ambulatory medical encounter has been common, albeit highly variable in content, format, and reach.
- Most modern electronic health record (EHR) systems have the ability to generate a printed summary of information related to a specific visit.
  - This summary is similar to a hospital discharge summary given to patients.



# Background (cont.)

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- Recent Centers for Medicare & Medicaid Services (CMS) criteria for meaningful use (MU) virtually mandate that EHRs have the capability to generate an after-visit summary (AVS) for practices to be eligible for financial incentives or avoid penalties.
  - Criterion: clinical summaries should be provided to patients for more than 50 percent of all office visits within 3 business days.



# Background (cont.)

- According to the National Learning Consortium (NLC), sponsored by the HIT Research Center, the clinical summary is intended to
  - “support continuity of patient care by providing patients and their families with relevant and actionable information. It is designed to be given to patients at the end of an office medical visit as a summary of what happened during the visit and to provide information and instructions to guide their next healthcare steps.”



# Background (cont.)

- Recommended minimum elements:
  - Patient name
  - Provider name
  - Date and location of visit
  - Reason(s) for visit
  - Vital signs
  - Problem list/current conditions\*
  - Medication list\*
  - Medication allergies\*
  - Diagnostic test/lab results\*
  - Patient instructions

\* Required for Stage 1 MU



# Background (cont.)

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- Eight years ago, one of the members of our PBRN, a large urban network of community clinics, began to implement the Epic EHR.
- Two other PBRN members adopted Epic in subsequent years.
- One of our primary care research fellows at the time was interested in HIT research and after becoming a faculty member (clinician/researcher) was contracted by one of the clinic networks to help configure its Epic system.



# Research Questions

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- How should Epic's capability to generate a printed AVS be used?
- What did patients want in an AVS?
- What did physicians think should be included in an AVS?
- How did the amount of information included in the AVS affect patient-centered outcomes?



# AHRQ-Funded Project to Support AVS Research

- AHRQ Task Order #17: Using Health Information Technology to Improve Healthcare Quality in Primary Care Practices and in Transitions Between Care Settings
  - “Evaluation of Computer Generated After Visit Summaries to Support Patient-Centered Care”
- Project funded through PRIME-Net, a PBRN network; carried out in SPUR-Net (Houston/Harris County, TX)
- Co-investigators: J. Travis Gossey, Anthony Brown, Susan G. Nash



# Project Aims and Design

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- Aims
  - To determine patient and provider preferences for AVS content and format (qualitative phase)
  - To test the effect of varying the amount of information included in the AVS on patient recall, satisfaction, and self-reported adherence to treatment (randomized trial)
- Setting/patients
  - Four SPUR-Net clinics with diverse patient populations that had implemented Epic EHR in the past 3 years



# Results of Qualitative Phase

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- Physicians are concerned about...
  - lack of flexibility to tailor the EHR-generated AVS to patient language preference and reading level and
  - accuracy of medication lists and problem lists (which depend on provider updating info).
- Patients are not concerned about format and liked receiving the AVS.
- Patients wanted more details about individualized treatment goals and recommended behaviors.



# AVS Design Decisions for Randomized Trial

- Format (font style and size, number of pages) is not an issue.
- Because the content of each AVS is generated by EHR data entered at visit and other programming constraints (e.g., problems and diagnoses based on numeric codes), reading level and language cannot be manipulated.
- Some content is required by Joint Commission rules, and there are also other ethical concerns.
- Team decided to focus on testing whether the volume of information included had an effect on patient outcomes.



# AVS Content Categories

|  | Form 1 maximum | Form 2 | Form 3 minimum | Control AVS Clinics 1 and 2 | Control AVS Clinics 3 and 4 |
|--|----------------|--------|----------------|-----------------------------|-----------------------------|
| Patient name, visit date                 | ✓              | ✓      | ✓              | ✓                           | ✓                           |
| Chief complaint                          | ✓              |        |                |                             | ✓                           |
| <b>Allergies *</b>                       | ✓              |        |                |                             | ✓                           |
| Immunizations                            | ✓              |        |                | ✓                           |                             |
| Vital signs                              | ✓              | ✓      |                | ✓                           |                             |
| <b>Medications*</b>                      | ✓              | ✓      | ✓              | ✓                           | ✓                           |
| Diagnosis                                | ✓              | ✓      | ✓              | ✓                           | ✓                           |
| <b>Problem List *</b>                    | ✓              | ✓      |                |                             |                             |
| Lab orders                               | ✓              |        |                |                             | ✓                           |
| Physician's contact information          | ✓              | ✓      | ✓              | ✓                           | ✓                           |
| Follow-up appointments /Referrals        | ✓              | ✓      | ✓              | ✓                           | ✓                           |
| Instructions (free text)                 | ✓              | ✓      | ✓              | ✓                           | ✓                           |
| * required for Stage 1 of Meaningful Use |                |        |                |                             |                             |

**After Visit Summary****Visit Information/Información de la visita**Date & Time  
6/30/2011 3:50 PM

Provider

Location  
BFM**Your To Do List**Future Orders  
**XR CHEST PA AND LATERAL \*\* [IMG36 Custom]**Please Complete By  
6/30/11Expires  
12/30/12**Visit Diagnosis/Diagnóstico en Esta Visita****Diabetes mellitus type II [250.00C]****Problem List**

Priority Class

Date Reviewed: 6/30/2011

|                                     |  |                      |
|-------------------------------------|--|----------------------|
| Claustrophobia [300.29C]            |  | 6/30/2011 – Present  |
| Hypertension [401.9AJ]              |  | 6/14/2011 – Present  |
| Pulmonary embolism [415.19AD]       |  | 5/10/2011 – Present  |
| Chronic anticoagulation [V58.61F]   |  | 5/10/2011 – Present  |
| Seizure disorder [345.90DQ]         |  | 11/17/2010 – Present |
| Dyslipidemia [272.4CR]              |  | 11/17/2010 – Present |
| Diabetes mellitus type II [250.00C] |  | 11/17/2010 – Present |
| LEG EDEMA, BILATERAL [782.3]        |  | 9/9/2008 – Present   |
| OBESITY, MORBID [278.01C]           |  | 5/16/2006 – Present  |

**Your Vitals Were/Sus Signos Viales – Last Recorded**

BP 117/81 Pulse 84 Temp(Src) 97.4 F (36.3 C) Oral

Ht 5'8" (1.727 m)

Wt 330 lb (149.687 kg)

BMI 50.18 kg/m2

**Current Medications/Medicamentos Actuales**

|   |  |
|---|--|
| pravastatin (PRAVACHOL) 80 MG tablet (Taking)                           | Take 1 Tab by mouth daily. Discontinue simvastatin   |
| carvedilol (COREG) 6.25 MG tablet (Taking)                              | Take 1 Tab by mouth 2 times daily (with meals). Discontinue prior dose                             |
| warfarin (COUMADIN) 5 MG tablet (Taking/Discontinued)                   | Take by mouth daily. Sun 7.5, mon 7.5, tues 10, wed 7.5. thur 10, fri 7.5 = total 57.5 mg per week |
| Glucose Blood Test Strip (FREESTYLE TEST STRIPS) (Taking)               | TEST TWICE DAILY AS DIRECTED   |
| potassium chloride (KDUR) 10 MEQ tablet (Taking)                        | Take 10 mEq by mouth daily   |
| lisinopril (PRINIVIL, ZESTRIL) 2.5 MG tablet (Taking)                   | Take 1 Tab by mouth daily  |
| metolazone (ZAROXOLYN) 2.5 MG tablet (Taking)                           | Take 1 Tab by mouth daily  |
| furosemide (LASIX) 20 MG tablet (Taking)                                | Take 1 Tab by mouth 2 times daily  |
| fluticasone (FLONASE) 50 MCG/ACT nasal spray (Taking)                   | 2 Sprays by Each Nostril route daily   |
| glyBURIDE-metformin (GLUCOVANCE) 5-500 MG per tablet (Taking)           | 2 PILLS PO BID WITH FOOD   |
| lamotrigine (LAMICTAL) 100 MG tablet (Taking)                           | Take 1 Tab by mouth 2 times daily  |
| Blood Glucose Monitoring Suppl (BLOOD GLUCOSE MONITOR KIT) KIT (Taking) | 1 Each 2 times daily (before meals).   |
| glucose blood VI test strips (BLOOD CLUCOSE TEST STRIPS) strip (Taking) | Use one strip as directed  |
| Lancets Fine 28G MISC (Taking)  | 2 times daily (before meals). Use to test blood sugars   |
| Sure Comfort Lancets 28G MISC (Taking)                                  | 2 times daily. As directed.  |
| ASPRIN EC 325 MG PO TBEC (Taking)                                       | 1 tab po daily   |

**Instructions/Instrucciones**

Stop warfarin 4 days before procedure, switch to LMWH lovenox until day before surgery, then stop, have procedure and resume lovenox until can restart warfarin—stop lovenox when INR back up to greater than 2.

Enoxaparin (LOVENOX) 150 MG/ML injection Sig: Inject 1 mL into the skin every 12 hours  
Lovenox 150 mg q12hr 330lb (150kg) 1 mg/kg/dose every 12 hours  
Use until INR 2-3

# SAMPLE AVS—Form 2



# Results of Randomized Trial

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- 272 patients were recruited at office visits (68 from each clinic) and randomized to one of four groups; 272 completed first follow-up interview at 2–3 days postvisit, and 212 completed second phone interview at 2 weeks.
- Average age was 52; 50% of patients preferred Spanish.
- Overall, 64% had adequate health literacy (varied by language, but not group assignment).
- Average number of meds = 5.8.



# Results of Randomized Trial (cont.)

- Free recall of content
  - Patients were most likely to recall medications as a category (58%), followed by instructions (32%) and diagnosis (18%)—there were no differences by group.
  - Patients recalled 53% of their medication details (name, dosage, schedule)—there were no differences by group.
- Satisfaction with AVS content
  - 94% of patients liked receiving the printed AVS—there were no differences by group.
  - Mean satisfaction scores on an 11-item scale were  $3.9 \pm .46$  (5- point Likert scale)—there were no differences by groups.



# Results of Randomized Trial (cont.)

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- Self-reported adherence (being able to follow the doctor's advice) was high and was not associated with AVS group.
- Satisfaction with AVS was higher among English speakers than among Spanish speakers, and was higher among patients with higher health literacy than among patients with low health literacy, independent of AVS type received.



# Conclusions

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- Primary care patients like to receive a printed summary of their visit.
- The most important information for the patient appears to be the medication list.
- The total volume of information on the AVS does not affect satisfaction, recall of salient information, or ability to adhere to physician instructions.



# Implications for Practices That Are Designing AVSs

- Meeting MU guidelines for information to include on the AVS should not adversely affect patients' ability to recall salient content (no worry about information overload or confusing the patient).
- Much of the information included in a lengthy AVS will likely not be noted or recalled if it is not salient to the patient.
- In the qualitative phase, both patients and providers stressed that information on the AVS had to be accurate.
  - EHR systems that do not easily generate accurate, updated information are problematic.



# Lessons Learned

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- Commercial EMR systems with AVS capabilities have limitations in the extent of tailoring content to individuals (e.g., differences in language or literacy).
- Choice of content depends on multiple considerations:
  - System capabilities and technical support
  - Regulatory guidelines
  - Patient safety (particularly applies to med lists and lab tests)
  - Patient and provider preferences



# Dissemination

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- Manuscript under review
  - Pavlik V, Brown A, Nash S, Gossey JT: Patient Recall, Satisfaction, and Self-Reported Adherence Are Unrelated to Variations in Content of an EHR - Generated After-Visit Summary: A Randomized Clinical Trial.



# Contact Info

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Valory N. Pavlik

[vpavlik@bcm.edu](mailto:vpavlik@bcm.edu)

Baylor College of Medicine



# Q & A

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Please submit your questions by using the Q&A box to the right of the screen.



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