A National Web Conference on Advanced Application of Health Information Exchange Systems

Presented by:
Mollie R. Cummins, Ph.D., R.N., F.A.A.N.
Jason Shapiro, M.D.
Joshua Vest, Ph.D., M.P.H.

Moderated By:
Edwin Lomotan, M.D.
Agency for Healthcare Research and Quality

April 21, 2016
Agenda

• Welcome and Introductions
• Presentations
• Q&A Session With Presenters
• Instructions for Obtaining CME Credits

Note: After today’s Webinar, a copy of the slides will be emailed to all participants.
Presenters and Moderator
Disclosures

The following presenters and moderator have no financial interests to disclose:

• Mollie R. Cummins, Ph.D., R.N., F.A.A.N.
• Jason Shapiro, M.D.
• Joshua Vest, Ph.D., M.P.H.
• Edwin Lomotan, M.D.

Jason Shapiro, M.D., would like to disclose that his spouse is an in-house attorney at Purdue Pharma.

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• Questions will be read aloud by the moderator.
AHRQ HIE Webinars

• **Webinar 1 (March 16, 2016):** Factors Contributing to the use of Health Information Exchange in Health Care Organizations

• **Webinar 2 (today):** Advanced Application of Health Information Exchange Systems

(https://healthit.ahrq.gov/)
Learning Objectives

At the conclusion of this activity, the participant will be able to:

1. Discuss the potential effects of Health Information Exchange (HIE)-driven process models and advanced informatics tools to improve communication between Emergency Departments (ED) and Poison Control Centers.

2. Describe the development of a HIE-based tool to support new e-Quality measures used among multiple hospital systems for ED returns and frequent users.

3. Explain the implications of how HIE services are defined geographically.
Health Information Exchange: Making Data Move and Matter for Poisoning

Mollie R. Cummins, Ph.D., R.N., F.A.A.N.
Associate Professor, College of Nursing
Adjunct Associate Professor, Department of Biomedical Informatics
University of Utah, Salt Lake City, UT
Disclosures

- The research activities described in this presentation are funded by the U.S. Agency for Healthcare Research and Quality (R01 HS21472-03). We also describe related work funded by the Office of the National Coordinator for Health Information Technology (90IX0003/01-00).
1. Describe the Utah model for HIE-supported collaboration during emergency medical management of poison exposures.

2. Describe the use of standards to support bidirectional HIE between EDs and poison control centers.

3. Describe the importance of workflow integration in applications of HIE.
Our Collaboration

- Mollie Cummins
- Guilherme Del Fiol
- Barbara Crouch
- Matt Hoffman
- Tom Greene
- Todd Allen
- Scott Nelson

- Sidney Thornton
- Pallavi Ranade
- Darren Mann
- Scott Narus
- Aly Khalifa
- Heather Bennett
- Nena Bowman
Poisoning in the United States

- Leading cause of unintentional injury death in the United States.$^1$
- Top 10 cause of nonfatal injury requiring treatment in EDs.$^2$
Age-adjusted Death Rates per 100,000 Population
Poisoning, All Intents, All Races, All Ethnicities, Both Sexes, All Ages
Annualized Age-adjusted Rate for United States: 13.52

Reports for All Ages include those of unknown age.
* Rates based on 20 or fewer deaths may be unstable. States with these rates are cross-hatched in the map (see legend above). Such rates have an asterisk (*).
The standard population for age-adjustment represents the year 2000, all races, both sexes.

Produced by: the Statistics, Programming & Economics Branch, National Center for Injury Prevention & Control, CDC
Data Sources: NCES National Vital Statistics System for numbers of deaths; US Census Bureau for population estimates.
U.S. Poison Control Centers

• Field calls from both the general public and health care providers
• Provide case-specific consultation and treatment recommendations
• Provide ongoing follow-up to monitor patient outcome
• Reduce unnecessary ED visits\(^3,4,5\)
• Approximately 25% of poison exposures reported to poison control centers are managed in a health care facility.
Poison Center Information Management

Public Health:
• Transmit standard data elements to National Poison Data System (NPDS)
• Email PDF case summaries
• Fax information

Patient Care:
• Telephone for patient information and consultation
• Fax for supplemental poison information
What’s Wrong With the Telephone?

Advantages
- Verbal communication expressive
- Low cost
- Flexible

Disadvantages
- Verbal communication high risk for error$^{6,7}$
- Fragile in disaster scenarios$^{8,9}$
- Known source of interruption in the ED environment$^{10,11}$
Inefficiencies and Safety Vulnerabilities for ED-PCC Collaboration

- *Multiple* telephone calls involving varied dyads
- Process unsupported by shared documentation
- ED nurse unavailable to take PCC call (7.5%)
- Telephone calls routed through multiple ED staff members in an attempt to reach the appropriate care provider
- Exchange of clinical information with nonclinical staff (8%)
- Patient discharged prior to any successful synchronous telephone communication between the ED care provider and a PCC specialist (55%)
- Ambiguous communication (22%)
- PCC specialist unable to obtain requested information from the ED (12%)
AHRQ R01 HS21472-03, PI Cummins (2013-2018)

Specific Aims:

1. Develop a model process for HIE-supported ED–PCC collaboration.
2. Develop and implement informatics tools for HIE-supported ED–PCC collaboration.
3. Evaluate the effects of the model HIE process and informatics tools on workflow, communication, efficiency, and utilization.
The Vision

- Bidirectional HIE in support of emergency medical treatment for poison exposure
- Standards-based
- Telephone for complex case discussion or “breaking the glass”
- Improved collaboration and information availability at the point of decisionmaking
- Workflow-integrated
Workflow Integration

HL7 C-CDA Document Type

Semi-Automated

Referral Note

Request for consultation

Lab results, treatments administered, patient status

Automated

Summary Information
PCC Refers New Case to ED

Before
• PCC calls and talks to triage or charge nurse.
• Some information written on a paper form or Post-it note.
• Information may or may not reach clinicians who see patient.

After
• PCC sends HL7 consultation note.
• Patient displayed under “pre-arrivals” in ED tracking system.
• Provider clicks to view consultation note with summary and initial treatment recommendations.
PCC Refers New Case to ED

Before

4 y.o. female, playing with Tylenol bottle, amount? 2 or 3PM

After

Poisoning Consultation Note

Patient: Electronic Classify:

Date of Birth: [Blank]

Table of Contents:

Table of Contents

- Differential Diagnosis
  - Thyroid Disease
- Plan of Care
  - Laboratory Testing
  - DCIS
  - CT
  - MRI

Plan of Care

- Laboratory Testing
  - Thyroid Function Tests
  - Ultrasound
  - MRI
- DCIS
- CT
- MRI
- PET/CT

Differential Diagnosis

- Thyroid Disease
- Carcinoma
- Adenoma
- Myxedema
- Hypothyroidism

Table of Contents

1. Differential Diagnosis
2. Plan of Care
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4. DCIS
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Differential Diagnosis

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Laboratory Testing

- Thyroid Function Tests
- Ultrasound
- MRI

Plan of Care

- DCIS
- CT
- MRI
- PET/CT

Poisoning Consultation Note

Relevant Information

- Present Illness
- Past Medical History
- Family History
- Social History

Presentation

- 4 y.o. female, playing with Tylenol bottle, amount?

2 or 3PM
Overview of HIE for Poisoning
Software and Informatics Tools

• Design C-CDA consultation note for poisoning use case

• Mapping from UPCC database to C-CDA consultation note

• Software to enable poison center HIE
  ▶ Create and send C-CDA consultation note
  ▶ Receive, store, and view C-CDA notes (3 types)
  ▶ Dashboard-style monitoring of active HIE cases
Barriers, Challenges, and Solutions

- Patient discovery
- Case-based data
- Automatically triggering ED-initiated referral
- Evolution of information systems
Measuring Outcomes

- Utah Poison Control Center
- Two Intermountain Healthcare community EDs
- Pre-implementation/post-implementation design
- Categories of measurement:
  - Workflow/communication
  - Efficiency
  - Utilization
  - User evaluation of tools and processes
• Related operational work funded by the Office of the National Coordinator for Health Information Technology (ONC), Department of Health and Human Services’ program “Advance Interoperable Health Information Technology Services to Support Health Information Exchange” Interoperability for Healthier Communities (PI: T. Rivera, Utah Health Information Network, grant no. 90IX0003/01-00)

• Modified, low-barrier version of ED-PCC HIE (limited or no integration on ED side, utilizing Direct and the Utah cHIE)

• Available to all EDs in Utah

• Contribute data to UDOH environmental exposure database
Toward a Learning Health System for Poisonings

1. Share data in support of patient care.
   - More complete, detailed, accurate data

then...

2. Aggregate data across organizational boundaries.
3. Use data to learn how to better monitor, understand, prevent, and treat poison exposures.
4. Use the same data for both clinical and public health.


Mollie R. Cummins, Ph.D., R.N., F.A.A.N.
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HIE Empowered Frequent ED User and Early ED Returns Use Cases

Jason Shapiro, M.D.
Associate Professor, Emergency Medicine and
Co-Director, Masters of Science in Biomedical Informatics
Icahn School of Medicine at Mount Sinai
This project was supported by grant number R01HS021261 from the Agency for Healthcare Research and Quality (AHRQ). The content is solely the responsibility of the authors and does not necessarily represent the official views of AHRQ.
• HIE in the “downstate” NY metropolitan area
• Formed by the merger of 3 smaller HIEs: NYCLIX (Manhattan), LIPIX (Long Island), and BHIX (Brooklyn)
• > 16 million unique patients
• 211 participant organizations with 612 facilities and > 35,000 acute and extended care beds
• > 12,000 users with >10,000 searches per month
• > 80,000 alerts delivered per month
Anytime a patient visits more than one site, he or she causes fragmentation of their medical information.
Crossover

~ 9% across the entire exchange

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<td>5</td>
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<table>
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<th>Patients with data available from other sites</th>
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</thead>
<tbody>
<tr>
<td>Site 1</td>
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</tr>
<tr>
<td>Site 2</td>
<td>18%</td>
</tr>
<tr>
<td>Site 3</td>
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<tr>
<td>Site 4</td>
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<td>Site 5</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>19%</strong></td>
</tr>
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</table>

Data were collected during 12 one-week data collection periods between October 18, 2009, and January 23, 2009.

*NYCLIX – unpublished data*
Two HIE-Enabled eQuality Measures

- Frequent ED visits/patients
- Early (72-hour) ED returns
Two HIE-Enabled eQuality Measures

• Frequent ED visits/patients
Two HIE-Enabled eQuality Measures

• Frequent ED visits/patients
  ► HIE-based frequent ED user notification service
Two HIE-Enabled eQuality Measures

• Frequent ED visits/patients
  ▶ HIE-based frequent ED user notification service

• Early (72-hour) ED returns
  ▶ HIE-based report to empower ED CQI process
Frequent ED Users

• ≥ 4 visits per year is most common definition
• 4.5% to 8% of all ED patients
• Account for 21-28% of visits
• More social, psychiatric, and substance abuse issues
• Sicker with higher acuity and more complex conditions
Frequent ED Users

- Admitted more frequently
- Incur higher costs
- Have higher mortality rates
- Not typically uninsured, but “underinsured”
- Visits often not limited to a single institution
Frequent ED Users

• Data from 10 EDs participating in NYCLIX (6/10 – 5/11)
• 920,507 ED visits by 591,632 patients
• Looked at ED “super users” (≥ 4 visits in 30 days)
• 4,785 patients (site-spec data) ➞ 5,756 (HIE-wide data)
• 45,771 visits (site-spec data) ➞ 53,031 (HIE-wide data)
Frequent ED Users

• 20% increase in identified visits
• 16% increase in identified patients

Health Affairs, Shapiro et al., 2013
Frequent ED Users and Crossover

- 29% had crossover visits compared to 3% of non-ED users
- > Nine-fold increase in crossover among frequent ED users

*Health Affairs, Shapiro et al., 2013*
Frequent ED Users and Crossover

• Healthix Data from 03/01/09 – 02/28/14

• 8,243,194 ED visits by 3,704,342 patients

• # of patients who went to 1, 2, 3…n EDs

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<td>≥ 25</td>
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</tr>
<tr>
<td>≥ 29</td>
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</table>

Healthix– preliminary data 3/09 – 2/14
Frequent ED Users and Crossover

- Frequent users visited 73% more hospitals
- 205 patients visited ≥ 10 hospitals
- 11 patients visited ≥ 20 hospitals
Frequent ED Users

- 409 patients with > 100 ED visits
- 44 patients with > 300 visits
- The max visits by a single patient was 987
For the original 10 NYCLIX HIE sites, expanding to a 31-hospital HIE increased the ability to identify frequent ED users by 5.9%.
Early (72-hour) ED Returns

- Widespread use as marker for high-risk patients
- Poor overall measure of ED or physician quality
  - Early return patients not sicker or admitted more frequently
- Considerable value as a screening tool for CQI
Early (72-hour) ED Returns

- Data from 3/01/09 to 2/28/14
- 12,669,657 encounters from 31 EDs in Healthix
- 544k patients (site-spec) ➔ 606k (31 site HIE-wide)
- 848k visits (site-spec) ➔ 955k (31 site HIE-wide)
Early (72-hour) ED Returns

- 11.4% increase in identified patients
- 12.6% increase in identified visits
Early (72-hour) ED Returns

• For the 11 hospitals in the original NYCLIX HIE, expanding to a 31-hospital HIE increased the ability to identify 72-hour return visits by 74.6%.

Acad Emerg Med, Shy et al., 2016
How Can HIE Help?
What HIE *really* offers  
(for the first time)

A real-time, community-wide clinical dataset
Secondary Use Cases

- Care coordination
- Quality measurement
- Research/CER
- Population health management
- Predictive modeling
Clinical Event Notifications

Event monitoring

Routing

Detects events at members about patients being cared for by community providers (subscription)

Community caregivers

members

Edge Server

Edge Server

Edge Server

Edge Server
Clinical Event Notifications

Subscription-based
- ED
- Primary care
- Home care
Clinical Event Notifications

- Analytics-based
  - Frequent ED users
  - 30-day readmissions
  - CT alerts
Clinical Event Notifications

Figure 1. Clinical Event Notification (CEN) Flowchart

65+ patient evaluated by GEDI WISE SW, Rx, PT, NP

65+ patient triaged to Geriatric ED area

EHR “flags” patient as GEDI WISE & adds subscription file

1. EHR logs encounter from Healthix institution so future clinicians may review

2. notification log file

3. EHR message

If a Healthix visit matches GEDI WISE subscriber, a clinical event notification (CEN) is generated

GEDI WISE subscription file

Patient arrives at Healthix member ED (or is admitted or discharged from inpatient)

Healthix queries subscription file

4. clinician email

5. clinician text

Third-party app routes notification to clinicians (GEDI WISE NPs)

Patient care events at Mount Sinai automatically trigger enrollment in the GEDI WISE program (upper left) and lead to the adding of the patient to the GEDI WISE subscription file. When future patient activity occurs at a Healthix institution (lower left) the patient’s details are checked against the subscription file and if a match occurs, a notification is generated and routed across five systems: 1) an encounter is created in the Mount Sinai EHR so providers outside of GEDI WISE can view the event, 2) the notification is written to a data file for analytics, 3) GEDI WISE recipients receive the notification in their EHR “in-basket”, 4) email, and 5) a text message to their internet protocol-based “zone” phone.
Clinical Event Notifications

Figure 2. Examples of CEN as shown in (1) EHR, as an "external visit" encounter within the patient’s chart, (2) as an email to a clinician and (3) as a secure clinical phone message via third-party app.
Contact Information

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The Geography of Community Health Information Organizations in the United States

Joshua R Vest, Ph.D., M.P.H.
Indiana University Richard M. Fairbanks School of Public Health
Department of Health Policy & Management
Regenstrief Institute

This project was funded by the Agency for Healthcare Research and Quality (#HS020304-01A1).
Complete findings appear in Vest JR. Health Care Manage Rev 2016 Mar 15. [Epub ahead of print]
Community Health Information Organizations (HIOs)

- Provide a region or State with the technical infrastructure and collaborative governance necessary for HIE.
- Support reconciling patient identity across sites, locating records across different EHRs, maintaining directories of providers, and routing electronic messages.
- Have received significant public and private financing.
- HIOs are an important part of Federal health information technology strategy to achieve widespread adoption of HIE.
“Community” health information management systems
“Community” health information networks
“Local” health information infrastructures
“Regional” health information organizations
“State” designated entities
But is Geography an Effective Organizing Principle? Some Indications of Practical challenges...

Community HIOs report serving an area defined by a political boundary, but patients often cross that boundary to seek care.

Because of disparate funding and development histories, States may have overlapping community HIOs.

Areas in the United States may not have any community HIO providing services.
To Better Understand Exchange Activity in the United States, This Project Sought to Answer…

1. How frequently do community HIOs’ self-reported geographic service areas overlap or leave gaps across the United States?

2. How do the areas’ community HIOs report serving compare to the areas from which patients seek care?
1. (face) Validated inventory

2. GIS analyses based on self-reported geography (service areas)

3. GIS analyses of the health care markets (hospital service areas) of included members
• **Self-reported service area** = the geography the HIO claims or declares to serve

• **Market-based service area** = the actual health care markets included in the HIO
Validated inventory

- Compilation of various lists
- Reviewed websites
- Consulted with representatives from HIMSS
You are invited to participate in this research study by suggesting corrections about a mapped health information exchange effort (or any omissions in the map). This study is being funded by the Agency for Healthcare Quality & Research. More information is available on the ABOUT THIS STUDY page.

The purpose of this webpage is to help validate or correct the map content. The form below allows you to provide feedback, comments, corrections, validation or omissions directly to the study PI. THE MAP MAY NOT BE IMMEDIATELY UPDATED.

Your participation is completely voluntary and your responses will be kept confidential. Your participation will not be disclosed. Your comments will not be reported or identified with your name or email address in any way. No responses will be publicly reported.

You may be contacted by the investigator to clarify any map corrections you submit. At the end of the study period all emails, email addresses, and identifiers will be destroyed.

You may not get any personal benefit from participating, but the knowledge gained may benefit others.

If you have any questions about this research project you may contact the study investigator, Joshua Vest, at jov2025@med.cornell.edu or the Weill Cornell Medical College Institutional Review Board at 979 962 8196.

By completing the form below and hitting the Submit button you are consenting to participate.

Name *

First

Last

Email *

Comment *


<table>
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<th>Sub-state exchanges</th>
<th>State / Multi-state</th>
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<tbody>
<tr>
<td>N</td>
<td>131</td>
<td>88</td>
<td>43</td>
</tr>
</tbody>
</table>
Comparison of Self-Reported Areas to Markets Served
Community HIO Activity Based on Market Areas
Implications

The occurrence of overlapping efforts creates the risk of incomplete information.

Differential hospital participation

Variable, cross State, and intersecting HIOs reduce the ability of public health agencies to leverage information.

Gaps

Multiple connections to HIOs

Cross State data collection

HIOs may face conflicting policies and laws when considering actual markets served.
Community HIO coverage raises concerns about incomplete patient information and challenges public health agencies’ attempts to collect community-wide information.

Thanks to Pamela Matthews and Julie Moffitt at HIMSS, Olga Strachna, Jimmie Fowler, Frank Popowitch Jr, and Rainu Kaushal for their assistance.
Joshua Vest, Ph.D., M.P.H

joshvest@iu.edu
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