The impact of health information exchange

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Any discussion requires clarification about the “two faces” of HIE...

Technology
- The “how”
- The “verb”
- Methods & modes of sharing

Organization
- The “who”
- The “noun”
- Entities working to make HIE occur
The two main streams of health information exchange research:

- **Usage**
  Who, why and how?

- **Impact**
  What is the effect?

Disclaimer: this won’t be an exhaustive review.
• Outpatient & specialty practices slower to adopt
• For profit institutions slower to adopt
• Competition inhibits HIE
• Governance, legal, technology, financial barriers
• High project failure rates

• Outpatient & specialty practices slower to adopt
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The one area that is more about the organization of HIE than the technology.
Tracking surveys indicate that HIE adoption among hospitals outpaces adoption among ambulatory care providers.

Furukawa, Patel et al. Health Affairs 2013; Furukawa, King et al. Health Affairs 2014;
<table>
<thead>
<tr>
<th>Specialty</th>
<th>Health information exchange with any other providers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-primary care specialty</strong></td>
<td>0.66** [0.54,0.81]</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>Under 50 years</td>
<td>REF</td>
</tr>
<tr>
<td>50 years and over</td>
<td>1.12 [0.90,1.39]</td>
</tr>
<tr>
<td><strong>Practice size</strong></td>
<td></td>
</tr>
<tr>
<td>Single physician</td>
<td>REF</td>
</tr>
<tr>
<td>2-5 physicians</td>
<td>1.61** [1.21,2.15]</td>
</tr>
<tr>
<td>6-10 physicians</td>
<td>1.60** [1.15,2.23]</td>
</tr>
<tr>
<td>11+ physicians</td>
<td>2.36** [1.56,3.59]</td>
</tr>
<tr>
<td><strong>Practice type</strong></td>
<td></td>
</tr>
<tr>
<td>Single-specialty</td>
<td>REF</td>
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<tr>
<td>Multi-specialty</td>
<td>2.01** [1.56,2.60]</td>
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<tr>
<td><strong>Ownership</strong></td>
<td></td>
</tr>
<tr>
<td>Physician or physician group</td>
<td>REF</td>
</tr>
<tr>
<td>Hospital or academic medical center</td>
<td>2.42** [1.87,3.13]</td>
</tr>
<tr>
<td>HMO or other health care organization</td>
<td>2.83** [1.87,4.27]</td>
</tr>
<tr>
<td>Community health center</td>
<td>0.52* [0.31,0.88]</td>
</tr>
<tr>
<td>Other or unknown</td>
<td>0.97 [0.67,1.40]</td>
</tr>
</tbody>
</table>

Furukawa, King et al. Health Affairs 2014
The research on HIE adoption among hospitals also indicated...

..for profit hospitals were less likely to adopt HIE....

..competition inhibited adoption & implementation....

...specialty hospitals more likely to exchange with in-system members than externally....
Governance (the purposeful guiding and steering activities) can be a challenge in interorganizational collaborative organizations.

Joint Benefits
Joint decision making
Trust
Equality
Varied needs
Individual priorities
Control

Driving interest in enterprise HIE.
• Stand alone systems disrupt workflow
• Integration of HIE into EHR improves usage
• Frequent reliance on “proxy” users
• Automated delivery can overwhelm workflows

Information sent (HL7)

EHR holding tank

Information reviewed by staff

Put info. into EHR?

Record viewed by physician

Example workflow of “push” HIE that uses proxy

Information need

Get info from HIE?

Staff queries database

Information viewed by physician

Example workflow of “pull” HIE that uses proxy

Adapted from Kierkegaard et al App Clin Info 2014
- Physicians generally supportive of HIE as a concept: believe can provide useful information, saves money & duplication
- Usage of stand alone portal HIE is low
- Physicians & other clinicians access HIE system less frequently than staff
- Wide variance in user behavior
- Automated delivery of results appears preferable to query-based HIE

HIE users with different jobs have different methods of access.

Vest & Jasperson J Med Syst 2012
Physicians may have more favorable views of “push” HIE.

Figure 1. Proportions of physicians (push users: n=78; pull users: n=52) very satisfied with aspects of push and pull HIE in order of push proportions.

Largely survey & qualitative work
Often single site studies
Science being outpaced by technology
Measurement reliability & construct validity issues

What is usage? What do usage metrics mean?

HIE is a process or an organization?

What is a health information organization?

Different levels of analysis
• Associated with reductions in:
  • admissions via the ED
  • 30 day hospital readmissions
  • imaging use (& repeated)
  • laboratory tests
- Memphis, Tennessee
- Matched cohort design
- HIE access associated with 73% lower odds of hospital admissions via the ED

- Rochester, New York
- Cohort design
- HIE access associated with 30% lower odds of hospital admission via the ED

- Israel
- Cohort design, stratified by diagnosis
- HIE access associated with 13% lower odds of hospital admission via the ED

- Rochester, New York
- Cohort design
- 57% lower odds of same-cause readmission within 30 days
Memphis, Tennessee
Matched cohort design
HIE associated with lower CT use in one site
HIE associated with more CT use at another site

Buffalo, New York
Randomized trial
ED physicians assigned to HIE exposure group (given scribes)
HIE access associated with 52% reduction in expected laboratory tests
HIE access associated with 36% reduction in expected imaging exams ordered

Indianapolis, Indiana
Randomized trial
Patient randomized
Display of prior results reduced test ordering
• Associated with reductions in:
  • admissions via the ED
  • 30 day hospital readmissions
  • imaging use (& repeated)
  • laboratory tests

• Studies showing no or negative association with:
  • admissions via the ED
  • repeat ED visits
  • laboratory tests
• Associated with reductions in:
  • admissions via the ED
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  • repeat ED visits
  • laboratory tests

A Randomized, Controlled Trial of Clinical Information Shared From Another Institution
• Indianapolis, Indiana
• RCT of ED physicians
• No effect on repeat ED visits
• No effect on admission rates

Impact of an electronic link between the emergency department and family physicians: a randomized controlled trial
Lang et al. CMAJ 2006
• Montreal, Canada
• RCT with outpatient providers
• No effect on repeat ED visits
Potential savings attributed to reductions in utilization:
- Admission costs
- Imaging costs
- Return on Investment (ROI)
No cost savings for imaging or laboratory tests

$29 per ED visit saved

$2.9M / yr in avoided hospital imaging payments

$360K / yr in avoided admissions
$600K / yr in avoided readmissions
$2.50 per patient in avoided repeat imaging

$26 per ED visit saved

$2.50 per patient in avoided repeat imaging

$1.9M / yr in savings for EDs

Ross et al. JAMIA 2013
Vest et al. Applied Clinical Informatics 2014
Vest et al. JAMIA 2014
Jung et al. Journal of the American College of Radiology 2015
Frisse et al. JAMIA 2012
Lammers et al. Medical Care. 2014
• Potential savings attributed to reductions in utilization:
  • Admission costs
  • Imaging costs
• Return on Investment (ROI)
• Studies also show:
  • No (or even) increased costs
• Return on Investment (ROI) or cost savings is often “perceived” or “anticipated”
• Associated with reductions in:
  • Unnecessary imaging & diagnostic tests
• Associated with improvements to:
  • Care coordination
  • Ambulatory care quality indicators
• Associated with public health improvements
Minneapolis, Minnesota
- Qualitative / Chart Review
- Access of HIE information cited as reasons against duplicate diagnostic procedures

Memphis, Tennessee
- Cohort design of headache patients
- HIE access associated with 62% lower odds of neuroimaging
- Associated with increased guideline adherence

Memphis, Tennessee
- Cohort design of repeat patients with back pain
- HIE access associated with 64% lower odds of diagnostic imaging
- No cost savings

All hospitals in California and Florida
- Panel analysis
- Hospitals with HIE associated with reduced redundant imaging

Minneapolis, Minnesota
- Qualitative / Chart Review
- Access of HIE information cited as reasons against duplicate diagnostic procedures
• Louisiana
  • Case – cohort design of HIV patients
  • HIE associated with re-engaging patients into ongoing care

• Cincinnati, Ohio
  • Cohort of ambulatory practice physicians
  • HIE portal use associated with increased scores on quality of care composite index

• Hudson Valley, New York
  • HIE alerts helped identify pediatric asthma patients for intervention & coordination

• Indianapolis, Indiana
  • HIE improves the completes and timeliness of notifiable disease reporting for public health departments
Applications of Health Information Exchange Information to Public Health Practice

Patrick Klerkeaard, PhD,1 Rainu Kaushal, MD, MPH,2,3,4,5,6 and Joshua R Vest, PhD, MPH2,3


- Binghamton, New York
- HIE enabled access to critical health information during natural disasters

http://mikesaltzman.com/binghamton-flooding-emergency-information/
• Evidence from very few exchange efforts (<10? out of more than 120+)
• Very little on patient outcomes (i.e. better health)
• Methodological concerns

<table>
<thead>
<tr>
<th>Outcome type</th>
<th>Observationala studies</th>
<th>Experimentalb studies</th>
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<tbody>
<tr>
<td>Hospital admissions (n = 14)</td>
<td>90.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Hospital readmissions (n = 5)</td>
<td>100.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Number of imaging tests (n = 12)</td>
<td>62.5</td>
<td>25.0</td>
</tr>
<tr>
<td>Repeat imaging tests (n = 8)</td>
<td>83.3</td>
<td>25.0</td>
</tr>
<tr>
<td>Number of lab and diagnostic tests (n = 10)</td>
<td>83.3</td>
<td>25.0</td>
</tr>
<tr>
<td>Repeat lab and diagnostic tests (n = 5)</td>
<td>66.7</td>
<td>50.0</td>
</tr>
<tr>
<td>Number of ED visits (n = 4)</td>
<td>50.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Repeat ED visits (n = 1)</td>
<td>—c</td>
<td>0.0</td>
</tr>
<tr>
<td>Length of hospital stay (n = 2)</td>
<td>—c</td>
<td>0.0</td>
</tr>
<tr>
<td>Outpatient visits (n = 2)</td>
<td>—c</td>
<td>0.0</td>
</tr>
<tr>
<td>Number of appointments (n = 1)</td>
<td>100.0</td>
<td>—c</td>
</tr>
<tr>
<td>Number of referrals (n = 1)</td>
<td>0.0</td>
<td>—c</td>
</tr>
<tr>
<td>Repeat specialty consultations (n = 1)</td>
<td>—c</td>
<td>0.0</td>
</tr>
<tr>
<td>Ambulatory care-sensitive hospitalizations (n = 1)</td>
<td>0.0</td>
<td>—c</td>
</tr>
<tr>
<td>Patient visit costs (n = 5)</td>
<td>50.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Annual financial savings (n = 3)</td>
<td>100.0</td>
<td>—c</td>
</tr>
<tr>
<td>Costs of lab tests (n = 2)</td>
<td>0.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Costs of radiology tests (n = 1)</td>
<td>0.0</td>
<td>—c</td>
</tr>
</tbody>
</table>

*Weaker evidence may indicate publication bias.*
**Usage**

**Positives**
- General clinician & patient support for HIE
- HIE supports the work of different professionals & organizations
- Integration into EHRs supports usage

**Negatives**
- Many barriers to workflow
- Probably under-utilized

**Impact**

**Positives**
- Strongest evidence from emergency department
- Can reduce unnecessary utilization
- Indications of cost savings

**Negatives**
- Needs stronger evidence
- Needs generalizable evidence
Additionally, significant gaps exist by type of HIE organization, or what do we know about the “nouns”?

What about comparisons of organizations?

Derived from reported data in Rudin et al. Annals of Internal Medicine 2015
Where do we go from here?

- Need to fill in the gaps.
- Need to be clear.
- Need to be practical.
- Need some bravery.

The end of MU?
The evidence in support of HIE is promising, but the evidence base needs to improve.

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