The Secondary Use of Electronic Clinical Data for Public Health Practice

Health Sciences Informatics Grand Rounds
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Lecture Objectives:

1. Describe the potential benefits of EHR data for public health practice
2. Examine past and ongoing projects of secondary use of EHR in public health
3. Examine barriers (technical, policy, and empirical) that stand in the way of optimal benefit of the secondary use of EHR data for improvement in public health practice

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Disclosure

Roland Gamache, Ph.D., MBA reports that he has no financial relationship with any commercial interest.
Objectives

- Benefits for public health from electronic clinical data
- Working use-cases
  - Flu
  - TB
  - Syndromic surveillance
  - ELR
- Barriers to implementation
The Problem

- Data needed for public health processes, including situational awareness processes, are scattered across separate systems.
- Public health generally lacks methods for communicating with clinical enterprise that are at once efficient, reliable, consistent, and comprehensive.
- This situation hinders bi-directional communication capabilities between PH and clinical care.
- HIE's can facilitate bi-directional communication.
Health Definition

- Health is a state of well-being and the capability to function in the face of changing circumstances.

Institute of Medicine, Committee definition
Public Health

- Fulfilling society’s interest in assuring conditions in which people can be healthy

Institute of Medicine, 1988
Fulfilling society’s interest in assuring conditions in which people can be healthy
What is Public Health Informatics?

Public health application of science and practice, res...
What is Public Health Informatics?

Public health informatics is the systematic application of information, and computer science and technology to public health practice, research, and learning.
Public Health Response Cycle

- Assessment → Policy Development
- Evaluation → Assurance
The Value of Data

Unlike medical or laboratory equipment, which wears out and loses value with use, information becomes more valuable the more it is used. Information does not grow in value, however, merely by residing in a database. The more it is made accessible to increasing numbers of people and used in more ways, the better it serves society.

Public Health Informatics Institute, Topics In Public Health Informatics
Indiana Birth Defects Registry

- Hiring freeze – no new staff
- Matching and case identification
- Data feeds from all hospitals
- $50,000 remaining in budget for data analysis
- Needed a tool to link births, deaths, low birth weight, newborn screening, chart audits and hospital UB92 data
Started the Indiana Birth Defects and Problems Registry

- Title is a combination of state law and funding terminology
- Initial emphasis on matching birth and death records
- The registry was person-centric to develop a birth defects profile
- It was easier just to keep all matched records than try to screen for just the birth defect records
What changed in this environment?

- Standards were being accepted
- Preparedness grants in the state had ensured high speed connection with all hospitals and nearly all Local Health Departments
- Hospitals more interested in sharing data (HIPAA scare was ending)
As the IBDPR grew to include more data sets and developed an expanded “Child ‘Public’ Health Profile”, the registry became part of a larger system.
Integrated Data System (IDS)
• Ongoing collection and assessment of health-related data that:
  – Precede diagnosis and lab results
  – Identify **sufficient probability** that a case or an outbreak may warrant a public health response
Statewide infrastructure for electronic transfer and analysis of data from hospitals and other patient care institutions for the early detection of:

- Acts of bioterrorism
- Disease outbreaks and other public health emergencies
- Situational awareness
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  – Situational awareness
PHESS Data Sources

- Hospital Emergency Departments
  - Based on patient chief complaint
  - No interruption to emergency department work flow
  - Transmitted in real-time to Regenstrief Institute
  - Supported by state statute
Current PHESS in Indiana

- Number of hospitals
  - 104
Syndromes for Emergency Department Chief Complaint Data

- Respiratory
- Gastrointestinal
- Fever
- Neurological
- Rash
- Botulism-like
- Hemorrhagic illness
- Shock / Coma
- Other
Sample Events

- Carbon monoxide exposure
- Foodborne outbreak
- Tornado injuries
- Detection of bioterrorism exercise
- Influenza-like illness tracking
Alert Time Series

Daily Data Counts

- Alert
- Warning
- Data
Alert Time Series

Daily Data Counts for Other Syndrome

Elevated number of tornado-related trauma cases
System Discrimination

![Graph showing ED visit count for different categories over time.](image)
Alert Time Series
(Respiratory Syndrome)
Action Steps

- Odd spike:
  - “interesting” chief complaints
  - flu-like symptoms
  - 3 hr presentation window
  - sought care at ED outside of home zip

- Followed up with LHD and ED

- Resolution: Patients part of bioterrorism exercise
Influenza-like Illness Tracking
Combining Syndromic and Clinical Results
The Indiana Network for Patient Care
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An operational community wide electronic medical record
The Indiana Network for Patient Care

An operational community wide electronic medical record
The Indiana Network for Patient Care (INPC) is a 16-year-old health information exchange. It includes clinical data from over 80 hospitals, the public health departments, local laboratories, imaging centers, a few large-group practices closely tied to hospital systems, with plans to continue expanding.

The exchange data repository carries:
- over 4 billion discrete clinical results
- over 79 million text reports
- more than 25 million different patient registrations of over 12 million unique patients
Delivery – An Illustration
Delivery – An Illustration
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Integrated Data System (IDS)
Clinical Health Information Flow

Hospital ED Registration
Clinical Health Information Flow

Hospital ED Registration → HL7 ADT message → Hospital Interface Engine (Routing)
Clinical Health Information Flow

Hospital ED Registration

HL7 ADT message

Hospital Interface Engine (Routing)

Hospital Firewall (Encryption)
Clinical Health Information Flow

1. Hospital ED Registration
2. Hospital Interface Engine (Routing)
3. Hospital Firewall (Encryption)
4. Network Connection
5. Firewall (Decryption)
Clinical Health Information Flow

Hospital ED Registration

Hospital Interface Engine (Routing)

Hospital Firewall (Encryption)

Network Connection

RG Message Processor

RG Message Listener

Firewall (Decryption)
Clinical Health Information Flow

- Hospital ED Registration
- Hospital Interface Engine (Routing)
- Hospital Firewall (Encryption)
- Network Connection
- RG Message Processor
- RG Message Listener
- Firewall (Decryption)
Population Health Information Flow

Hospital ED Registration
Population Health Information Flow

Hospital ED Registration ➔ HL7 ADT message ➔ Hospital Interface Engine (Routing)
Population Health Information Flow

Hospital ED Registration → HL7 ADT message → Hospital Interface Engine (Routing) → Hospital Firewall (Encryption)
Population Health Information Flow

- Hospital ED Registration
- HL7 ADT message
- Hospital Interface Engine (Routing)
- Hospital Firewall (Encryption)
- Network Connection
- Firewall (Decryption)
Population Health Information Flow

1. Hospital ED Registration
2. Hospital Interface Engine (Routing)
3. Hospital Firewall (Encryption)
4. Network Connection
5. RG Message Processor
   - Batched, delivered to ISDH every 3 hours
6. RG Message Listener
7. Firewall (Decryption)
Automated electronic laboratory reporting (ELR) for public health requires the detection of specific positive clinical laboratory results, however;

- clinical laboratory results are often identified local codes that represent identical concepts in different laboratory systems
- mapping local laboratory test codes to the LOINC® vocabulary standard enables interoperable data sharing and aggregation from many sources
- the task of mapping each local code in a laboratory test dictionary to a code from a vocabulary standard can be daunting because it is a complex and resource demanding process
As few as 80 distinct laboratory result codes can account for over 80% of the total volume of laboratory results seen in a typical health care system. The challenge and cost of mapping local codes to a standard vocabulary in resource-limited settings is significant. One potential strategy to mitigate this burden is to focus the mapping effort on the highest volume tests. This frequency-based approach will be referred to as “selective mapping.”
The Problem

However, the selective mapping approach may have adverse consequences for public health as it relies more on automated electronic laboratory reporting systems for the reporting of notifiable diseases and population-based surveillance in the community.
The LOINC Top 2000 presents a much more manageable target than trying to match all of the codes in a typical laboratory’s 2000-5000 term dictionary to one of the 68,000 LOINC codes in the current release (December 2011).
The Centers for Disease Control and Prevention (CDC) developed and published the Reportable Condition Mapping Table (RCMT), a resource that provides mappings between reportable conditions and their associated LOINC coded laboratory tests.

In addition to the codes in the LOINC Top 2000, the LOINC codes in the RCMT also represent an important target for mapping for public health use cases.
Notifiable Condition Detector

- In operation over 10 years
- Receives more than 350,000 real-time HL7 clinical transactions daily
- Identified 833,710 potentially reportable conditions to public health from 3/8/97 through 12/5/11
  - (It is not uncommon for a patient to present with multiple reportable conditions)
ELR Completeness+

Electronic Laboratory Reporting (INPC) - 3278

Passive Reporting (Health Dept.) - 550
- 282 (50.36%)
- 73 (13.33%)
- 10 (1.82%)

Passive Reporting (Hospital) - 515
- 77 (14.89%)

4,785 total reportable cases
INPC - 4,625 (97%)
Health Dept - 905 (19%)
Hospitals - 1,142 (24%)

### TABLE 2—Reporting Timeliness for Traditional Methods and Electronic Laboratory Reporting, by Condition: Indianapolis, Ind, 2001

<table>
<thead>
<tr>
<th>Condition</th>
<th>Average Lag Time, Days</th>
<th>No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacteriosis</td>
<td>0.0</td>
<td>1</td>
</tr>
<tr>
<td>Chlamydial infection</td>
<td>10.0</td>
<td>363</td>
</tr>
<tr>
<td>Cryptosporidiosis</td>
<td>0.0</td>
<td>1</td>
</tr>
<tr>
<td><em>Escherichia coli</em> O157:H7 infection</td>
<td>-1.0</td>
<td>1</td>
</tr>
<tr>
<td>Giardiasis</td>
<td>3.5</td>
<td>2</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>4.0</td>
<td>4</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>2.2</td>
<td>17</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>5.5</td>
<td>157</td>
</tr>
<tr>
<td>Histoplasmosis</td>
<td>-8.5</td>
<td>4</td>
</tr>
<tr>
<td>Salmonellosis, nontyphoid</td>
<td>-1.0</td>
<td>3</td>
</tr>
<tr>
<td>Shigellosis</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Streptococcus: group A</td>
<td>1.2</td>
<td>5</td>
</tr>
<tr>
<td>Streptococcus: group B</td>
<td>20.0</td>
<td>2</td>
</tr>
<tr>
<td>Syphilis</td>
<td>4.4</td>
<td>17</td>
</tr>
</tbody>
</table>

Note. Negative values indicate that electronic laboratory reports were received later than did spontaneous reports on average. Only conditions for which timeliness could be calculated are included.

ELR identified cases 7.9 days earlier than did spontaneous reporting.

Percent of Public Health Reportable Conditions Identified by LOINC Codes Contained in the LOINC Top 2000

- 65.3%
- 34.7%
Top Reported Public Health Codes

[Graph showing cumulative percent vs. number of reportable laboratory test codes observed in the NCD]
A Sensitivity Analysis of the Rate of Notifiable Public Health Results Identified by Mapping the Most Common LOINC® Codes

![Chart showing the percentage of reported public health conditions included in mapped clinical LOINC conditions vs. number of clinical LOINC conditions mapped.]
Project Summary

- Using only the Top 2000 clinical codes would potentially miss just under 35% of the reportable public health conditions.
- Reviewing the community public health needs and ensuring that the top Public Health (136 LOINC codes for Indiana) are also included in this mapped set of local terms would increase the percentage of automated reported cases to public health to 98% of the reported conditions.
- Using the same strategy as clinical systems, selectively including public health observations can minimize mapping effort while providing a robust automated reporting system for the community.
Background

- An increase in tuberculosis (TB) among homeless men residing in Marion County, Indiana was noticed in the summer of 2008. (n=30)
- The Marion County Public Health Department (MCPHD) hosts screening events at homeless shelters in hopes of finding unidentified cases.
- To locate men who had a presumptive positive screen, MCPHD partnered with Regenstrief Institute (RI) to create an alert for providers who use the Gopher patient management system in one of the city’s busiest emergency departments.
This patient had a recent positive TB screen (PPD/IGRA). Marion County is currently experiencing a TB outbreak among homeless individuals.

Please obtain a CXR on this patient if they lack a CXR over the last three months. If the CXR indicates air space disease the patient should be considered a TB suspect and admitted. Homeless persons who are PPD/IGRA positive with air space disease on CXR should not be discharged to a shelter untreated.

Please alert the Marion County Health Department that the patient was seen in the ED. Phone 221-2110 during normal business hours and 373-2404 after 5 p.m. Please leave a voice mail if no answer, and note if treatment for respiratory infection was administered.

1. OMIT Chest PA-Lat XR  R/o active TB
2. OMIT AFB Culture    obtain daily x 3
Numbers

- Fifty-Three (53) different patients have been on the alert list since activation
- One notification in 13 months of activation
- December 1, 2010, provider ordered a chest x-ray and notified the MCPHD staff
TB Patients Lost to Follow-Up

Number of Individuals

- No visit to ED
- Seen in ED
- Seen in ED with Notification
- Seen in ED then TB Clinic
Review of patient system

- 12 other patients were seen in the emergency departments while on active alert lists
- Some patients were seen >1 time while on the list
- Some cases showed that the chest x-rays were performed as requested but the patient records did not indicate if the procedure was prompted due to the alert or because the patient presented with symptoms of TB.
Future plans

- Work with ED staff to educate them on reason/need for alert
- Add the Alert at a better place in the workflow so that it impacts the clinical encounter (GOPHER to ROES)
- Partner with local mental health agency to create a similar alert in their patient management system
Only one patient confirmed to be identified via the alert
12 individuals were found that were not able to be located by traditional public health means
The proximity of the follow-up in the TB clinic suggests that some information was shared with the patient as part of the ED encounter
Multiple strategies must be used to reach this population for care
Population Based Rulings

There are manifold restraints to which every person is necessarily subject for the common good. On any other basis organized society could not exist with safety to its members. Society based on the rule that each one is a law unto himself would soon be confronted with disorder and anarchy. Real liberty for all could not exist under the operation of a principle which recognizes the right of each individual person to use his own, whether in respect of his person or his property, regardless of the injury that may be done to others.

. . . [Thus,] in every well-ordered society charged with the duty of conserving the safety of its members, the rights of the individual in respect of his liberty may at times, under the pressure of great dangers, be subjected to such restraint, to be enforced by reasonable regulations, as the safety of the general public may demand.

- Justice Harlan

US Supreme Court Decision, Feb. 20, 1905
Privacy and Security

Privacy

Transparency
An **INFORMATICS SAVVY ORGANIZATION** is one that has an informatics-skilled workforce, a disciplined approach to information system design and use, and reliably managed IT operation.

**INFORMATICS** implies a disciplined approach to information systems design and use that drives improvements in public health practice.
Summary

- HIE can help public health and providers meet “Meaningful Use” criteria
- Enhanced surveillance activity
- Broadcast messaging
- Improved information flow
  - Bi-directional communication
- Outbreak management