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RWJF ID#: 71596

File Name: 71596GPmeeting01.pdf

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Affiliation: IU Richard M Fairbanks School of Public Health, Regenstrief Institute,
Department of Veterans Affairs

Title: Improving Population Health through Targeted Decision Support

Organization and Meeting: PHSSR: 2015 Annual PHSSR Keeneland Conference

Date and Location: April 20-22, 2015; Lexington, KY

Brian Dixon, PhD, MPA, BA***Improving Population Health through Targeted Decision Support***

Co-Investigator(s): Zuoyi Zhang, PhD; P. Joe Gibson, PhD, MPH; Xiaochun Li, PhD; Patrick Lai, MPH; Uzay Kirbiyik, MD, MPH; Jennifer Williams, MPH, BS; Rebecca Hills, PhD; Debra Revere, MS; & Shaun Grannis, MD, MS

Background: Surveillance is the cornerstone of public health practice. Traditionally, health departments have relied on passive, manual reporting of communicable diseases by hospitals, laboratories and clinics. Yet passive approaches can be burdensome for reporters, producing incomplete, delayed reports which impede follow-up and delay recognition of community disease patterns and outbreaks.

Research Objective: We seek to understand the various sources and methods by which hospitals, labs, and clinics report communicable disease information to public health authorities.

Data Sets and Sources: The Indiana Health Information Exchange (IHIE) is a large, robust HIE network in which clinical messages (such as laboratory results) are electronically delivered to over 25,000 physicians. In addition, the HIE network reports positive laboratory results for communicable and infectious notifiable diseases to the Marion County Public Health Department (MCPHD), which is responsible for communicable disease surveillance for its jurisdiction.

Study Design: We are evaluating an intervention designed to pre-populate the official communicable disease reporting form with patient demographics, lab results, and provider information available from the IHIE electronic health record system. The pre-populated form is delivered electronically to providers. Prior to deploying the intervention, we gathered baseline reporting information from fax, paper, and electronic reports that constitute a reported case and were submitted by both providers and labs to MCPHD.

Analysis: Key data required to investigate and close cases were manually abstracted from each report. We measured the completeness of reporting data elements separately for paper, fax, and electronic reports, stratifying by report type. We also calculated reporting rates and examined the results stratified by clinical source, disease and report type.

Principal Findings: We collected 11,997 reports submitted to public health for 8,754 unique cases across seven conditions (chlamydia, gonorrhea, syphilis, Hepatitis C, Acute Hepatitis B, Salmonella, and Histoplasmosis). Completeness of data elements varied by report type: lab report completeness averaged 73% with a range from 2.3% to 100% while provider report completeness averaged 64% with a range from 18.6% to 100%. Lab report completeness was higher than corresponding provider report fields for 12 of 15 critical fields. Lab reporting rates also matched or exceeded the rates for provider reports across all conditions.

Conclusions: The rise of ELR capacity among health departments and the superior completeness of lab reports may improve disease reporting to public health agencies and decrease the amount of information collected from providers. Yet lab report completeness remains problematic in many cases. Health information exchanges may help support more complete capture and synthesis of multiple reports from labs and providers in support of surveillance practice.

Implications for Public Health Practice and Policy PHSSR: Contributes to PH practice by exploring not only which interventions are effective but also why they are effective. Our intervention seeks to streamline clinical and public health workflow related to notifiable condition reporting. Moving forward, we will analyze the impact of pre-populated forms on report completeness, clinical staff burden, reporting rates, and timeliness to further understand how HIE networks can support notifiable disease reporting.

Improving Population Health through Targeted Decision Support

Brian E. Dixon, MPA, PhD, FHIMSS

Keeneland PHSSR Conference

April 21, 2015



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**Regenstrief Center for
Biomedical Informatics**

Better Health Through Informatics

Agenda

- Population Health Decision Support
- Case Reporting Then and Now
- A Pop Health Decision Support Intervention
- Preliminary Findings

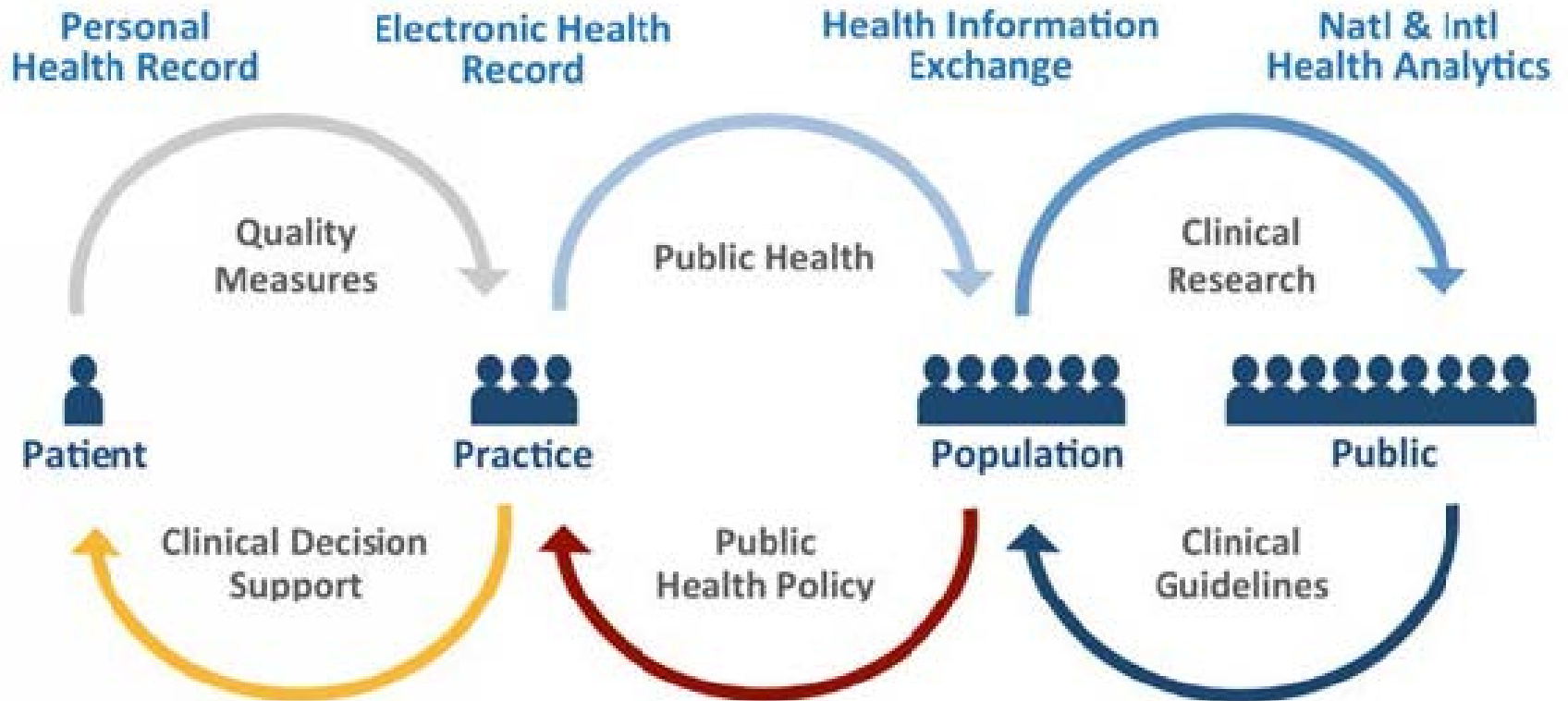
Clinical Decision Support

- Computer-based clinical decision support (CDS) can be defined as the use of the computer to bring *relevant knowledge* to bear on the *health care* and *well being* of a patient.
– Greenes, 2007



Friedman, JAMIA, 2008

How Does CDS 'Fit' into Public Health?

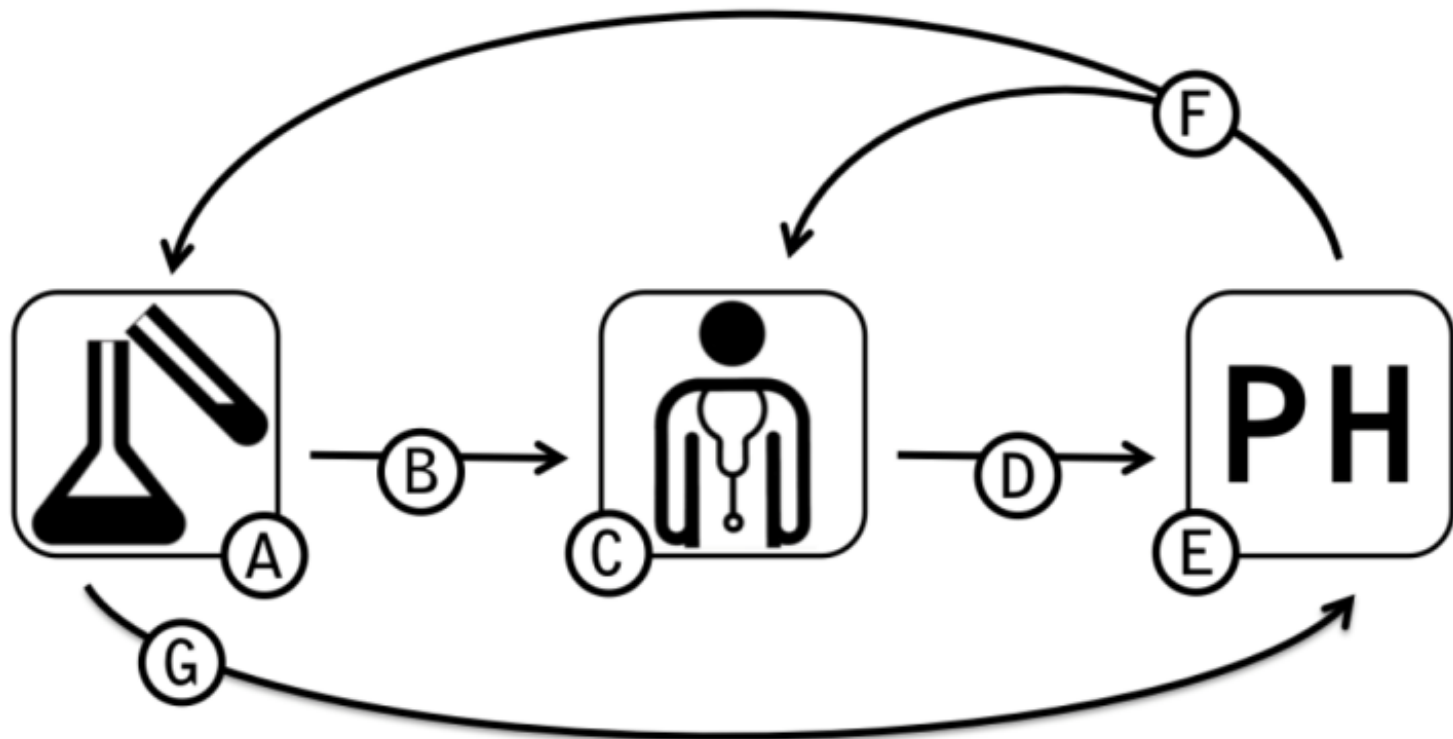


Office of the National Coordinator for Health IT, 2014


PH Decision Support

- Public health decision support (PHDS) can be defined as the use of the computer to bring *relevant knowledge* to bear on the *health and well-being* of a *population*.
 - Dixon, Gamache, Grannis, 2013
- Examples:
 - Vaccine forecasting report
 - Suggestion for ordering stool culture

Traditional Case Reporting Workflow



Official State CDR Form

 **CONFIDENTIAL REPORT OF COMMUNICABLE DISEASES**
 State Form 43823 (R2 / 11-96)
 THIS FORM CONTAINS CONFIDENTIAL INFORMATION PER 410 IAC 3.1-2-18.

DISEASE

patient Information

Name (last, first, m.i.)

If child, name of parent (last, first, m.i.)

Address (number and street)

City, ZIP code

County

Telephone number () ()

(Not Required For STD's)
 Check all that apply:
 Health Care Worker
 Food Service
 School (student / staff)
 Day Care (attendant / staff)

Date of birth (month, day, year)

Age

SEX

Male Female

RACE

White Black Unknown Multi-Racial

ETHNICITY

Hispanic Non-Hispanic Unknown

Name of school / day care?

Pregnant?
 Yes No Unknown

Part of an outbreak?
 Yes No Unknown

lab Information

Etiologic agent

Date of diagnosis (month, day, year)

Stage (syphilis only)

Symptoms associated with infection?
 Yes No Unknown

IF YES

(Not Required for STD's) Onset date (month, day, year)

Died? Yes No

Pertinent symptoms, signs:

Lab test(s) and result(s)

Date(s)

Treatment (name of antibiotic)

Dosage

Date initiated

Antibiotic resistance: Yes No NOT DONE

If Yes, what antibiotic?

provider Information

Reporting Facility Code (see other side for codes)

Name of physician and address

Record number

Person reporting (other than physician)

Telephone number () ()

Telephone number () ()

Date of report

Check here if you need more cards

LOCAL HEALTH DEPARTMENT USE ONLY

Date received (month, day, year)

Follow-up initiated? Yes No

Name of investigator

patient Information

Name
 Address
 Phone#
 DOB
 Gender
 Race/ethnicity

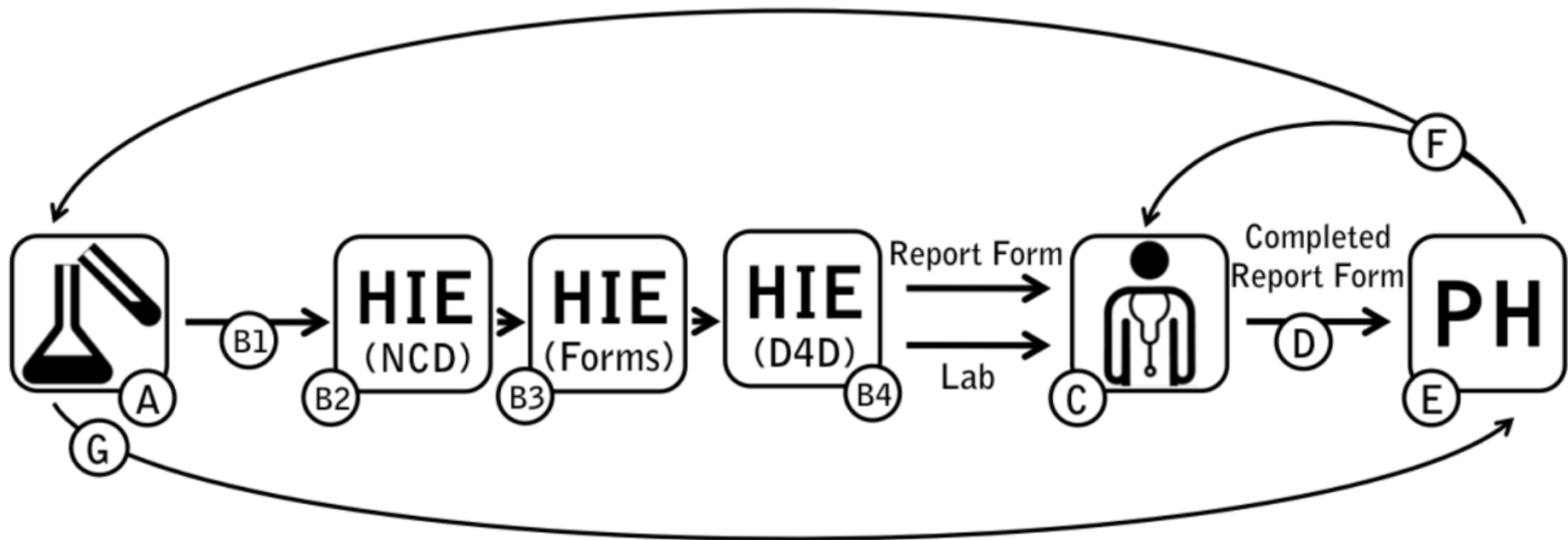
provider Information

Physician name
 Physician address
 Phone#
 Reported by
 Report date

lab Information

Etiologic agent
 Test name
 Test date
 Treatment initiation date
 Treatment (drugs)

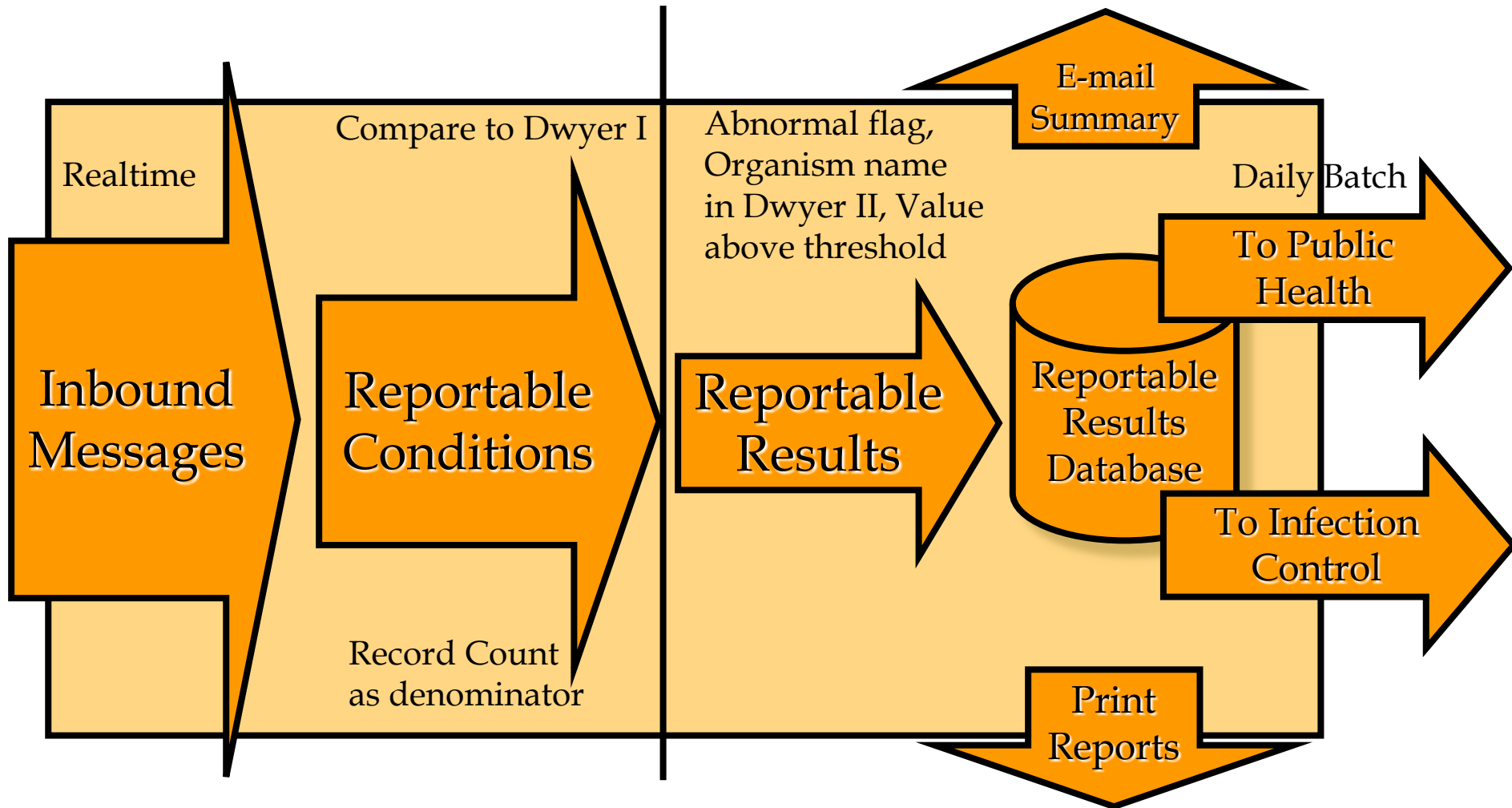
Enhanced Case Reporting Workflow



Enhancement Builds Upon Core Infrastructure

- Automated case detection
 - Identification of cases that must be reported
- Clinical messaging
 - Getting information to its recipient in a way that is integrated into workflow
- Public health communication pathways
 - Electronic laboratory reporting
 - Fax communications

The Notifiable Condition Detector



Triggers for Case Detection

- ICD-9 / ICD-10 / SNOMED CT
 - Clear signal of clinical or lab confirmed diagnosis
- LOINC
 - Clear signal of test that examines PH condition
 - Yet the “result” can be hard to confirm
- Natural Language Processing
 - Hard but necessary as labs “dump” results into standard messages

Clinical Messaging/Public Health Communication

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Login Screen



Indiana Health Information Exchange portal

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Welcome

Please enter your username and password, then press "Log in".

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Dixon, Brian
A to Z Family Practice
DOCUMENT INBOX

Document INBOX

Holds all new documents. VT is 'visit type': OP (Outpatient), IP (Inpatient), ER (Emergency), MC (Misc) or blank if not known.

Filters:

Actions:

<input type="checkbox"/>	Provider	MRN	Patient Name	Arrival	VT	Doc Type	Doc Details
<input type="checkbox"/>	Benton, Peter	000000	AUSTIN, SAM	2007 10/04 01:27 AM		Lab (St. Francis)	Basic Metabolic Panel
<input type="checkbox"/>	Benton, Peter	000000	BENTON, PETER	2007 10/04 01:27 AM		Microbiology (St. Francis)	TRICHOMONAS WET PREP EXAM
<input type="checkbox"/>	Benton, Peter	003768	BRADY, JIMMY	2007 10/04 01:27 AM		Transcription (Morgan)	CONSULTATION REPORT
<input type="checkbox"/>	Benton, Peter	10709	BRADY, JIMMY	2007 10/04 01:27 AM	!	Lab (St Vincents)	HEMATOCRIT POC
<input type="checkbox"/>	Benton, Peter	200072	BROWN, JAMES	2007 10/04 01:27 AM		Radiology (St Vincents Mercy)	BONE SCAN
<input type="checkbox"/>	Benton, Peter	90004	BROWN, JAMES	2007 10/04 01:27 AM		Radiology (SERH)	CR TIBIA FIBULA 2 VW RT 73590 [prelim]
<input type="checkbox"/>	Benton, Peter	60000	BRADY, JIMMY	2007 10/04 01:27 AM		Radiology (St Clare)	CT PELVIS W 72193
<input type="checkbox"/>	Benton, Peter	90008	BROWN, JAMES	2007 10/04 01:27 AM		Radiology (St Vincents Mercy)	CHEST-PA & LATERAL
<input type="checkbox"/>	Benton, Peter	00009	BROWN, JAMES	2007 10/04 01:27 AM		Radiology (St Clare)	CR WRIST MIN 3 VW RT 73110
<input type="checkbox"/>	Benton, Peter	16009	BROWN, JAMES	2007 10/04 01:27 AM	!	Lab (St. Francis)	STAT CBC w/DIFF
<input type="checkbox"/>	Benton, Peter	07200	BROWN, JAMES	2007 10/04 01:27 AM	!	Lab (St Vincents)	STAT TOTAL PROTEIN PE
<input type="checkbox"/>	Benton, Peter	00000	BROWN, JAMES	2007 10/04 01:27 AM		Transcription (Morgan)	HISTORY
<input type="checkbox"/>	Benton, Peter	00000	BROWN, JAMES	2007 10/04 01:27 AM		Lab (St Vincents)	Allocated Unit
<input type="checkbox"/>	Benton, Peter	70000	BROWN, JAMES	2007 10/04 01:27 AM		Radiology (St Francis)	US PELVIS + TRANSVAGINAL [prelim]
<input type="checkbox"/>	Benton, Peter	70000	BROWN, JAMES	2007 10/04 01:27 AM		Face Sheet (St Vincents)	Patient Registration
<input type="checkbox"/>	Benton, Peter	48003	GIROUX, JEFFREY	2007 10/04 01:27 AM		Radiology (St Clare)	RF UGI W/SMALL BOWEL 74245
<input type="checkbox"/>	Benton, Peter	10008	GIROUX, JEFFREY	2007 10/04 01:27 AM	!	Lab (St Vincents)	STAT CBC
<input type="checkbox"/>	Benton, Peter	90000	GIROUX, JEFFREY	2007 10/04 01:27 AM	!	Lab (GLHS)	CBC/AUTO DIFF
<input type="checkbox"/>	Benton, Peter	45005	GORDON, GORDON	2007 10/04 01:27 AM	!	Lab (Morgan)	COMPREHENSIVE PROFILE
<input type="checkbox"/>	Benton, Peter	45005	GORDON, GORDON	2007 10/04 01:27 AM		Lab (Morgan)	AMYLASE LEVEL
<input type="checkbox"/>	Benton, Peter	45005	GORDON, GORDON	2007 10/04 01:27 AM		Lab (Morgan)	CREATINE PHOSPHOKINASE
<input type="checkbox"/>	Benton, Peter	88000	GORDON, GORDON	2007 10/04 01:27 AM		Radiology (St Clare)	CR CHEST PA/LAT 71020
<input type="checkbox"/>	Benton, Peter	90000	GRACE, MARGARET	2007 10/04 01:27 AM	!	Lab (St Vincents)	STAT TOTAL PROTEIN PE
<input type="checkbox"/>	Benton, Peter	50005	GRACE, MARGARET	2007 10/04 01:27 AM	!	Lab (St Vincents)	GLUCOSE POC
<input type="checkbox"/>	Benton, Peter	00002	GRACE, MARGARET	2007 10/04 01:27 AM		Radiology (St Clare)	MRI BRAIN W/WO CONTRAST 70553
<input type="checkbox"/>	Benton, Peter	00000	GRACE, MARGARET	2007 10/04 01:27 AM	!	Lab (St Vincents)	TOTAL PROTEIN PE
<input type="checkbox"/>	Benton, Peter	60000	HANCOCK, JEFFREY	2007 10/04 01:27 AM		Transcription (Morgan)	EEG AWAKE AND DROWSY AMBULATE
<input type="checkbox"/>	Benton, Peter	00000	HANCOCK, JEFFREY	2007 10/04 01:27 AM		Microbiology (St. Anthony CP)	Urine Culture [prelim]
<input type="checkbox"/>	Benton, Peter	00005	HANCOCK, JEFFREY	2007 10/04 01:27 AM		Lab (St Vincents)	AMNIO FL ACHE
<input type="checkbox"/>	Benton, Peter	00009	HANCOCK, JEFFREY	2007 10/04 01:27 AM	!	Lab (St Vincents)	STAT CHLAM GC DNA SDA
<input type="checkbox"/>	Benton, Peter	50000	HANCOCK, JEFFREY	2007 10/04 01:27 AM		Lab (Morgan)	VALPROIC ACID (DEPAKENE) LEVEL
<input type="checkbox"/>	Benton, Peter	60005	HANCOCK, JEFFREY	2007 10/04 01:27 AM		Lab (St. Francis)	Basic Metabolic Panel
<input type="checkbox"/>	Benton, Peter	28000	JANSEN, JAYLOR	2007 10/04 01:27 AM		Radiology (St Clare)	CT CHEST WO 71250

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A to Z Family Practice

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INBOX Review

Navigation:

Actions:

Copy for: Benton, Peter

Pt: _____



St. Clare
 MEDICAL CENTER
Sisters of St. Francis Health Services

St. Clare Medical Center
 1710 Lafayette Road
 Crawfordsville, IN 47933
 (765) 362-2800

Pt: D	MR#:	DOB: 1 / / 19	Sex: M
Acct: 30 01	Location: SCEDE		
Accession#: 32	Pt Class: E	Admit Date:	
Order#:		Primary Care:	
Ordered by: CARTER, JOHN			
Attending:			

Final Report

EXAM: CR WRIST MIN 3 VW RT 73110
 EXAM DATE: Sep 10 2007 11:17AM ACCESSION#: 3291227

ADMITTING DIAGNOSIS: EXTREMITY PN

CLINICAL HISTORY: Recent trauma. The patient presents with pain in wrist.

IMPRESSION: No evidence of an acute or healing fracture.

RESULT: Three views of the right wrist show no evidence of an acute or healing fracture. The distal radius and ulnar are intact. the carpals are normal in appearance, position and alignment. Incidental note is made of metallic plates and screws in the fourth and fifth metacarpals, consistent with open reduction of prior fractures.

Read by: JAMES PEARCE MD

Reviewed and Electronically signed by:
 JAMES PEARCE MD
 d: Sep 10 2007 12:07A

Inbox

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Grannis, Shaun J.
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Actions:

	Provider	MRN	Patient Name	Arrival	!	VT	Doc Type	Doc Details
<input type="checkbox"/>	UNKNOWN (NPI_ALL_PP_MASTER: 000000001)			2012 09/24 04:46 PM			Disease Reporting (Indiana Dept Health)	Public health notifiable condition
<input type="checkbox"/>	UNKNOWN (NPI_ALL_PP_MASTER: 000000001)			2012 09/24 04:46 PM			Disease Reporting (Indiana Dept Health)	Public health notifiable condition
<input type="checkbox"/>	UNKNOWN (NPI_ALL_PP_MASTER: 000000001)			2012 09/24 04:46 PM			Disease Reporting (Indiana Dept Health)	Public health notifiable condition
<input type="checkbox"/>	UNKNOWN (NPI_ALL_PP_MASTER: 000000001)			2012 09/24 04:46 PM			Disease Reporting (Indiana Dept Health)	Public health notifiable condition
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Notifiable Report

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Navigation:

Actions:

Copy for: UNKNOWN (NPI_ALL_PP_MASTER: 000000001) Pt: [REDACTED]



**CONFIDENTIAL REPORT OF
COMMUNICABLE DISEASES**

State Form 43823 (R2 / 11-96)

THIS FORM CONTAINS CONFIDENTIAL
INFORMATION PER 410 IAC 3.1-2-18.

DISEASE

HEPATITIS C

Name (last, first, m.i.)		
If child, name of parent (last, first, m.i.)		
Address (number and street)		Telephone number
City, ZIP code		<p>(Not Required For STD's) Check all that apply:</p> <input type="checkbox"/> Health Care Worker <input type="checkbox"/> Food Service <input type="checkbox"/> School (student / staff) <input type="checkbox"/> Day Care (attende / staff)
County		
Date of birth (month, day, year)	Age	
SEX	RACE	ETHNICITY
<input checked="" type="checkbox"/> Male <input type="checkbox"/> Female	<input checked="" type="checkbox"/> White <input type="checkbox"/> Black <input type="checkbox"/> Unknown	<input type="checkbox"/> Hispanic <input type="checkbox"/> Non-Hispanic <input type="checkbox"/> Unknown
Pregnant?	Name of school / day care?	

So What Happens Next?

- Today clinics must print these forms, complete them manually, and submit them to local health departments using Fax
 - Some use electronic fax
- In the future, we hope to work with SHA to deliver completed forms electronically directly into the state NEDSS system

ARF Project Status

- Baseline data collection completed
 - Existing counts of disease cases, data quality, and processes within public health department
 - Continuing to analyze baseline numbers
- Intervention went live in Sept 2013
 - Turned on intervention in clinics using a rolling approach through end of 2013
 - Collecting post-intervention data
 - Beginning analysis of post-intervention data

Baseline Completeness

- 12,309 reports for 8,353 unique patients
 - Chlamydia, gonorrhea, syphilis, Hepatitis C, Acute Hepatitis B, Salmonella, and Histoplasmosis
- Data Completeness (Not NULL)
 - Provider: 65% mean (Range 33.6% - 100%)
 - Fax-based Lab: 75% mean (Range 14.2% - 100%)
 - ELR: 73% mean (Range 0.01% - 100%)
 - ELR completeness higher for 11 of 15 fields
 - Lab higher compared to provider except race and ethnicity
 - Similar patterns across all conditions

Completeness Discussion

- What can lab reports not provide?
 - Ethnicity; sometimes race
 - Treatment: was order written; med dispensed?
 - Clinical symptoms

- Strategies for getting these data electronically
 - CPOE, eRx and Pharmacy systems
 - Direct EHR access for PH workers

Timeliness Results*

- Most cases are reported within 1 day
 - >80% reported within 3 days
- For nearly all cases, lab is the *first* signal
 - Only 11% cases have provider report at all
- Lab report types
 - ELR, Fax, PH clinic, NEDSS

Next Steps

- Enhanced form generation
 - Currently developing enhanced forms across the various condition groups
 - Turn on enhanced form in mid-2015

- Analysis and dissemination
 - Continue to analyze baseline, post-intervention
 - Synthesize qualitative data
 - Publish findings

Acknowledgements

- Key folks supporting my work
 - Shaun Grannis (IUSM and Regenstrief)
 - Zuoyi Zhang (Regenstrief)
 - Jennifer Williams (Regenstrief)
 - P. Joe Gibson (Marion Co. Public Health Dept.)
 - Debra Revere and Becky Hills (U. Washington)
 - Patrick Lai, MPH (SOIC) and Uzay Kirbiyik (FSPH)
- The work presented was supported by grants from AHRQ (R01HS020209) and RWJF (71596) part of the PHSSR Portfolio.

Questions?

Answers

Brian E. Dixon, MPA, PhD, FHIMSS
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Research Scientist, Regenstrief Institute;
Health Research Scientist, Department of Veterans Affairs

<http://tinyurl.com/fsphbed>

Twitter: @dpugrad01

References

- Dixon BE, Grannis SJ, Revere D. Measuring the impact of a health information exchange intervention on provider-based notifiable disease reporting using mixed methods: a study protocol. *BMC Medical Informatics and Decision Making* 2013; 13:121.
- Revere D, Hills RA, Williams J, Grannis SJ, Dixon BE. Leveraging health information exchange to improve population health reporting processes: Lessons in using a collaborative-participatory design process. *eGEMs (Generating Evidence & Methods to improve patient outcomes)*. 2014; 2(3):12.
doi: 10.13063/2327-9214.1082