Health Information Exchange as a Driver of Improved Population Health

Julia Adler-Milstein, PhD

January 19, 2017

Overview of Talk

- Context and Definitions
  - Population health, HIE, and how they relate
- Impact of Interoperability (and HIE): The Evidence
  - Are we seeing the expected benefits?
- Improving our Understanding of Impact: An Empirical Study

Definitions

Population Health Management → **Population Health**

"the iterative process of strategically and proactively managing clinical and financial opportunities to improve health outcomes and patient engagement, while also reducing costs"

"the health outcomes of a group of individuals, including the distribution of such outcomes within the group."

Kindig, Health Affairs 2015

Definitions

Timely information from all sites of care in the care continuum, which can be used to measure clinical and financial outcomes, and to identify opportunities for intervention

"the iterative process of strategically and proactively managing clinical and financial opportunities to improve health outcomes and patient engagement, while also reducing costs"

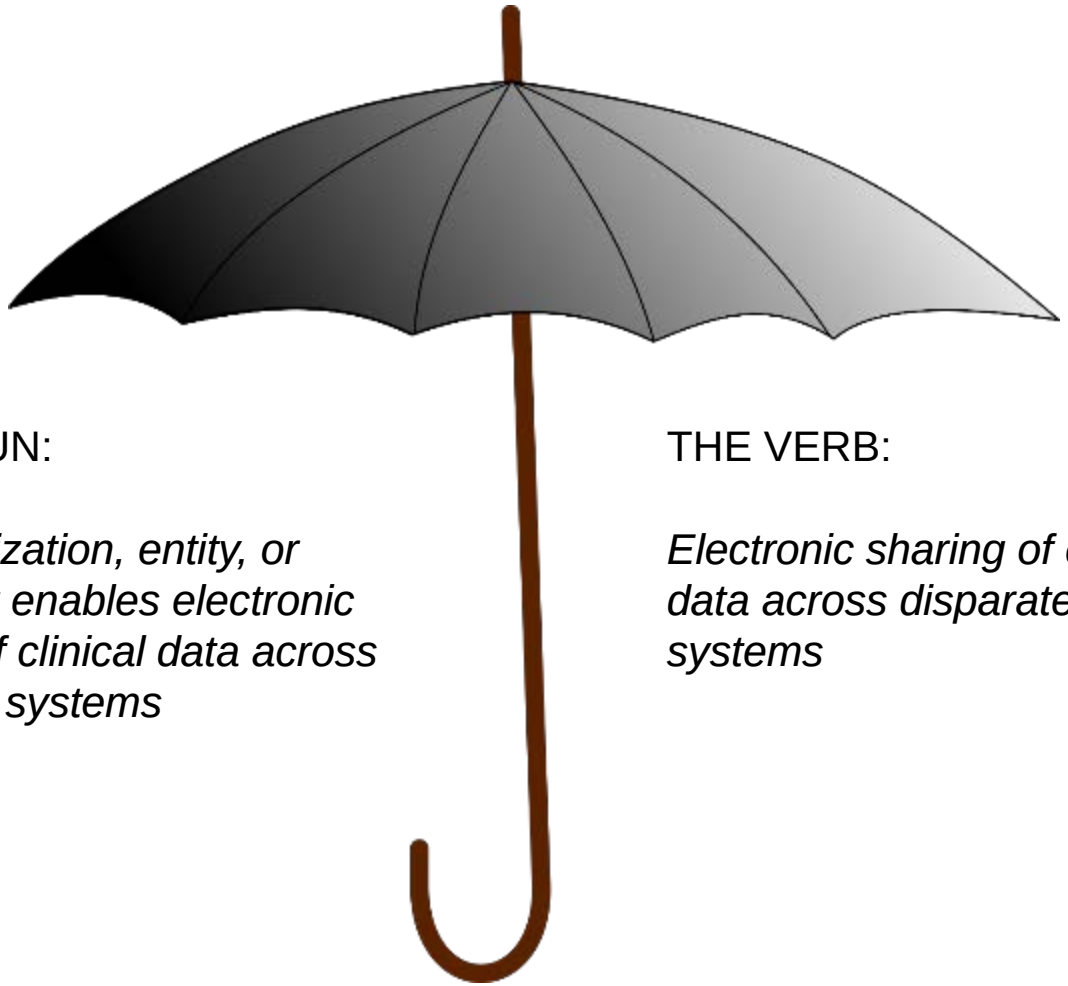
"the health outcomes of a group of individuals, including the distribution of such outcomes within the group."

Today's Reality

Despite substantial investment to digitize the U.S. healthcare system:

- **Patient health information is <u>siloed</u>**
- **When patient information is pulled from multiple siloes, it is <u>not readily integrated</u>**

Health Information Exchange



THE NOUN:

An organization, entity, or effort that enables electronic sharing of clinical data across disparate systems

THE VERB:

Electronic sharing of clinical data across disparate systems

HIE in the U.S. Today

- Policy actions to stimulate HIE and create conditions for HIE to succeed, but still largely left up to the market
- The result: <u>many different ways HIE is occurring</u>
- In the US, we think of these in three main buckets:
  - State or Community-based HIE efforts (also called HIOs, RHIOs)
  - Vendor-mediated HIE efforts
  - Enterprise HIE efforts

HIE in the U.S. Today

Today, there is substantial heterogeneity in HIE capabilities: some providers have nothing while other providers are connected to a subset of other providers.

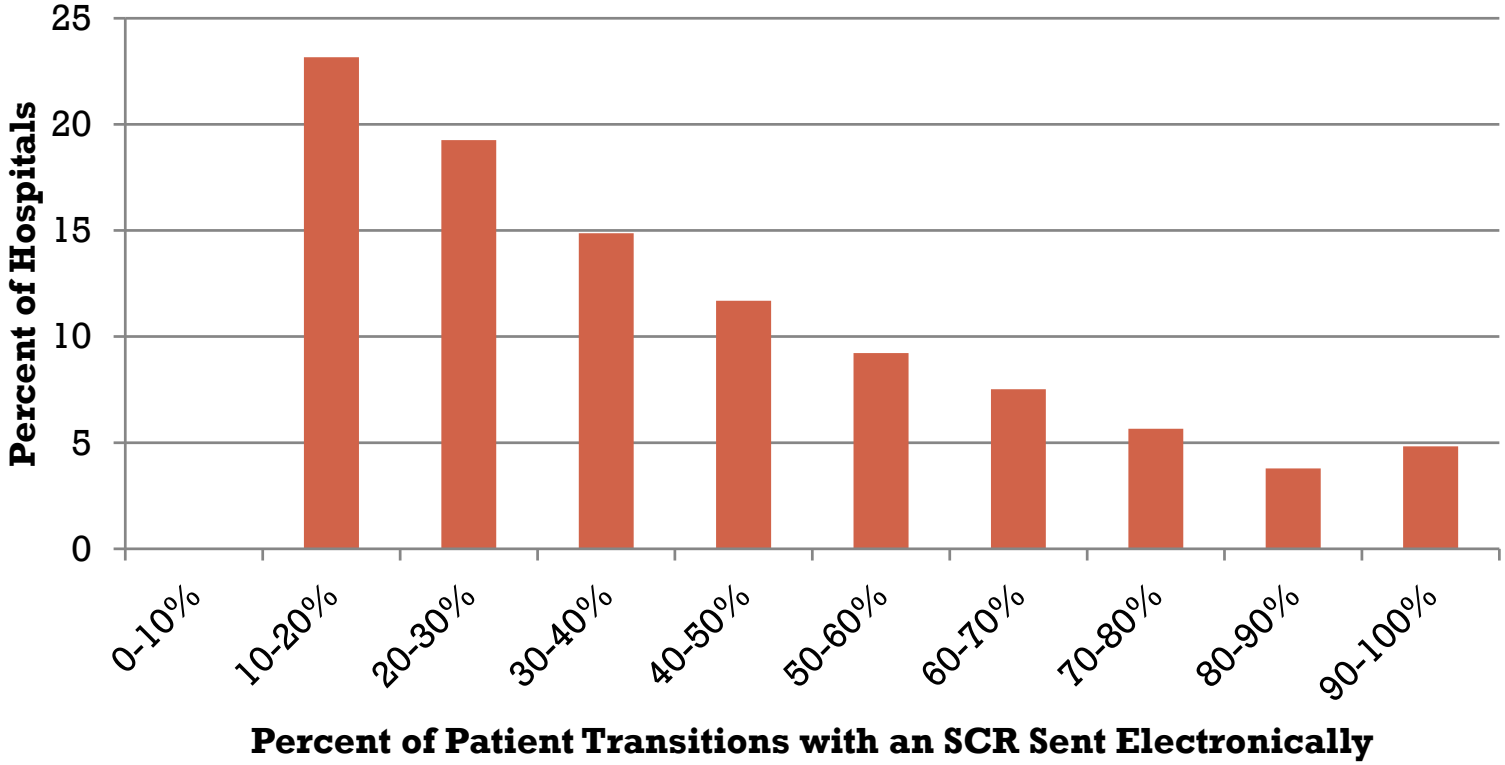
To really understand what someone means when they say they do HIE, need to ask:

(1) Who is sharing?

(2) What is being shared?

(3) How is it being shared?

How often is HIE happening when patients are discharged from the hospital?



N=1,822 hospitals; data through April 2016; CMS 2016

Overview of Talk

- Context and Definitions
- **Impact of HIE: The Evidence**
  - **Are we seeing the expected benefits?**
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And what do we know about the impact?

- Where HIE is occurring, is it improving care and associated outcomes?

- Evidence is weak, and mixed
  - Suggests low levels of use, often due to poor workflow integration
  - Most consistent evidence comes from emergency department settings and avoiding redundant utilization
  - Little insight into mechanisms

By Saurabh Rahurkar, Joshua R. Vest, and Nir Menachemi

Despite The Spread Of Health Information Exchange, There Is Little Evidence Of Its Impact On Cost, Use, And Quality Of Care

ABSTRACT Health information exchange (HIE), which is the transfer of electronic information such as laboratory results, clinical summaries, and medication lists, is believed to boost efficiency, reduce health care costs, and improve outcomes for patients. Stimulated by federal financial incentives, about two-thirds of hospitals and almost half of physician practices are now engaged in some type of HIE with outside organizations. To determine how HIE has affected such health care measures as cost, service use, and quality, we identified twenty-seven scientific studies, extracted selected characteristics from each, and meta-analyzed these characteristics for trends. Overall, 57 percent of published analyses reported some benefit from HIE. However, articles employing study designs having strong internal validity, such as randomized controlled trials or quasi-experiments, were significantly less likely than others to associate HIE with benefits. Among six articles with strong internal validity, one study reported paradoxical negative effects, three studies found no effect, and two studies reported that HIE led to benefits. Furthermore, these two studies had narrower focuses than the others. Overall, little generalizable evidence currently exists regarding benefits attributable to HIE.

Annals of Internal Medicine

REVIEW

Usage and Effect of Health Information Exchange

A Systematic Review

Robert S. Rudin, PhD; Aneesa Motala, BA; Caroline L. Goldzweig, MD, MSHS; and Paul G. Shekelle, MD, PhD

Background: Health information exchange (HIE) is increasing in the United States, and it is incentivized by government policies.

Purpose: To systematically review and evaluate evidence of the use and effect of HIE on clinical care.

Data Sources: Selected databases from 1 January 2003 to 31 May 2014.

Study Selection: English-language hypothesis-testing or quantitative studies of several types of data exchange among unaffiliated organizations for use in clinical care that addressed health outcomes, efficiency, utilization, costs, satisfaction, HIE usage, sustainability, and attitudes or barriers.

Data Extraction: Data extraction was done in duplicate.

Data Synthesis: Low-quality evidence from 12 hypothesis-testing studies supports an effect of HIE use on reduced use or costs in the emergency department. Direct evidence that HIEs were used by providers was reported in 21 studies involving 13 distinct HIE organizations, 6 of which were located in New York, and generally showed usage in less than 10% of patient encounters. Findings from 17 studies of sustainability suggest that approximately one quarter of existing HIE organizations consider themselves financially stable. Findings from 38 studies about attitudes and barriers showed that providers, patients, and other stakeholders consider HIE to be valuable, but barriers include technical and workflow issues, costs, and privacy concerns.

Limitation: Publication bias, possible selective reporting of outcomes, and a dearth of reporting on context and implementation processes.

Conclusion: Health information exchange use probably reduces emergency department usage and costs in some cases. Effects on other outcomes are unknown. All stakeholders claim to value HIE, but many barriers to acceptance and sustainability exist. A small portion of operational HIEs have been evaluated, and more research is needed to identify and understand success factors.

Primary Funding Source: U.S. Department of Veterans Affairs. (PROSPERO registration number: CRD42014007469)

Ann Intern Med. 2014;161:803-811. doi:10.7326/M14-0877 www.annals.org
For author affiliations, see end of text.

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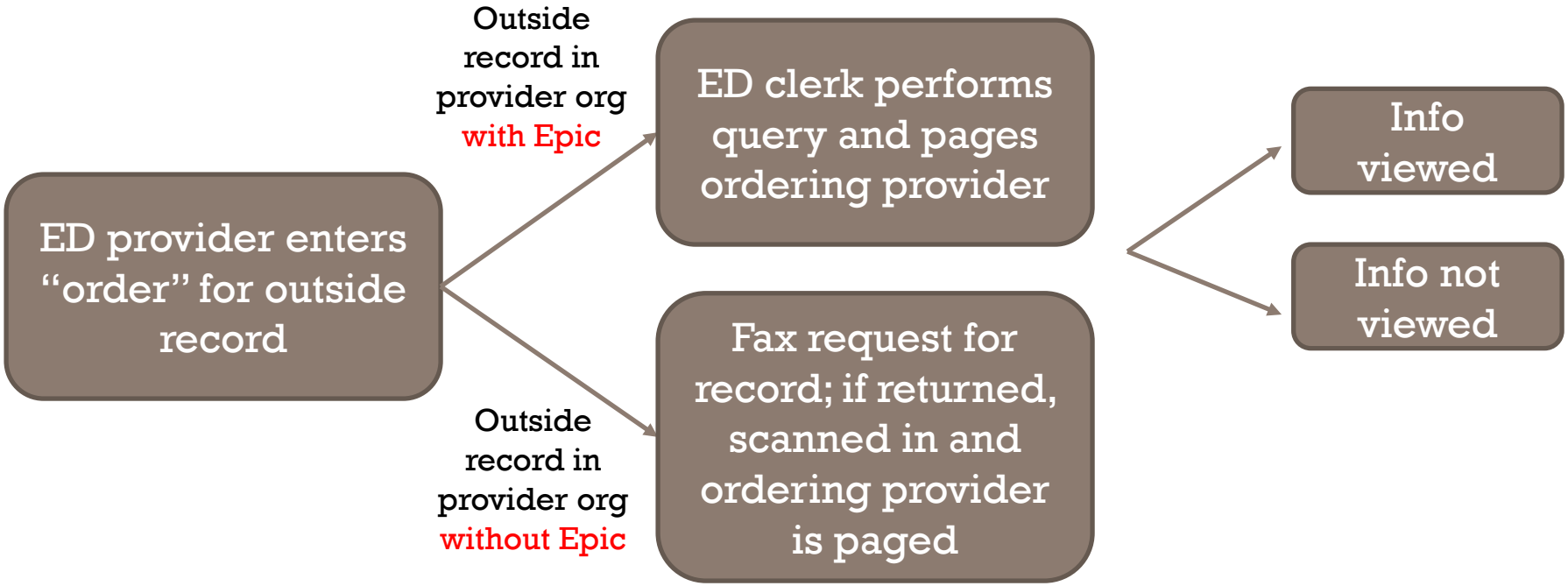
Study: Setting

Study: (Simplified) Workflow



Study: Order for Outside Record

Request for Outside Records
Routine

Accept | Cancel

Priority: Routine | Routine | STAT

Questions:

Prompt	Answer
1. Name of Organization	
2. Record(s)	Inpatient record, Outpatient record, Operative Report, Consults, Treatment Summary, Discharge Summary, Emergency Room Record, Entire Medical Record, Laboratory Tests/Results, Pathology, Previous EKG Image, X-Ray - Imaging Films/CD, X-Ray - Imaging Reports, Other
3. Records for the last:	1 Month, 3 Months, 6 Months, 9 Months, 1 Year, >1 Year
Single response	

Comments (F6): Click to add text

Frequency: Once

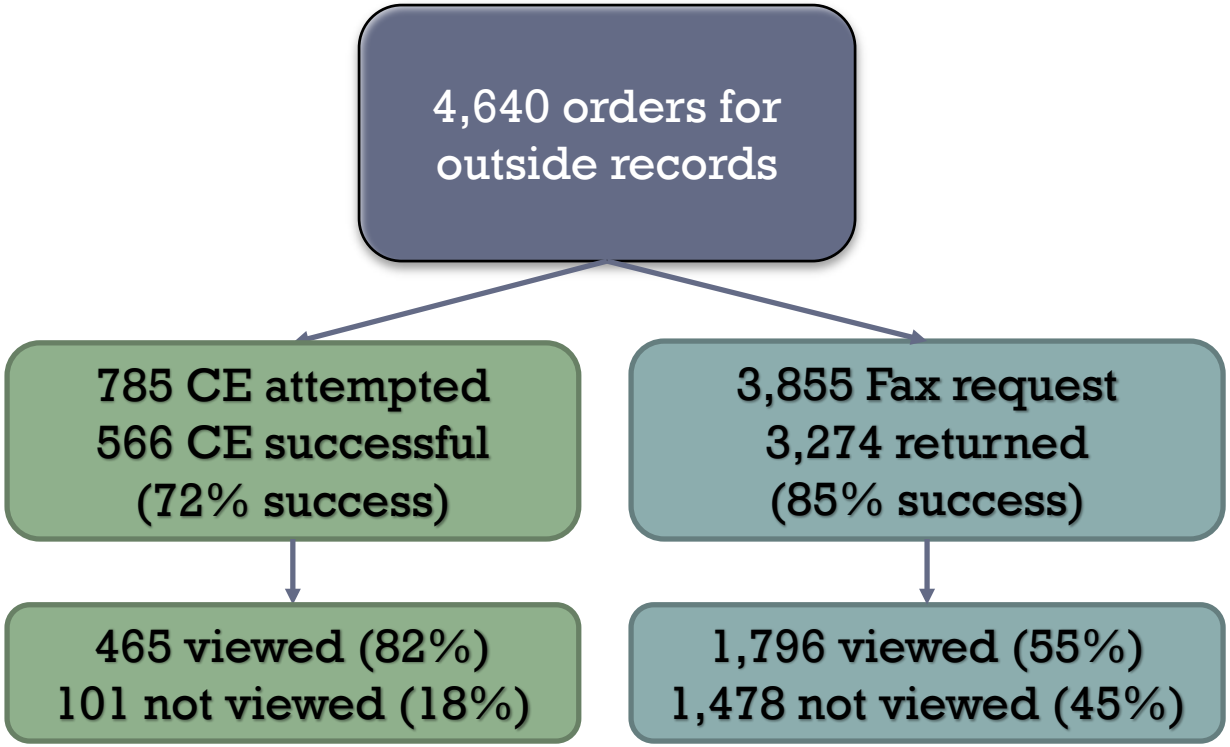
Starting: 2/3/2014 | Today | Tomorrow | At: 1139

First Occurrence: **Today 1139**

Next Required | Link Order | Accept | Cancel

Study: Sample

Timeframe:
February 14, 2014 (3 weeks after CE go-live date) - February 13, 2015



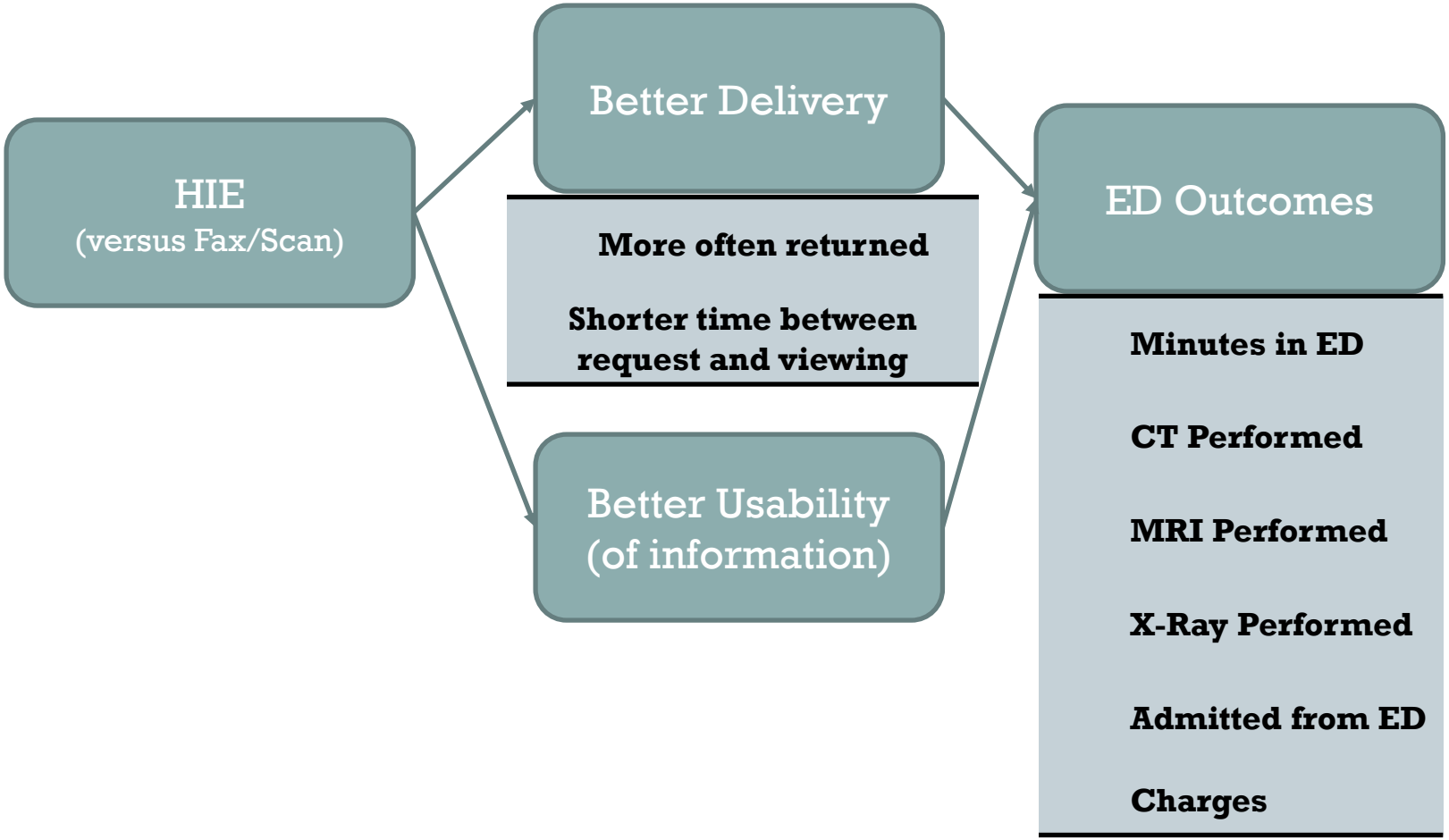
Key Findings 1:

Most requests fulfilled via fax

HIE not returning information more routinely…

… but what is returned is viewed more often

Conceptual Model

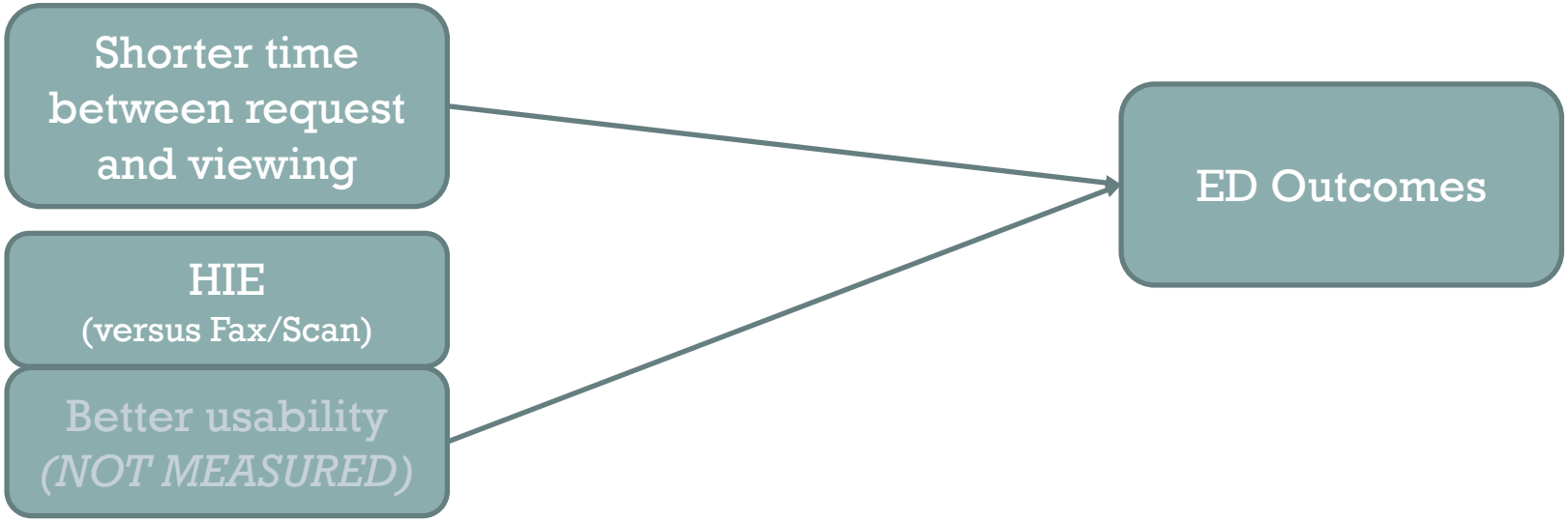


Research Questions

When information is returned and viewed:

1. is HIE associated with better ED outcomes?

2. are order-to-access time and HIE independently associated with better ED outcomes?



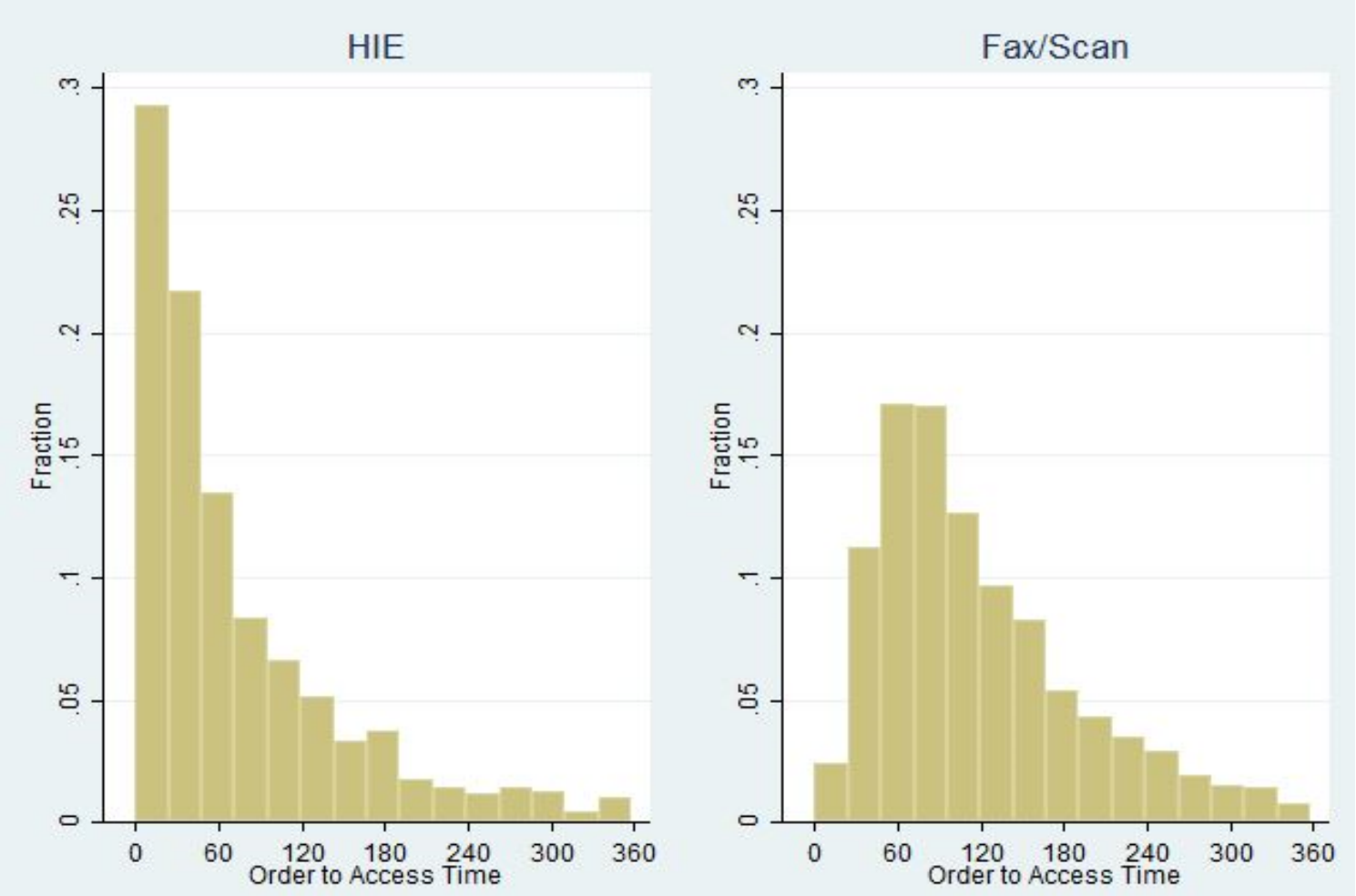
Sample Patient and Encounter Characteristics

	Outside Records Returned via Fax/Mail (n=1,796)	Outside Records Returned via Health Information Exchange (n=465)	P-value
Case Mix and Acuity Measures			
Charlson Index	0.23	0.17	0.12
Triage Status†	2.5	2.5	0.55
# of Prior Inpatient Visits	1.32	1.28	0.74
# of Prior Outpatient Visits	20.0	18.4	0.36
# of Prior ED Visits	1.79	1.54	0.21
Abnormal Systolic BP	42.0%	44.4%	0.35
Abnormal Diastolic BP	17.1%	18.2%	0.58
Abnormal Temp	2.0%	1.8%	0.70
Abnormal Pulse Ox	17.1%	16.6%	0.79
Abnormal Respiration Rate	14.3%	16.8%	0.18
Abnormal Pulse	25.7%	28.0%	0.32
Prior Interaction with Health System			
# of Prior Inpatient Visits	1.32	1.28	0.74
# of Prior Outpatient Visits	20.0	18.4	0.36
# of Prior ED Visits	1.79	1.54	0.21
Visit Time			
Seen on Weekday	77.0%	75.3%	0.43
During Business Hours	58.6%	58.5%	0.98

Sample Patient and Encounter Characteristics

	Outside Records Returned via Fax/Mail (n=1,796)	Outside Records Returned via Health Information Exchange (n=465)	P-value
Patient Demographics			
Age	46.8	44.5	0.04
Female	56.9%	59.6%	0.30
Race			
Native American	0.3%	0.4%	
Asian	0.7%	2.2%	
Black	16.0%	14.4%	
Pac-Island	0.1%	0.2%	0.05
Other	2.6%	4.1%	
Unknown	0.4%	0.2%	
White	79.7%	78.5%	
Insurance Type			
Commercial	61.7%	69.4%	
Military	0.9%	0.4%	
Medicaid	5.5%	5.2%	0.02
Medicare	28.1%	22.8%	
Self-Pay	3.8%	2.2%	

Time between order and viewing



MEAN: 72 minutes
SD: 86 minutes

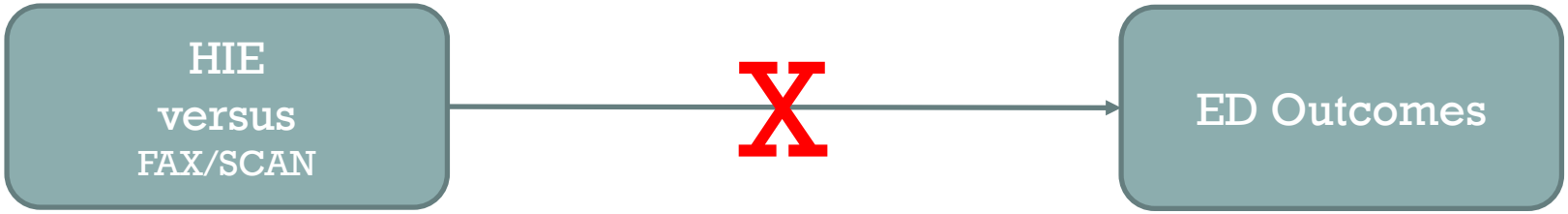
MEAN: 131 minutes
SD: 90 minutes

Is HIE associated with better ED outcomes?

	Time in ED (Minutes) (95% CI)	Likelihood of CT (Percentage points) (95% CI)	Likelihood of MRI (Percentage points) (95% CI)	Likelihood of XRAY (Percentage points) (95% CI)	Likelihood of Admission (Percentage points) (95% CI)	Charges (Dollars) (95% CI)
Outside Records Returned via HIE Versus FAX/SCAN	-27.7	1.9	-0.1	-2.8	0.05	-1,100

* p<0.05, ** p<0.01, *** p<0.001

Key Finding 2: No direct relationship between HIE and outcomes



Are order-to-access time and HIE independently associated with better ED outcomes?

	Time in ED (Minutes) (95% CI)	Likelihood of CT (Percentage points) (95% CI)	Likelihood of MRI (Percentage points) (95% CI)	Likelihood of XRAY (Percentage points) (95% CI)	Likelihood of Admission (Percentage points) (95% CI)	Charges (Dollars) (95% CI)
Outside Records Returned via HIE versus FAX/SCAN	23.8	4.2	1.5	-0.6	2.5	36.9
Outside Records Request to Access Time (60 minute increments saved)	-52.8***	-2.4***	-1.7***	-2.2***	-2.5***	-1,160***

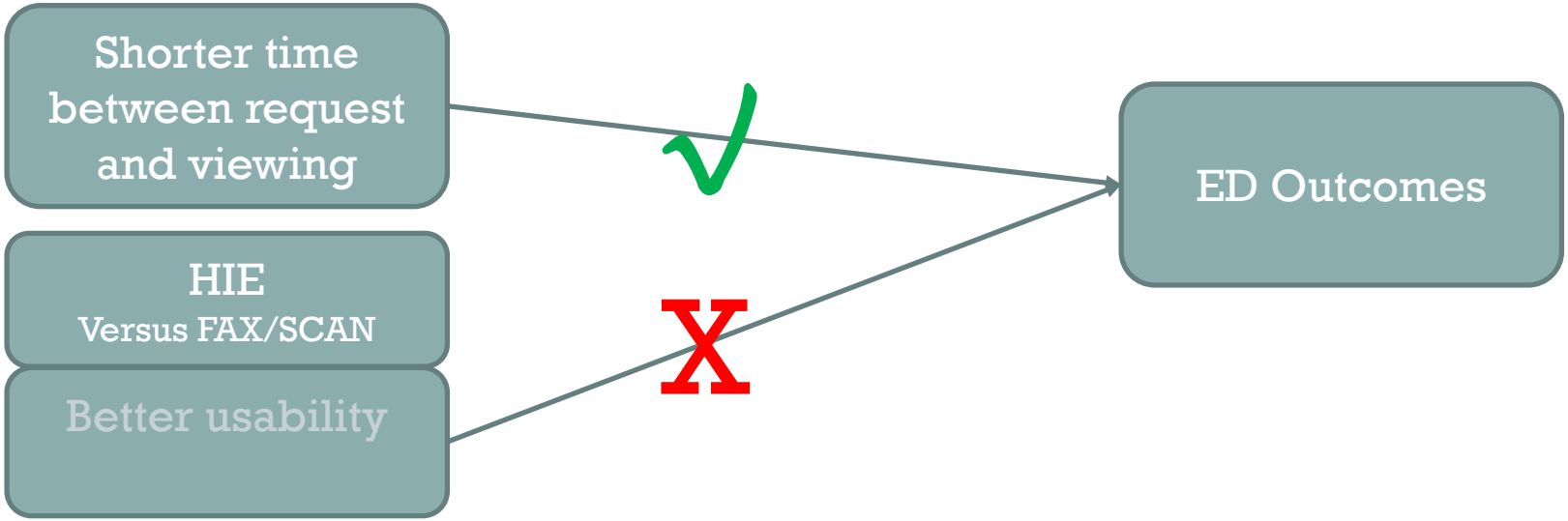
* p<0.05, ** p<0.01, *** p<0.001

Are order-to-access time and HIE independently associated with better ED outcomes?

Key Finding 3:

Shorter time between information request and viewing is associated with better ED outcomes across the board.

HIE does not have any additional benefit.



Magnitude of Impact

- For every hour saved in accessing outside information:

ED length of stay	52.8 minutes shorter	10.6% mean
Likelihood of CT	2.4 percentage points lower	7.2% of mean
Likelihood of MRI	1.7 percentage points lower	18.5% of mean
Likelihood of X-Ray	2.2 percentage points lower	3.8% of mean
Likelihood of Admission	2.5 percentage points lower	4.7% of mean
Estimated charges	$1,106 lower	6.3% of mean

Limitations

- Single site, one approach to HIE (Epic CE)
- Fax comparison group is somewhat "electronic" → underestimate of benefits
- Retrospective, observational data
- Reduced utilization = redundant or valuable?

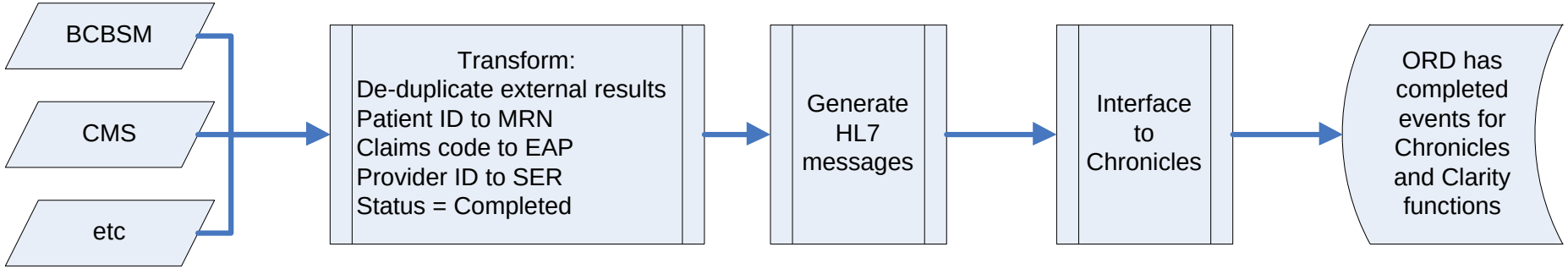
Implications for HIE Impact

- **Time is what matters: workflow is key**
- **Differences in structure and format of information not making a difference**
- **A substantial fraction of information is never viewed**

Implications for Population Health Management

- **HIE is still limited – both coverage and use**
- **Requires "knowing what you don't know"**
- **Built to get information to physicians quickly, not to support population health**

HIE for Population Health: Claims→EHR



External Claims Data Events

Mammogram
Bilateral mastectomy
Pap and HPV DNA tests
Hysterectomy
Colonoscopy
FOBT
Flex Sigmoidoscopy
Colectomy (total)

Pneumococcal vaccination
Influenza vaccination
Eye exam
Diabetic foot exam
Well Child Exam
Dx or Tx of Nephropathy

Chlamydia screening
Spirometry test
HbA1c test
Microalbumin test
Ejection fraction test
eGFR test
Serum creatinine test

HIE for Population Health: A Patient Story

A patient has a long, strong relationship with a UMHS PCP. The PCP has the patient on a 5 year colorectal cancer screening plan.

That patient sees a non-UMHS gastroenterologist for some concern.

- That GI doc orders a colonoscopy, and properly manages the results: communicating clearly to the patient that a 3 year screening interval is now indicated.

UMHS receives that colonoscopy event as external claims data and interfaces it to Chronicles.

- The patient's HM for Colorectal Cancer Screening is updated, and now reflects a Next Due of +5 years.

The patient views the updates in her/his MyUofMHealth.org records, noting that UMHS knows about that recent colonoscopy and that she/he is still on a 5 year screening interval.

- The patient decides to stick with the UMHS screening interval, since they have the relationship with the PCP

  …and doesn't know that the PCP didn't see the result.

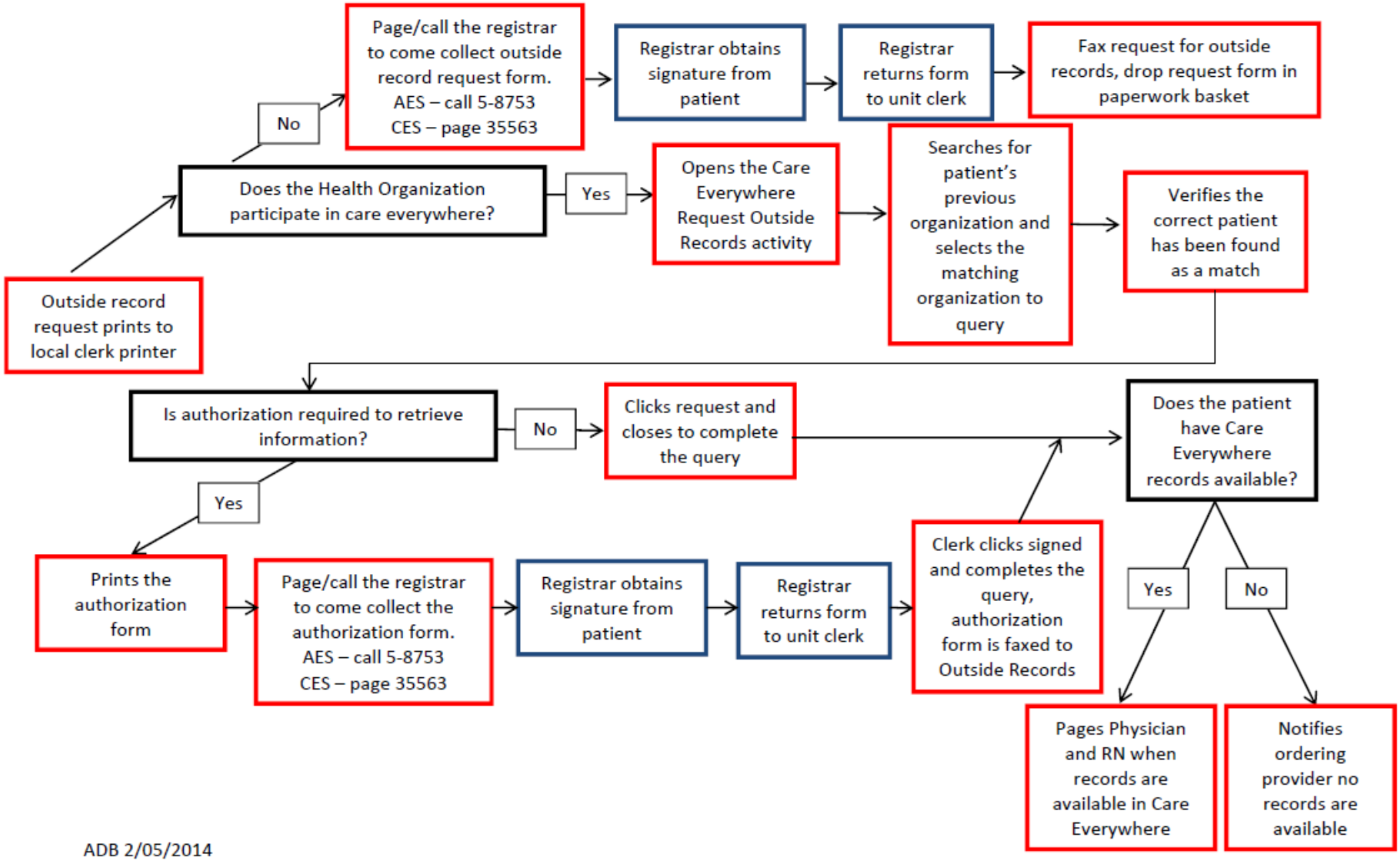
Conclusions

- **Why** are we doing HIE?
  - Ensure providers have access to complete patient information
  - Facilitate creation of/access to large pools of clinical data for surveillance, QI, learning, population health management
- **How** should we do HIE?
  - Still unclear. What is clear is that we are trying a lot of different approaches and should have the opportunity to learn what works and what doesn't – both for individual patient care and for population health.
- **What** is the impact of HIE?
  - Growing evidence-base, with mix of positive findings and no impact.
  - Little evidence of the impact of HIE on improved population health.

Extra Slides

Care Everywhere – Clerical and Registrar Workflow

Clerical responsibility | Registrar responsibility

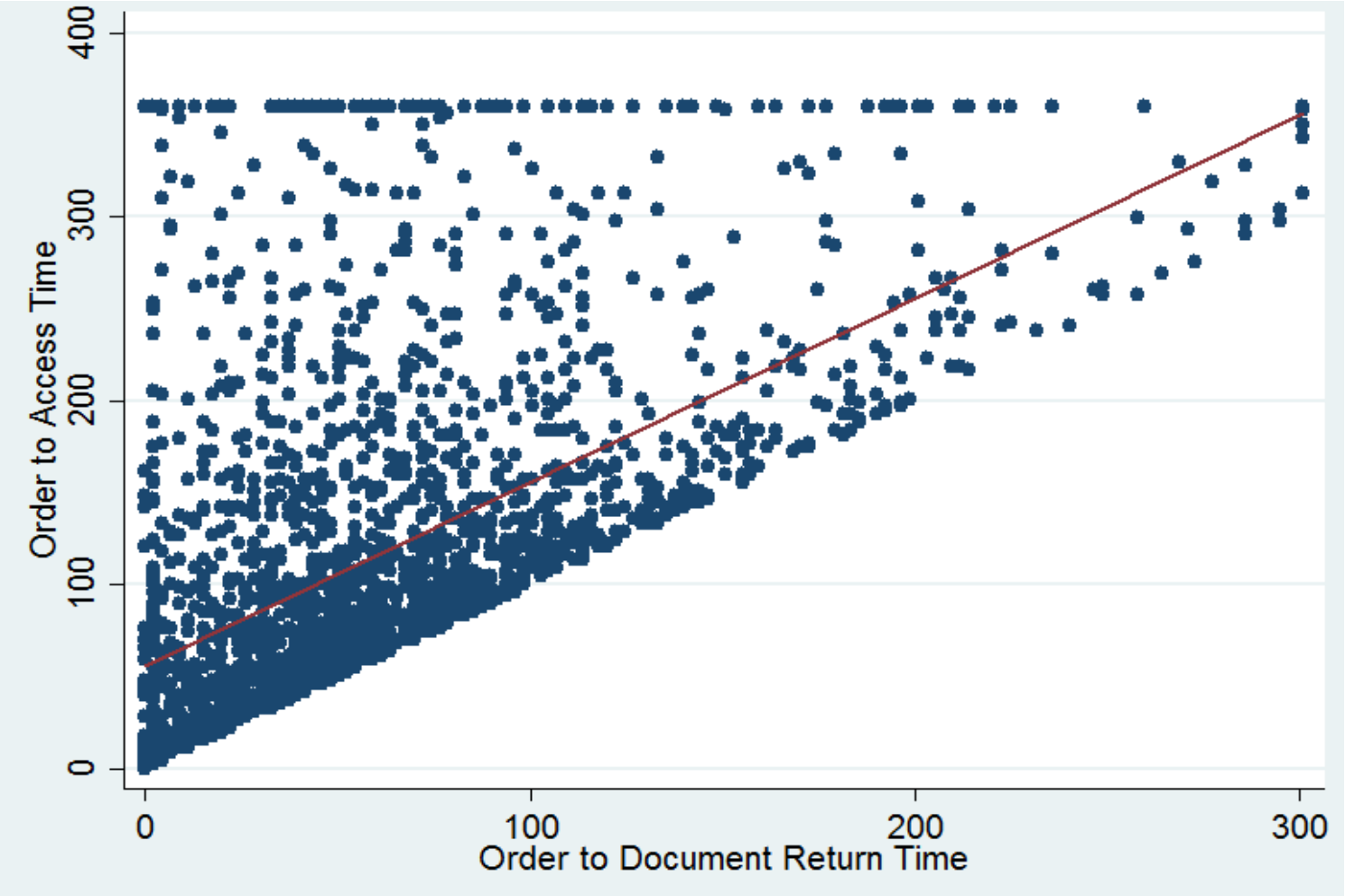


ADB 2/05/2014

Study: Data - Outcomes

	Outside Records Returned via Fax/Mail (n=1,796)	Outside Records Returned via Health Information Exchange (n=465)	P-value
Minutes in ED	502.9	470.6	0.05
CT Performed	32.6%	33.3%	0.77
MRI Performed	9.0%	8.6%	0.78
Radiograph Performed	57.9%	54.0%	0.13
Admitted from ED	53.5%	52.4%	0.69
Charges ($, Encounter Total)	19,576	17,883	0.15

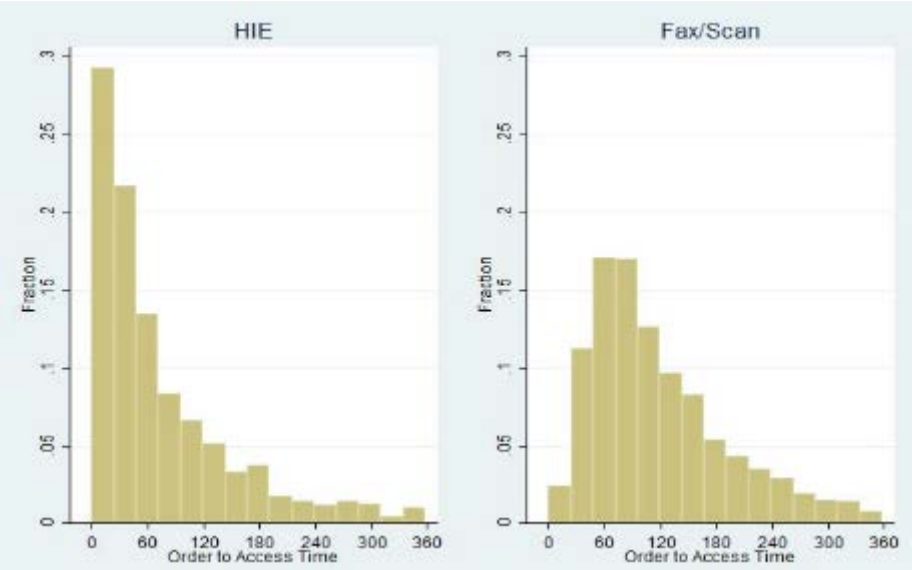
Bivariate Relationship between Outside Record Request to Document Return Time and Outside Record Request to Access Time



Results

Time from Order to Access = HIEvFax + Controls

- Coefficient on HIEvFax: -58.5 minutes ($p<0.001$)



Results

	Time in ED (Minutes) (95% CI)	Likelihood of CT (Percentage points) (95% CI)	Likelihood of MRI (Percentage points) (95% CI)	Likelihood of XRAY (Percentage points) (95% CI)	Likelihood of Admission (Percentage points) (95% CI)	Charges (Dollars) (95% CI)
Outside Records Request to Access Time (60 minute increments saved)	-52.8 (-61.0 - -44.6)	-2.4 (-3.6 – -1.1)	-1.7 (-2.5 – -0.9)	-2.2 (-3.5 – -0.9)	-2.5 (-3.7 – -1.3)	-1,160 (-633 – -1687)
Outside Records Returned via HIE Relative to Fax/Mail	23.8 (-7.0 – 54.5)	4.2 (-0.5 – 6.3)	1.5 (-1.5 – 4.5)	-0.6 (-5.5 – 4.3)	2.5 (-20.0 – 7.0)	36.9 (-1947 – 2021)
ORIGINAL MODEL: Outside Records Returned via HIE Relative to Fax/Scan	-27.7 (-58.5–3.1)	1.9 (-2.7 – 6.5)	-0.1 (-3.0 – 2.8)	-2.8 (-7.5 – 2.0)	0.05 (-4.3 – 4.4)	-1,100 (-3,023 –824)
Change in Effect of HIE when Order To Access Time Included (p-value)	51.5***	2.3***	1.6***	2.2***	2.5***	1,136***