A National Web Conference on Using Health IT to Enable Greater Care Coordination Across Acute and Outpatient Settings of Care

May 14, 2013

1:30 pm – 3:00 pm ET

Moderator and Presenters Disclosures

Moderator:

Angela Nunley, MSEd*

Agency for Healthcare Research and Quality

Presenters:

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*Have no financial, personal, or professional conflicts of interest to disclose.

† Dr. Dorr would like to disclose that he receives royalties for non-exclusive licensing from Oregon Health and Science University to various entities.

The Impact of EHR Use & Teamwork on Care Coordination

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Background: EHR

- In 2009 ARRA HITECH allocated over $30 billion to promote adoption and meaningful use of electronic health records (EHRs)
  - Provides up to $60K per doctor
  - Meaningful Use criteria defined to target improvements in care coordination and clinical care quality
- In 2012 40% of physicians working in outpatient clinics used EHRs
  - Up from 17% in 2008
- Conflicting evidence on the effect of EHRs

Background: Primary Care Teams

- 2001 Institute of Medicine (IOM) report called for health care redesign with emphasis on primary care teams
- Multidisciplinary primary care teams typically include:
  - Physicians
  - Nurse practitioners
  - Registered nurses
  - Behavioral medicine specialists
  - Physical therapists
  - Clinical health educators
  - Medical assistants

Background: Primary Care Teams

- Theoretical and structural models promote use of primary care teams and health IT
  - Chronic Care Model
  - Patient-Centered Medical Homes
- Organizational theory
  - Collective learning
  - Technology adoption
- Limited information on how the organizational context may impact the EHR effect

EHR is not a Silver Bullet

- Provides more information and new channels for communication

> *"Now primarily using [the EHR] across all providers, which has helped a lot. Less gets lost through the cracks."*

> *"[The EHR has] made it easier to check on hospital course, tests, discharge summaries, consults, etc."*

- However, can also result in information overload

> *""There is so much information and repetition in the system. It's easy to miss the important points."*

> *"Handoffs continue to be a problem. Communication is still needed, not just relying on [the EHR] messages. Info is generally available but sometimes hard to access—that is, it is "buried" and not easily found."*

Source: Quotes from KPNC primary care clinician surveys (2005-2008) on barriers to care coordination

INFORMATION OVERLOAD!

Teams and Informal Learning

Team member relationships reinforce informal learning

- Reinforced by communication and strength of working relationships
- Members more open to experimenting, trial and error
- Sharing best practices with each other

"Colleagues taught me more [on how to use EHRs] than formal presentations."

"[I learned to use EHRs] mostly by practicing, trying to solve problems, talking to other people, and a lot of trial and error."

"Learned [to use the EHR] the most from colleagues; it's helpful when we all meet to share knowledge."

Source: Quotes from KPNC primary care clinician surveys (2005-2008) on how they learned to use the EHR.

Care Coordination and Electronic Health Records: Connecting Clinicians

Ilana Graetz[1,2], Mary Reed [1], Thomas Rundall[2], Jim Bellows[3], Richard Brand[4], John Hsu[1, 2]

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Abstract

Objective: *To examine the association between use of electronic health records (EHR) and care coordination.*

Study Design: *Two surveys, in 2005 and again in 2006, of primary care clinicians working in a prepaid integrated delivery system during the staggered implementation of an EHR system. Using multivariate logistic regression to adjust for clinician characteristics, we examined the association between EHR use and clinicians' perceptions of three dimensions of care coordination: timely access to complete information; treatment goal agreement; and role/responsibility agreement.*

Results: *Compared to clinicians without EHR, clinicians with 6+ months of EHR use more frequently reported timely access to complete information, and being in agreement on treatment goals with other involved clinicians. There was no significant association between EHR use and being in agreement on roles and responsibilities with other clinicians.*

Conclusions: *EHR use is associated with aspects of care coordination involving information transfer and communication of treatment goals.*

INTRODUCTION

The number of Americans living with at least one chronic condition is large and growing. In 2005

Existing evidence indicates that clinicians rarely have access to complete medical information when patient care is transferred across providers and that patient safety may be jeopardized during these transitions in care[2,6-8]. Lack of timely information often results in inadequate patient monitoring, redundant care, medical errors[9-11], or greater use of hospital and emergency services[12]. Any practical realization of a model for coordinated care must rely heavily on the timely availability of comprehensive clinical information, likely provided through an integrated EHR system. Integrated EHR systems, which compile a comprehensive patient clinical record, have clear potential to significantly improve the coordination of clinical care delivery by improving the availability and timeliness of patient's medical information[13-18].

In this study, we investigate the impact of implementing a commercially available, integrated EHR system on multiple measures of care coordination. Using primary care clinician surveys collected in 2005 and 2006, we investigate the association between use of EHR and three clinician reported measures of care coordination: 1) availability and timeliness of relevant medical information; 2) agreement on treatment goals and plans among a patient's clinicians; 3) and agreement

Care Coordination and Electronic Health Records: Connecting Clinicians

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ORIGINAL RESEARCH | IMPROVING PATIENT CARE

Outpatient Electronic Health Records and the Clinical Care and Outcomes of Patients With Diabetes Mellitus

Mary Reed, DrPH; Jie Huang, PhD; Ilana Graetz, BA; Richard Brand, PhD; John Hsu, MD, MBA, MSCE; Bruce Fireman, MA; and Marc Jaffe, MD

Background: Physicians can receive federal payments for meaningful use of complete certified electronic health records (EHRs). Evidence is limited on how EHR use affects clinical care and outcomes.

Objective: To examine the association between use of a commercially available certified EHR and clinical care processes and disease control in patients with diabetes.

Design: Quasi-experimental design with outpatient EHR implementation sequentially across 17 medical centers. Multivariate analyses adjusted for patient characteristics, medical center, time trends, and facility-level clustering.

Setting: Kaiser Permanente Northern California, an integrated delivery system.

Patients: 169 711 patients with diabetes mellitus.

Intervention: Use of a commercially available certified EHR.

Measurements: Drug treatment intensification and hemoglobin A_{1c} (HbA_{1c}) and low-density lipoprotein cholesterol (LDL-C) testing and values.

Results: Use of an EHR was associated with statistically significant improvements in treatment intensification after HbA_{1c} values of 9% or greater (odds ratio, 1.10 [95% CI, 1.05 to 1.15]) or LDL-C values of 2.6 to 3.3 mmol/L (100 to 129 mg/dL) (odds ratio, 1.06 [CI, 1.00 to 1.12]); increases in 1-year retesting for HbA_{1c} and LDL-C levels among all patients, with the most dramatic change among patients with the worst disease control (HbA_{1c} levels ≥9% or LDL-C levels ≥3.4 mmol/L [≥130 mg/dL]); and decreased 90-day retesting among patients with HbA_{1c} levels less than 7% or LDL-C levels less than 2.6 mmol/L (<100 mg/dL). The EHR was also associated with statistically significant reductions in HbA_{1c} and LDL-C levels, with the largest reductions among patients with the worst control (0.06-mmol/L [2.19-mg/dL] reduction among patients with baseline LDL-C levels ≥3.4 mmol/L [≥130 mg/dL]; $P < 0.001$).

Limitation: The EHR was implemented in a setting with strong baseline performance on cardiovascular care quality measures.

Conclusion: Use of a commercially available certified EHR was associated with improved drug treatment intensification, monitoring, and physiologic control among patients with diabetes, with greater improvements among patients with worse control and less testing in patients already meeting guideline-recommended glycemic and lipid targets.

Primary Funding Source: National Institute of Diabetes and Digestive and Kidney Diseases.

Ann Intern Med. 2012;157:482-489. www.annals.org

For author affiliations, see end of text.

Abstract

Objective:
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Study De
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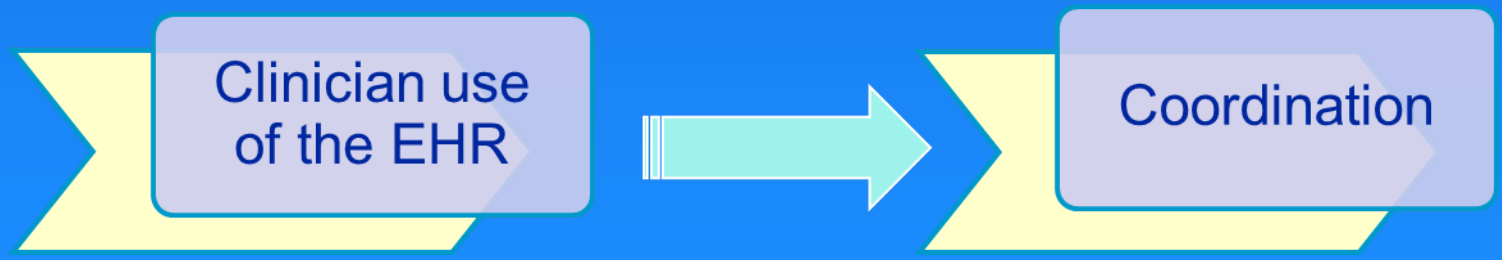
Objective

- To examine whether the effects of EHR use on care coordination are different depending on the primary care team members' working relationships.



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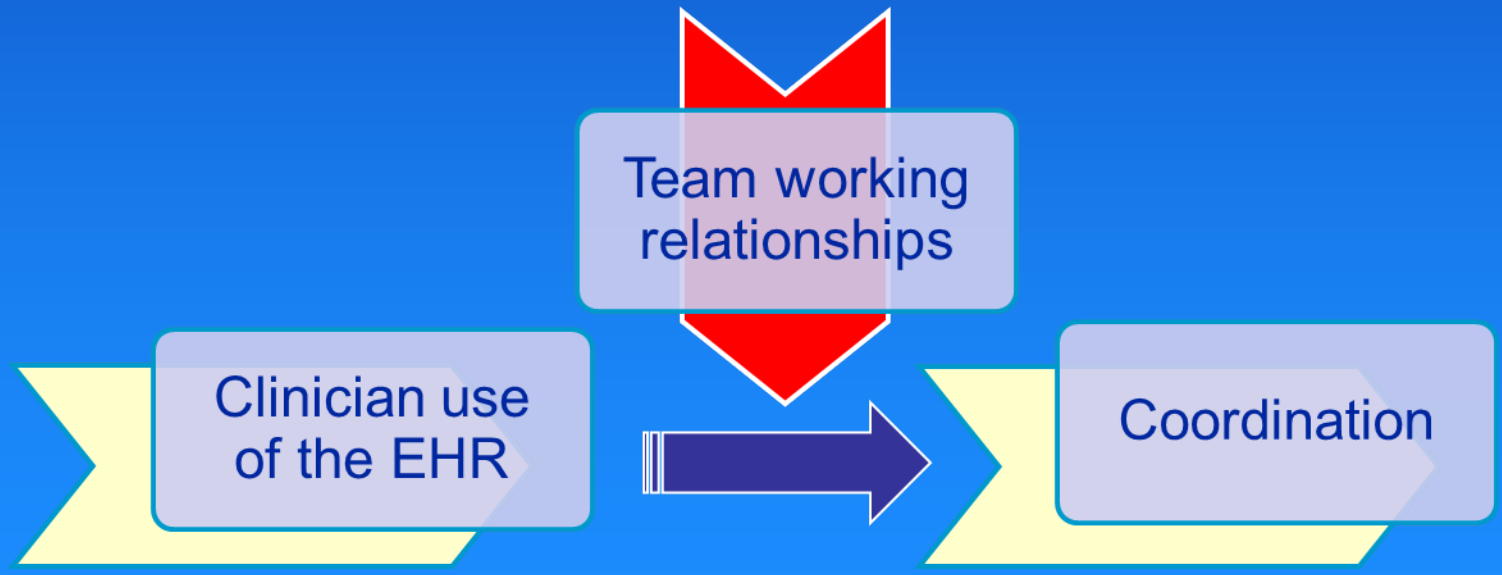
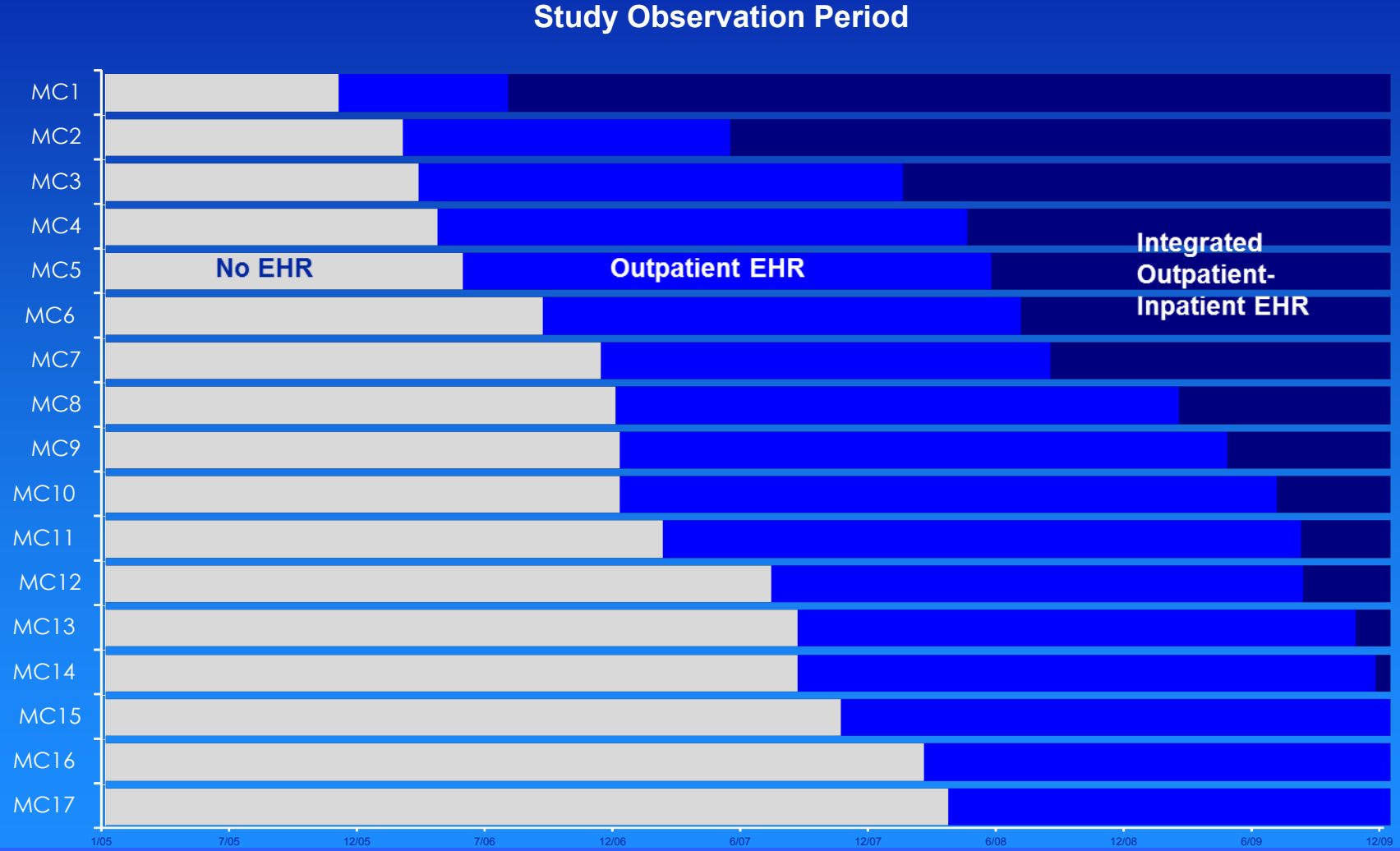


Methods: Setting

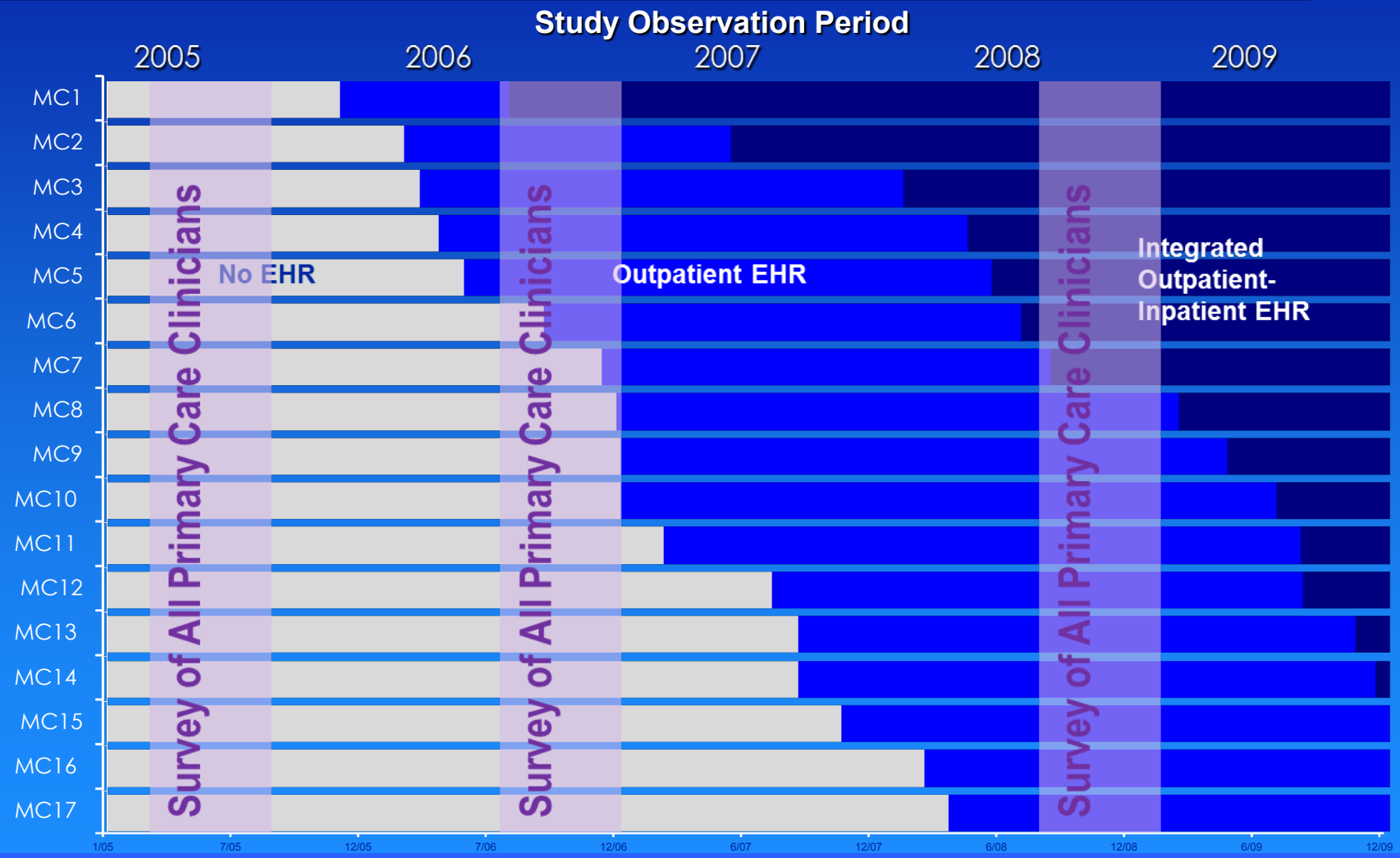
- Kaiser Permanente Northern California
  - Large, prepaid integrated delivery system (IDS)
  - 17 medical centers and 110 primary care teams
  - Outpatient and inpatient care for over three million members
- EHR System
  - Commercially available, Epic-based system
  - Certified → eligible for 'Meaningful Use' payments
    - Integrated patient clinical information at the point-of-care
    - Clinical decision support
    - Computerized physician order entry
    - Secure messaging with patients and other clinicians

Staggered EHR Implementation



Note: This figure shows the schedule of staggered outpatient (light blue) and inpatient (dark blue) EHR implementation across all study medical centers during the study period 2005-2010. After implementation, the EHR completely replaced the paper medical chart and a limited patchwork of preexisting non-integrated health IT tools. Use of those early health IT tools was limited, as paper-based alternatives were still in use. EHR = Electronic Health Record.

Staggered EHR Implementation



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Survey: Coordination of Care

- How often does each of the following occur when care is transferred across delivery sites?
  1. All relevant medical information is available.
  2. The information transfer is timely, i.e., available when it is needed.
  3. All clinicians agree on the treatment goals and plans.
  4. All clinicians agree on roles and responsibilities of each party.

- Response categories: [never, rarely, sometimes] and [usually and always]

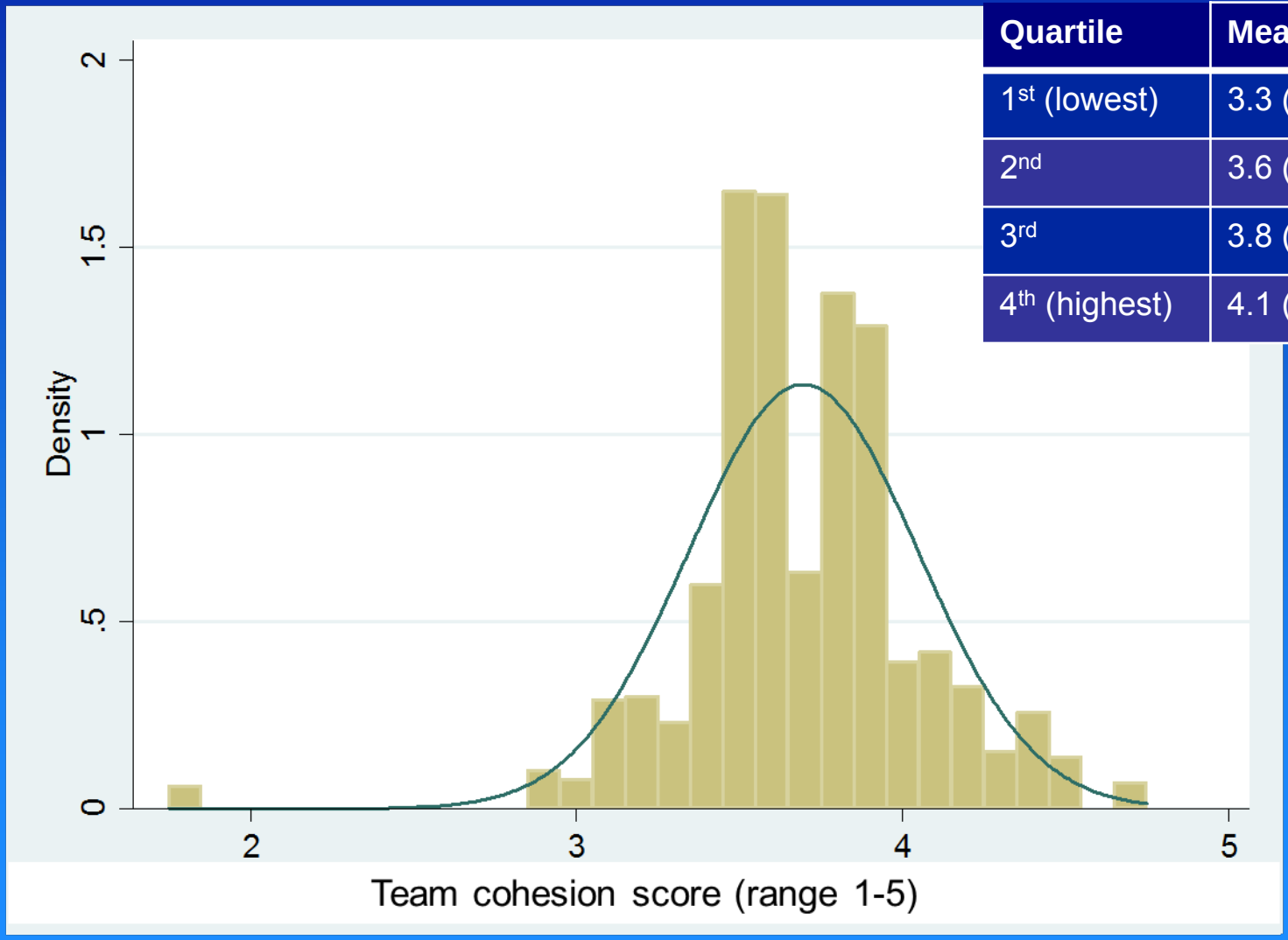
Team Cohesion Survey Questions

1. When there is conflict on this team, the people involved usually talk it out and resolve the problem successfully.
2. Our team members have constructive work relationships.
3. There is often tension among people on this team (reverse scored).
4. The team members operate as a real team.

   - Response: Likert agreement scale (1-5)
   - Responses averaged over 4 items per responded and aggregated across team members. We categorized team cohesion scores into quartiles and created an indicator variable for teams in the lowest quartile.

Cronbach's alpha = 0.83

Primary Care Team Cohesion



Quartile	Mean (SD)	Min	Max
1st (lowest)	3.3 (0.1)	2.8	3.5
2nd	3.6 (0.1)	3.5	3.7
3rd	3.8 (0.1)	3.7	3.9
4th (highest)	4.1 (0.1)	3.9	4.4

Primary Care Team Cohesion

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1st (lowest)	3.3 (0.1)	2.8	3.5
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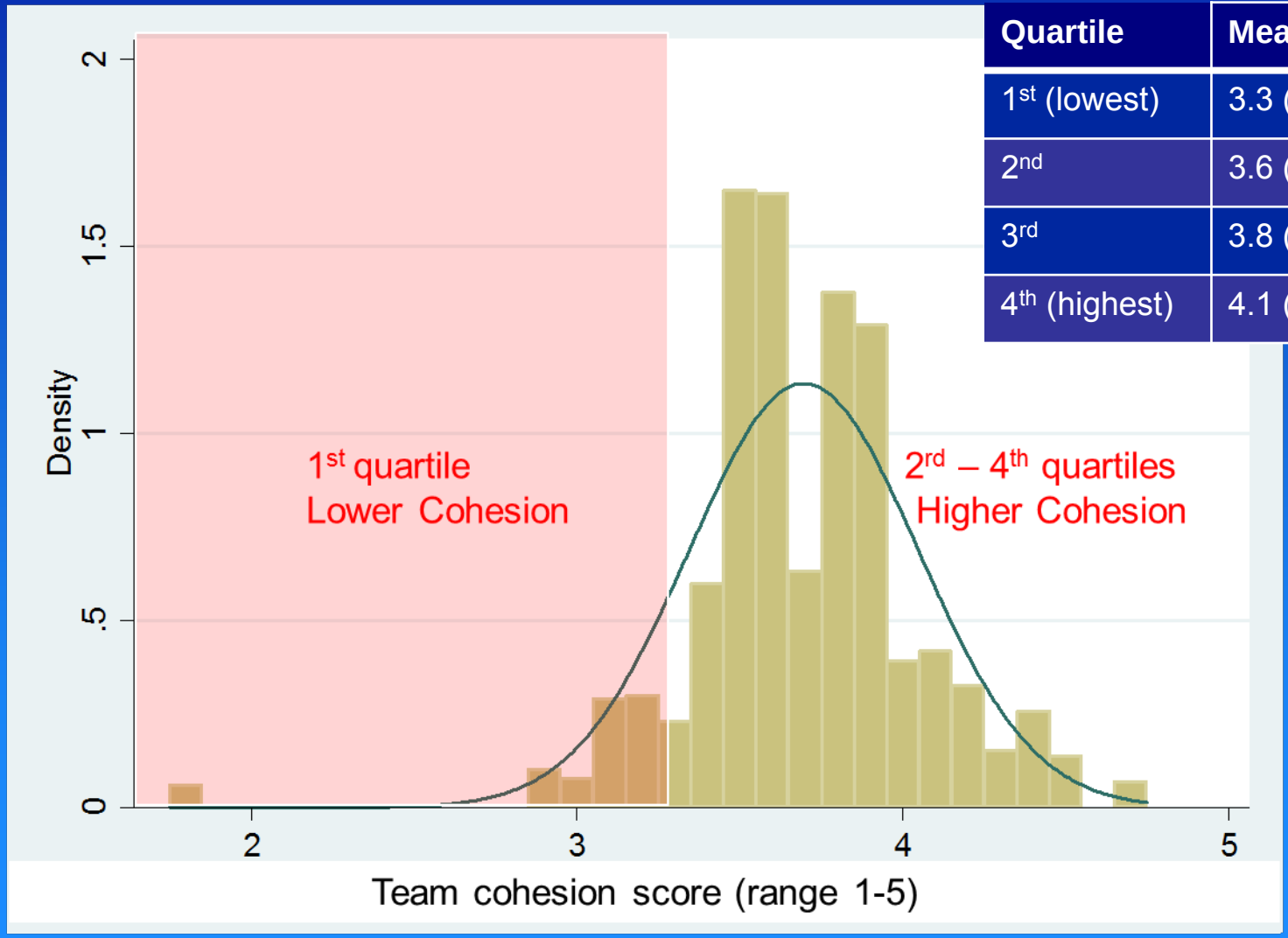
4th (highest)	4.1 (0.1)	3.9	4.4



Participant Characteristics: Primary Care Clinicians

Survey collection year		2005 (N=565)	2006 (N=678)	2008 (N=626)
Response Rate	(%)	48.1	61.5	60.8
Gender:	Male	45.3	46.0	48.3
	Female	54.7*	54.0*	51.7
Race/Ethnicity:	Non-white	51.0	56.9	60.8
	White	49.0	43.1	39.2
Training:	N.P/P.A.	15.8*	11.7*	5.6
	M.D./D.O.	84.3	88.4	94.4
Age:	25-39	36.0	38.1*	39.5*
	40-54	47.5	45.1	44.8
	55+	16.5	16.8	15.7
EHR Status:	No integrated EHR	100.0	93.7	52.2
	Integrated EHR	0.0	6.3	47.8

*$p<0.05$ comparing respondents and nonrespondents

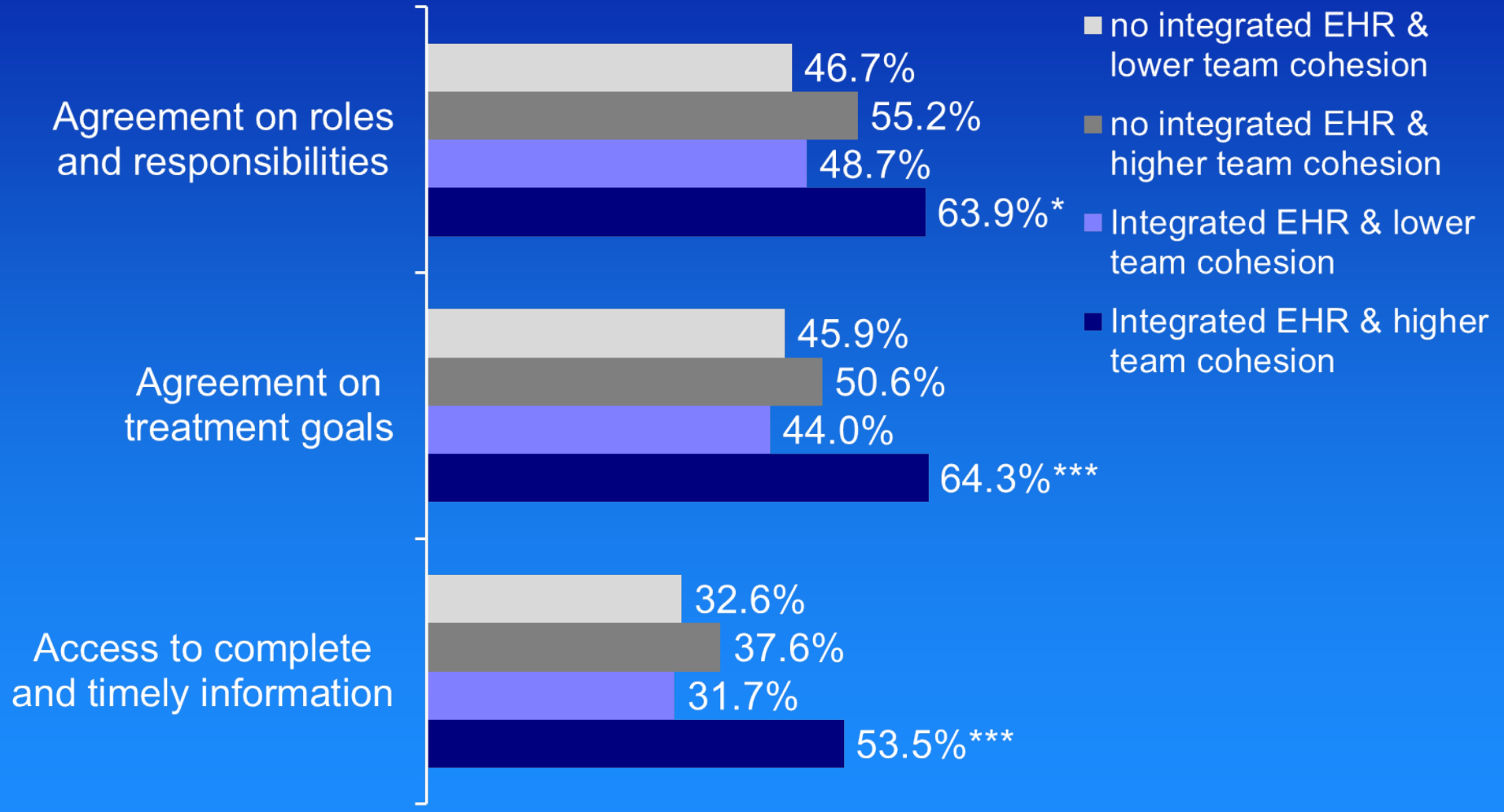
Primary Care Team Characteristics by Survey Year

Survey collection year Mean (SD)		2005 (N=105)		2006 (N=106)		2008 (N=104)	
Primary care clinicians per team		11.14	(3.78)	10.4	(3.86)	9.86	(5.92)
Respondents per team		5.39	(2.32)	6.40	(2.71)	6.01	(4.24)
Team cohesion score:	Lower	3.30	(0.35)	3.23	(0.35)	3.18	(0.42)
	Higher	3.87	(0.27)	3.87	(0.23)	3.83	(0.19)

Methods: Analysis

- Model: Logistic regression with random intercepts for clinician and medical center (GLLAMM)
- Outcome variables: Three reported dimensions of care coordination across delivery sites (binary)
- Predictor variables: Interaction
  - Integrated outpatient-inpatient EHR
  - Team Cohesion Indicator
- Covariates: Survey year (2005, 2006, or 2008) and clinician characteristics (gender, age, race/ethnicity, and M.D. vs. N.P./P.A.)

Adjusted Coordination of Care Across Delivery Sites: By Integrated EHR and Team Cohesion



Note: We computed the marginal adjusted percent of respondents who reported each outcome by fitting the logistic regression models as if all respondents had (1) no EHR and low team cohesion, (2) no EHR and high team cohesion, (3) EHR and low team cohesion, and (4) EHR and high team cohesion. *p<0.05, **p<0.01, ***p<0.001, p-values compare EHR with no EHR for clinicians working in team with high and with low cohesion.

Limitations

- All data collected from a single, integrated delivery system
  - Single EHR system
  - High baseline level of quality within the system
- Limited survey response rate
- Self-reported data

Conclusion

Improvements in clinician reported measures of care coordination associated with EHR-use varied by level of team cohesion

- Significant improvements for clinicians working in teams with higher cohesion
- No improvements for clinicians working in primary care teams with lower cohesion

Implications

- The organizational context is important for understanding the EHR effect on quality.
- Teams with a strong working relationships more successfully leveraged the EHR to achieve greater improvements in care coordination.
- Efforts to increase EHR use should consider including combined interventions that also target team function.

Contact Information

Thank You!

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An Automated Notification Strategy for Managing Tests Pending at Discharge (TPADs)

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BWH Hospitalist Service

Division of General Medicine

Brigham and Women's Hospital

Partners HealthCare, Inc.

DESIGN & IMPLEMENTATION

Supported by BWH HIT Innovations Program

March 2, 2012, 1:47 PM

Think Like a Doctor: Doubled Over in Pain Solved!

By LISA SANDERS, M.D., Columnist

On Thursday, we challenged Well readers to figure out the diagnosis for a 30-year-old man with a two-week history of severe abdominal pain.

More than 600 readers wrote in with some very thoughtful assessments of this patient's problem.

The correct diagnosis is...

Acute Intermittent Porphyria

The first person to figure it out was Dr. Hilary Seligman, from the University of Californ that during her medical school years at Baylor in there were five causes of severe abdominal pain t overlooked. Porphyria was one of them. And she sees a patient with that kind of pain.

A Problem in the System:

In this case, the patient benefited from a fairly rapid diagnosis of his porphyria. Although those weeks of pain may have seemed like years to the patient, the average time to diagnosis for most patients with this disease is counted in years rather than weeks, according to Desiree Lyon Howe, the executive director of the American Porphyria Foundation. When the patient and his wife met others with porphyria at the Mount Sinai clinic, they were amazed and horrified to hear the common story of years of painful episodes before a diagnosis was made.

Nevertheless, this diagnosis was almost missed. If the patient hadn't gone back to Mount Sinai when the pain returned, it is very unlikely that he would have found out about his positive test. Who knows how long it might have taken for him to get the right diagnosis?

The New York Times

TPADs: Epidemiology†

- 41% patients discharged with TPADs
  - 43% abnormal
  - 31% heme, chem, path; 27% radiology; 42% microbiology
  - 9.4% considered potentially actionable
- **Physicians are aware of only 40% of the final results of TPADs.**
- Few institutions have standardized systems to manage this patient safety concern.

†Roy CL, Poon EG, Karson AS, Ladak-Merchant Z, Johnson RE, Maviglia SM, Gandhi TK. *Patient safety concerns arising from test results that return after hospital discharge.* Ann Intern Med. 2005 Jul 19;143(2):121-8.

What about Discharge Documentation?

Table 1. Timeliness, Completeness, and Accuracy of Information Transfer at Hospital Discharge*

	Median % (Range)	
	Discharge Letters	Discharge Summaries
Availability and timeliness		
Received by primary care physician		
Within 48-72 h	25.5 (8-75)[25,28,43,61]	1[28]
Within 1 wk	[illegible]	[illegible][19,28]
Within 2 wk	[illegible]	[illegible]
Within 4 wk	79.5 (43-90)[illegible]	52 (37-77)[20,21,28,59]
At all	89 (39-99)[19,22,25,26,28,43,61]	75 (27-95)[19,21,28,68,69]
Available in hospital medical record	82 (77-85)[illegible]	85 (82-93)[30,68,69]
Content missing from discharge information		
Administrative information		
Patient's full name	(0-30)[illegible]	5.5 (0-11)[19,33]
Patient's age	17.5 (3-30)[16,19,20,33]	26.5 (20-33)[19,33]
Dates of admission and discharge	[illegible]	
Name of responsible hospital physician	[illegible]	25 (23-27)[19,33]
Name of physician preparing discharge summary	[illegible]	7[33]
Name of primary care physician	17.5 (0-27)[20,33]	16 (7-58)[33,59,69]
Medical information		
Main diagnosis	13 (2-31)[15,16,19,20,26,28,33]	17.5 (10-39)[15,18,19,33,34,59,68,69]
Other diagnoses	83[16]	28 (7-37)[34,59,69]
Presenting symptoms	48.5 (28-69)[16,33]	20 (19-21)[33,69]
History of present illness	29[16]	
Medical history	48[16]	
Social history	84[16]	
Physical examination findings	45.5 (21-70)[16,33]	10.5 (1-20)[33,68]
Diagnostic test results	65 (20-75)[16,19,26,33]	38 (33-63)[19,23,33,68]
Consultant recommendations	33[17]	52[35]
Treatment/hospital course	29.5 (22-45)[16,19,26,33]	14.5 (7-22)[19,33]
Discharge medications	25 (7-48)[16,20,33,49]	21 (2-40)[24,33,59,68,69]
Test results pending at discharge	88[20]	65[69]
Follow-up plans	30 (23-48)[16,19,28,33,49]	14 (2-43)[19,24,27,30,33,68,69]
Patient or family counseling	92 (92-97)[19,26,33]	91 (90-92)[19,33]

*Values represent the median percentage and range reported across studies (superscript citations).
†Results for the interval 5 to 9 days since discharge were accepted to accommodate variable reporting across studies.

Lots of info, but are we transferring timely knowledge?

Kripalani, S. et al. JAMA 2007;297:831-841

The Fundamental Problem…

Right Information

Right Person

Right Time

Why Not Health IT?

shm Journal of HOSPITAL MEDICINE www.journalofhospitalmedicine.com

ORIGINAL RESEARCH CME

Lessons Learned From Implementation of a Computerized Application for Pending Tests at Hospital Discharge

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Partners Healthcare System, Inc., Boston, Massachusetts.

Disclosure: This study was funded by a grant from the Harvard Risk Management Foundation, Cambridge, MA.

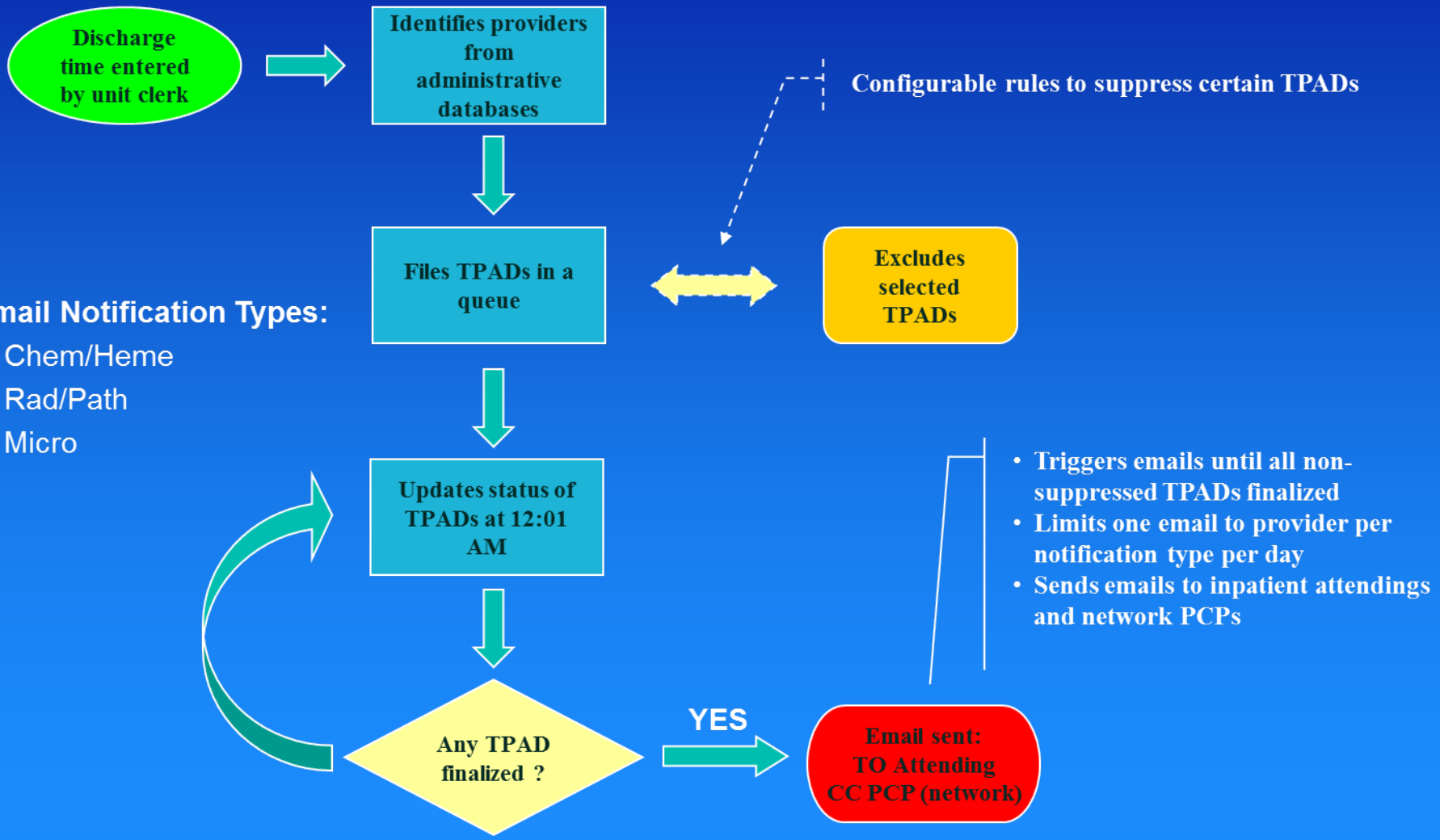
- To be successful, HIT systems must
  - Conform to workflow of both inpatient and ambulatory providers
  - Support coordination of care across care settings
  - Promote a seamless transition in knowledge and responsibility
  - Facilitate test result acknowledgement

BWH Pilot System Automated Email Notification for TPADs

- Identify patients discharged with TPADs
- Notify responsible physicians of the finalized results of TPADs via secure, network email **at the time they become available**
  - TO Discharging Inpatient Attending
  - CC Primary Care Physicians (Network PCPs)
- Three email notification types:
  1. Chemistry, Hematology
  2. Radiology, Pathology
  3. Microbiology (culture† and non-culture)

†El-Kareh R, Roy C, Williams DF, Poon EG. Impact of automated alerts on follow-up of post-discharge microbiology results: a cluster randomized controlled trial. J Gen Intern Med. 2012 Oct;27(10):1243-50.

Design of System: A Coordinated Sequence of Events



Design Considerations

Goal: Maximize utility of system by timely notification of **relevant** results

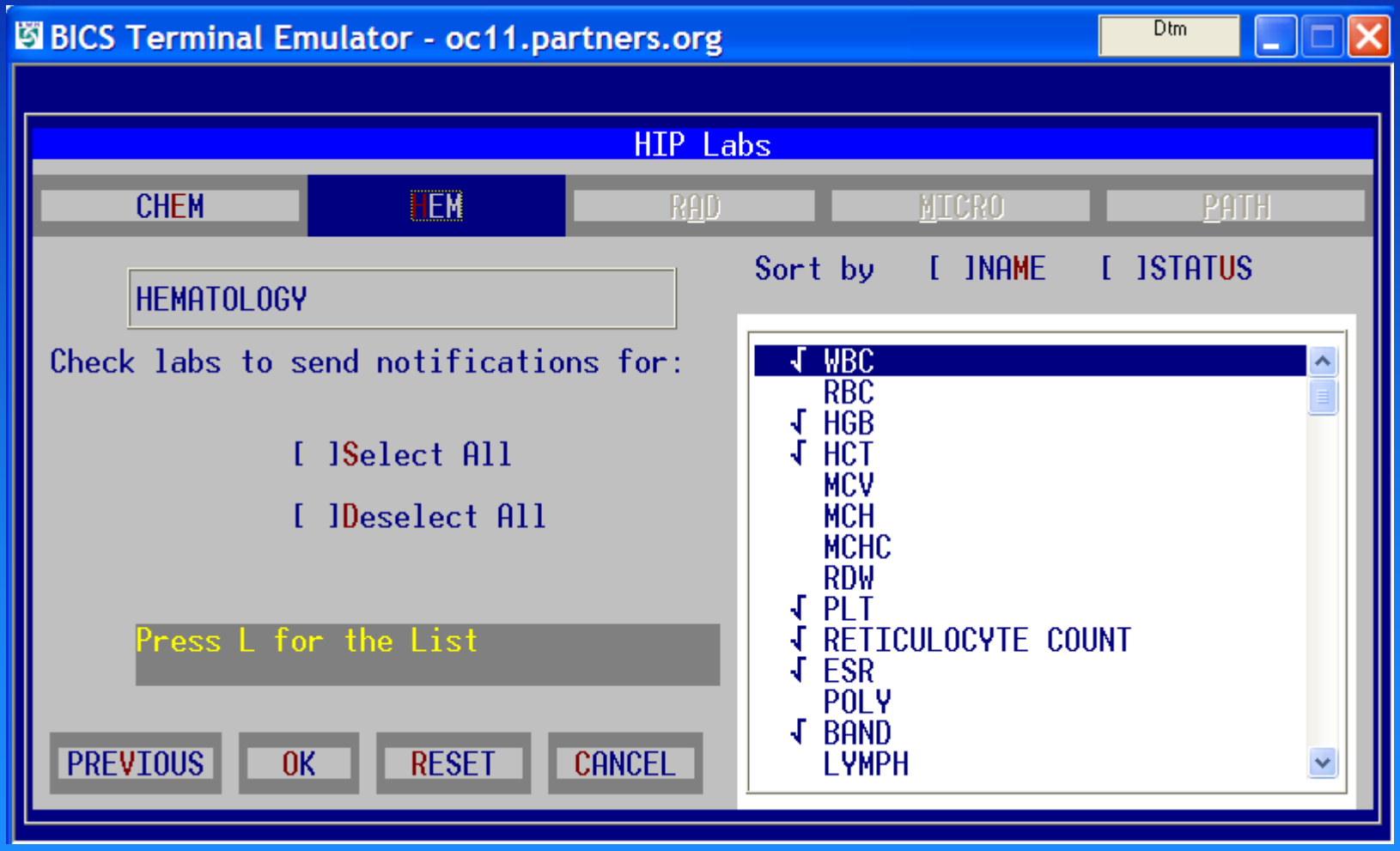
Important Questions:

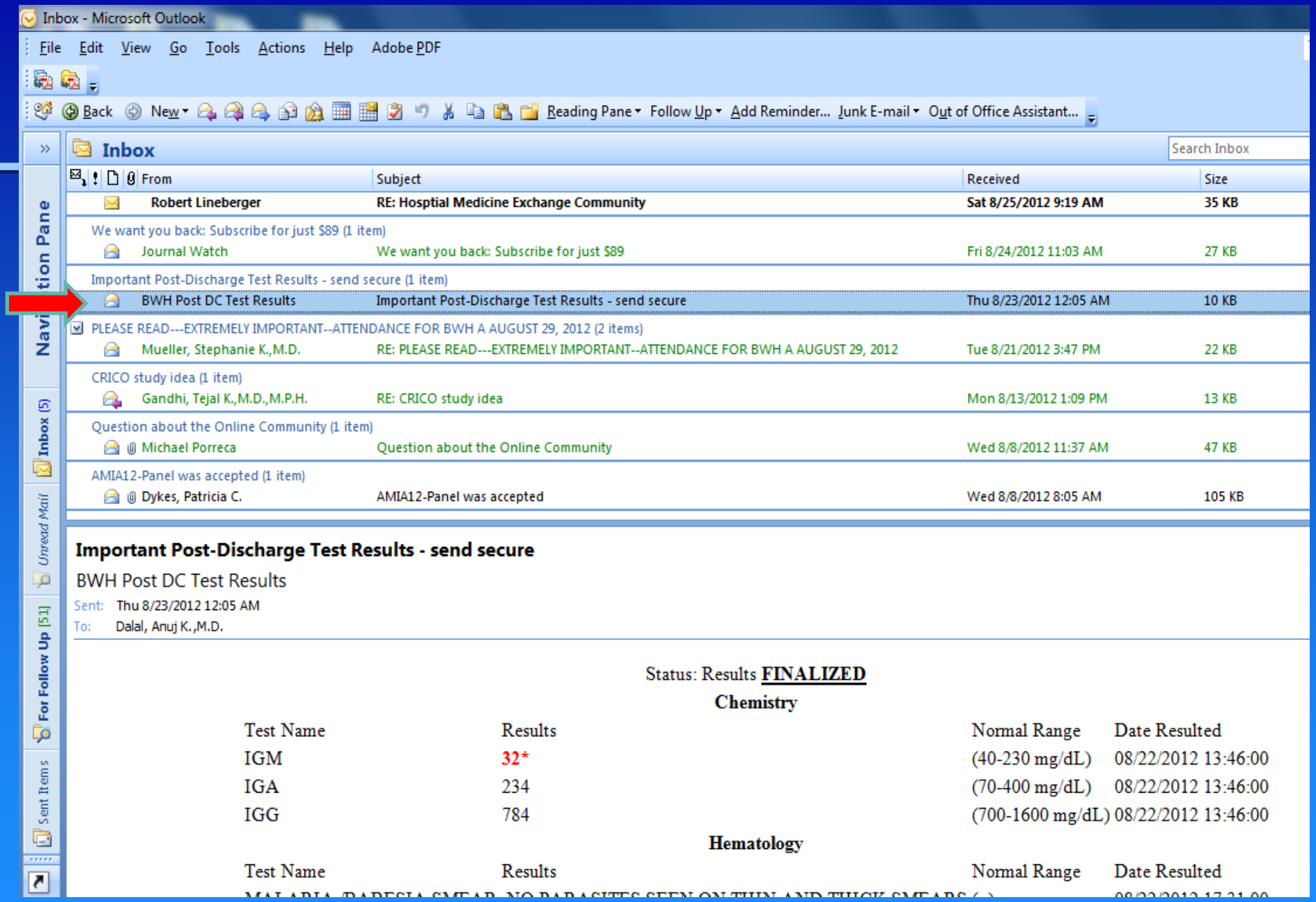
1. Should we notify providers only on abnormal results?
2. Should we notify providers on negative results and, if so, which ones?
3. Should we exclude only commonly ordered inpatient results with fast turn-around (i.e., all basic metabolic panels, CBCs, coags, etc.)?

Design Considerations: Alert Fatigue

- Incorporated logic to suppress certain, inpatient-specific, non-essential TPADs, modifiable "on-the-fly"
- Kept to a minimum during pilot period to see what is coming through (i.e., kept sensitivity high)
  - Chemistry: ABG, VBG
  - Hematology: RBC, MCV, MCH, MCHC, Diff Count
  - Radiology:
    - Fluoroscopy use
    - Uploaded outside hospital images (no reports generated)
  - Pathology/Microbiology: none
- Limited notification volume to no more than one email per notification type per day until all TPADs finalized.
  - Micro alerts: after initial notification, sent subsequent notifications only on abnormal results

Configurable System: Lab Selection

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Robert Lineberger RE: Hosptial Medicine Exchange Community Sat 8/25/2012 9:19 AM 35 KB
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BWH Post DC Test Results Important Post-Discharge Test Results - send secure Thu 8/23/2012 12:05 AM 10 KB
PLEASE READ---EXTREMELY IMPORTANT--ATTENDANCE FOR BWH A AUGUST 29, 2012 (2 items)
Mueller, Stephanie K.,M.D. RE: PLEASE READ---EXTREMELY IMPORTANT--ATTENDANCE FOR BWH A AUGUST 29, 2012 Tue 8/21/2012 3:47 PM 22 KB
CRICO study idea (1 item)
Gandhi, Tejal K.,M.D.,M.P.H. RE: CRICO study idea Mon 8/13/2012 1:09 PM 13 KB
Question about the Online Community (1 item)
Michael Porreca Question about the Online Community Wed 8/8/2012 11:37 AM 47 KB
AMIA12-Panel was accepted (1 item)
Dykes, Patricia C. AMIA12-Panel was accepted Wed 8/8/2012 8:05 AM 105 KB
Navigation Pane
Inbox (5)
Unread Mail
For Follow Up [51]
Sent Items
Important Post-Discharge Test Results - send secure
BWH Post DC Test Results
Sent: Thu 8/23/2012 12:05 AM
To: Dalal, Anuj K.,M.D.
Status: Results FINALIZED
Chemistry
Test Name Results Normal Range Date Resulted
IGM 32* (40-230 mg/dL) 08/22/2012 13:46:00
IGA 234 (70-400 mg/dL) 08/22/2012 13:46:00
IGG 784 (700-1600 mg/dL) 08/22/2012 13:46:00
Hematology
Test Name Results Normal Range Date Resulted


AT&T
7:59 AM
Tue 75/57
Wed 72/63
Thu 72/57
Fri 73/55
Sat 68/48
Sun 59/43
Tap to Tweet
Tap to Post
Mail
BWH Post DC Test Results 7:59 AM
Important Post-Discharge Test Results
August 4, 2011 Dear Dr. Dalal: HARRY POTTER
(BWH# 12345678), for whom you were the att…
Calendar Tuesday, October 2
Research Time in 1m
CCSTR/ANCR Initiatives 8:30 AM
Anuj to Call Cheyl @ 617-643-5293 to 9:00 AM
CCSTR Bi-weekly Update 9:00 AM
New Phone #! Dial: (877) 495-8204 to 10:00 AM
Code: 933 508 7593 Host: Jennifer Lenoci-E…
Hospitalist Service QI/Res Ta… 2:30 PM
DGIM Conf Room, 3rd Floor, One to 3:30 PM

Chemistry/Hematology Notification

March 29, 2011
Dear Dr. HOSPITALIST, M.D.:

DISCHARGED PATIENT (BWH# 12345678), [redacted]om you were the attending of record, was discharged from Brigham and Women's Hospital on 03/27/2011. Some tests from this hospitalization were still pending at the time of discharge. We have listed below 1) tests whose results have been finalized after discharge, and 2) tests whose results are still pending. Chemistry and Hematology test types are included in this service. Radiology, Pathology, and Microbiology test types are available in separate notifications

The patient's PCP, NON-NETWORK PROVIDER, did not receive this notification because s/he does not have a Partners email address listed.

This is a new service we are piloting that we hope you will find to be helpful. Note: Any corrections or changes made after tests are finalized are not captured by this service but are reported per current lab protocol.

Inpatient Attending: HOSPITALIST, M.D. Work Phone: 111-111-1111
Primary Care Physician: NON-NETWORK PROVIDER, M.D. Work Phone: 222-222-2222

Status: Results **FINALIZED**
Hematology

Test Name	Results	Normal Range	Date Resulted
ANTITHROMBIN III FUNCTIONAL	76	(69-127 %)	03/28/2011 11:29:00
APCR (FACTOR 5 LEIDEN)	4.17;NEW REFERENCE RANGE EFFECTIVE 3/19/08; PREVIOUS REFERENCE RANGE 0.8-2.50	(2.3-15.0)	03/28/2011 11:21:00

Status: Results **PENDING**
Chemistry

Test Name	Specimen Login Time
ANTI-PROTHROMBIN	03/25/2011 17:04:00
CARDIOLIPIN IGG	03/25/2011 17:04:00
CARDIOLIPIN IGM	03/25/2011 17:04:00

Please email the BWH Post-Discharge Results Notification Service for any questions, comments, and concerns related to this alert.

Chemistry/Hematology Notification

March 30, 2011
Dear Dr. HOSPITALIST, M.D.:

DISCHARGED PATIENT (BWH# 12345678), for whom you were the attending of record, was discharged from Brigham and Women's Hospital on 03/27/2011. Some tests from this hospitalization were still pending at the time of discharge. We have listed below 1) tests whose results have been finalized after discharge, and 2) tests whose results are still pending. Chemistry and Hematology test types are included in this service. Radiology, Pathology, and Microbiology test types are available in separate notifications

The patient's PCP, NON-NETWORK PROVIDER, did not receive this notification because s/he does not have a Partners email address listed.

This is a new service we are piloting that we hope you will find to be helpful. Note: Any corrections or changes made after tests are finalized are not captured by this service but are reported per current lab protocol.

Inpatient Attending: HOSPITALIST, M.D. Work Phone: 111-111-1111
Primary Care Physician: NON-NETWORK PROVIDER, M.D. Work Phone: 222-222-2222

Status: Results **FINALIZED**

Chemistry

Test Name	Results	Normal Range	Date Resulted
CARDIOLIPIN IGG	16;METHODOLOGY CHANGE 8/23/99.;PRE CHANGE REFERENCE RANGE 0-22 GPL, POST CHANGE REFERENCE RANGE 0-15 GPL	(0-15 GPL units)	03/29/2011 11:46:00
CARDIOLIPIN IGM	14	(0-15 MPL units)	03/29/2011 11:46:00

Hematology

Test Name	Results	Normal Range	Date Resulted
ANTITHROMBIN III FUNCTIONAL	76	(69-127 %)	03/28/2011 11:29:00
APCR (FACTOR 5 LEIDEN)	4.17;NEW REFERENCE RANGE EFFECTIVE 3/19/08; PREVIOUS REFERENCE RANGE 0.8-2.50	(2.3-15.0)	03/28/2011 11:21:00

Status: Results **PENDING**

Chemistry

Test Name	Specimen Login Time
ANTI-PROTHROMBIN	03/25/2011 17:04:00

Please email the BWH Post-Discharge Results Notification Service for any questions, comments, and concerns related to this alert.

Chemistry/Hematology Notification

March 31, 2011
Dear Dr. HOSPITALIST, M.D.:

DISCHARGED PATIENT (BWH# 12345678), for whom you were the attending of record, was discharged from Brigham and Women's Hospital on 03/27/2011. Some tests from this hospitalization were still pending at the time of discharge. We have listed below 1) tests whose results have been finalized after discharge, and 2) tests whose results are still pending. Chemistry and Hematology test types are included in this service. Radiology, Pathology, and Microbiology test types are available in separate notifications

The patient's PCP, NON-NETWORK PROVIDER, did not receive this notification because s/he does not have a Partners email address listed.

This is a new service we are piloting that we hope you will find to be helpful. Note: Any corrections or changes made after tests are finalized are not captured by this service but are reported per current lab protocol.

Inpatient Attending: HOSPITALIST, M.D. Work Phone: 111-111-1111
Primary Care Physician: NON-NETWORK PROVIDER, M.D. Work Phone: 222-222-2222

Status: Results **FINALIZED**

Chemistry

Test Name	Results	Normal Range	Date Resulted
ANTI-PROTHROMBIN	3	(0-20 UNITS)	03/30/2011 14:23:00
CARDIOLIPIN IGG	16;METHODOLOGY CHANGE 8/23/99.;PRE CHANGE REFERENCE RANGE 0-22 GPL, POST CHANGE REFERENCE RANGE 0-15 GPL.	(0-15 GPL units)	03/29/2011 11:46:00
CARDIOLIPIN IGM	14	(0-15 MPL units)	03/29/2011 11:46:00

Hematology

Test Name	Results	Normal Range	Date Resulted
ANTITHROMBIN III FUNCTIONAL	76	(69-127 %)	03/28/2011 11:29:00
APCR (FACTOR 5 LEIDEN)	4.17;NEW REFERENCE RANGE EFFECTIVE 3/19/08; PREVIOUS REFERENCE RANGE 0.8-2.50	(2.3-15.0)	03/28/2011 11:21:00

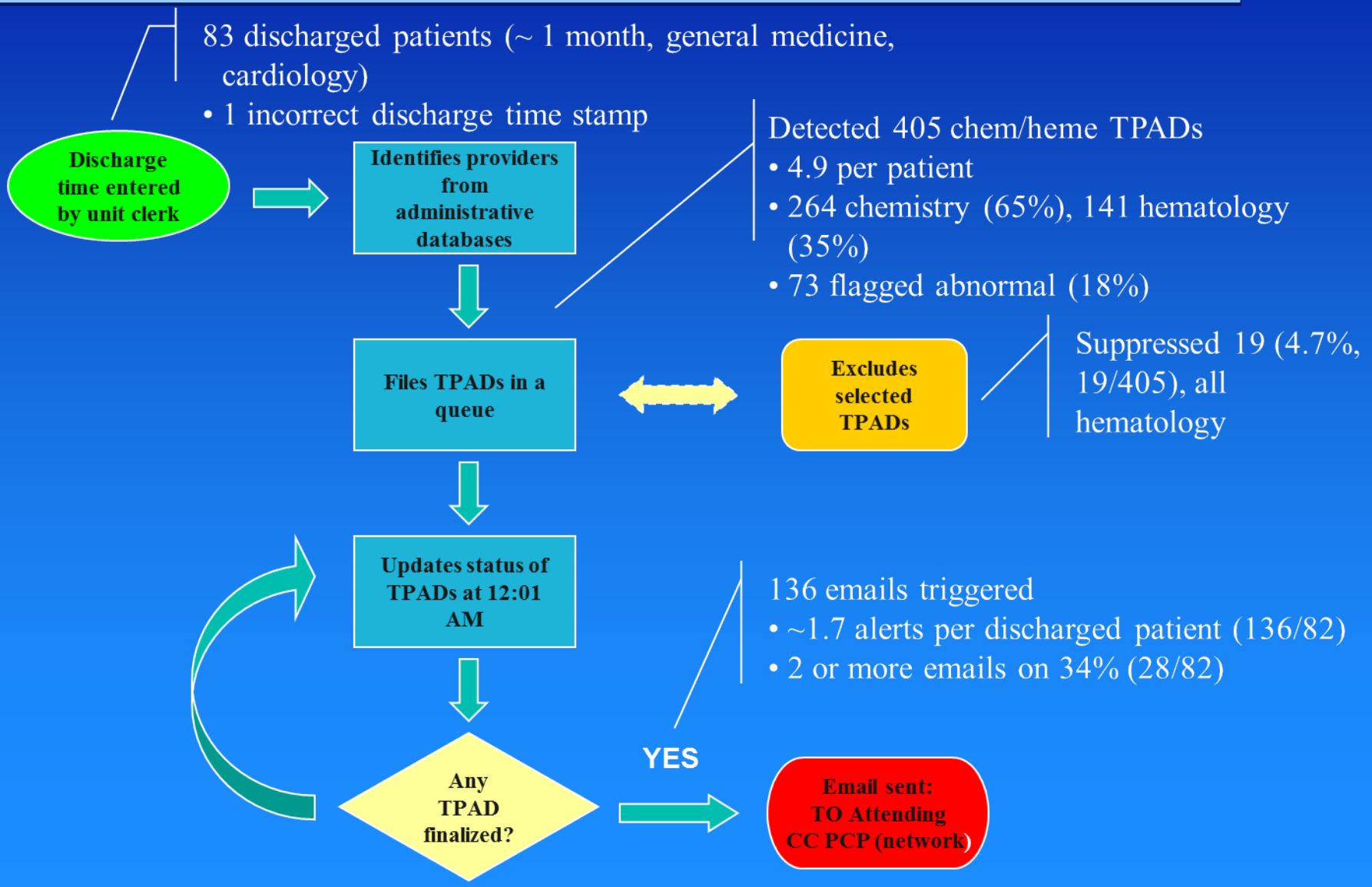
Status: Results **PENDING**

Please email the BWH Post-Discharge Results Notification Service for any questions, comments, and concerns related to this alert.

Measures

- Background performance
  - What's happening "under the hood"?
    - TPAD processing: volume, % flagged abnormal, % suppressed by rules
    - Reliability: discharge time, provider identification
- Email notification performance
  - What did physicians see?
    - Volume of notifications by discharged patient, provider, and test type?

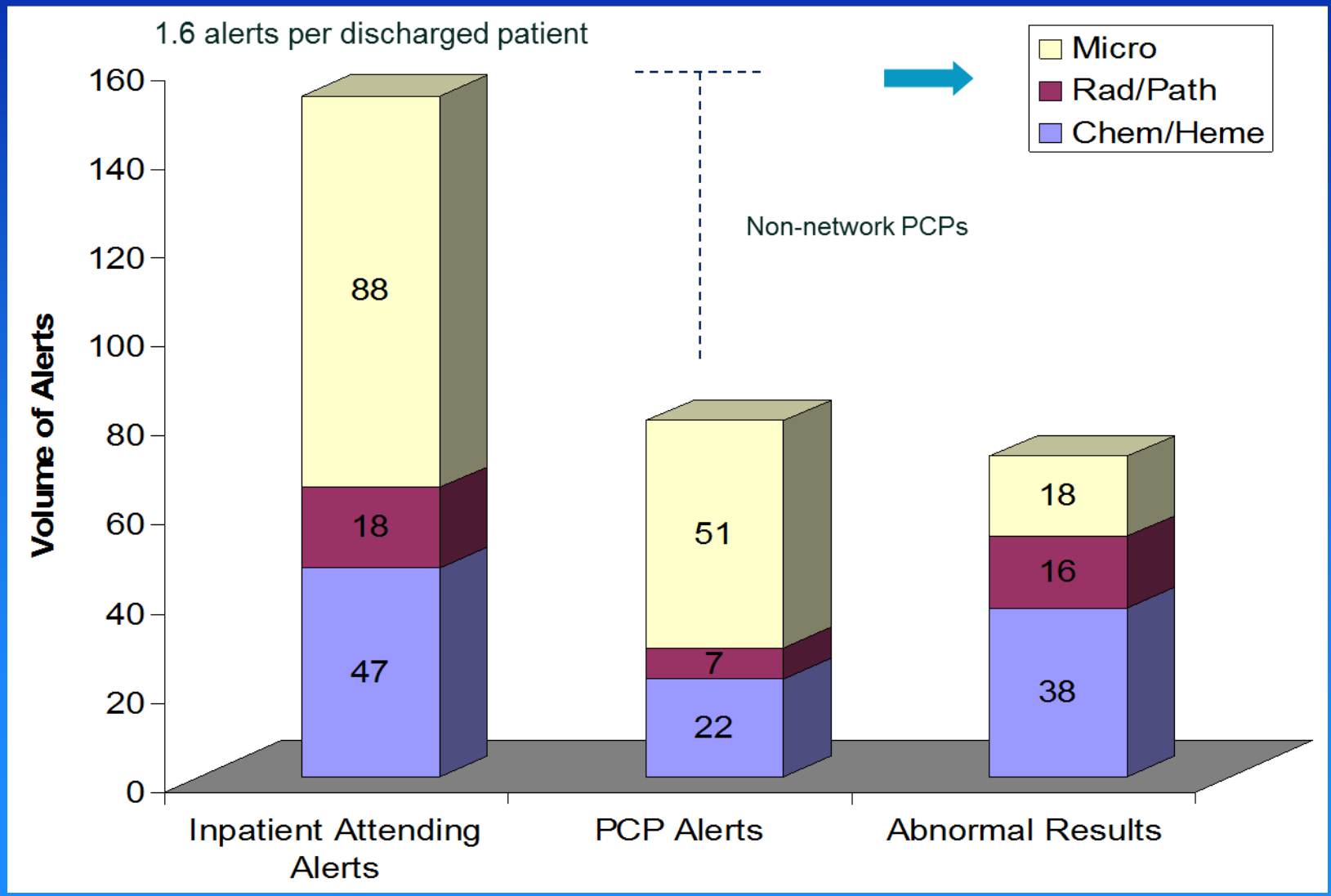
Background Performance



Background Performance

- One incorrectly entered discharge time stamp (1.2%, 1/83)
  - Unit clerk inadvertently "discharged" patient on Day 4 of 10-day hospitalization
    - Detected 510 TPADs (249 chem, 261 heme)!
  - Triggered 9 emails!
  - A rare event
- 3 responses from physicians (on 3 distinct patients) claiming email sent to incorrect provider (3.6%, 3/83)
  - 2 from inpatient attending
  - 1 from PCP

Email Notifications Sent to Providers on 95 Discharged Patients with All TPADs Finalized



Conclusions: Design

- Automated email notification is a feasible and reliable strategy for managing results of TPADs and is compatible with workflow
- Successful implementation is dependent on accuracy and reliability of
  - Discharge time stamp
  - Provider identification

Garbage in, garbage out phenomena

Conclusions: Design

- The high volume of TPADs and notifications to providers are challenging to negotiate
  - Logic to limit volume and frequency of notifications to minimize alert fatigue
  - A user-configurable system to modify suppression rules is desirable

Key Features of BWH Pilot

- Recognizes and highlights TPADs as an important subset of test results
- Reliably identifies the responsible provider
  - Contact info for non-network PCPs when available
- Opens a communication thread with PCP at the time potential actions need to be taken
  - i.e., knowledge transfer
- Facilitates transfer of responsibility to next provider
  - i.e., acknowledgment
- Logic and configurable rules to minimize alert fatigue

Dalal AK, Schnipper JL, Poon EG, et al. *Design and implementation of an automated email notification system for results of tests pending at discharge.* Journal of the American Medical Informatics Association. Published Online First: 19 January 2012; doi:10.1136/amiajnl-2011-000615.

EVALUATION

DID WE IMPROVE AWARENESS?
DID PHYSICIANS LIKE IT?

Supported by AHRQ Grant 1R21HS018229-01

Study Aims

- Purpose:
  - To evaluate the impact of automated email notification system
- Primary outcome:
  - Inpatient attending awareness of TPAD results
- Secondary outcomes:
  - PCP awareness of TPAD results
  - Physician awareness of actionable TPADs
  - Satisfaction with notification system

Physician Clustered RCT

- Activated system for independently randomized inpatient attendings and PCPs
- Inpatient general medicine and cardiology services from 10/2010 thru 5/2011
- Surveyed intervention and control physicians with regard to:
  - Primary outcome: Awareness of TPAD results by inpatient attending
  - Overall satisfaction with the system

Randomization Scheme

Randomized Physician	Att_I	Att_C
PCP_I	PCP_IAtt_I **PATIENT INCLUDED**	PCP_IAtt_C **PATIENT EXCLUDED**
PCP_C	PCP_CAtt_I **PATIENT EXCLUDED**	PCP_CAtt_C **PATIENT INCLUDED**

Patients of discordant pairs excluded

1. Inpatient attendings (Att) & PCPs randomized prior to study initiation or at the time of discharge
2. Discharged patients with TPADs were identified by the notification system and assigned to intervention or control by randomized physician.

549 patients with TPADs with physician randomized to concordant arms (survey generated):
Intervention = 295; Control = 254

54 excluded:
0 physicians opted out;
16 attendings misidentified;
2 no test result/test cancelled;
8 alerts not firing properly;
28 duplicate survey generated

54 excluded:
6 physicians opted out;
21 attendings misidentified;
3 no test result/test cancelled;
24 duplicate survey generated

Intervention

241 patients with TPADs (surveys sent)

53 patients with incorrect or misidentified PCP

241 surveys sent to 56 attendings
188 surveys sent to 137 PCPs

No response:
102 surveys sent to 17 attendings
121 surveys sent to 87 PCPs

139 surveys completed by 39 attendings
67 surveys completed by 50 PCPs

Control

200 patients with TPADs (surveys sent)

32 patients with incorrect or misidentified PCP

200 surveys sent to 55 attendings
168 surveys sent to 134 PCP

No response:
64 surveys sent to 14 attendings
86 surveys sent to 73 PCPs

136 surveys completed by 41 attendings
82 surveys completed by 61 PCPs

	Intervention N (%)	Usual Care N (%)	p-value
Inpatient Attendings	N=56	N=55	
Age – yr	45.4 (9.4)	44.7 (11.1)	0.26
Male sex – no. (%)	35 (64)	36 (65)	0.84
Attending Experience (years)			
<5	23 (41)	33 (62)	0.09
5-10	17 (30)	10 (19)	
10+	16 (29)	10 (19)	
Specialty			
Hospitalist	21(38)	14 (25)	0.48
Traditional Internist	6 (11)	5 (9)	
Cardiologist	22 (40)	28 (51)	
Other Subspecialist	6 (11)	8 (15)	
Years Employed at BWH (mean)	10.62 (8.42)	10.87 (9.04)	0.89

Discharged Patients†	N=241 (I)	N=200 (C)	p-value
Age – yr			
Median	61.0	59.5	0.83
Inter-quartile range	44.0-75.0	45.5-73.0	
Male sex – no. (%)	114 (47)	97 (49)	0.80
Race			
White	149 (62)	120 (60)	0.71
Black	52(22)	42 (21)	
American Indian	1 (<1)	-	
Hispanic	32 (13)	27 (14)	
Other	7 (3)	10 (5)	
Socioeconomic status (Median Income by Zip Code)			
<=39,000	80 (34)	60 (31)	0.88
39,001 – 47,000	51 (22)	47 (24)	
47,001 – 63,000	52 (22)	43 (22)	
>63,000	53 (22)	46 (23)	
Case-Severity Mix			
DRG weight median (IQR)	1.10 (0.80-1.75)	1.03 (0.80-1.62)	0.37
No. with network PCPs	123 (72)	107 (69)	0.63
No. with non-network PCPs	48 (28)	48 (31)	
30-day readmission	56 (23)	34 (17)	0.10
30-day mortality	2 (<1)	2 (1)	1.00
Avg comorbidity score per discharge	2.06 (2.18)	2.06 (2.38)	0.76

Impact

PRIMARY OUTCOME	Intervention	Control	Crude OR [95% CI] p-value
Awareness of Any TPAD Result(s) by Inpatient Attending			
% (No.) Inpatient Attendings Aware	**76% (106/139)**	**38% (52/136)**	**5.19 [3.08, 8.74] p<0.0001**
Hospitalist	80% (76/95)	36% (31/86)	7.10 [3.64,13.8] p<0.0001
Non-Hospitalists¥	72% (28/39)	43% (20/47)	3.44 [1.39, 8.50] p=0.007

Impact

SECONDARY OUTCOMES	Intervention	Control	Crude OR [95% CI] p-value
Awareness of Any TPAD Result(s) by PCP			
% (No.) PCPs Aware	**57% (39/69)**	**33% (27/83)**	**2.70 [1.39, 5.22] p=0.003**
Network PCP	65% (35/54)	33% (24/73)	3.76 [1.79, 7.90] p=0.0004
Non-network PCP	18% (2/11)	29% (2/7)	0.56 [0.06, 5.24] p=0.61
Awareness of Actionable TPAD Result(s)			
% (No.) Inpt Attendings Aware	**59% (16/27)**	**29% (8/28)**	**3.64 [1.18, 11.18] p=0.02**
% (No.) PCPs Aware	**65% (13/20)**	**48% (13/27)**	**2.00 [0.61, 6.57] p=0.25**

SATISFACTION MEASURES	Satisfied	Neutral	Dissatisfied
Physician Satisfaction with Current System (Usual Care)			
% (No.) Inpatient Attendings	**11% (15)**	**17% (23)**	**72% (95)**
Hospitalist	7% (6)	16% (14)	77% (66)
Non-Hospitalists¥	19% (9)	19% (9)	62% (29)
% (No.) PCPs	**17% (14)**	**15% (12)**	**68% (54)**
Network PCP	15% (11)	16% (12)	69% (50)
Non-Network PCP	42% (3)	-	58% (4)
Physician Satisfaction with Automated Email Notifications (Intervention)			
% (No.) Inpatient Attendings	**89% (118)**	**4% (5)**	**7% (10)**
Hospitalist	93% (88)	2% (2)	5% (5)
Non-Hospitalists¥	79% (30)	8% (3)	13% (5)
% (No.) PCPs	**70% (43)**	**19% (12)**	**11% (7)**
Network PCP	81% (43)	11% (6)	8% (4)
Non-network PCP	-	67% (6)	33% (3)

Selected Comments

"I find this extremely useful, knowing the final results of tests, both test results that are positive as well as negative."
"Was unaware of this test even being ordered—had it not been for auto-notification, would never have known about test or result. No call to PCP as test is in normal range and will not affect management."
"The concept is great. All the notifications I have received are for negative results. Might be more worthwhile for blood tests if it was only for abnormal results."
"I think this is terrific. Results are clear and trail of ownership is, too. Keep up the good work."
"I would prefer if results that were pending showed up in my results manager list."

Conclusions: Evaluation

- Awareness of finalized TPAD results under usual care is still poor.
- Physicians receiving automated email notifications are significantly more aware of TPAD results compared to usual care physicians.
- Intervention physicians are highly satisfied.
  - Physicians vary with regard to type of results they wish to receive.

Limitations

- A robust culture of email utilization by inpatient physicians
- Small sample size → powered to detect difference in awareness of any test result, not actionable test results
- Generalizability → single institution, two services, proprietary system

Implications

- Automated email notification is a promising strategy to improve awareness of the results of TPADs by physicians
  - Potential to mitigate an important patient safety concern
- Future studies
  - Analyze downstream actions taken
  - Elucidate desired features to maximize utility for physicians (e.g., electronic acknowledgment)
  - Demonstrate effectiveness for other clinical services, hospitals, and electronic medical record platforms.

Contact Information

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Redesigning Primary Care: Addressing the Needs of Our Most At-risk Patients with Care Management Plus

David A. Dorr, M.D., M.S.
Associate Professor / Vice Chair
Department of Medical Informatics & Clinical Epidemiology
General Internal Medicine & Geriatrics
Oregon Health and Science University

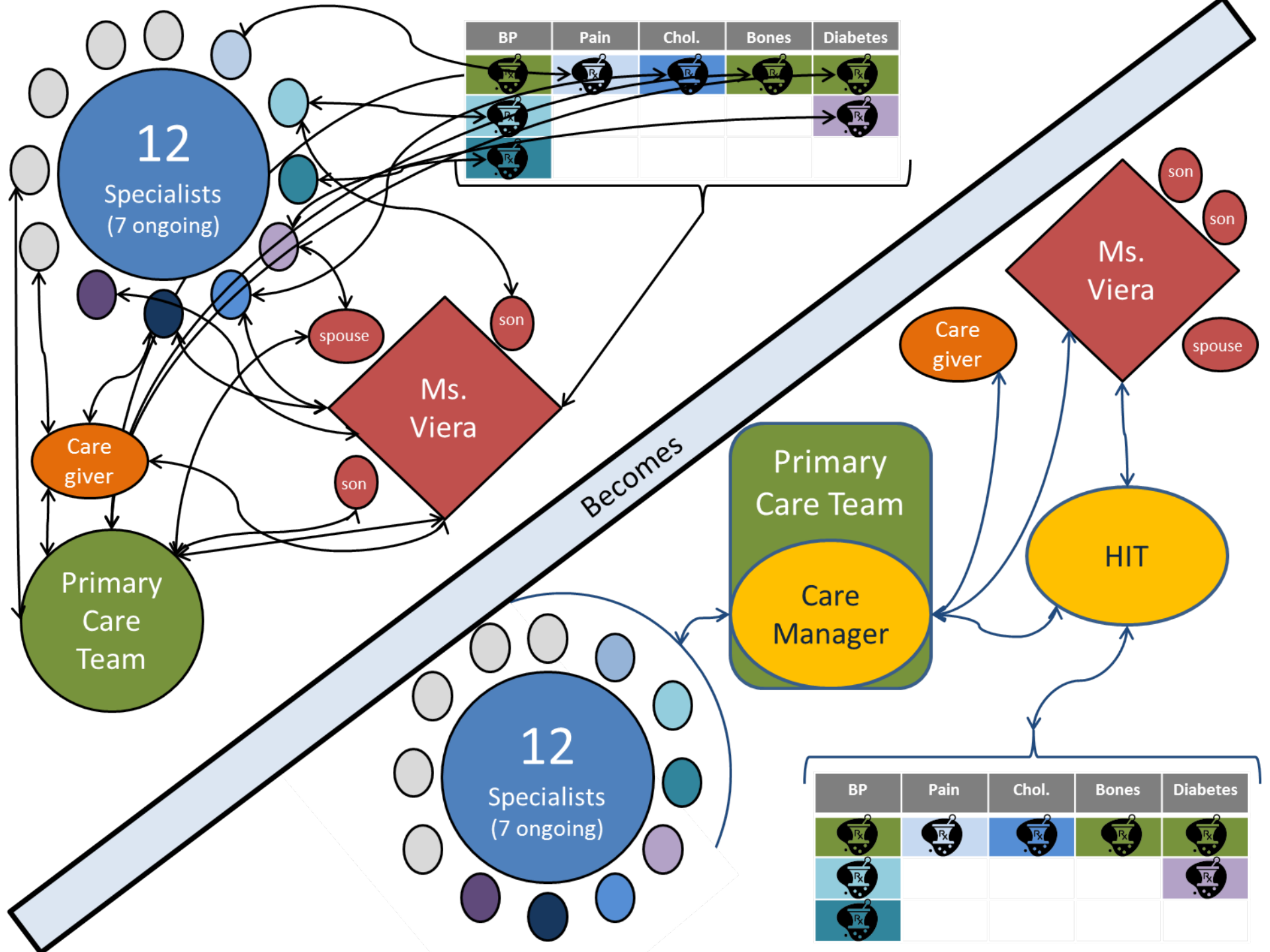
Funding for this research from The John A. Hartford Foundation, AHRQ, Intermountain Healthcare, the Gordon and Betty Moore Foundation and the National Library of Medicine

Why Do We Need Care Innovation?

- Ms. Viera: 75-year-old woman with diabetes, systolic hypertension, mild congestive heart failure, arthritis, and recently diagnosed dementia.

She comes to clinic with five issues + two more “hallway issues”!

What can a primary care team do?


BP
Pain
Chol.
Bones
Diabetes
12
Specialists
(7 ongoing)
spouse
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giver
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Primary
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Becomes
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Manager
Care
giver
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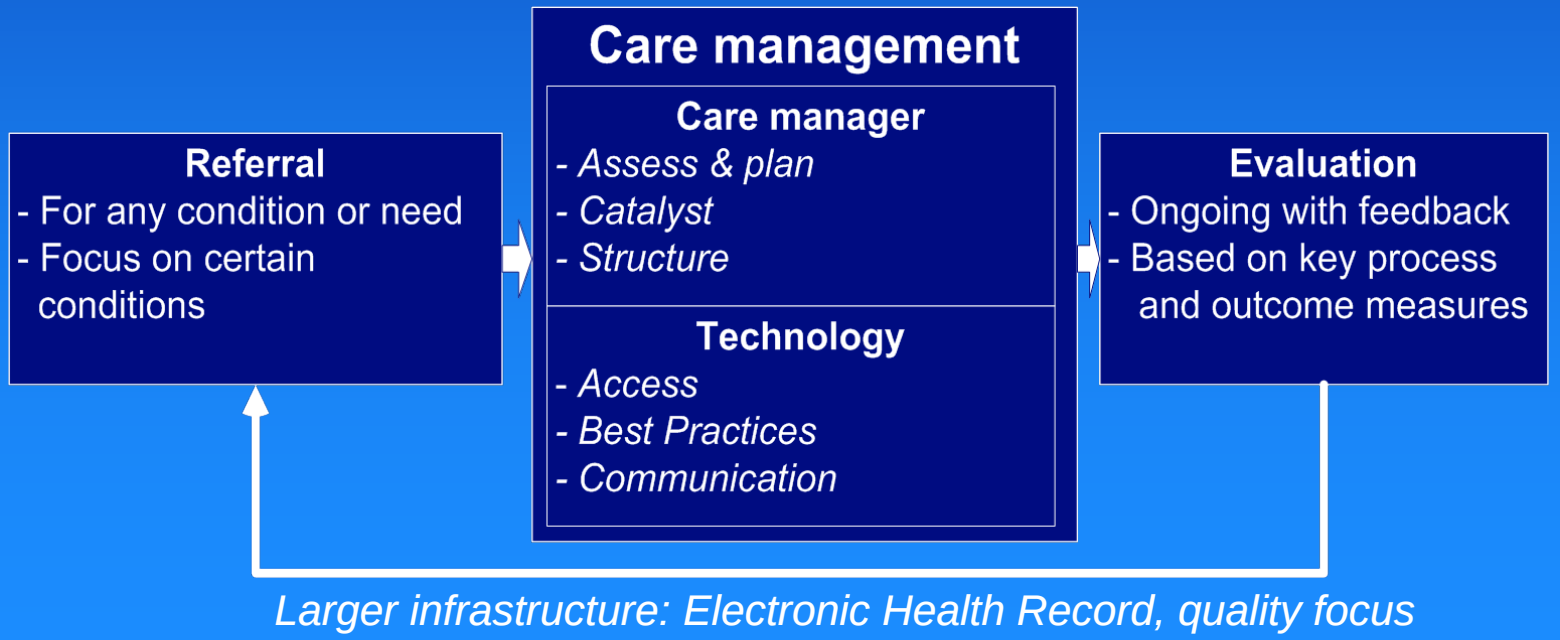
son
Ms.
Viera
spouse
HIT
12
Specialists
(7 ongoing)
BP
Pain
Chol.
Bones
Diabetes

Past: Heroism in the Face of Multiple Illnesses

Multiple diseases increase risk and coordination *exponentially* (5+ : 90 x risk of hospitalization; 10x Rx; 13 providers vs. 2) . Managing in a primary care panel would take 18 hrs/day. Patients have better process scores, but *worse* preventable hospitalizations.

Intervention: Care Management Plus

Dissemination to over 200 clinical teams



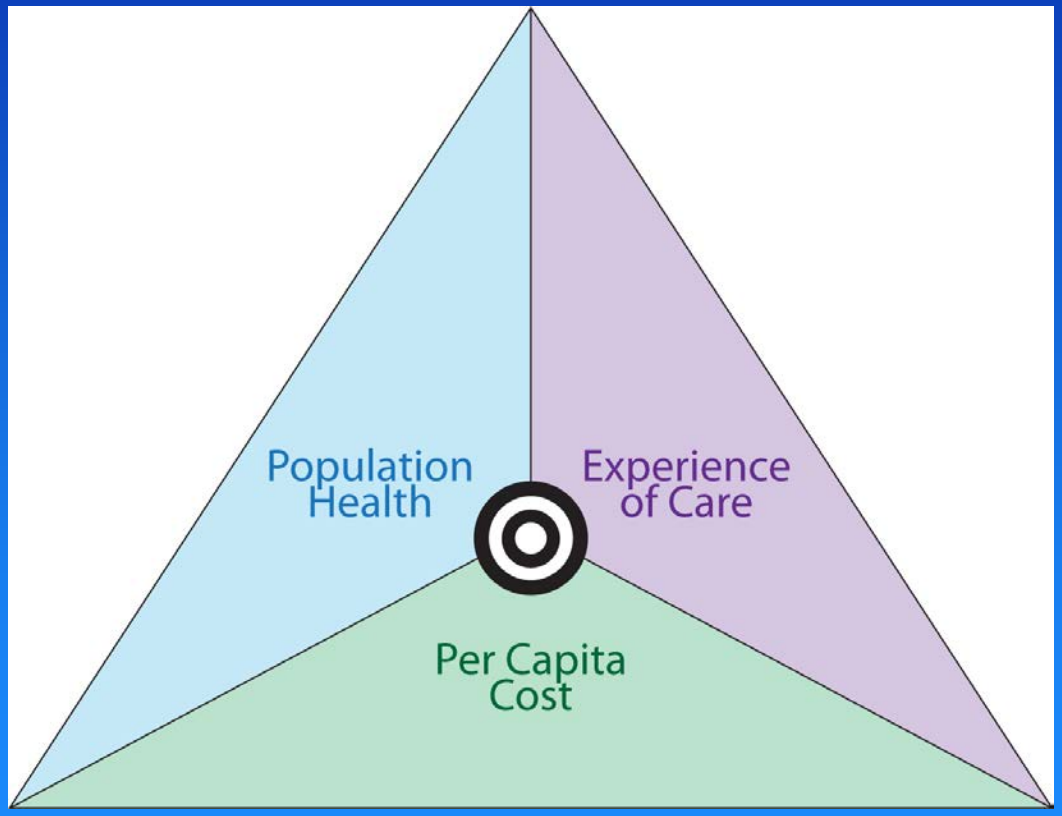
Larger infrastructure: Electronic Health Record, quality focus

Anderson, 2004 ; Woolf, 2002; Baron, 2007, 2010; Werner , 2008

Summary of Studies from CM+

The TRIPLE aim of health care

Improved diabetes, depression outcomes

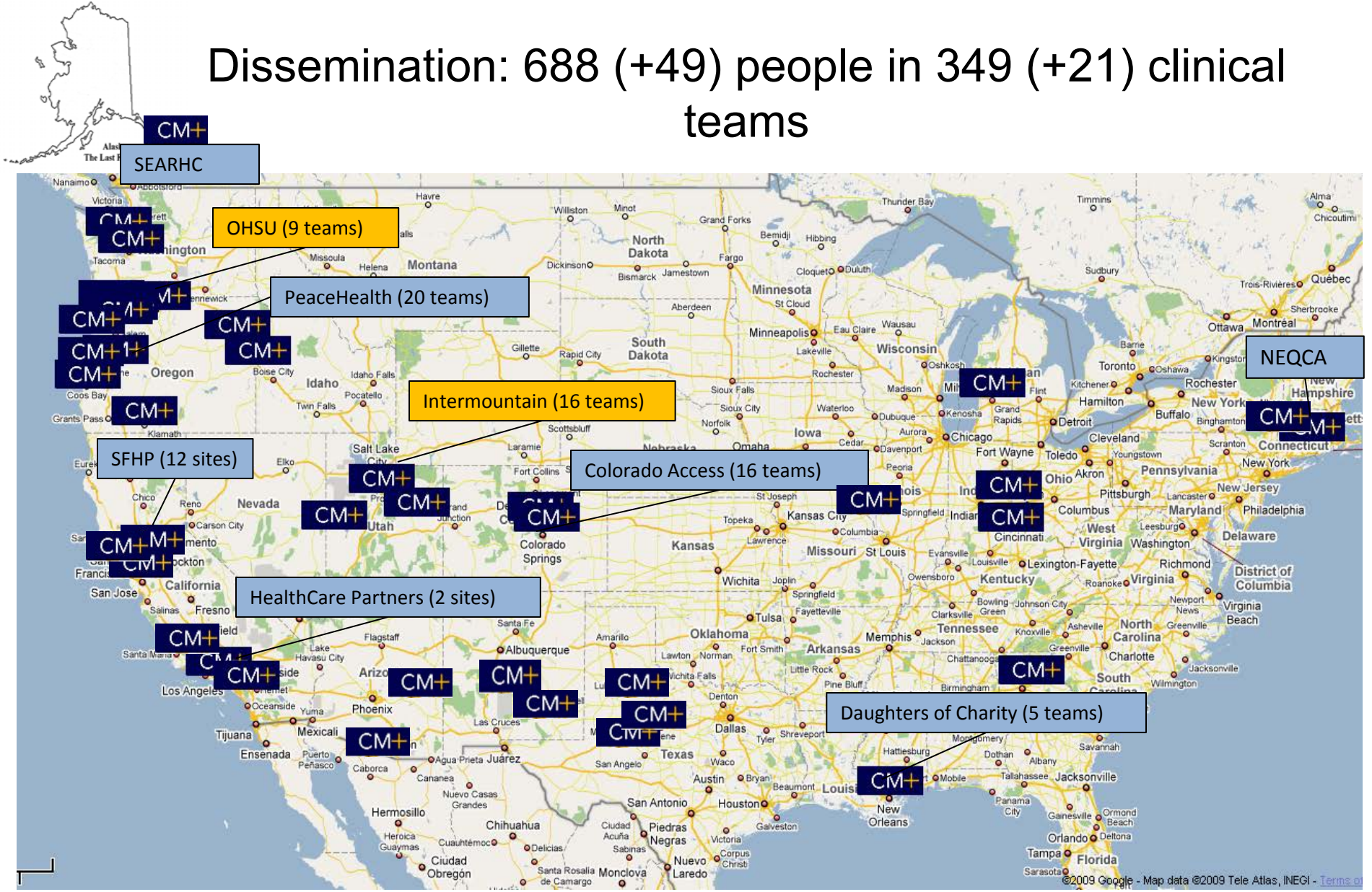


Improved patient, care manager, and provider experience

Reduction in hospitalizations, cost

http://www.caremanagementplus.org/pubs.html

Dissemination: 688 (+49) people in 349 (+21) clinical teams



Components: TEAM READINESS

The right people on the team with the right training is a core principle.

Patients are taught to self-manage and have a **guide** through the system.

Care managers receive special training in
- Education, motivation, coaching
- Disease-specific protocols, care for seniors, caregiver support
- Connection to community resources

Providers / other staff
- Need to participate in protocol development, implementation, adaptation
- Need to learn about care management (usually from the care managers)

High Risk Patient List Report

ICCIS Only | Clinic Only | Both ICCIS & Clinic

EHR ID	Last Name	First Name	Clinic Priority	ICCIS Priority	Phone	Physician	Insurance	Care Manager
EHRID99738	A126	Annie	High	High	(503)999-9734	Beatrice Carter		Kelsey Fake
EHRID99757	A236	Armond	Normal	High	(503)999-9757	Parnel Fieldman		Kelsey Fake
EHRID99613	A364	Andrew	Normal	High	(503)999-9606	Beatrice Carter		Kelsey Fake
EHRID99883	A416	Andrea	Normal	High	(503)999-9884	Beatrice Carter		Kelsey Fake
EHRID99882	A416	Arthur	High	High	(503)999-9883	Parnel Fieldman		Kelsey Fake
EHRID99927	A445	Augustus	High	Normal	(503)999-9928	Parnel Fieldman		Hannah Test
EHRID99915	A446	Amy	Normal	High	(503)999-9916	Jeremy Rogers		Kelsey Fake
EHRID99464	A500	Alice	Normal	High	(503)999-9457	Carl Generic		Kelsey Fake
EHRID99919	A536	A535	Normal	High	(503)999-9920	Carl Generic	Unknown	Susie Example
EHRID99948	A536	D543	Normal	High	(503)999-9949	Beatrice Carter	Unknown	Kelsey Fake
EHRID99506	A536	K655	Normal	High	(503)999-9499	Hillary Caseman	BC MEDADVANTAGE	
EHRID99599	A536	M240	Normal	High	(503)999-9592	Carl Generic	MEDICARE	Susie Example
EHRID99769	B160	N520	Normal	High	(503)999-9769	Carl Generic	MEDICARE	Hannah Test
EHRID99622	B200	R300	Normal	High	(503)999-9615	Parnel Fieldman	MEDICARE	

IT Component: Provides a means to track and enroll high risk patients.

The tickler is a centralized reminder list of tasks and communications that were proactively planned, but incomplete, which allows population-based tasks to be merged with individual encounter tasks into one easy-to-use list.

Care Manager Encounter Tickler List

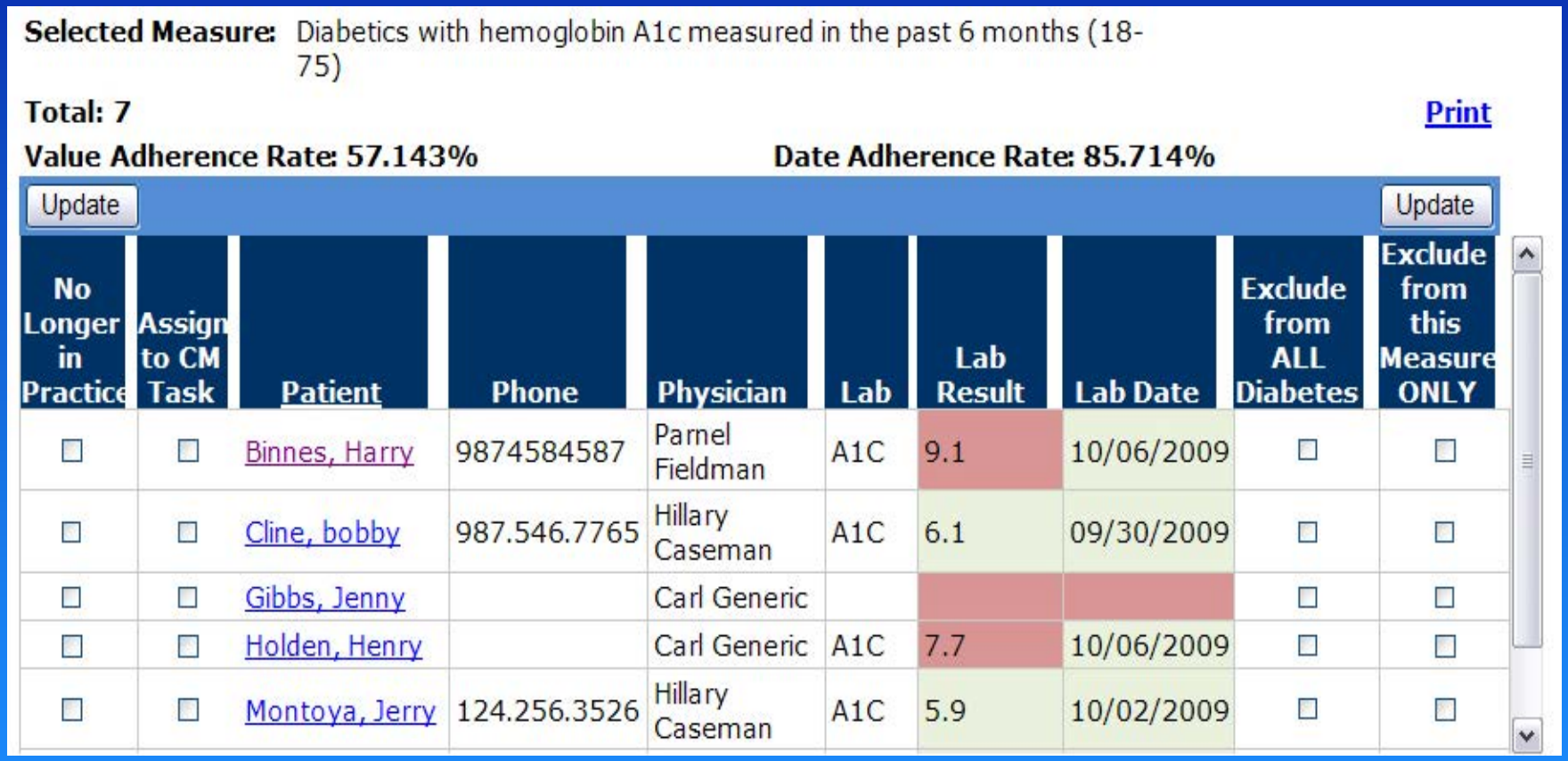
Care Manager: <---- All ----> **Start Date:** 05/02/2011 ... **End Date:** 06/02/2011 ... Run

Care Manager: All Care Managers

For Time Period: 05/02/2010 to 06/02/2011

Scheduled Date	Encounter Type	EHR ID	First Name	Last Name	Phone	PCP	Notes
2011-05-31, 12:25	Telephone Contact, Clinical Protocol(s)	EHRID99738	Annie	A126	(503)999-9734	Beatrice Carter	Quality Measure: PHQ2, score= 2 on 12/20/2010. Follow up with Annie to see how she is doing with her depression.
2011-04-11	Telephone Contact, Goals	EHRID99927	Augustus	A445	(503)999-9928	Parnel Fieldman	Goals Follow-Up: Activity: take the stairs instead of the elevator; Goals Follow-Up: Activity: take the stairs instead of the elevator;
2011-04-11	Care Conference, Diabetes	EHRID99738	Annie	A126	(503)999-9734	Beatrice Carter	Need to discuss Annie's difficulties reconciling different care plans.
2010-08-16	CM Office Visit, Diabetes	978253344	Timothy	Hartline	456.235.1125	Carl Generic	This is Tim's first encounter. Remember to do a PHQ9 and discus what he does and doesn't know about his recent diagnosis of diabetes.
2010-06-18	Telephone Contact, Clinical Protocol(s)	65748398	Bobby	Cline	987.546.7765	Hillary Caseman	Quality Measure: Diabetes : HbA1c Lab Date: never

Integrated Care Coordination Information System (ICCIS) Interactive Quality



Selected Measure: Diabetics with hemoglobin A1c measured in the past 6 months (18-75)

Total: 7 Print

Value Adherence Rate: 57.143% **Date Adherence Rate: 85.714%**

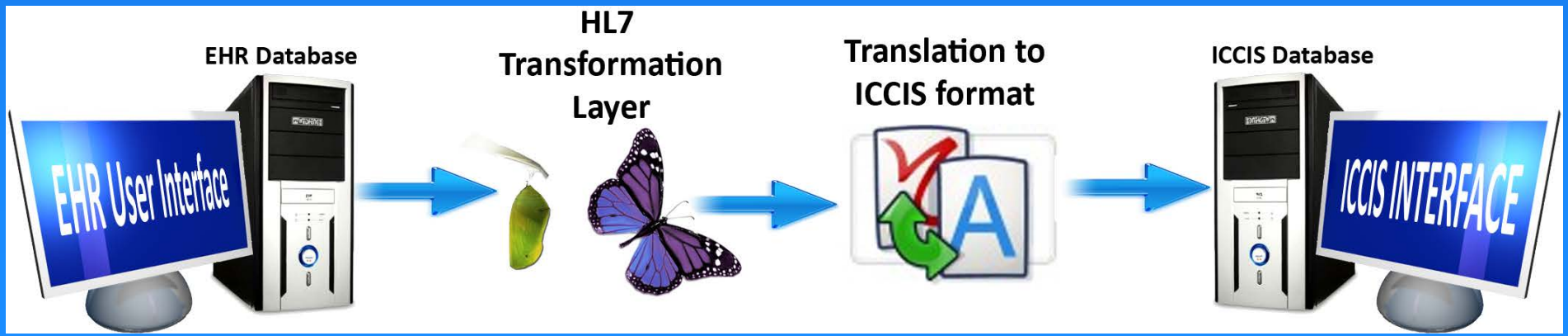
Update Update

No Longer in Practice	Assign to CM Task	Patient	Phone	Physician	Lab	Lab Result	Lab Date	Exclude from ALL Diabetes	Exclude from this Measure ONLY
☐	☐	Binnes, Harry	9874584587	Parnel Fieldman	A1C	9.1	10/06/2009	☐	☐
☐	☐	Cline, bobby	987.546.7765	Hillary Caseman	A1C	6.1	09/30/2009	☐	☐
☐	☐	Gibbs, Jenny		Carl Generic				☐	☐
☐	☐	Holden, Henry		Carl Generic	A1C	7.7	10/06/2009	☐	☐
☐	☐	Montoya, Jerry	124.256.3526	Hillary Caseman	A1C	5.9	10/02/2009	☐	☐

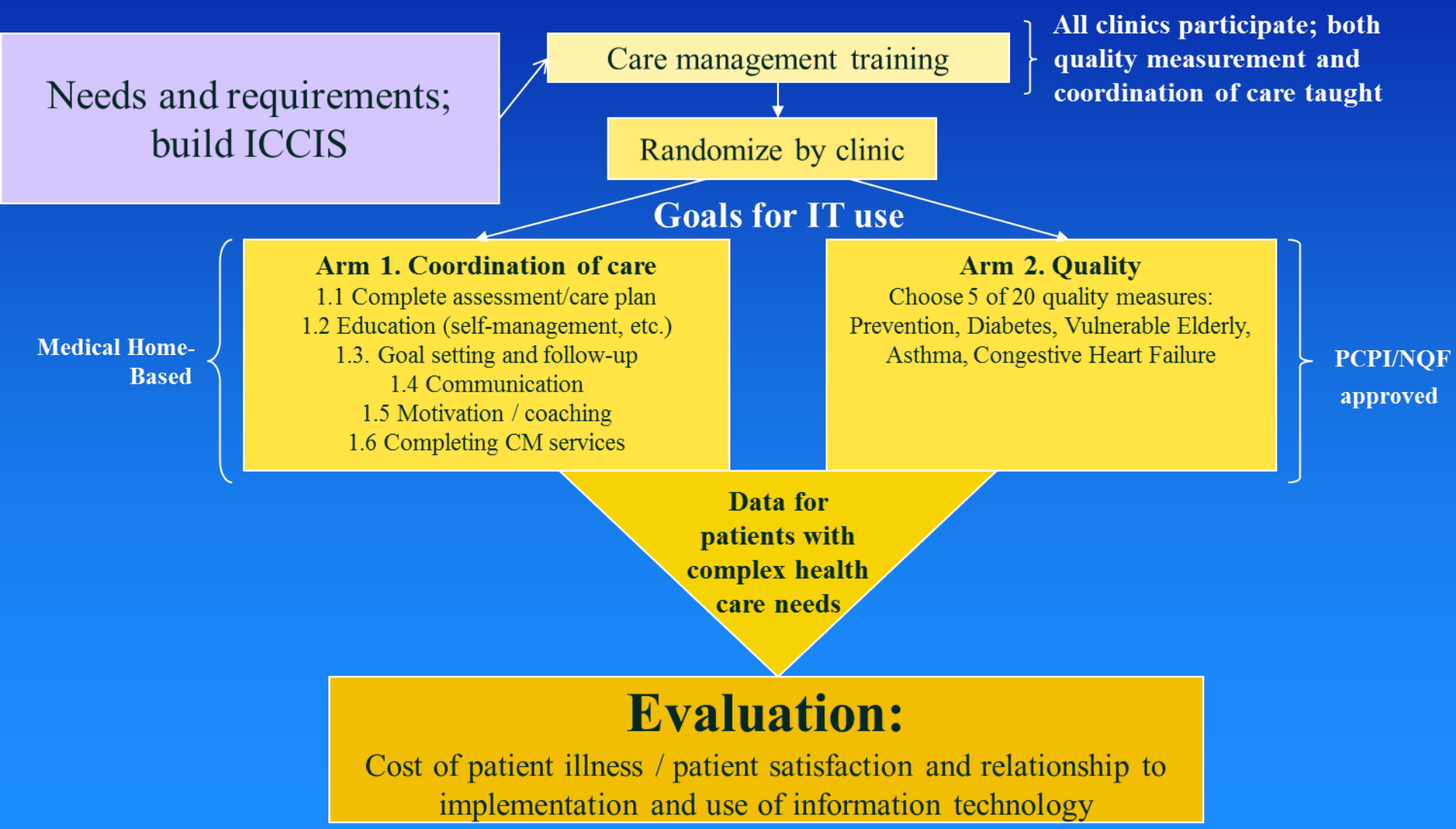
Offers the ability to document exclusions at multiple levels and generate targeted population-based review cycles, which avoids the problems caused by static quality reports and allows providers to efficiently focus outreach efforts on high risk populations.

Core Catalyst: How ICCIS Solves a Particular Challenge in Health Information Exchange

- Many health information exchange efforts falter at the value proposition versus technical and legal requirements.
- With ICCIS, we mapped seven different EHRs to a population management system / registry (PracticePartner, Epic, Centricity, TouchWorks, Intergy, CPRS, eClinicalWorks).
- We limited the exchange to targeted areas and pragmatic approaches to maximize value.
- Starting as research, legal issues may be easier but operations for care coordination and quality improvement are covered under HIPAA.

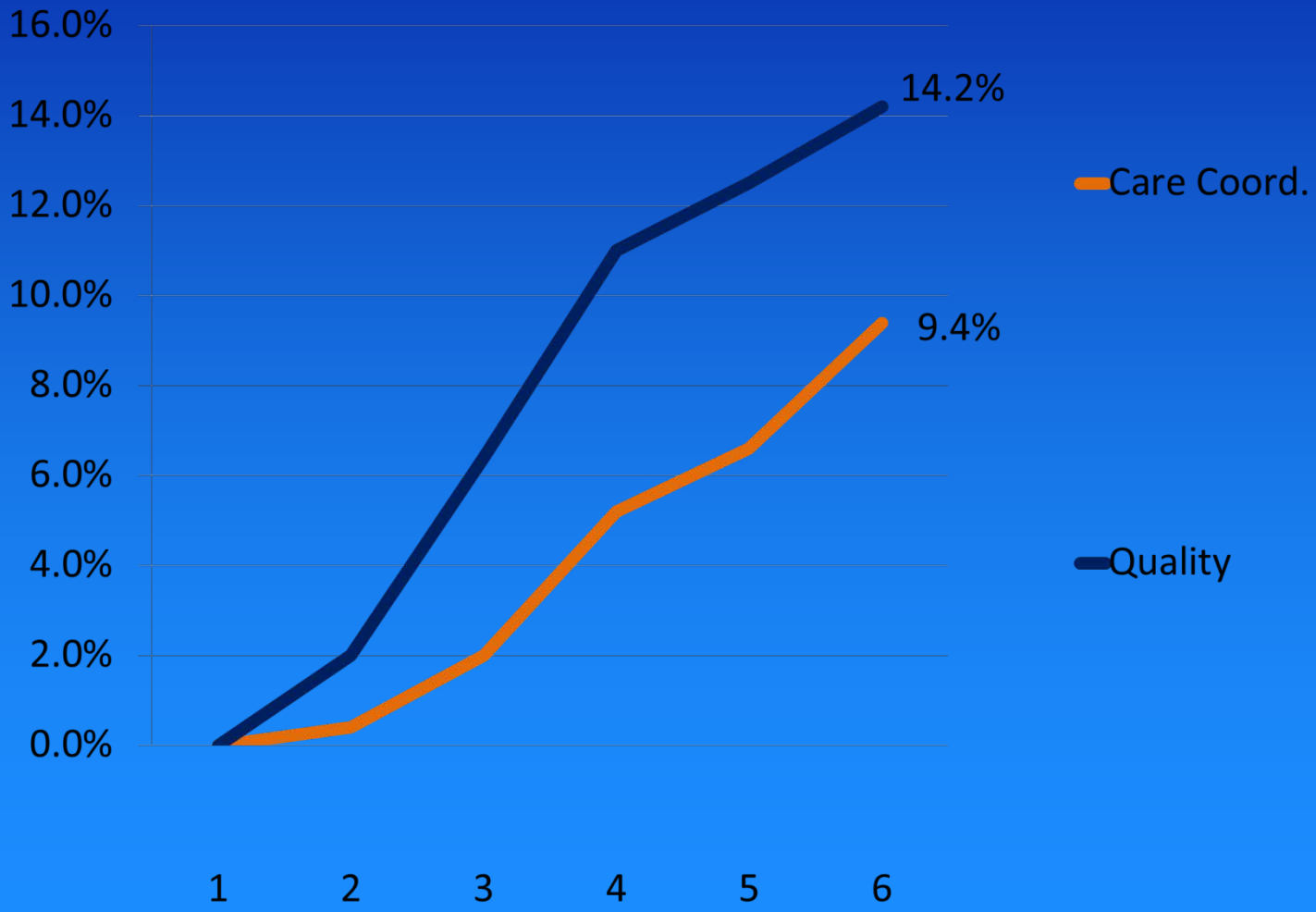


ICCIS Randomized Trial



Were the Incentives Effective?

Absolute adherence change for study arms



Incentives: Care Coordination Activities

Arms reimbursed	Activity	All clinics	Care Coord to quality ratio
Both	Care managed patients	4,043	1.3:1
	Sharing patient summaries	819	1:3
Arm 1 only	Completed encounters	12,605	1.8:1
	Assessment	1,176	1.8:1
	Education	2,925	4.3:1
	Goals	202	1:1.3
	Communication	3,820	3:1
	Motivational interviewing	2,108	1:3
Arm 2 only	Quality encounters	4,440	3:1
	Quality measure query runs	1,203	2:1
	Quality measure increases	119	1:1.3

Health Reform: Goals and Evidence

- Goals of health reform are the triple aim: improved population health, improved patient experience, **reduced costs.**
- **Has it been shown?** Large integrated systems, in nonrandomized trials, have shown substantial savings: $1.5 to $3 / $1 invested (Geisinger, GroupHealth, Intermountain Healthcare – CM+).[1]
- But other trials have shown mixed effects:
  - National Demonstration Project mixed outcomes[2]
  - Physician Group Practice CMS demonstration (University of Michigan, Marshfield clinic cost savings, others mixed)[3]
- **Opportunity:** Oregon was engaging in both Patient-Centered Medical Homes (including the Comprehensive Primary Care program from CMS) and Accountable Care Organization Redesign. Can we study and learn from this—**and push them to "high value elements"** that have been found but NOT instituted universally? [4]

[1] Reid, Health Affairs, May 2010; Dorr, JAGS, 2008; [2] Nutting, AFM, 2009; Crabtree, AFM, 2010; [3]PGP: https://www.cms.gov/demoprojectsevalrpts/md/ItemDetail.asp?ItemID=CMS1198992; [4]Fields, Health Affairs, 2010.

Transforming Outcomes for Patients through Medical Home Evaluation and reDesign (TOPMED)

Cluster randomized controlled trial in 8 clinics

Patient-centered primary care home evaluation, training

Intervention

- Incentives with multiplier
- Focused practice support
- Rapid cycle IT improvement

Control

- Same incentives without multiplier
- General practice support
- Same IT components

Sponsored by the Gordon and Betty Moore Foundation

High Value Elements and Mapping

High Value Element	Description	Patient-centered Medical Home Mapping
Identification of At-Risk Populations	Identifies and proactively addresses patients with high risk.	'Comprehensive care planning', 5.F.2
Care Management Based on Need	Assigns person or team to work closely with high-risk patients, providing higher access and services.	'Care management for complex patients', 5.C.2
Patient Engagement and Proactive Goal Setting	Coaches patients to set goals and follow up.	'Education & self-management support' 6.B
Integrated Information and Procedures Across Settings	Receives/shares and monitors utilization and referrals.	Meets 'Clinical information exchange' 4.D; 'Specialized care' standard 4.E, 'Care coordination' 5.E.3
Population Management Tools	Uses quality improvement for identification of need, corrective action, and longitudinal tracking.	Demonstrates improvement/meets benchmarks in quality (PCPCH 2.A.2-3); also 5.A

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  - Adam Wilcox

For more information: http://topmedtrial.org

http://Caremanagementplus.org

ICCIS demo:
http://caremanagementplus.org/iccis_captivate/ICCIS_captivate.swf

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Q & A

Please submit your questions by using the Q&A box to the right of the screen.

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