



U.S. Department of Health and Human Services



Agency for Healthcare Research and Quality

Advancing Excellence in Health Care • www.ahrq.gov

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.

This continuing education activity is managed and accredited by the Professional Education Services Group (PESG) in cooperation with AHRQ, AFYA, and RTI.

PESG, AHRQ, AFYA, and RTI staff have no financial interests to disclose.

Commercial support was not received for this activity.



How To Submit a Question

- At any time during the presentation, type your question into the “Q&A” section of your WebEx Q&A panel.
- Please address your questions to “All Panelists” in the drop-down menu.
- Select “Send” to submit your question to the moderator.
- Questions will be read aloud by the moderator.

The screenshot displays the WebEx interface with the 'Participants' tab selected. The 'Q&A' section is expanded, showing a list of participants under 'Speaking:'. The 'Ask:' dropdown menu is set to 'All Panelists'. A red arrow points to the 'Ask:' dropdown menu.

Participants Chat ? Q&A

Participants

Speaking:

- ▶ Panelists: 2
- ▶ Attendees:

Q&A

All (0)

Ask: All Panelists

Select a participant in the ask menu first and type your question here. There is a 256 character limit.

Send



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.



U.S. Department of Health and Human Services



Agency for Healthcare Research and Quality

Advancing Excellence in Health Care • www.ahrq.gov

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).

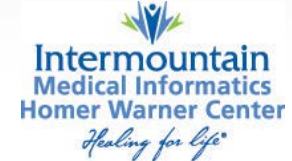


Learning Objectives

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



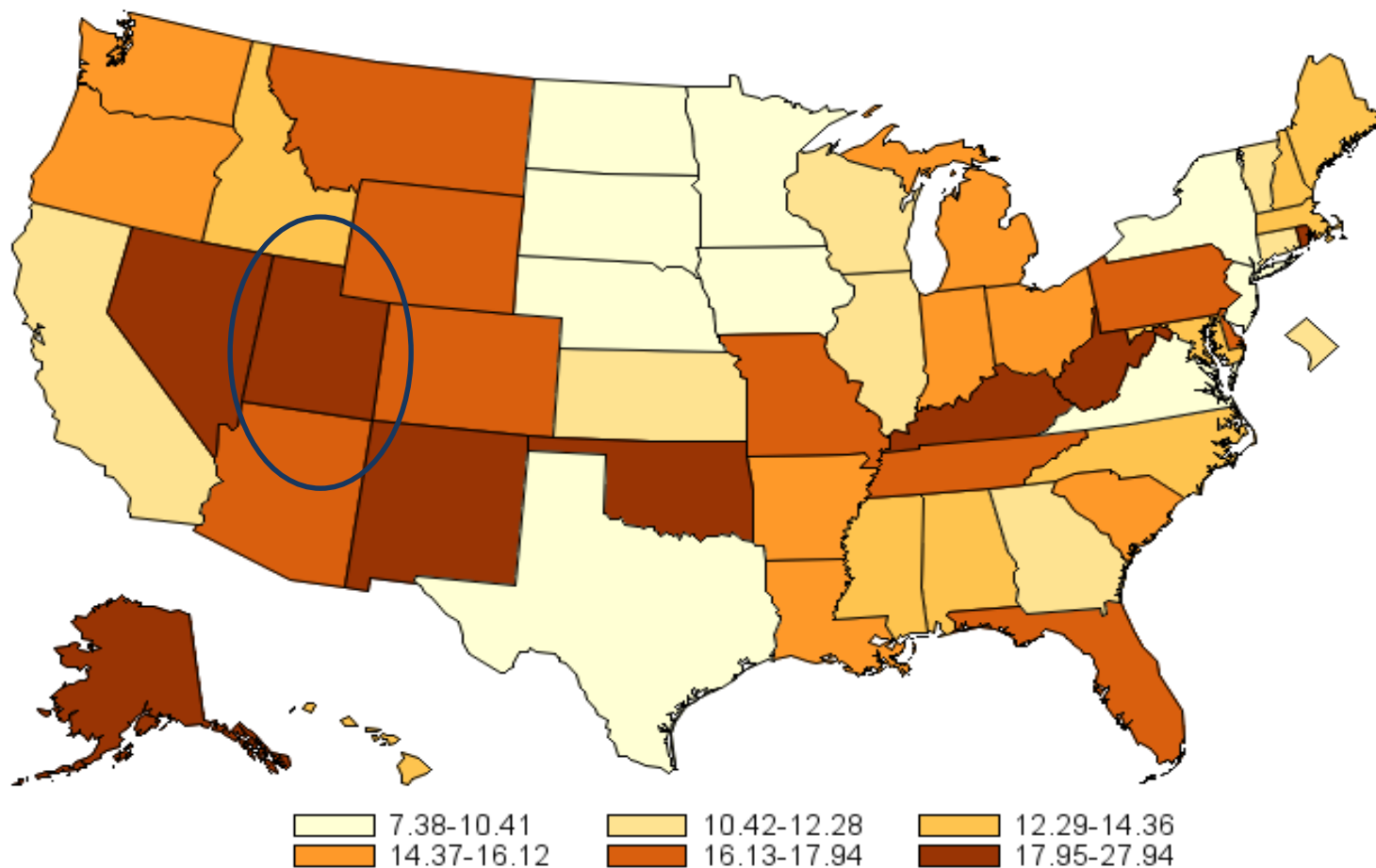
- Mollie Cummins
- Guilherme Del Fiol
- Barbara Crouch
- Matt Hoffman
- Tom Greene
- Todd Allen
- Scott Nelson
- Sidney Thornton
- Pallavi Ranade
- Darren Mann
- Scott Narus
- Aly Khalifa
- Heather Bennett
- Nena Bowman



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

2008-2010, United States
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.



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 Collaboration¹²

- *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%)



Electronic Exchange of Poisoning Information

AHRQ R01 HS21472-03, PI Cummins (2013-2018)

Specific Aims:

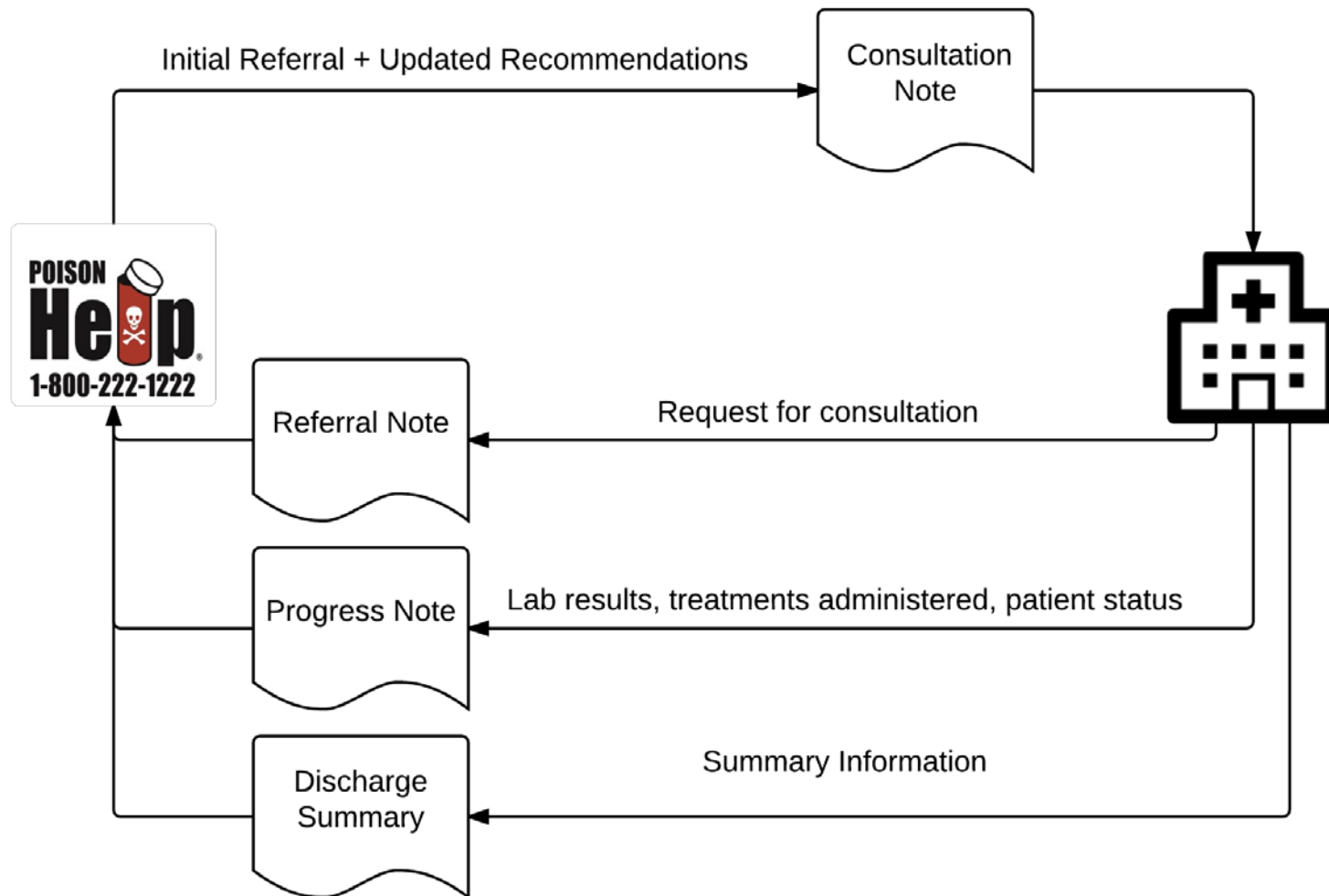
1. Develop a model process for HIE-supported ED–PCC collaboration.
2. Develop and implement informatics tools for HIE-supported ED–PCC collaboration.
3. Evaluate the effects of the model HIE process and informatics tools on workflow, communication, efficiency, and utilization.



The Vision

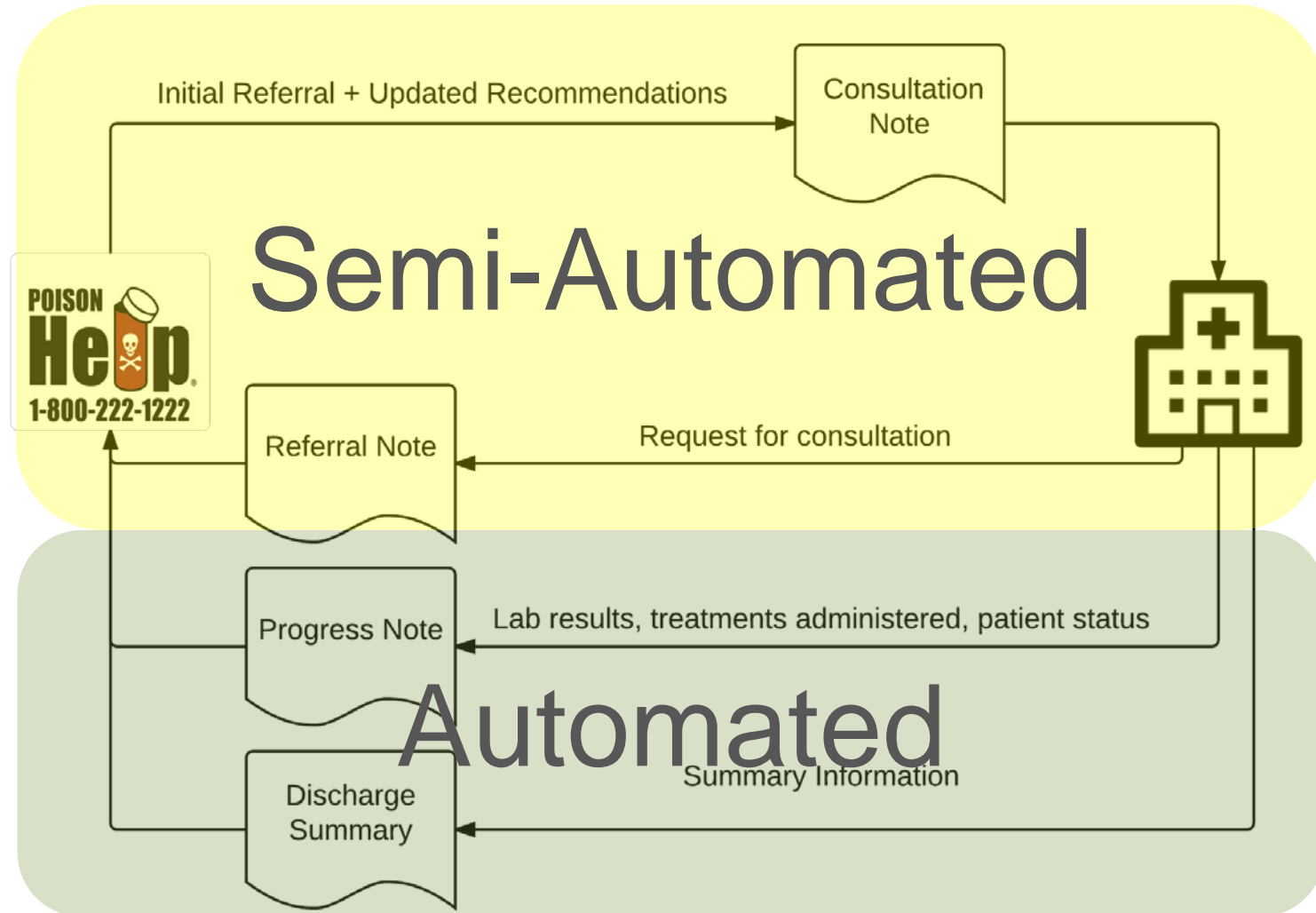
- Bidirectional HIE in support of emergency medical treatment for poison exposure
- Standards-based
- Telephone for complex case discussion or “breaking the glass”
- Improved collaboration and information availability *at the point of decisionmaking*
- *Workflow-integrated*

HL7 C-CDA Document Type



Workflow Integration

HL7 C-CDA Document Type





PCC Refers New Case to ED

Before

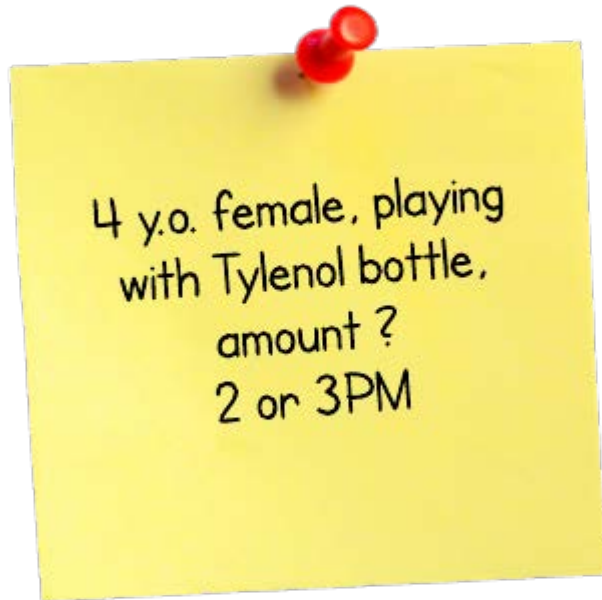
- PCC calls and talks to triage or charge nurse.
- Some information written on a paper form or Post-it note.
- Information may or may not reach clinicians who see patient.

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

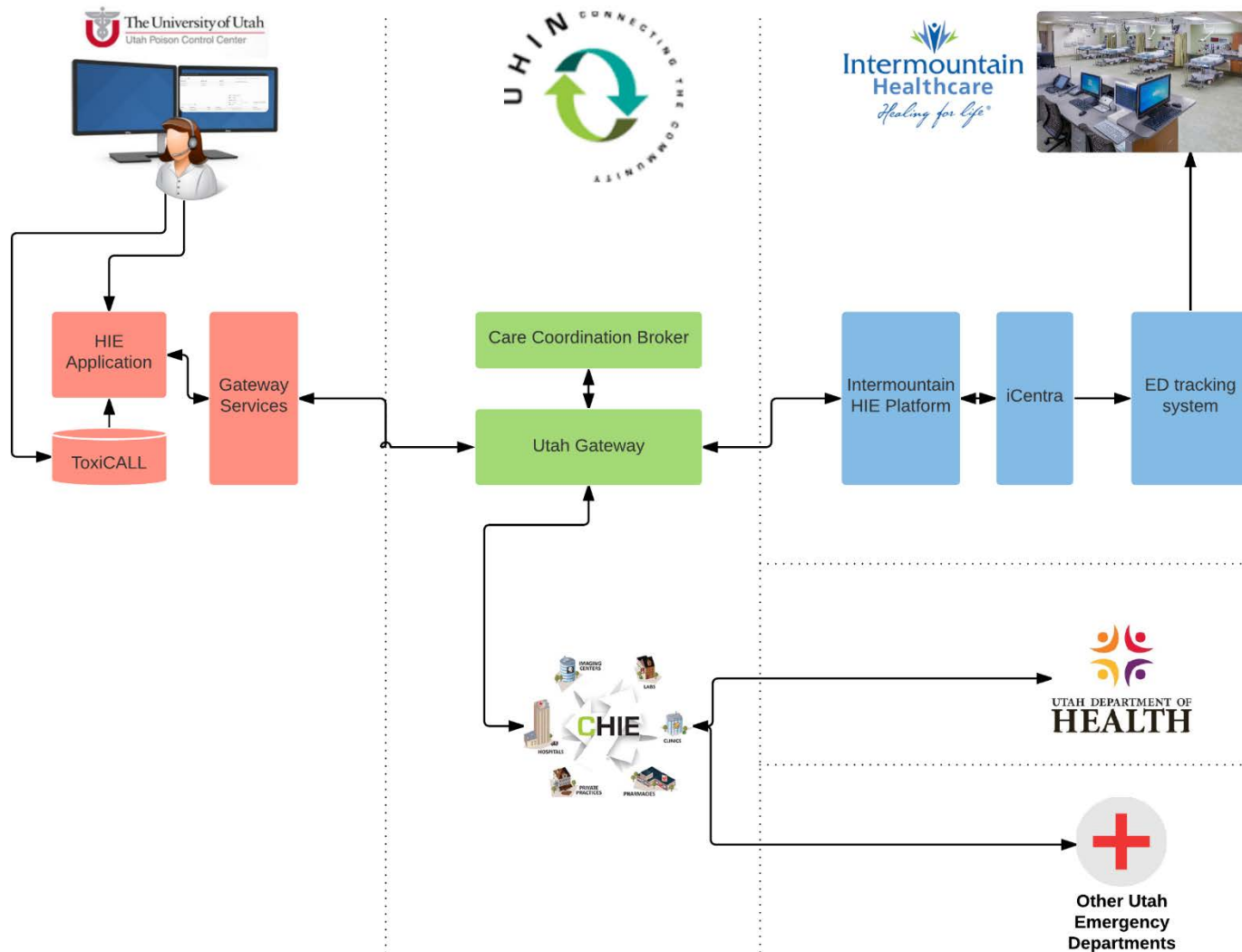


After

Poisoning Consultation Note

Patient	Gertrude Claudius																	
Date of birth	Table of Contents																	
Sex	<ul style="list-style-type: none"> REASON FOR REFERRAL CHIEF COMPLAINT HISTORY OF PRESENT ILLNESS GENERAL STATUS ASSESSMENT PLAN OF CARE PAST MEDICAL HISTORY MEDICATIONS 																	
Race																		
Ethnicity																		
Contact info																		
Patient IDs	REASON FOR REFERRAL																	
Document id	This is the reason for referral or be entered by the SPT or passed from the toxicologist. Risk this could be a venomous snake bite (i.e., rattlesnake).																	
Document Create	CHIEF COMPLAINT																	
Author	Unintentional - Environments: at Own residence																	
Contact info	HISTORY OF PRESENT ILLNESS																	
Encounter Id	<ul style="list-style-type: none"> Exposure Route(s): <ul style="list-style-type: none"> Ingestion Inhalation Aspiration Exposure Substance(s): 																	
Encounter Date	Substance Description	Sequence Number	Quantity	Concentration	Onset/Time	Formulation												
Encounter Locat	CARBON MONOXIDE	1	900 unknown	NA	estimate	BA NA												
Informant	SPOC	2	NA unknown	NA	estimate	BA NA												
Contact info	<ul style="list-style-type: none"> Time of Exposure: Unknown Symptom(s): <ul style="list-style-type: none"> Bradycardia Cardic Dysrhythmia Corneal Abrasion Brachycosm 																	
Information recd	<ul style="list-style-type: none"> Subjective: This is just a testing text as a subjective narration for history of the present illness. 																	
Document maint by	GENERAL STATUS																	
Contact info	Dizziness and Headache (just for testing)																	
Table of Cont	ASSESSMENT																	
<ul style="list-style-type: none"> REASON FOR REFERRAL CHIEF COMPLAINT HISTORY OF PRESENT ILLNESS GENERAL STATUS ASSESSMENT PLAN OF CARE PAST MEDICAL HISTORY MEDICATIONS 	<ul style="list-style-type: none"> General Substance(s) Information: <table border="1"> <thead> <tr> <th>Substance Description</th> <th>Toxic Dose</th> <th>Common Effects</th> <th>Time to Peak Concentration</th> </tr> </thead> <tbody> <tr> <td>CARBON MONOXIDE</td> <td>NA</td> <td>NA</td> <td>NA</td> </tr> <tr> <td>SPOC</td> <td>NA</td> <td>NA</td> <td>NA</td> </tr> </tbody> </table> <ul style="list-style-type: none"> (Just for testing) There is a risk this could be a venomous snake. 						Substance Description	Toxic Dose	Common Effects	Time to Peak Concentration	CARBON MONOXIDE	NA	NA	NA	SPOC	NA	NA	NA
Substance Description	Toxic Dose	Common Effects	Time to Peak Concentration															
CARBON MONOXIDE	NA	NA	NA															
SPOC	NA	NA	NA															
	PLAN OF CARE																	
	<ul style="list-style-type: none"> Recommended Diagnostic Testing and Monitoring: (Just Testing) CBC, Coagulason profile, Fibrinogen, CMP Recommended Observation Times: 8 hours (Just Testing) Treatments and Interventions: <ul style="list-style-type: none"> SpO2 Oxygen (just for testing) Mark the border of the edema, and monitor for increased swelling 																	
	PAST MEDICAL HISTORY																	
	(Just Testing) there is no past medical history available																	
	MEDICATIONS																	
	(Just Testing) There is no medication history available																	

Overview of HIE for Poisoning



- Design C-CDA consultation note for poisoning use case¹⁴
- Mapping from UPCC database to C-CDA consultation note¹⁴
- 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



Scale and Spread

- 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.



References

1. Rudd RA, Aleshire N, Zibbell JE, Gladden RM. Increases in Drug and Opioid Overdose Deaths - United States, 2000-2014. *MMWR Morb Mortal Wkly Rep.* 2016 Jan 1;64(50-51):1378-82. doi: 10.15585/mmwr.mm6450a3. PubMed PMID: 26720857.
2. Centers for Disease Control, National Center for Injury Prevention and Control. National Estimates of the 10 Leading Causes of Nonfatal Injuries Treated in Hospital Emergency Departments, United States – 2013. http://www.cdc.gov/injury/wisqars/pdf/leading_causes_of_nonfatal_injury_2013-a.pdf Accessed April 1, 2016.
3. LoVecchio F, Curry S, Waszolek K, Klemens J, Hovseth K, Glogan D. Poison control centers decrease emergency healthcare utilization costs. *J Med Toxicol.* 2008 Dec;4(4):221-4.
4. Zaloshnja E, Miller T, Jones P, Litovitz T, Coben J, Steiner C, et al. The impact of poison control centers on poisoning-related visits to EDs-- United States, 2003. *Am J Emerg Med.* 2008 Mar;26(3):310-5.
5. Blizzard JC, Michels JE, Richardson WH, Reeder CE, Schulz RM, Holstege CP. Cost-benefit analysis of a regional poison center. *Clin Toxicol (Phila).* 2008 Jun;46(5):450-6.
6. Spencer R, Coiera E, Logan P. Variation in communication loads on clinical staff in the emergency department. *Ann Emerg Med* 2004; 44:268–273.
7. Coiera EW, Jayasuriya RA, Hardy J, Bannan A, Thorpe ME. Communication loads on clinical staff in the emergency department. *Med J Aust* 2002; 176:415–418.
8. Vassilev ZP, Kashani J, Ruck B, Hoffman RS, Marcus SM. Poison control center surge capacity during an unusual increase in call volume— results from a natural experiment. *Prehosp Disaster Med* 2007; 22:55–58.
9. Caravati EM, Latimer S, Reblin M, Bennett HK, Cummins MR, Crouch BI, Ellington L. High call volume at poison control centers: identification and implications for communication. *Clin Toxicol (Phila)* 2012; 50:781–787.
10. Brixey JJ, Tang Z, Robinson DJ, et al. Interruptions in a level one trauma center: a case study. *Int J Med Inform* 2008; 77:235–241.
11. Brixey JJ, Robinson DJ, Tang Z, Johnson TR, Zhang J, Turley JP. Interruptions in workflow for RNs in a Level One Trauma Center. *AMIA Annu Symp Proc* 2005: 86–90.
12. Cummins MR, Crouch B, Gesteland P, Wyckoff A, Allen T, Muthukutty A, Palmer R, Peelay J, Repko K. Inefficiencies and vulnerabilities of telephone-based communication between U. S. poison control centers and emergency departments. *Clin Toxicol (Phila).* 2013 Jun;51(5):435-43. doi: 10.3109/15563650.2013.801981. Epub 2013 May 23. PubMed PMID: 23697459.
13. Del Fiol G, Crouch BI, Cummins MR. Data standards to support health information exchange between poison control centers and emergency departments. *J Am Med Inform Assoc.* 2015 May;22(3):519-28. doi: 10.1136/amiainjnl-2014-003127. Epub 2014 Oct 23. PubMed PMID: 25342180.
14. Khalifa, AMA, Del Fiol, G, Cummins MR. Public Health Data for Individual Patient Care: Mapping Poison Control Center Data to the C-CDA Consultation Note (unpublished manuscript, under review).



Contact Information

Mollie R. Cummins, Ph.D., R.N., F.A.A.N.

mollie.cummins@utah.edu



U.S. Department of Health and Human Services



Agency for Healthcare Research and Quality

Advancing Excellence in Health Care • www.ahrq.gov

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



Acknowledgements

- 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



Crossover

Anytime a patient visits more than one site, he or she causes fragmentation of their medical information.



Crossover

~ 9% across the entire exchange

# of Sites Visited	Count
2	401,762
3	78,519
4	16,719
5	3,637
6	747
7	197
8	65
9	18
10	10
11	3
12	1
Total	474,600

Site	Patients with data available from other sites
Site 1	19%
Site 2	18%
Site 3	21%
Site 4	18%
Site 5	19%
Total	19%

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) \rightarrow 5,756 (HIE-wide data)
- 45,771 visits (site-spec data) \rightarrow 53,031 (HIE-wide data)



Frequent ED Users

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



Frequent ED Users and Crossover

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



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

# of sites visited	# of pts
≥ 1	3,704,342
≥ 2	436,887
≥ 3	69,779
≥ 4	15,021
≥ 5	4,651
≥ 6	1,939
≥ 7	966
≥ 8	499
≥ 9	310
≥ 10	205
≥ 11	143
≥ 12	97
≥ 13	70
≥ 14	50
≥ 15	38
≥ 16	32
≥ 17	24
≥ 18	18
≥ 19	12
≥ 20	11
≥ 21	8
≥ 22	5
≥ 23	4
≥ 24	3
≥ 25	2
29	1



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



Frequent ED Users

- 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%.

How Can HIE Help?



What HIE *really* offers (for the first time)

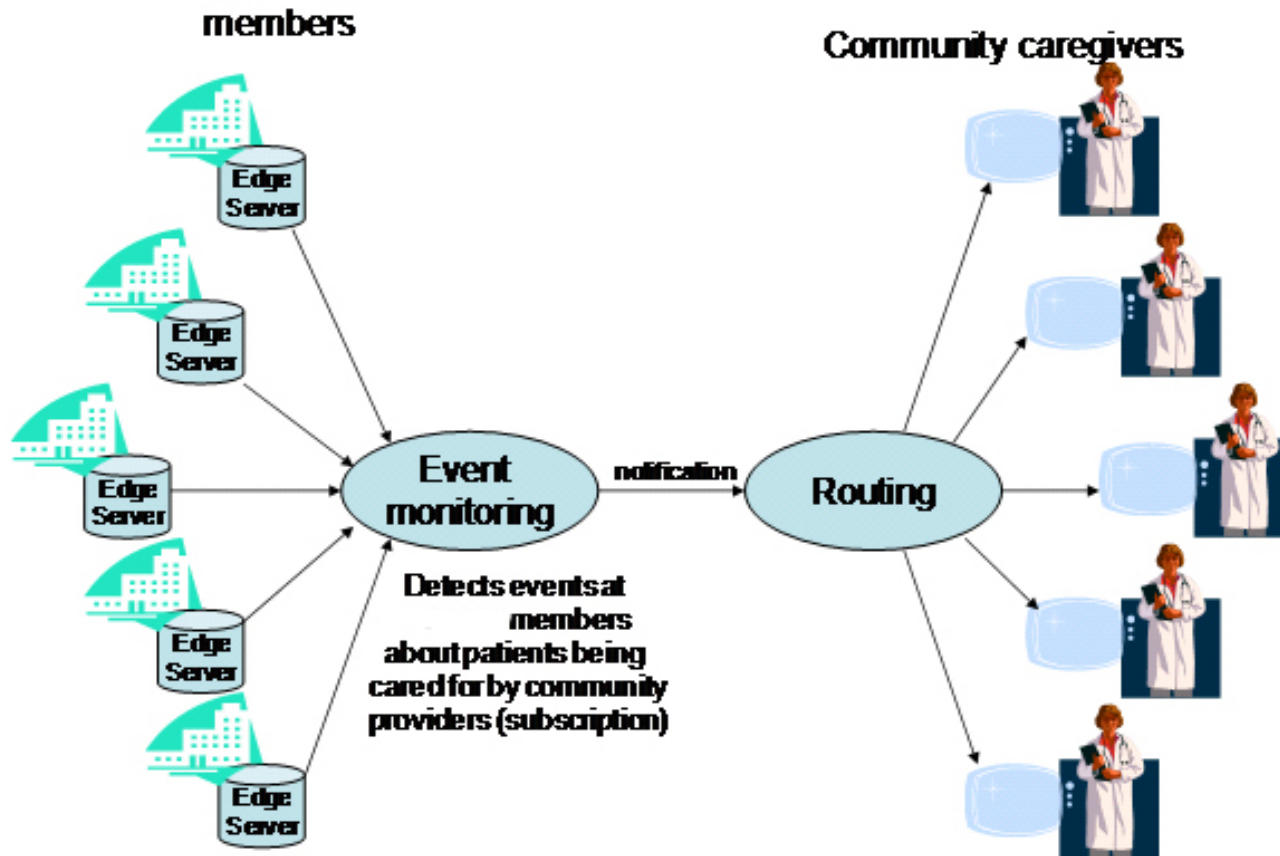
A real-time, community-wide clinical dataset



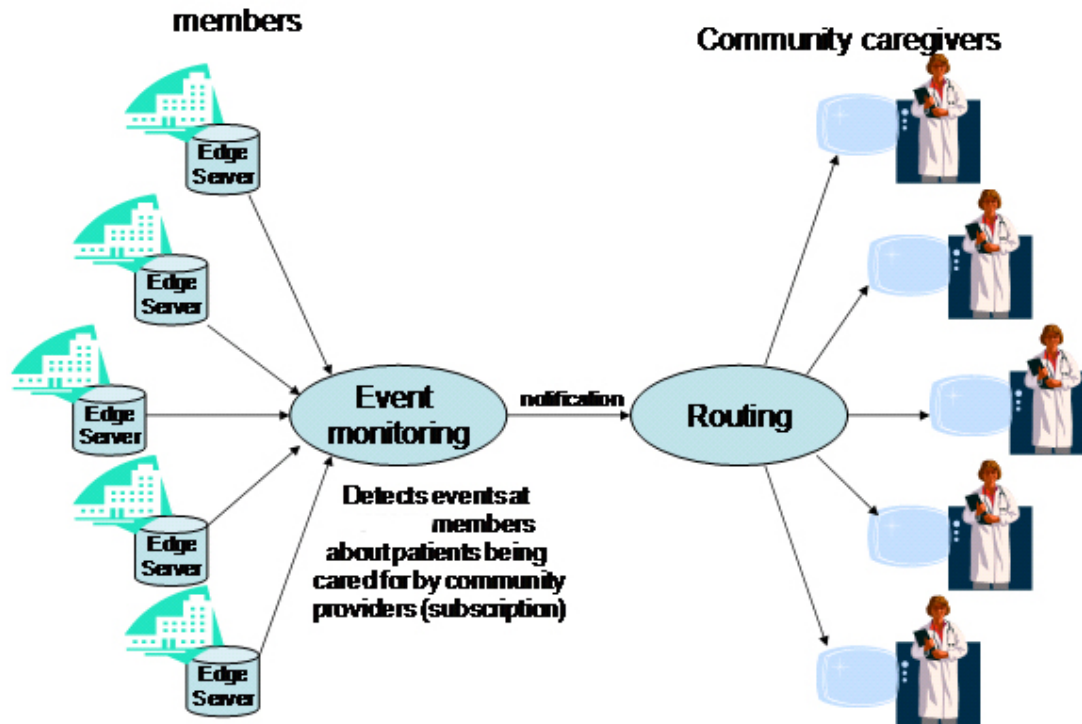
Secondary Use Cases

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

Clinical Event Notifications



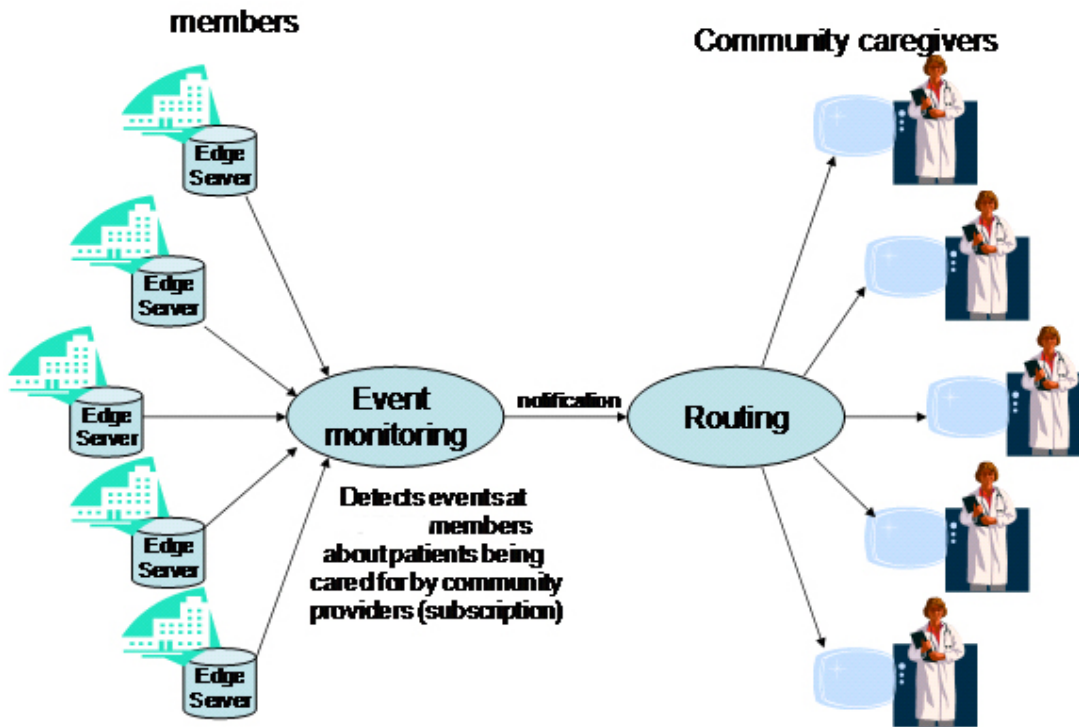
Clinical Event Notifications



Subscription-based

- ED
- Primary care
- Home care

Clinical Event Notifications

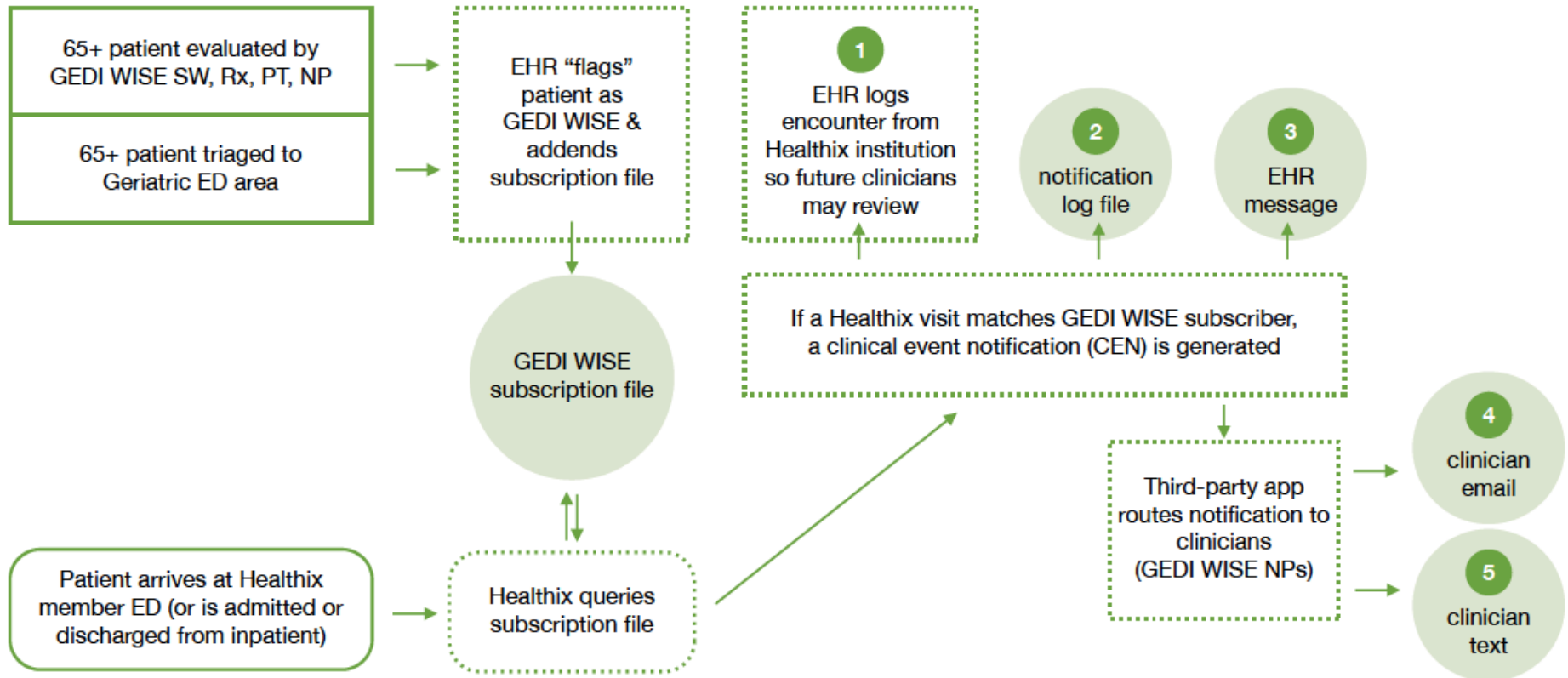


Analytics-based

- Frequent ED users
- 30-day readmissions
- CT alerts

Clinical Event Notifications

Figure 1. Clinical Event Notification (CEN) Flowchart



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

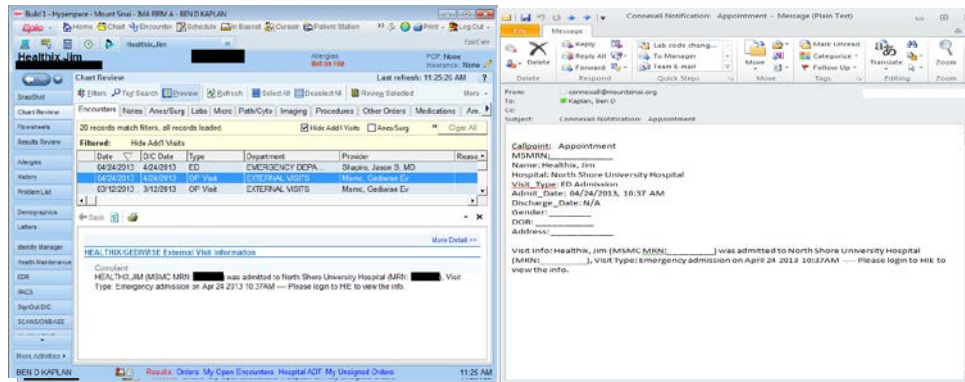
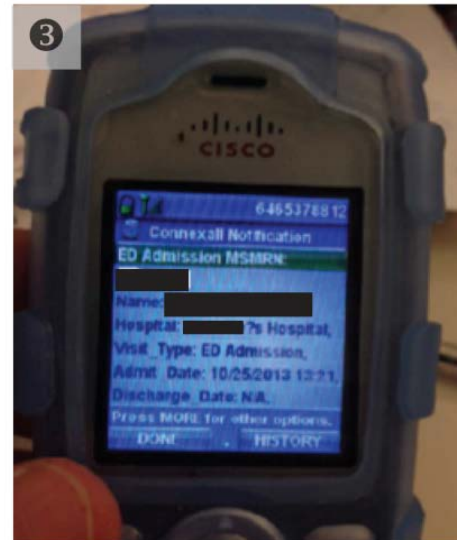


Figure 2. Examples of CEN as shown in (1) EHR, as an "external visit" encounter within the patient's chart, (2) as an email to a clinician and (3) as a secure clinical phone message via third-party app.



Contact Information



Jason Shapiro, M.D.
jason.shapiro@mountsinai.org



U.S. Department of Health and Human Services



Agency for Healthcare Research and Quality

Advancing Excellence in Health Care • www.ahrq.gov

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



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.

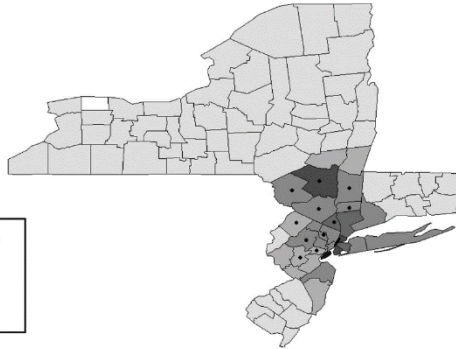
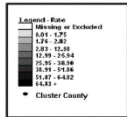


Geography is a Longstanding Organizing Feature of Community HIOs

- “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...

Orville et al., 2013



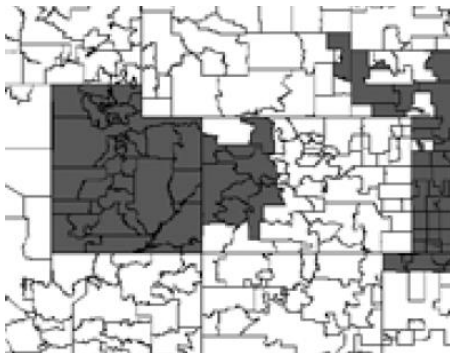
Community HIOs report serving an area defined by a political boundary, but patients often cross that boundary to seek care.

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.

Mathematica / RWJF



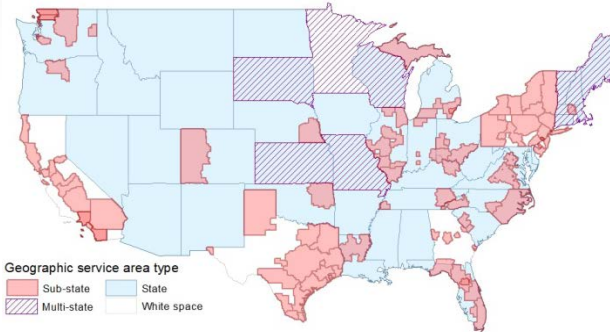


To Better Understand Exchange Activity in the United States, This Project Sought to Answer...

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?

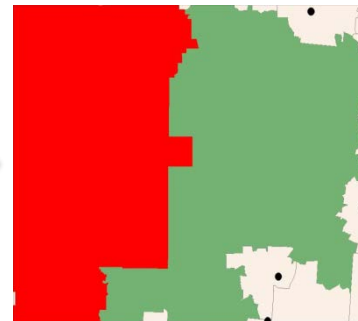
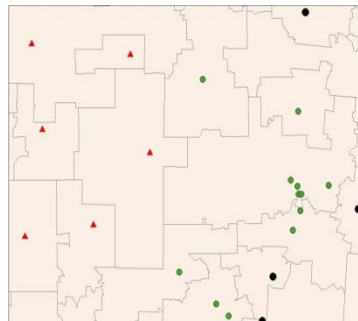
Approach

ID	Name	URL	Organization	Year	State	Multi-state	Validated
1	Alabama Health Information Exchange (AHIE)	http://ahie.hhs.gov	Alabama Health Information Exchange	2011	Alabama	Yes	Yes
2	Arizona Health Information Exchange (AZHIE)	http://ahie.arizona.gov	Arizona Health Information Exchange	2011	Arizona	Yes	Yes
3	Arkansas Health Information Exchange (AHIE)	http://ahie.arkansas.gov	Arkansas Health Information Exchange	2011	Arkansas	Yes	Yes
4	California Health Information Exchange (CHIE)	http://chie.ca.gov	California Health Information Exchange	2011	California	Yes	Yes
5	Colorado Health Information Exchange (CHIE)	http://chie.co.gov	Colorado Health Information Exchange	2011	Colorado	Yes	Yes
6	Connecticut Health Information Exchange (CHIE)	http://chie.ct.gov	Connecticut Health Information Exchange	2011	Connecticut	Yes	Yes
7	Delaware Health Information Exchange (DHIE)	http://dhie.de.gov	Delaware Health Information Exchange	2011	Delaware	Yes	Yes
8	Florida Health Information Exchange (FHIE)	http://fhie.fl.gov	Florida Health Information Exchange	2011	Florida	Yes	Yes
9	Georgia Health Information Exchange (GHIE)	http://ghie.ga.gov	Georgia Health Information Exchange	2011	Georgia	Yes	Yes
10	Hawaii Health Information Exchange (HHIE)	http://hhie.hawaii.gov	Hawaii Health Information Exchange	2011	Hawaii	Yes	Yes
11	Idaho Health Information Exchange (IHIE)	http://ihie.idaho.gov	Idaho Health Information Exchange	2011	Idaho	Yes	Yes
12	Illinois Health Information Exchange (IHIE)	http://ihie.illinois.gov	Illinois Health Information Exchange	2011	Illinois	Yes	Yes
13	Indiana Health Information Exchange (IHIE)	http://ihie.in.gov	Indiana Health Information Exchange	2011	Indiana	Yes	Yes
14	Iowa Health Information Exchange (IHIE)	http://ihie.iowa.gov	Iowa Health Information Exchange	2011	Iowa	Yes	Yes
15	Kansas Health Information Exchange (KHIE)	http://khie.ks.gov	Kansas Health Information Exchange	2011	Kansas	Yes	Yes
16	Kentucky Health Information Exchange (KHIE)	http://khie.ky.gov	Kentucky Health Information Exchange	2011	Kentucky	Yes	Yes
17	Louisiana Health Information Exchange (LHIE)	http://lhie.la.gov	Louisiana Health Information Exchange	2011	Louisiana	Yes	Yes
18	Maine Health Information Exchange (MHIE)	http://mhie.maine.gov	Maine Health Information Exchange	2011	Maine	Yes	Yes
19	Maryland Health Information Exchange (MHIE)	http://mhie.maryland.gov	Maryland Health Information Exchange	2011	Maryland	Yes	Yes
20	Massachusetts Health Information Exchange (MHIE)	http://mhie.mass.gov	Massachusetts Health Information Exchange	2011	Massachusetts	Yes	Yes
21	Michigan Health Information Exchange (MHIE)	http://mhie.michigan.gov	Michigan Health Information Exchange	2011	Michigan	Yes	Yes
22	Minnesota Health Information Exchange (MHIE)	http://mhie.minn.gov	Minnesota Health Information Exchange	2011	Minnesota	Yes	Yes
23	Mississippi Health Information Exchange (MHIE)	http://mhie.ms.gov	Mississippi Health Information Exchange	2011	Mississippi	Yes	Yes
24	Missouri Health Information Exchange (MHIE)	http://mhie.mo.gov	Missouri Health Information Exchange	2011	Missouri	Yes	Yes
25	Montana Health Information Exchange (MHIE)	http://mhie.mt.gov	Montana Health Information Exchange	2011	Montana	Yes	Yes
26	Nebraska Health Information Exchange (NHIE)	http://nhie.ne.gov	Nebraska Health Information Exchange	2011	Nebraska	Yes	Yes
27	Nevada Health Information Exchange (NHIE)	http://nhie.nv.gov	Nevada Health Information Exchange	2011	Nevada	Yes	Yes
28	New Hampshire Health Information Exchange (NHIE)	http://nhie.nh.gov	New Hampshire Health Information Exchange	2011	New Hampshire	Yes	Yes
29	New Jersey Health Information Exchange (NJHIE)	http://njhie.nj.gov	New Jersey Health Information Exchange	2011	New Jersey	Yes	Yes
30	New Mexico Health Information Exchange (NMHIE)	http://nmhie.nm.gov	New Mexico Health Information Exchange	2011	New Mexico	Yes	Yes
31	New York Health Information Exchange (NYHIE)	http://nyhie.ny.gov	New York Health Information Exchange	2011	New York	Yes	Yes
32	North Carolina Health Information Exchange (NCHIE)	http://nchie.nc.gov	North Carolina Health Information Exchange	2011	North Carolina	Yes	Yes
33	North Dakota Health Information Exchange (NDHIE)	http://ndhie.nd.gov	North Dakota Health Information Exchange	2011	North Dakota	Yes	Yes
34	Ohio Health Information Exchange (OHIE)	http://ohie.ohio.gov	Ohio Health Information Exchange	2011	Ohio	Yes	Yes
35	Oklahoma Health Information Exchange (OHIE)	http://ohie.ok.gov	Oklahoma Health Information Exchange	2011	Oklahoma	Yes	Yes
36	Oregon Health Information Exchange (OHIE)	http://ohie.oregon.gov	Oregon Health Information Exchange	2011	Oregon	Yes	Yes
37	Pennsylvania Health Information Exchange (PHIE)	http://phie.pa.gov	Pennsylvania Health Information Exchange	2011	Pennsylvania	Yes	Yes
38	Rhode Island Health Information Exchange (RHIE)	http://rhie.ri.gov	Rhode Island Health Information Exchange	2011	Rhode Island	Yes	Yes
39	South Carolina Health Information Exchange (SCHIE)	http://schie.sc.gov	South Carolina Health Information Exchange	2011	South Carolina	Yes	Yes
40	South Dakota Health Information Exchange (SDHIE)	http://sdhie.sd.gov	South Dakota Health Information Exchange	2011	South Dakota	Yes	Yes
41	Tennessee Health Information Exchange (THIE)	http://thie.tn.gov	Tennessee Health Information Exchange	2011	Tennessee	Yes	Yes
42	Texas Health Information Exchange (THIE)	http://thie.tx.gov	Texas Health Information Exchange	2011	Texas	Yes	Yes
43	Utah Health Information Exchange (UHIE)	http://uhie.utah.gov	Utah Health Information Exchange	2011	Utah	Yes	Yes
44	Vermont Health Information Exchange (VHIE)	http://vhie.vermont.gov	Vermont Health Information Exchange	2011	Vermont	Yes	Yes
45	Virginia Health Information Exchange (VHIE)	http://vhie.virginia.gov	Virginia Health Information Exchange	2011	Virginia	Yes	Yes
46	Washington Health Information Exchange (WHIE)	http://whie.wa.gov	Washington Health Information Exchange	2011	Washington	Yes	Yes
47	West Virginia Health Information Exchange (WVHIE)	http://wvhie.wv.gov	West Virginia Health Information Exchange	2011	West Virginia	Yes	Yes
48	Wisconsin Health Information Exchange (WHIE)	http://whie.wisconsin.gov	Wisconsin Health Information Exchange	2011	Wisconsin	Yes	Yes
49	Wyoming Health Information Exchange (WHIE)	http://whie.wyoming.gov	Wyoming Health Information Exchange	2011	Wyoming	Yes	Yes



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



(face) Validated inventory

- Compilation of various lists
- Reviewed websites
- Consulted with representatives from HIMSS

LEO	State	HHS/OIG/Other/Other Organization Name	Type/Innov	Closed/Orig	URL	Address/Zip Code	Other Links	Transformed	NIP_Gov_T1	Status
2 AK		Alaska Health Network (AHN)	1		http://www.ak.hhs.gov/ahnet	4225 Laurel Street, Suite 100 Anchorage		2007		Nonprofit
3 AL		Alabama Health Information Exchange (AHIE)	1		http://ahie.al.gov			2007		Nonprofit
6 AR		State Health Alliance for Health Exchange (SHAHE)	1		http://ohr.lark.com	3403 W. Lusher Ave., Victory Building	http://ohr.lark.com	2011		Nonprofit
10 AZ		Health Information Network of Arizona (HINA)	1		http://www.hina.org	1000 N. McDowell Drive, Suite 100	http://www.hina.org	2011		Nonprofit
15 CA		Central Valley California (HIE)	1		http://www.cvhie.org	785 Tucker Road, Suite 9	95614	2008		Nonprofit
18 CA		Florida Empire HIE	1		http://www.empirehie.org	3990 Juniper Ave		2012		Nonprofit
21 CA		Orange County Partnership for Health	1		http://www.ocphie.org	300 N. State College Blvd., Suite 1100		2008		Nonprofit
22 CA		Redwood MedNet	1		http://www.rwmn.org	216 W. Parkins St., #106	94068	2005		Nonprofit
23 CA		San Diego Regional Health Information Exchange	1		http://www.sdrhie.org			2007		Nonprofit
24 CA		HealthCare Spot Area	1		http://www.hcsa.org	8001 A. Driveway, San Francisco	94124	2007		Nonprofit
25 CA		Santa Cruz HIE	1		http://www.schrhie.org	3200 Locust Avenue, Suite 100	Santa Cruz	2009		Nonprofit
27 CA		Los Angeles Network for Enhanced Services (LANES)	1		http://www.lanes.org	200 West Temple Street, Room 714	Los Angeles	2007		Nonprofit
28 CA		North Coast Health Information Network (NCHIN)	1		http://www.nchic.org	1100 Highway 101, Eureka	94001	2011		Nonprofit
34 CO		Colorado Regional Health Information Organization	1		http://www.crhio.org	3779 S. DERRY DRIVE, N. DR.	80118	2011		Nonprofit
35 CO		Quality Health Network	1		http://www.qhn.org	1775 S. DERRY DRIVE, N. DR.	80118	2011		Nonprofit
40 HI		DeLaware Health Information Network (DHIN)	1		http://www.dhin.org	307 West Creek Blvd., Suite 2	99701	2007		Nonprofit
47 FL		Big Bend Regional Healthcare Information Organization	1		http://www.brhie.org			2005		Nonprofit
49 FL		Central Florida Regional Health Information Organi	1		http://www.cfrhie.org	4402 Vineland Rd., Suite 2	32810	2003		Nonprofit
52 FL		Florida Health Information Exchange	1		http://www.flhie.org	2722 WALKER DRIVE, BLDG 2 RM 200	32610	2010		Nonprofit
56 FL		Spring Coast Health Information Trust - HIE	1		http://www.schit.org	P.O. Box 2044, Ocala	34476	2010		Nonprofit
60 FL		South Florida Health Information Exchange	1		http://www.sfhie.org	120 W. Orange Street, Suite 200	33136	2007		Nonprofit
66 FL		Gulf Coast Health Information Exchange	1		http://www.gchie.org	4800 26th Street, SW, Bradenton	FL 34209	2007		Nonprofit
70 GA		Charlottesville Health HIE	1		http://www.chh.ie	3400 Carnegie Professional Bldg, 3rd Fl	30606	2009		Nonprofit
70 HI		Health Information Exchange	1		http://www.hie.org	300 East Street, Suite 1000	Honolulu	2009		Nonprofit
79 IA		Iowa e-Health	1		http://www.ieh.org			2010		Nonprofit
82 IN		Indiana Health Data Exchange (IHIE)	1		http://www.ihie.org	404 West State Street, 3rd Fl, Box 4778	47401	2006		Nonprofit
82 IN		Central Indiana Health Information Exchange (CIHIE)	1		http://www.cihie.org	KIA Main Street, Suite 757	46204	2010		Nonprofit
88 IL		Health Information Exchange of Southern Illinois	1		http://www.hiesil.org	3000 West Lafayette St., Suite 600	62401	2009		Nonprofit
90 IL		Illinois Health Information Exchange (IHIE)	1		http://www.ihie.org	311 300 W. Randolph, Suite 4	60606	2010		Nonprofit
88 IL		Illinois Health Information Exchange (IHIE)	1		http://www.ihie.org	P.O. Box 7000, Quincy	62305	2011		Nonprofit
94 IN		Maple Grove Health Information Exchange	1		http://www.mghie.org	222 South Riverside Plaza, Suite 2000	47901	2010		Nonprofit
93 IN		Illinois Health Information Exchange (IHIE)	1		http://www.ihie.org	7000 South Lake Road, Suite 100	47901	2009		Nonprofit
100 IN		HealthCare HIE	1		http://www.hch.org	714 S. Riggs Street, 4th Floor	46204	2007		Nonprofit
101 IN		Indiana Health Information Exchange (IHIE)	1		http://www.ihie.org	840 N. Senate Ave., Suite 100	47404	2004		Nonprofit
103 IN		Indiana Health Information Network	1		http://www.inhin.org	120 N. Center Street, 6th South Wing	47404	2008		Nonprofit
105 KS		Wichita Health Information Exchange	1		http://www.wchie.org	1202 S. Hillside	67211	2009		Nonprofit
111 KY		Kentucky Health Information Exchange (KHIE)	1		http://www.khie.org			2010		Nonprofit
112 LA		Louisiana Health Information Exchange (LHIE)	1		http://www.lhie.org	8000 Pineda Plaza Blvd., Suite 300	70004	2010		Nonprofit
115 LA		Louisiana Rural Health Information Exchange (LHIE)	1		http://www.lrhie.org			2010		Nonprofit

Your assistance is requested

This website is intended to facilitate the participation of health information organizations in the US. The map displays the geography. Information about the creation of the map is available on the [ABOUT THIS STUDY](#) page.

- **BLUE:** State level health information organizations
- **PURPLE HATCH:** Local health information organizations
- **RED:** County, municipal health information organizations

For each exchange the following information is provided:

- Number of participating organizations
- Health system partnership
- Public health agency
- Long term care partnership
- Radiology or Laboratory

Clicking on the map below will provide more information about the exchange.

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.

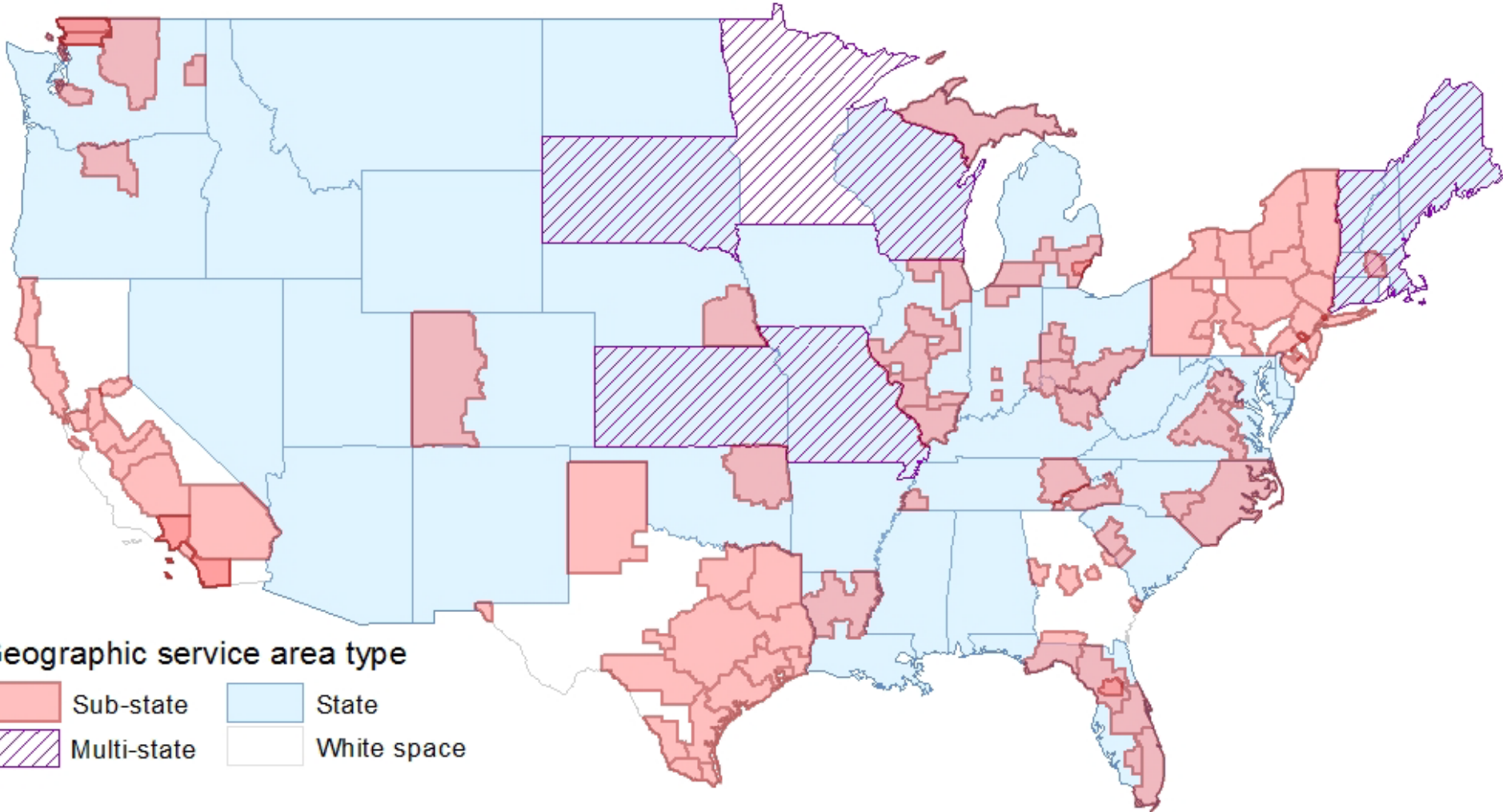
Name *

First

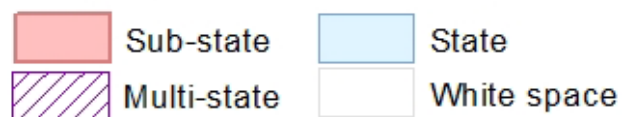
Last

Email *

Comment *

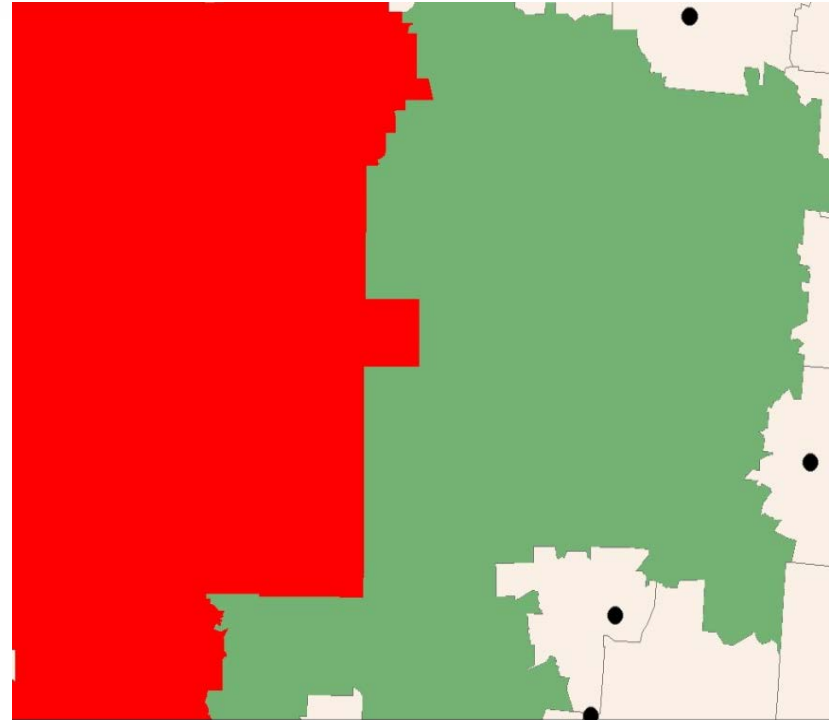
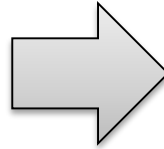
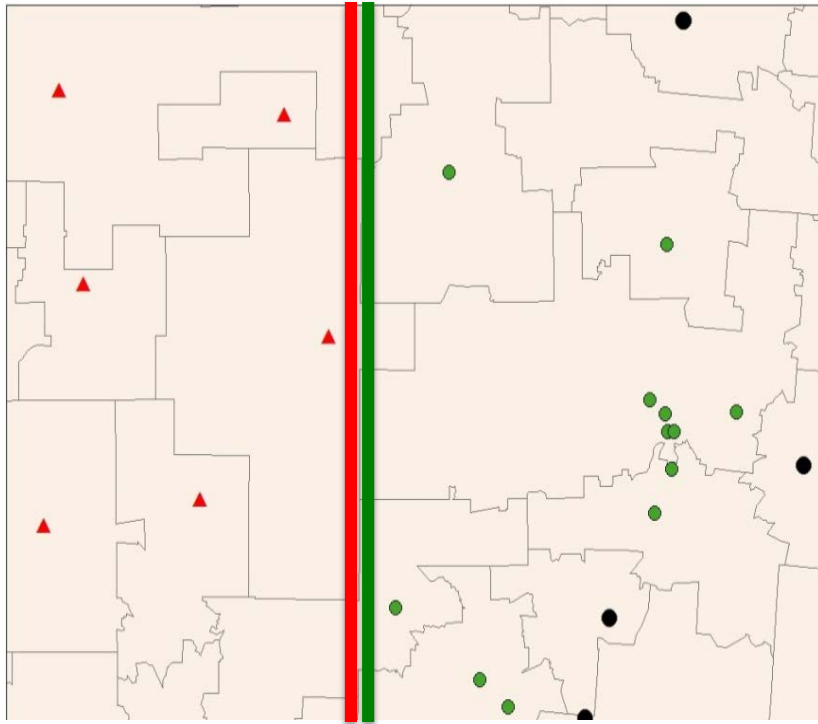


Geographic service area type



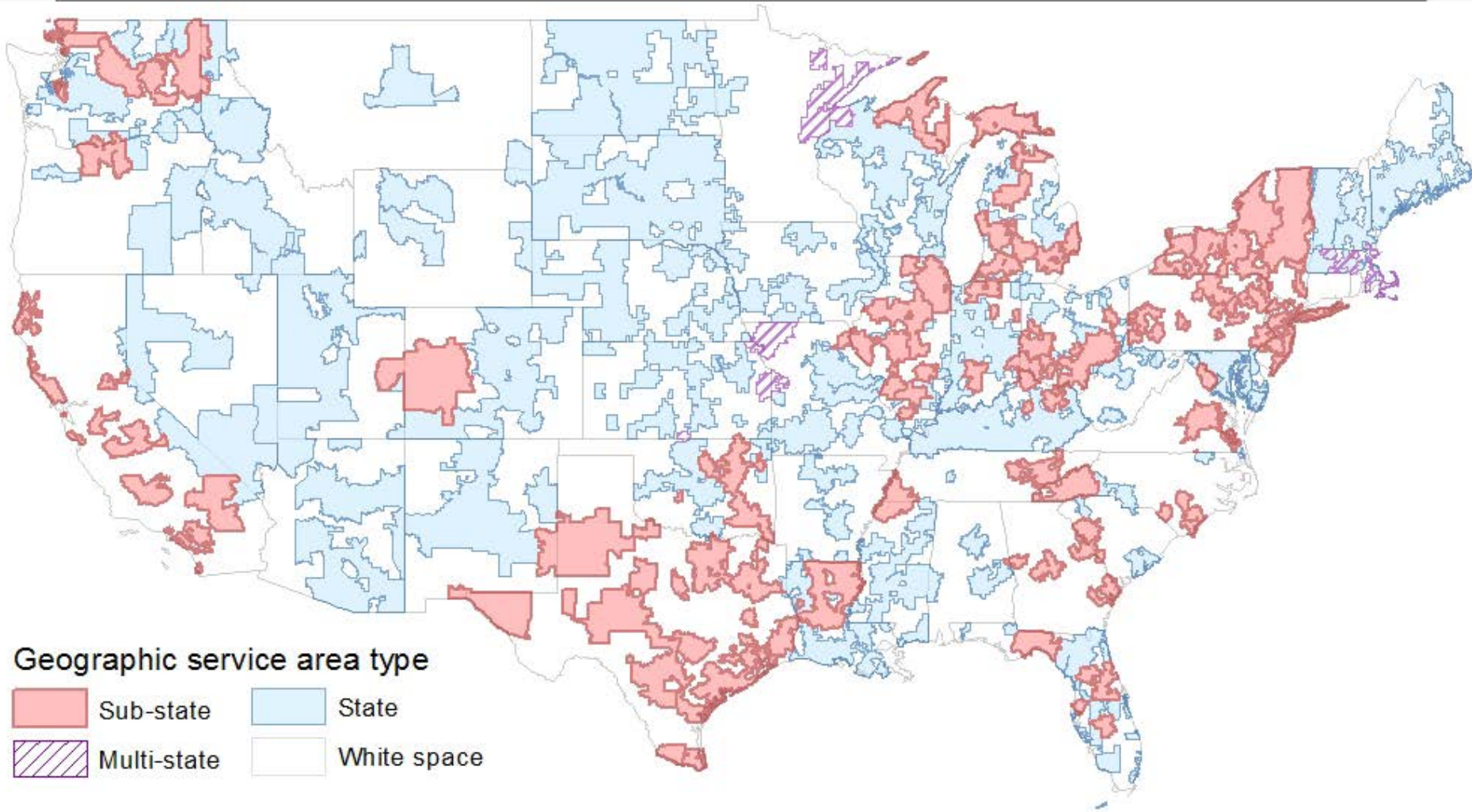
	Total	Sub-state exchanges	State / Multi-state
N	131	88	43

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.

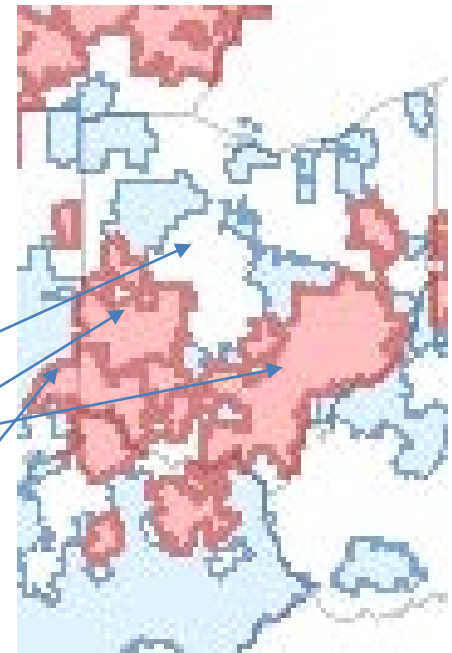
Differential hospital participation

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

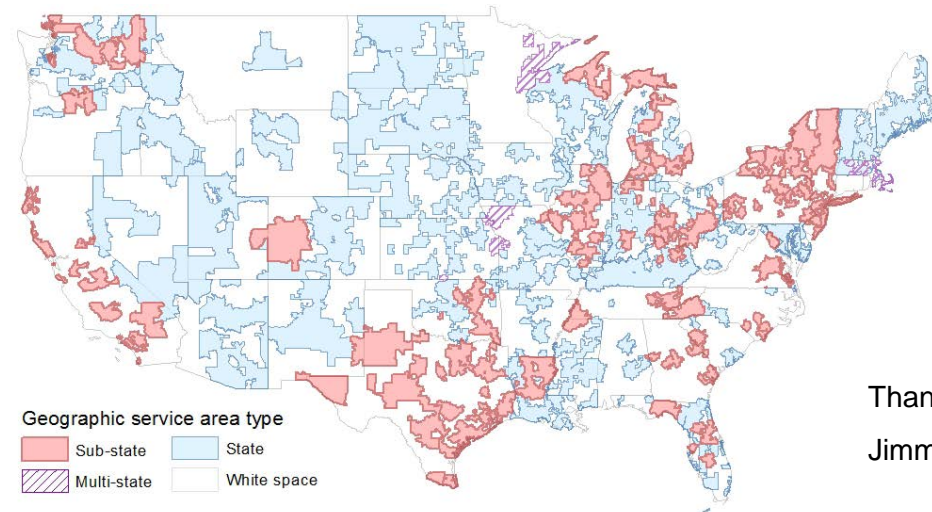
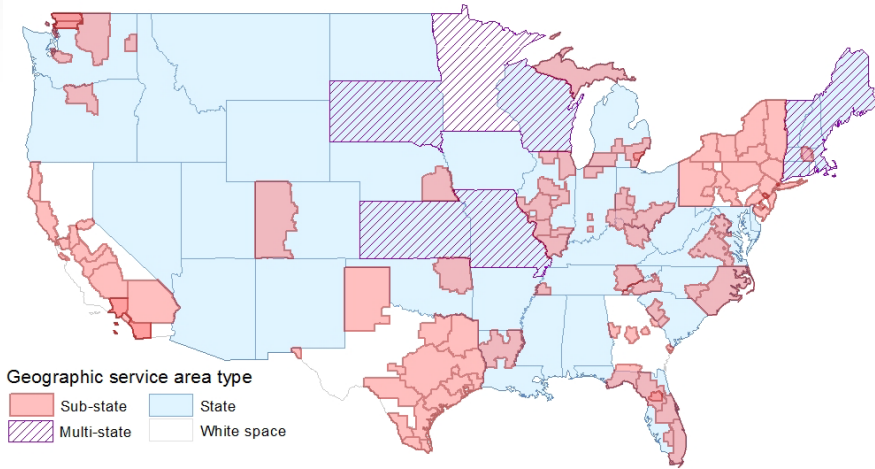
Gaps

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.



Contact Information

Joshua Vest, Ph.D., M.P.H

joshvest@iu.edu



How To Submit a Question

- At any time during the presentation, type your question into the “Q&A” section of your WebEx Q&A panel.
- Please address your questions to “All Panelists” in the drop-down menu.
- Select “Send” to submit your question to the moderator.
- Questions will be read aloud by the moderator.

The screenshot displays the WebEx interface for submitting a question. At the top, there are tabs for 'Participants', 'Chat', and 'Q&A'. The 'Q&A' tab is active. Below the tabs, there is a 'Participants' panel with a 'Speaking:' section and lists for 'Panelists: 2' and 'Attendees:'. At the bottom, there is a 'Q&A' panel with a dropdown menu set to 'All (0)'. A red arrow points to the 'Ask:' dropdown menu, which is currently set to 'All Panelists'. Below the dropdown is a text input field with a 256-character limit and a 'Send' button.



Obtaining CME/CE Credits

If you would like to receive continuing education credit for this activity, please visit:

<http://hitwebinar.cds.pesgce.com/eindex.php>