

Use of Clinical Decision Support and the Impact of Clinical Decision Support on Workflow

October 27, 2008

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**AHRQ National Resource Center
for Health Information Technology**



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Clinical Decision Support (CDS) and Workflow

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Industrial and Systems Engineering
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Agenda

- Very brief review of the effectiveness of CDS
- Interpretation of the mixed evidence from a workflow perspective
- Understanding workflow and workflow integration



State of the Evidence

“Nonetheless, there are **few CDS implementations** to date in **routine clinical use** that have **substantially delivered** on the promise to improve healthcare processes and outcomes, though there have been an **array of successes at specific sites** ... Yet even these successes **have generally not been widely replicated**. There are many reasons for the lack of diffusion of these systems.”¹



State of the Evidence

The Good

- Computerized Provider Order Entry (CPOE) with CDS can reduce medication error rates and increase the quality and efficiency of medication use²
- Using order sets as basic CDS within CPOE systems can, potentially, improve clinician efficiency³



State of the Evidence

The Good

- CDS integrated into CPOE can improve the use of the order sets⁴
- Computerized clinical reminders can increase compliance with guidelines and even save time⁵



State of the Evidence

The Good

- Well-designed interruptive alerts can increase alert acceptance to 67%⁶
- CDS can lead to faster diagnosis⁷



State of the Evidence

The Less Good

- Systems did a poor job of identifying severe clinically significant drug-drug interactions⁸
- Drug safety alerts are overridden 49%-96% of the time⁹



State of the Evidence

The Less Good

- Even allowing primary care physicians to customize drug alerts still resulted in 88% of alerts being ignored¹⁰
- Ambulatory CDS automation is criticized for being time consuming and unusable¹¹
- Primary care physicians working for the Veteran's Health Administration (VHA) rated their CDS as average¹²



State of the Evidence

The Less Good

- Reviews that have demonstrated CDS can improve physician outcomes have not been able to demonstrate improvements to patient outcomes⁷



Why are the Results Mixed?

Workflow integration problems

“Rather, the CDS should unobtrusively, but effectively, remind clinicians of things they have truly overlooked and support corrections, or better yet, put key pieces of data and knowledge seamlessly into the context...”¹

“Systems that alter clinician workflow by not integrating all relevant information for informed decision making into one place run the risk of distracting already busy clinicians. ...”¹⁴

A systematic review of CDS effectiveness found that CDS can improve clinical practice if there was workflow integration¹⁵



Clearly workflow integration is key. But what do we mean by workflow and workflow integration?



Workflow

- Workflow can be defined as the flow of work through space and time, where work is comprised of three components: *inputs* are *transformed* into *outputs*.



What is Workflow?

- **Inter-organizational workflow:**
 - workflow between a primary care physician and a community pharmacy or
 - between an emergency department physician and a primary care physician to share information about a patient
- **Clinic-level workflow:**
 - flow of a physician, nurse or patient through physical space
 - and the flow of information, in paper or electronic formats, among people at a practice or clinic



What is Workflow?

- Intra-visit workflow:
 - workflow during a patient visit, which involves the workflow of the visit (e.g. start by asking for a problem list, then do history and physical, then prescribe treatment)
- Cognitive workflow – the workflow in the head:
 - Sensation, perception, decision making, response execution
 - A clinician might be thinking “listen for any significant acute problems and deal with those first. Also, investigate my concern about spousal abuse. If I don’t hear any, focus on the chronic problems.”
 - This is unlikely to be observable



What is Workflow?

- People flow through space and time.
- Information flows through space and time in paper and electronic formats
- Objects, such as medications, flow through space and time
- The flow of all of those, information, people, and products and the different levels of workflow are necessary to consider when designing CDS to support workflow

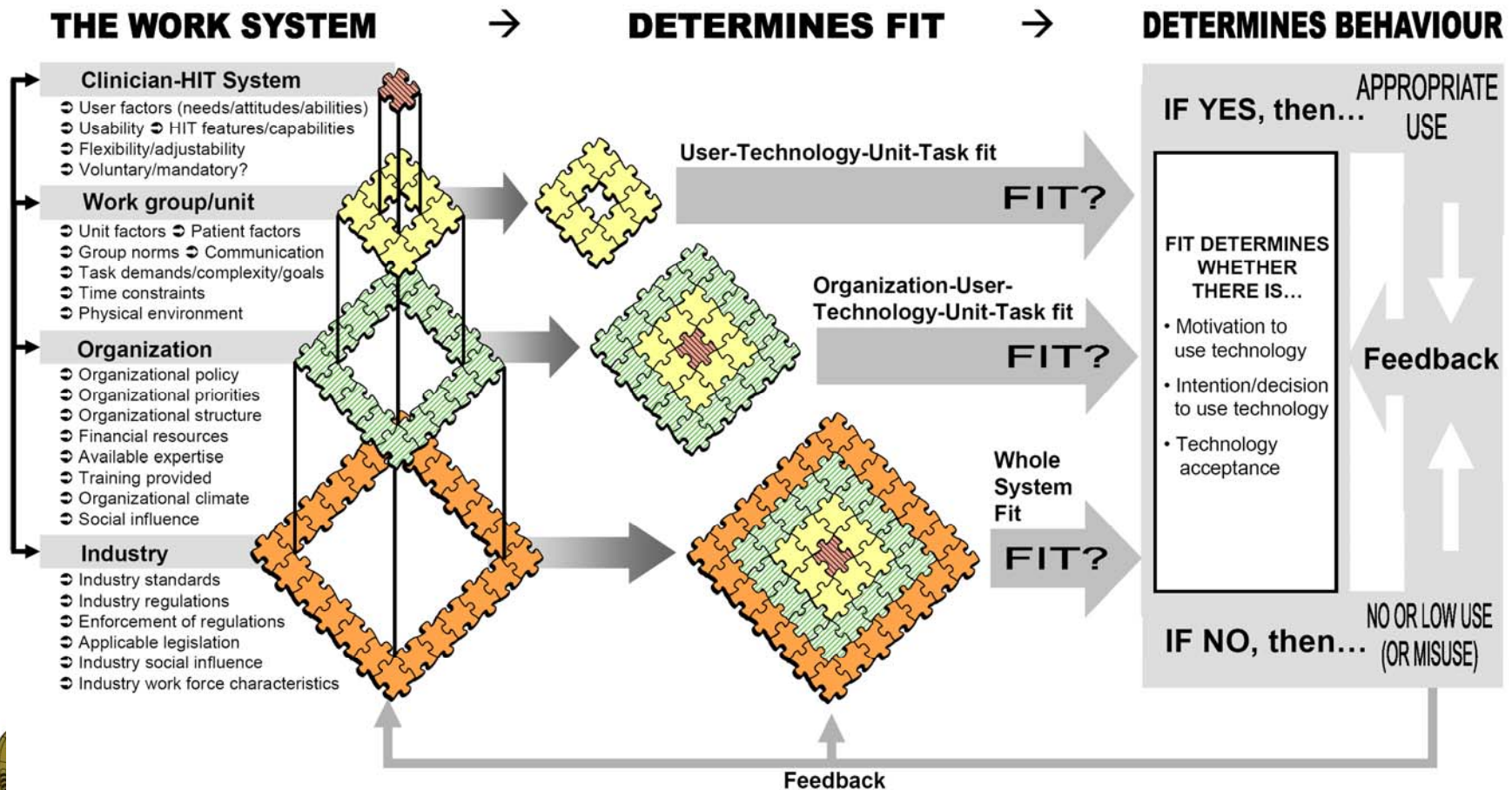


What does it mean to integrate CDS into workflow?

- Making sure CDS supports the flow of work desired at the multiple levels



HIT-workflow integration¹⁶



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Thank you!

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Clinical Decision Support (CDS)

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From EBM to CDS: *Salto Mortale?*

Salto Mortale:

- deadly jump
- full somersault
- dangerous or crucial undertaking



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From EBM to CDS: Underlying Logic of Alerts

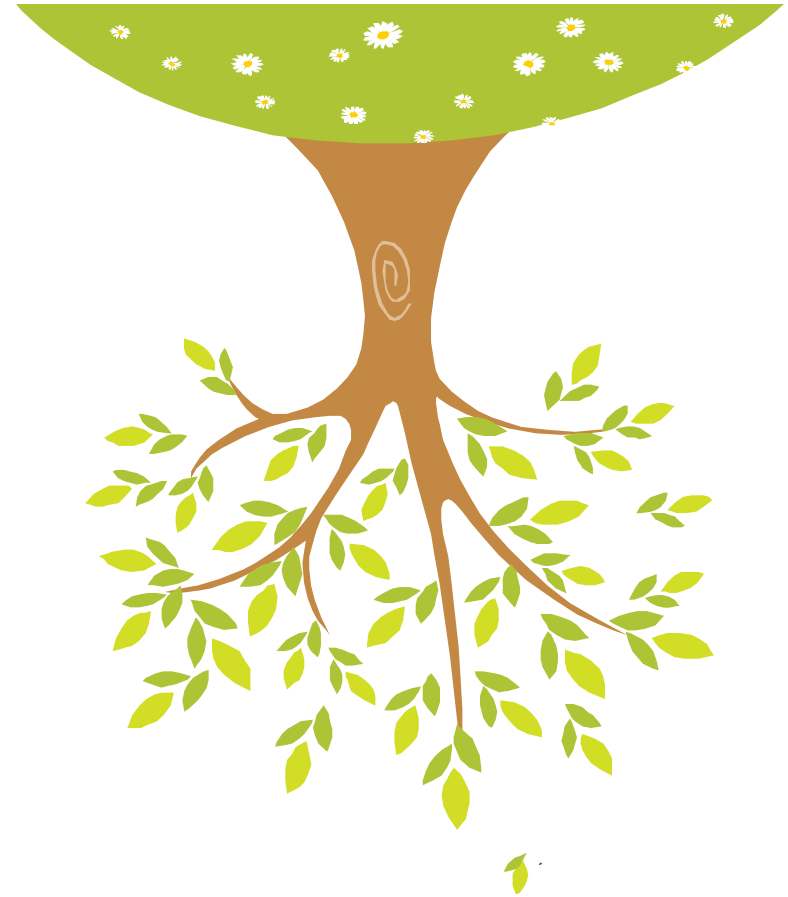
The Decision Tree



Alerts, Underlying Logic

The
Decision
Tree

Correct
direction?



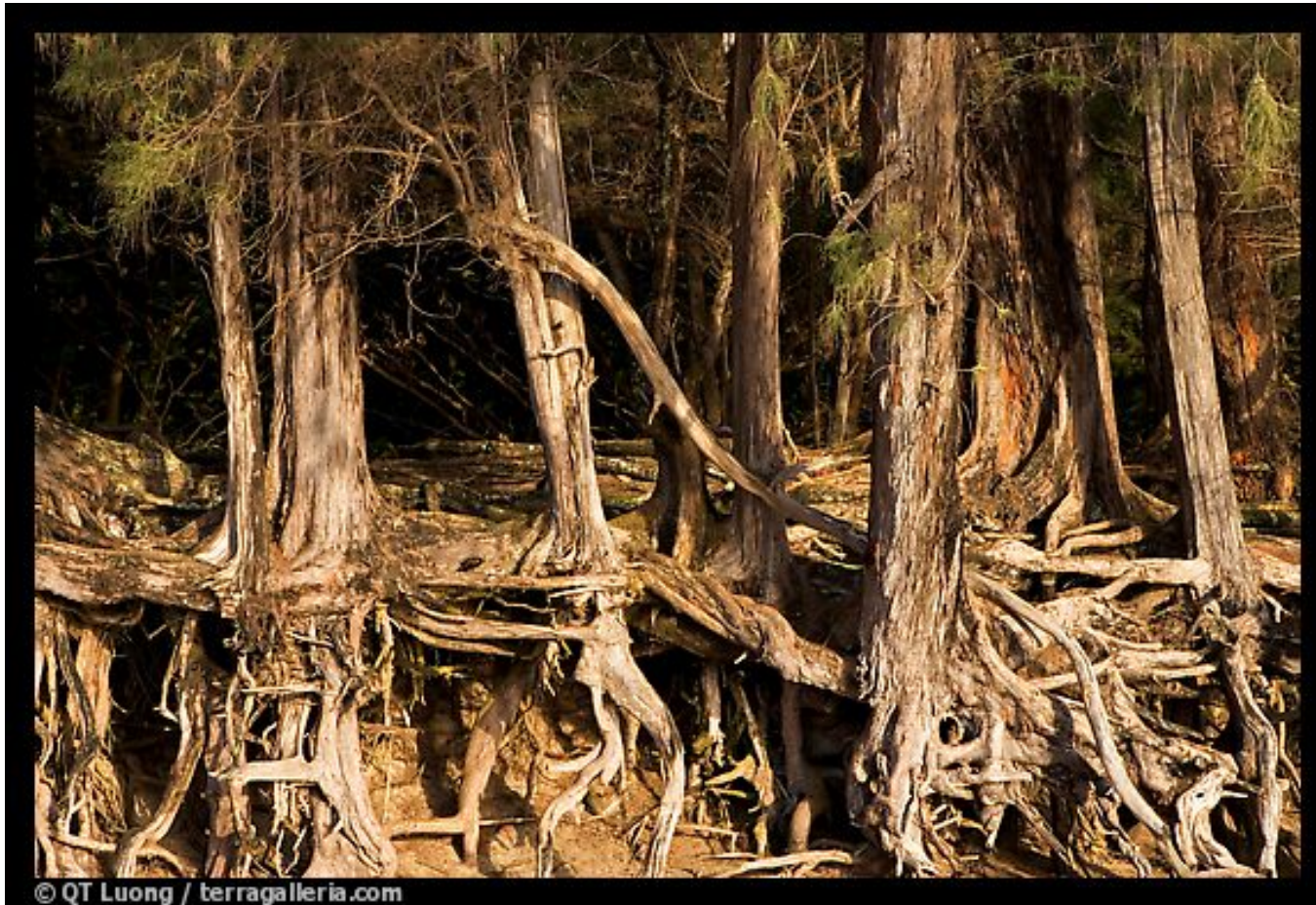
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Reality: A Simple Decision Tree



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More Reality: Decision Trees



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Data bases on which CDS are created

- Evidence on the Evidence

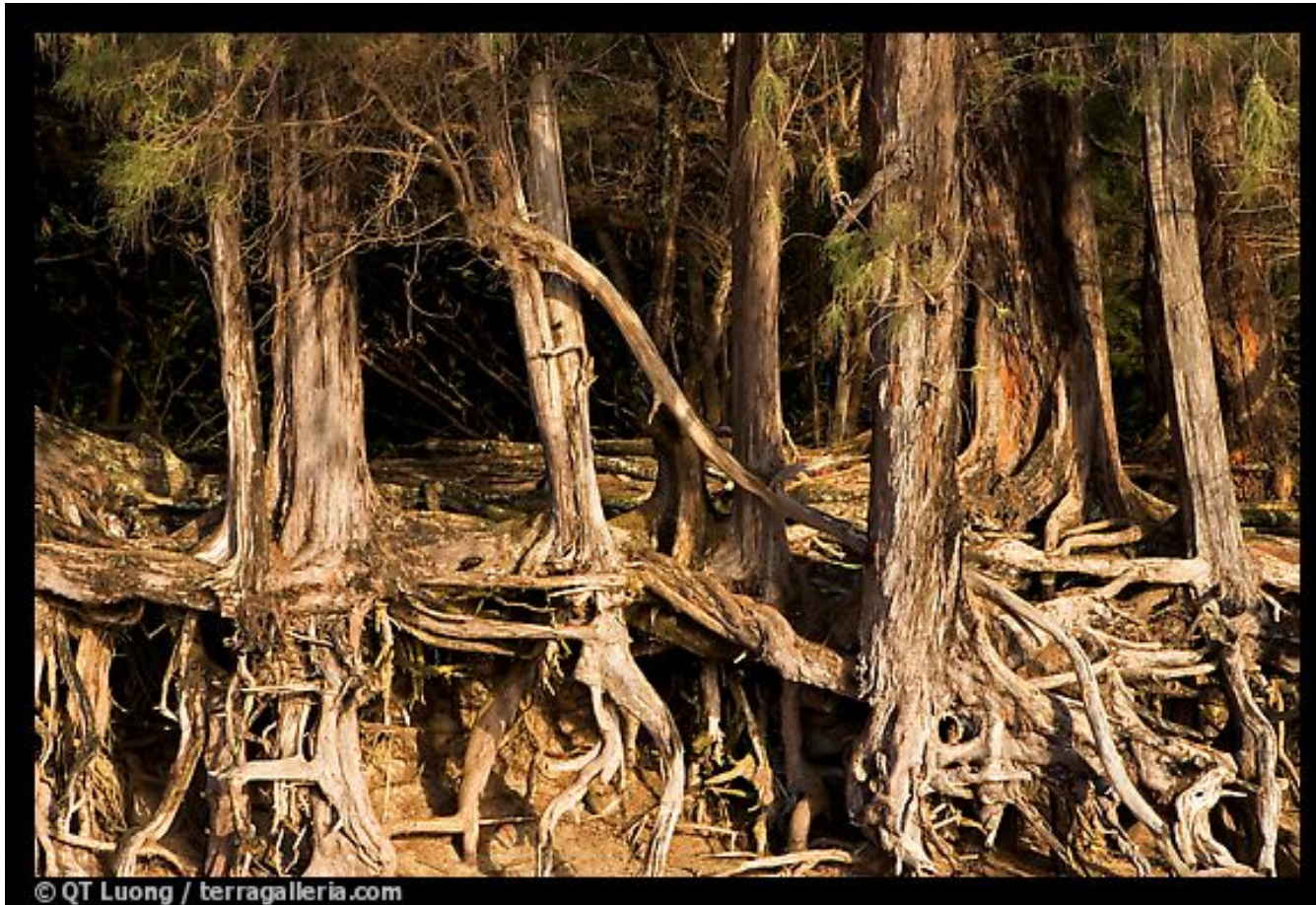


- Evidenced-Based Medicine: Promise and potential



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Decision Trees: Still Simplified



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Some Data

- 80-90% of alerts overridden
Fewer if tiered (i.e., increasing levels)

In study of 300 Overrides, 300 were medically correct.



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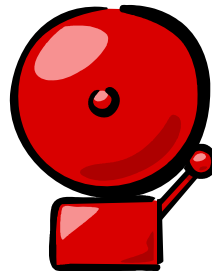
Types of CDS

Range of types and intensities:
Linkage to CPOE and EMRs



1. Requesting help (e.g., click to see more)

2. Alerts/Alarms



3. Order sets



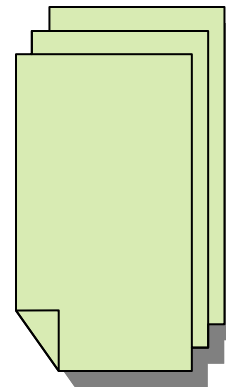
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Requesting Help

1. Hide n' go seek
2. More monitors?
3. Link to....



other documents



Abbreviated or not



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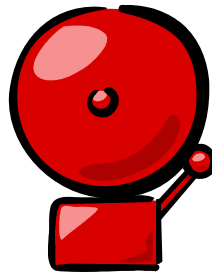
Alerts: For Rx and/or for Dosages

1. Regular:

OR

2. Tiered:

- Flash on screen
- Must Acknowledge
- Must justify override



Pt. X . Tried Rx previously. Pt allergic



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Alerts Just for You

- Service-specific



- Provider-specific



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Alerts: Other (unintended) Function



Bumpers



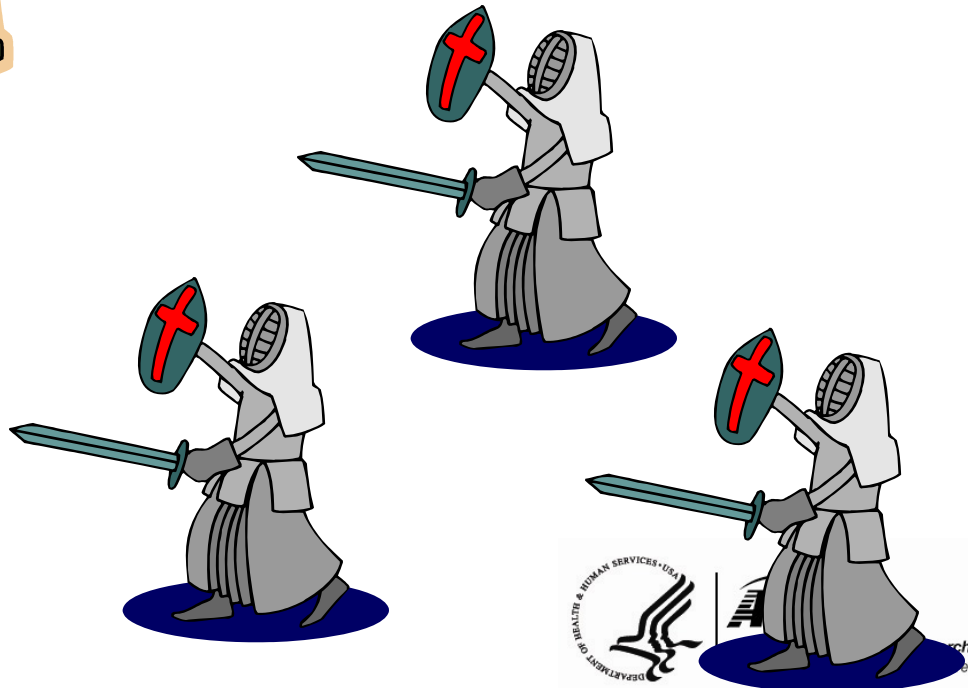
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Order Sets

- Acknowledge order sets as not-so-hidden CDS



- Order set wars



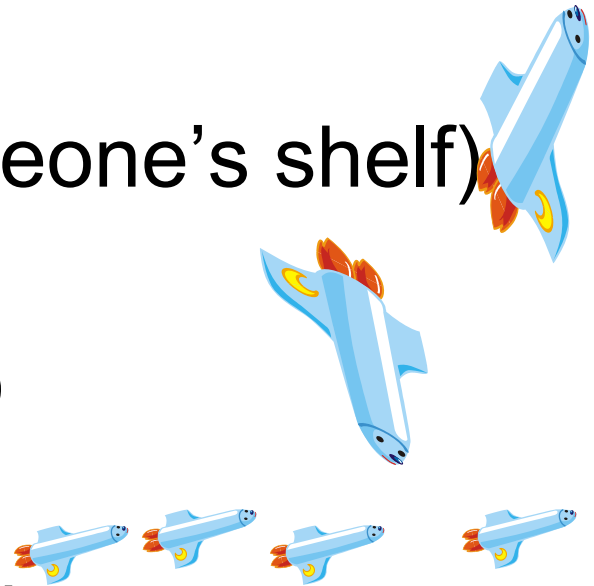
Competing Order Sets

- Danger of differing order sets when residents or others circulate across institutions and/or services.



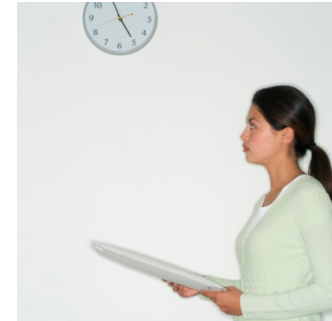
Trajectories of installation:

1. Off the shelf (or off someone's shelf)
2. Withdrawn
 - (Real story of Cedar-Sinai)
3. Re-introduced stepwise
4. Role of departments and power
5. CDS and order-set wars
6. Time and input and utility



Evaluations: What the data show

1. Implementation rates
2. Success rates
3. Factors influencing achievement
4. The bases of decision support:
building on CPOE and EMRs
5. Concerns of experienced providers



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The Future of CDS

- Learning from our mistakes
- Improved technology
- Concern about future clinicians who never practiced without them



- Don't leave home without them?



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Thank you!

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Use of Clinical Decision Support in Clinical Practice

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Disclosure

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 - The Agency for Healthcare Research and Quality
 - The Dept. of Commerce Technology Opportunities Program
 - The Health Resources and Services Administration
 - The National Cancer Institute
 - The National Eye Institute
 - The Pfizer Health Literacy Foundation
 - The Small Business Technology Transfer Grant program through the National Library of Medicine
- Dr. David Lobach and Dr. Kensaku Kawamoto have a pending patent application for the intellectual property related to SEBASTIAN, which represents one approach for instantiating the HL7 Decision Support Service described in this presentation. Drs. Lobach and Kawamoto and Duke University may benefit financially if products using SEBASTIAN are commercially successful.

Presentation Overview

- Success Factors for CDS
- CDS Engine - SEBASTIAN
- CDS Examples in Practice
 - Chronic Disease Management
 - Diagnosis and Management
 - Population Health Management
 - Medication Management
 - Care Transitions for Complex Patients
- Lessons Learned

Success Factors for CDS

- Systematic review to identify features of CDS systems important for improving clinical practice¹
- >10,000 manuscripts screened, 70 RCTs included
- 68% → significant improvement in clinical practice
- Most common system types and content:
 - 34%: Computer systems providing patient-specific advice on printed encounter forms or printouts attached to charts
 - 26%: Non-electronic systems that attached patient-specific advice on appropriate charts
 - 16%: CPOE systems with CDS capabilities
 - 81% chronic conditions, 23% acute conditions
 - 53% pharmacotherapy, 46% lab test ordering

¹ Kawamoto K, Houlihan C, Balas A, Lobach DF. Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. *BMJ*. 2005;330:765-72.

Principle Findings-1

Multi-variate regression analysis identified 4 features as independent predictors of success:

CDS Intervention Feature	Adjusted OR	p-value
Automatic provision of decision support as part of clinician workflow	112.1	< 0.00001
Provision of decision support at time and location of decision making	15.4	0.0263
Provision of a recommendation rather than just an assessment	7.1	0.0187
Computer generation of decision support	6.3	0.0294

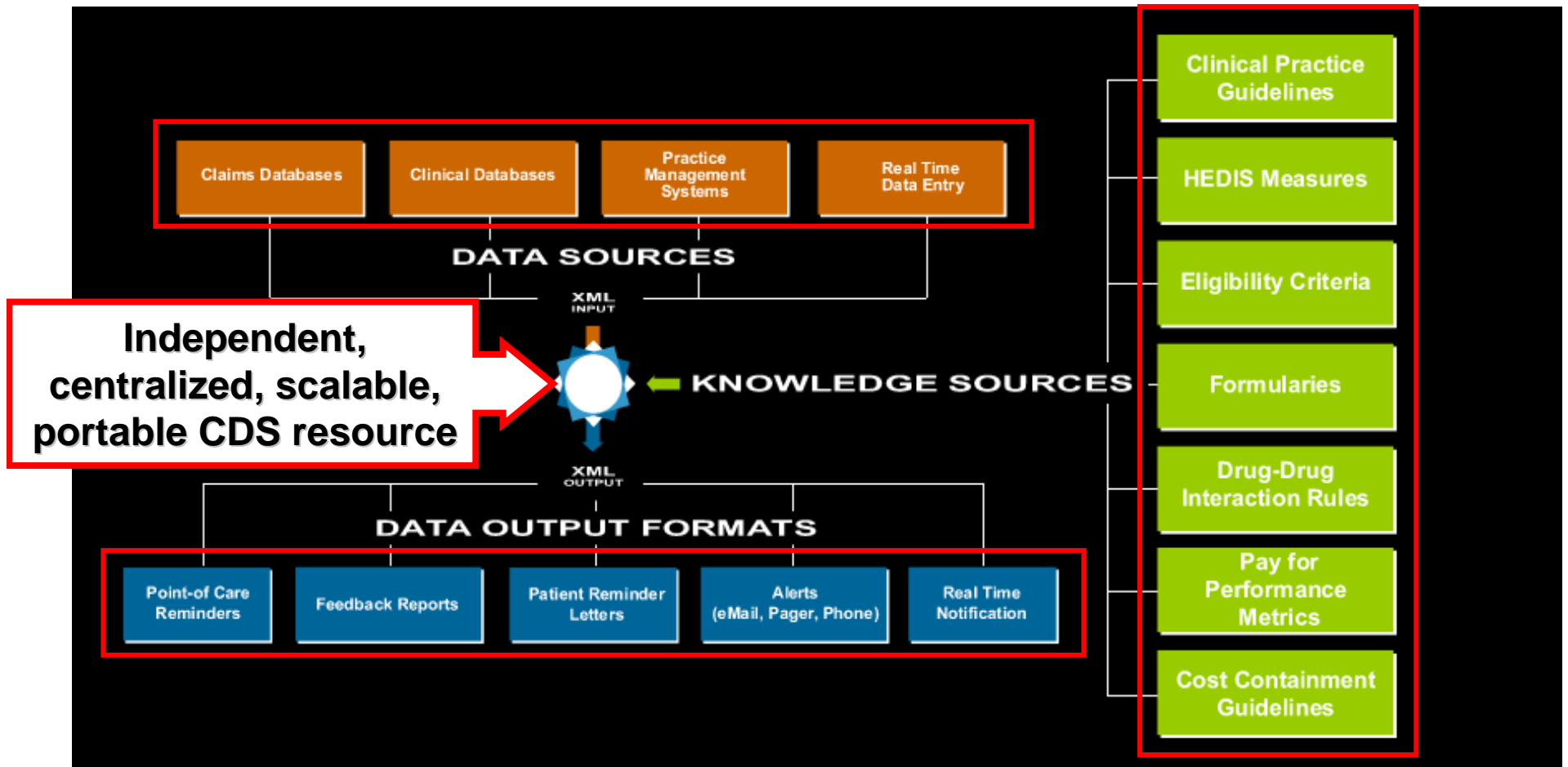
Principle Findings-2

- % of CDS interventions leading to significant improvements in clinical practice
 - CDS interventions lacking *any* of the 4 features → 46%
 - CDS interventions with all 4 features → 94% (n = 32)

Sebastian

**System for Evidence-Based
Advice through Simultaneous
Transaction with an Intelligent
Agent across a Network**

SEBASTIAN Overview



CDS for Chronic Disease Mgt

- Setting: Duke University Health System
- Goal: To provide guideline-based care recommendations for chronic diseases at the point of care

Duke University Health System

- Academic medical center and hospital with 2 associated community hospitals
- >100 academic and community-based clinics
- 10,765 full-time employees
 - 1,653 clinical faculty
 - 850 house staff physicians in training
- Inpatient admissions: 61,197 (FY07)
- Outpatient visits: 1.4 M (FY07)

Duke eBrowser -- Electronic Record Viewer

https://clinapp6.duhs.duke.edu:8081 - LOBAC002 eBrowser - Microsoft Internet Explorer

Patient Activity Rounding Orders OR Summary SIG Help All Results -Choose Patient List- - Choose Patient -
Duke type MRN Go Summary: DM Known Drug Allergies Patient: MRN:

All Results Dictated Reports Procs/Ops Radiology General Labs Microbiology Pathology Resp. Care New Results Print List

Report Type	Date/Time	Status	Fac
Comprehensive Clinic Note	07/06/2007 00:00		DUMI
GLYCATED HEMOGLOBIN (HBA1C)	03/22/2007 15:01		DUMI
CHOLESTEROL, TOTAL	03/22/2007 15:01		DUMI
LDL-CHOLESTEROL (DIRECT)	03/22/2007 15:00		DUMI
FAM Endocrinology Follow Up	03/22/2007 00:00		DUMI
MICROALBUMIN/CREATININE RATIO	07/13/2006 16:54		DUMI
GLYCATED HEMOGLOBIN (HBA1C)	07/13/2006 16:49		DUMI
LIPID PANEL (CALCULATED LDL)	07/13/2006 16:49		DUMI
OP4 (TBILI,AST,ALKPHOS,ALT)	07/13/2006 16:49		DUMI
OP7 (CO2,CL,K,NA,BUN,GLU,CR)	07/13/2006 16:49		DUMI
Endocrinology Consultation	07/13/2006 00:00		DUMI
MAMMOGRAPHY-SCREENING EXAM	05/25/2005 11:55		DUMI
Clinic Note	05/25/2005 00:00	Preliminary	DUMI
MAMMOGRAPHY-SCREENING EXAM	05/19/2004 09:00		DUMI
Clinic Notes	05/19/2004 00:00	Preliminary	DUMI
GLUCOSE WHOLE BLD BY GMD(POCT)	12/18/2003 14:15		DUMI
Family Med Clinic Note	12/18/2003 00:00	Preliminary	DUMI
Endocrine Bone Density Results	12/18/2003 00:00	Modified	DUMI
MICROALBUMIN/CREATININE RATIO	11/12/2003 11:40		DUMI
CREATINE KINASE	11/12/2003 11:33		DUMI
GLYCATED HEMOGLOBIN (HBA1C)	11/12/2003 11:33		DUMI
LIPID PANEL (CALCULATED LDL)	11/12/2003 11:33		DUMI
OP7 (CO2,CL,K,NA,BUN,GLU,CR)	11/12/2003 11:33		DUMI
OP4 (TBILI,AST,ALKPHOS,ALT)	11/12/2003 11:33		DUMI
ECG (ELECTROCARDIOGRAM STANDARD)	11/12/2003 10:48		DUMI
GLUCOSE WHOLE BLD BY GMD(POCT)	11/12/2003 09:33		DUMI
Family Med Clinic Note	11/12/2003 00:00	Preliminary	DUMI
CT PELVIS W/WO ENHANCE	10/01/2003 09:52		DUMI
CT DUAL ABDOMEN W/WO ENHANCMENT	10/01/2003 09:52		DUMI
Urology - Clinic Note	10/01/2003 00:00		DUMI
URINALYSIS COMPLETE	09/23/2003 13:37		DUMI
OP7 (CO2,CL,K,NA,BUN,GLU,CR)	09/23/2003 09:59		DUMI



Patient: [REDACTED]

GENLAB Chemistry: Final 03/22/2007 15:01 Acc# [REDACTED] Acct# [REDACTED]

GLYCATED HEMOGLOBIN (HBA1C)

			Reference
GLYCATED HEMOGLOBIN (HBA1C)	+8.3	%	[4.3-6.0]
AVERAGE BLOOD GLUCOSE (CALC)	197	mg/dL	

INTERPRETIVE DATA

AVERAGE BLOOD GLUCOSE ASSOCIATED WITH THIS PERCENT GLYCATED HEMOGLOBIN (BASED ON DCCT)

ATTENDING MD:
LOBACH, DAVID F

ORDERING MD:
LOBACH, DAVID F

PERFORMED BY:
DUHS FRANKLIN LAB 4425 BEN FRANKLIN BLVD DURHAM, NC 27704



Duke eBrowser – Disease Management Module

https://clinapp6.duhs.duke.edu:8081 - Patient Summary for [REDACTED] MRN: [REDACTED] - Microsoft Internet Exp...

Allergies/ADE Problems Medications Vitals Cautions Disease Mgmt. Print ? Send Feedback Close

Health Maintenance Diabetes * Hypertension *

Evaluate Patient for Diabetes

Duke Health Disease Management System – Diabetes


https://clinapp6.duhs.duke.edu:8081 - Patient Summary for [REDACTED] MRN: [REDACTED] - Microsoft Internet Exp... Send Feedback Close

Allergies/ADE Problems Medications Vitals Cautions Disease Mgmt. Print

Health Maintenance Diabetes * Hypertension *

Patient is diagnosed with Diabetes. Last evaluated at 7:18 PM on 08/15/2007.

Re-evaluate patient for Diabetes Remove Patient From Disease List Input Observations

Focus	Status	Relevant Data	Guidelines
B.P.	DUE NOW	Last Done: 03/22/07 (4m 24d ago) Last Value: 132/82 mmHg	q visit, goal < 130/80 ?
Weight	DUE NOW	Last Done: 03/22/07 (4m 24d ago) Last Value: 75.7 kg BMI: 30.5	q visit, goal BMI < 25 ?
Visual Foot Exam	DUE NOW	Last Done: 07/13/06 (1y 1m 2d ago) Last Value:	q visit ?
Foot Monofilament	DUE NOW	Last Done: 07/13/06 (1y 1m 2d ago) Last Value:	annual ?
Hgb _{A1C}	DUE NOW	Last Done: 03/22/07 (4m 24d ago) Last Value: 8.3%	q6mo if < 7%, q3mo if >= 7% ? 
Urine Micro alb/cr Ratio	DUE NOW	Last Done: 07/13/06 (1y 1m 2d ago) Last Value: 2.4 mg/g	annual ?
Total Chol.	✓ Not due	Last Done: 03/22/07 (4m 24d ago) Last Value: 187 mg/dL	annual, goal < 200 ?
LDL Chol.	✓ Not due	Last Done: 03/22/07 (4m 24d ago) Last Value: 110 mg/dL	annual, goal < 100 ?
Eye Exam	✓ Not due - already scheduled	Last Done: 08/09/07 (6d ago) Appt scheduled: 09/13/07	annual ?
Flu Vacc.	✓ Not flu season	Last Done: > 2 years ago	annual, unless egg allergic ?
Pneum. Vacc.	✓ Not due	Last Done: 01/03/07 (7m 12d ago)	once; revacc. if >= 65, last 5+ yrs ago when < 65 ?
ASA (81 mg)	CONSIDER Rx	Not known to be allergic to aspirin Aspirin not listed as prescribed	age >= 40, no contraindications ?
Education	DUE NOW	Last Done: Not on record	once; repeat annually if hgbA1c >= 7% ?

Duke Health Disease Management System – Diabetes Knowledge

https://clinapp6.duhs.duke.edu:8081 - Care Metric - Microsoft Internet Explorer

Care Metric	Care Guideline	Help Information on Care Metric
<p>Diabetes – Hgb_{A1C} test</p>	<p>Conduct every 6 months if meeting goal, every 3 months if not meeting goal. Goal: < 7.0%</p>	<p>Guideline:</p> <ul style="list-style-type: none"> - Monitor Hgb_{A1C} level every 6 months if meeting goal (Hgb_{A1C} level < 7.0%), every 3 months if not meeting goal. (E_{ADA}) - Manage patient as appropriate to achieve Hgb_{A1C} level < 7.0%. (B_{ADA}) <p>Rationale:</p> <ul style="list-style-type: none"> - The hemoglobin A1C test measures a patient's average glycemia over the preceding 2–3 months. - Prospective randomized clinical trials have shown that improved glycemic control is associated with sustained decreased rates of retinopathy, nephropathy, and neuropathy. - In these trials, treatment regimens that reduced average A1C to ~7% (~1% above the upper limits of normal) were associated with fewer long-term microvascular complications. <p>What this rule does:</p> <ul style="list-style-type: none"> - This rule prompts for a Hgb_{A1C} test if it has been ≥ 5 months since the last test, if that test showed a Hgb_{A1C} level under 7.0%. Otherwise, this rule prompts for a Hgb_{A1C} test if it has been ≥ 2 months since the last test. <p>Data entry notes:</p> <ul style="list-style-type: none"> - Rule inactivation: this rule can be turned off for a specific patient and later turned back on if appropriate. - Documentation of reason for not delivering intervention: a clinician may document a reason for not delivering the recommended intervention. This reason will be displayed on future reminder screens until the intervention is completed. <p>References:</p> <p>(1) American Diabetes Association. Standards of Medical Care in Diabetes – 2006. <i>Diabetes Care</i>. 2006;29 (Supplement 1): S4-S42. Link to guideline as PDF. [note: Hgb_{A1C} monitoring guidelines are on pp. S10-S11]</p> <p>Link to evidence scale Link to responsible entity Link to maintenance information</p>

Duke Health Disease Management System – Diabetes

https://clinapp6.duhs.duke.edu:8081 - Patient Summary for [REDACTED] MRN: [REDACTED] - Microsoft Internet Exp... Send Feedback Close

Allergies/ADE Problems Medications Vitals Cautions Disease Mgmt. Print

Health Maintenance **Diabetes *** Hypertension *

Patient is diagnosed with Diabetes. Last evaluated at 7:18 PM on 08/15/2007.

Re-evaluate patient for Diabetes Remove Patient From Disease List **Input Observations**

Focus	Status	Relevant Data	Guidelines
B.P.	DUE NOW	Last Done: 03/22/07 (4m 24d ago) Last Value: 132/82 mmHg	q visit, goal < 130/80 ?
Weight	DUE NOW	Last Done: 03/22/07 (4m 24d ago) Last Value: 75.7 kg BMI: 30.5	q visit, goal BMI < 25 ?
Visual Foot Exam	DUE NOW	Last Done: 07/13/06 (1y 1m 2d ago) Last Value:	q visit ?
Foot Monofilament	DUE NOW	Last Done: 07/13/06 (1y 1m 2d ago) Last Value:	annual ?
Hgb _{A1C}	DUE NOW	Last Done: 03/22/07 (4m 24d ago) Last Value: 8.3%	q6mo if < 7%, q3mo if >= 7% ?
Urine Micro alb/cr Ratio	DUE NOW	Last Done: 07/13/06 (1y 1m 2d ago) Last Value: 2.4 mg/g	annual ?
Total Chol.	✓ Not due	Last Done: 03/22/07 (4m 24d ago) Last Value: 187 mg/dL	annual, goal < 200 ?
LDL Chol.	✓ Not due	Last Done: 03/22/07 (4m 24d ago) Last Value: 110 mg/dL	annual, goal < 100 ?
Eye Exam	✓ Not due - already scheduled	Last Done: 08/09/07 (6d ago) Appt scheduled: 09/13/07	annual ?
Flu Vacc.	✓ Not flu season	Last Done: > 2 years ago	annual, unless egg allergic ?
Pneum. Vacc.	✓ Not due	Last Done: 01/03/07 (7m 12d ago)	once; revacc. if >= 65, last 5+ yrs ago when < 65 ?
ASA (81 mg)	CONSIDER Rx	Not known to be allergic to aspirin Aspirin not listed as prescribed	age >= 40, no contraindications ?
Education	DUE NOW	Last Done: Not on record	once; repeat annually if hgbA1c >= 7% ?

Duke eBrowser – Disease Management Data Entry Screen

https://clinapp6.duhs.duke.edu:8081 - Patient Summary for [REDACTED]

Allergies/ADE Problems Medications Vitals Cautions Disease Mgmt. Print ? Send Feedback

Health Maintenance Diabetes * Hypertension *

Save Observations and Re-Evaluate Cancel

+ B.P. Measurement

+ Weight Measurement

- Visual Foot Examination

Visual Foot Exam:	Date Done: 08/15/2007 Observation: Left 5th toe ulcer
Documentation:	Date: _____ <input type="checkbox"/> Intervention considered but not delivered. Reason: <input checked="" type="radio"/> Patient refused <input type="radio"/> Medically inappropriate at this time <input type="radio"/> Scheduled for future visit <input type="radio"/> Other Comment: _____ (required except if "Scheduled for future visit" selected as reason)
Rule status:	<input type="checkbox"/> Inactivate rule for this patient. Reason: <input checked="" type="radio"/> Patient refuses <input type="radio"/> Medically inappropriate <input type="radio"/> Other

CDS for Diagnosis and Mgt

- Setting: Private practice ophthalmology and optometrist offices
- Goal: To overcome challenges to collecting complex clinical data at the point of care in order to provide diagnostic decision support and improve care documentation, staging and quality

FUTURE CARE

A study sponsored by the National Eye Institute and Duke University © 1-888-500-4032



Point-of-Care Data Collection and Decision Support for Eye Care Professionals

Principle Investigator: Paul Lee, MD, JD

Joint Project of

Division of Clinical Informatics, Dept. of Community and Family Medicine
and Department of Ophthalmology,
Duke University Medical Center, Durham, NC



NATIONAL INSTITUTES OF HEALTH

Sample Note – Color Diagrams

DILATED EXAM
 ✓ dilation and anesthetic
 warning discussed.
 N M C
 OD OS out X
 cmk@ 1030

ON

C/D 63 OD

ON

OS 72 CD

- 90 D
- CL
- Indirect

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□ previous photos reviewed

Capturing Detailed Diagrams

The screenshot displays the 'Eye Center' software interface for patient 'john smith' on '03-17-2005' at '01:07:24'. The interface is divided into several sections:

- Navigation Tabs:** Visual Acuity/Refraction, Exam 1, Slit Lamp, Optic Nerve & Retinal Exam 1, Retinal Exam 2.
- Retinal Diagrams:** Two circular diagrams representing the right eye (OD) and left eye (OS). The OD diagram shows a large red scribble at the bottom, while the OS diagram shows scattered red spots. Red arrows point from the OS diagram to the 'DRS OS' data entry section.
- Data Entry Sections:**
 - DRS OD:** Includes checkboxes for Normal, IRMA, Microaneurysms, NVE, Dot-Blot Hemorrhages, NVD, Cotton Wool Spots, and VH. A CSDME dropdown menu is also present.
 - DRS OS:** This section is highlighted with a red border and contains the same set of checkboxes and CSDME dropdown menu as the OD section.
- Bottom Navigation:** Main, History, Exam, Additional Tests, Decision Making, Finish Chart.

Eye Care Decision Support

Eye Center
08-17-2006 Current Patient: John Smith 12:36:34

Diagnosis Assessment Counseling/Discussion

Diagnoses - OD Diagnoses - OS

Stage Proliferative - Neovascularization	Diagnosis Proliferative
---	----------------------------


Modify Stage

- Normal
- Mild Non-Proliferative
- Moderate Non-Proliferative
- Severe NPDR - IRH
- Severe NPDR - VB
- Severe NPDR - IRMA
- Proliferative NV
- Proliferative VH
- Proliferative PRH

Proliferative S/P PRF

- DME - Mild
- DME - Moderate
- DME - Severe

Sample Retinal Image



Click the image to display a larger version.

Additional Diagnosis Notes - OD

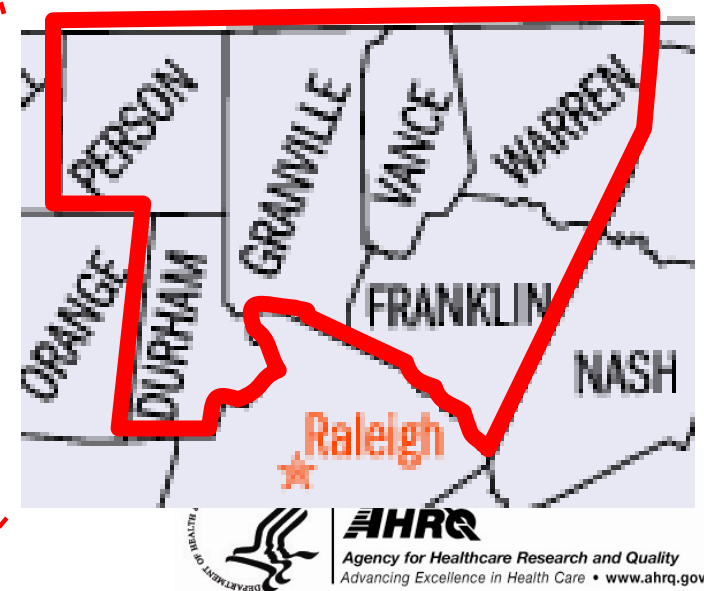
Notes

↓ Proliferative - Neovascularization ↑

Main History Exam Additional Tests Decision Making Finish Chart

CDS for Population Management

- Setting: Urban and rural safety net providers for Medicaid beneficiaries in a 6-county region of north central NC
- Goal: To improve appropriate utilization and quality of care



COACH HIE Context

- Receives and displays external billing/claims/clinical data from 5 hospitals, 8 clinics and NC State Medicaid
- Supports care management activities (documentation, communication, referrals, care plans, etc.) for 2 care management teams
- 5 Hospitals, 34 Primary Care Clinics, 3 Urgent Care Facilities, & 8 Government Agencies
- >40,000 Medicaid Beneficiaries

COACH Sample Screen

COACH
 Quick Search [] Go [Drafts](#) [New Patient](#) [Register LATCH](#) [Advanced Search](#) [Feedback](#) [Admin](#) [Help](#) [Logout](#)
 COACH PROD David F Lobach

Annette [View Patient](#) [Add to Patient List](#) [Printer Friendly](#) [Refresh](#) [Home](#)
 DOB: 04/25/ [] Age: [] Race: B Gender: F M/S: [] [Add a Program](#)
 Programs: [] MED- [] CA - [] (A)

[DEMOGRAPHICS](#) | [PROBLEMS & PROCEDURES](#) | [MEDS & ALLERGIES](#) | [CARE PLANS & PSYCHOSOCIAL](#) | [LABS & OBSERVATIONS](#) | [ENCOUNTERS](#) | [PROVIDERS](#) | [REFERRALS](#) | [DATA FORMS](#)

Addresses [Add an Address](#)

Address	City, State, Zipcode	County	Map Link
118 []	Durham, 27 []	Durham	(Map)
Po F []	Durham, NC []	Durham	(Map)
118 []	Durham, 27 []	Durham	(Map)
118 []	Durham, NC []	Durham	(Map)
132 []	Durham, NC []	Durham	(Map)
Po F []	Durham, 27 []	Durham	(Map)
Po F []	Durham, NC []	Durham	(Map)

Phone Numbers [Add a Phone Number](#)

Phone Number	Type
919 []	Home
919 []	Home

Active Providers [Add a Provider](#)

Provider	Role	Location	Status Date
Andrea Leach, RD	Nutritionist	DCHN	09/13/2004
Sharita Lee, HEd	H Ed	DCHN	07/16/2004
-Not Assigned-		Duke Medical Outpatient Cli	-

Comments & Other Information [Add a Comment](#)

Date	Author	Comments & Other Information
07/16/2004	Sharita L Lee/Dept_CFM/mc/Duke	Diabetes Disparities Collaborative

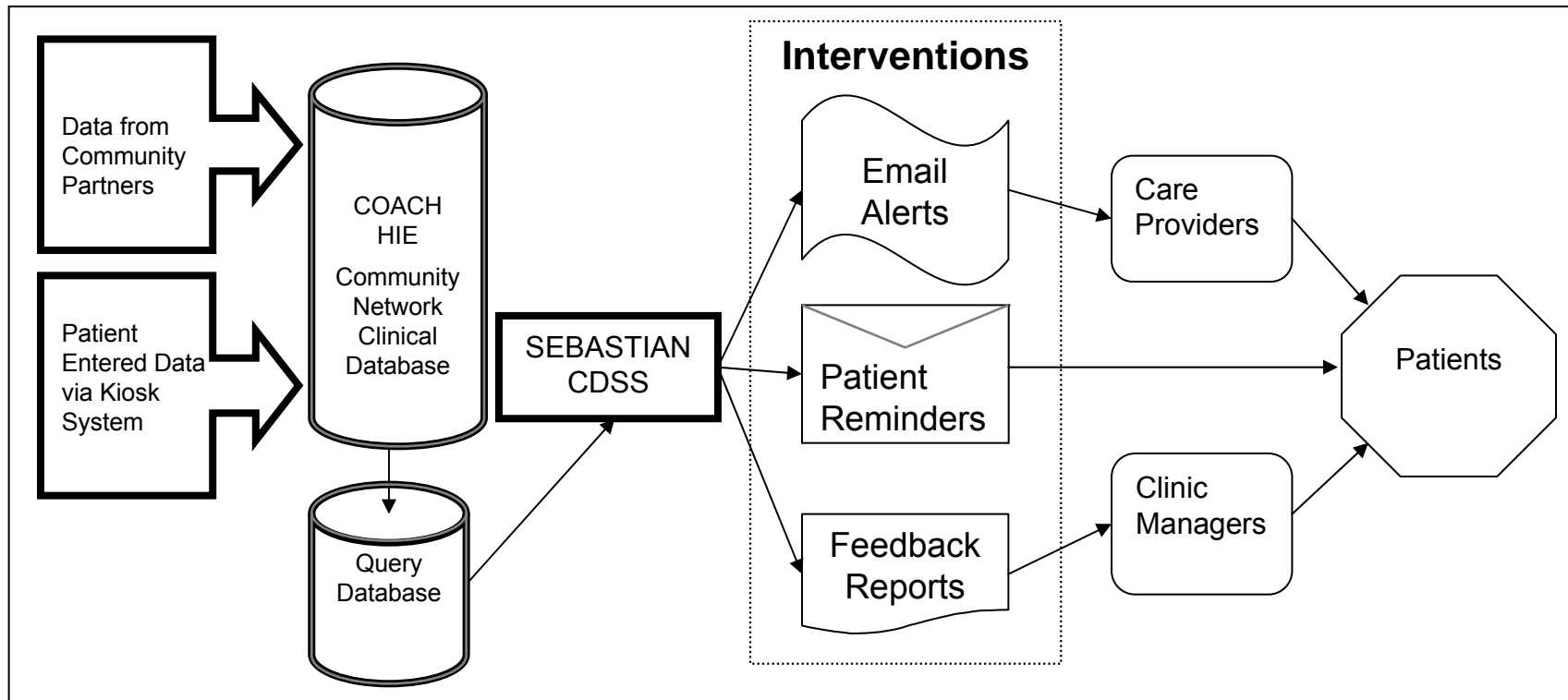
Guardian Name [Add a Parent/Guardian](#)

School [Add a School](#)

DCHN Case Code [Add a Case Code](#)

Case Manager

Population Mgt Intervention



Sample Provider Alert

COACH Alerts for Ms. Jenny Rawlings

Document ID: 24

08/08/05 (Mon)

If you have any questions or concerns, please contact Ken Kawamoto, M.D.-Ph.D. candidate, Duke University (kawam001@mc.duke.edu; 919-684-2340).

Patients requiring attention (highest priority patients listed first):

1. Norris, [REDACTED] ([COACH link](#)). 23 yr. old Caucasian female, DOB [REDACTED]/82.

Medicaid #: [REDACTED]

Duke MRN: [REDACTED]

Priority: 23.0

[REDACTED] Durham, NC 27[REDACTED]

Home #: 919-[REDACTED]

ED visits that may require follow-up:

3+ ED visits in 90 days, most recent in past month: The patient was seen at Duke Hospital ED (listed as 'Emergency Room-duke' in COACH) on 07/09/05. This visit was at least the 3rd ED visit in 90 days. Including this visit, the patient has had 13 such repetitive (3+ in 90 days) ED visit(s) in the past 6 months.

General preventive care needs:

DUE NOW - Chlamydia test: Women between the ages of 16 and 26 should be tested for Chlamydia once every year. We have no record of the patient having received a Chlamydia test in the past 2 years.

DUE NOW - Pap smear: Women between the ages of 21 and 64 should have a Pap smear at least once every 3 years to screen for cervical cancer. We have no record of the patient having received a Pap smear in the past 3 years.

2. Weaver, [REDACTED] ([COACH link](#)). 8 mo. old Caucasian male, DOB [REDACTED]/04.

Sample Feedback Report

Feedback Report - Duke Family Medicine

Active CAI Patients: 2,339

April 25, 2005

Sorted by: Highest priority patients

Williams, Jacob 15 year old African-American male 1001 Main Street, Durham, NC 27000-1001	Medicaid # 000000000 DOB 5/17/89 919-123-4567	Priority: 100 MRN: ABC1231
--	---	-------------------------------

Events requiring follow-up:

- ED visit for diabetes: 1/20/05, Duke Hospital; Encounter diagnosis - diabetes
- Multiple missed appointments by patient w/ diabetes: 2/18/05, Missed appointment at Duke CFM; (4th missed appointment in 60 days)

Health maintenance needs:

- DUE NOW -- Well-child visit: Patients aged 12-16 should have a well-child visit once every year. (CPT billing procedure code 99210). Last known well-child visit: 8/12/03 at Duke CFM.

Diabetes care needs:

- DUE NOW -- Hemoglobin A1c test: Recommended once every 6 months. Last known HgbA1c: 6/1/04 at Duke Pediatrics.
- DUE NOW -- LDL cholesterol test: Recommended once every 6 months. Last known LDL test: 6/1/04 at Duke Pediatrics.

Other issues requiring follow-up:

- NEED PHYSICIAN FOLLOW-UP – Risk factors for TB exposure: Patient reported information at health information kiosk visit on 1/25/05.

Other relevant information:

- **CAI status:** Active
- **CAI home clinic:** Duke CFM
- **High Medicaid cost:** Medicaid costs over last 6 months: \$5200. \$1000 (20%) on outpatient encounters, \$1530 (30%) on ED visits, \$2550 (50%) on inpatient encounters
- **Meets DCHN priority contact criteria:** Patient has diabetes and < 80% of diabetes care standards are met.

Doe, Jane 58 year old Caucasian female 200 Cedar Lane, Durham NC 27000-0200	Medicaid # 000000000 DOB 3/28/46 919-345-6789	Priority: 82 MRN: WXY4567
--	---	------------------------------

Events requiring follow-up:

- ED visit for asthma: 2/14/05, ED visit at Duke; Encounter diagnosis - diabetes
- Multiple missed appointments by patient w/ asthma: 2/25/05, Missed appointment at LCHC; (2nd missed appointment in 60 days)

Asthma care needs:

- Asthma Action Plan:** Patients with asthma should have a written asthma action plan. None documented. Patient reported information at health information kiosk visit on 2/10/05.

Sample Patient Letter

**Durham
Community
Health
Network**



*Lincoln Community Health Center – Duke University Medical Center – Durham County Department of Social Services
Durham County Health Department – Durham Pediatrics – Regional Pediatric Associates – Central Family Practice*

August 9, 2005

To the parents of [REDACTED],

We are sending you this letter to address your child's health care needs. Based on our records, it appears your child may be due for the following services:

**Same rules for diabetes used
across 4 applications**

Diabetes services that may be due:

- Hemoglobin A1c test:** This test is recommended every 6 months for patients with diabetes.
- Cholesterol test:** This test is recommended every 12 months for patients with diabetes.
- Urine protein test:** This test is recommended every 12 months for patients with diabetes.

Please call our office at (919) 477-2202 to schedule an appointment, so that the doctor can check to see if your child is in need of these services. Also, please bring this letter with you to the appointment and show it to the doctor. We look forward to seeing you soon!

Sincerely,

Your Care Team

Your Care Team
Regional Pediatric Associates
A Member of the Durham Community Health Network

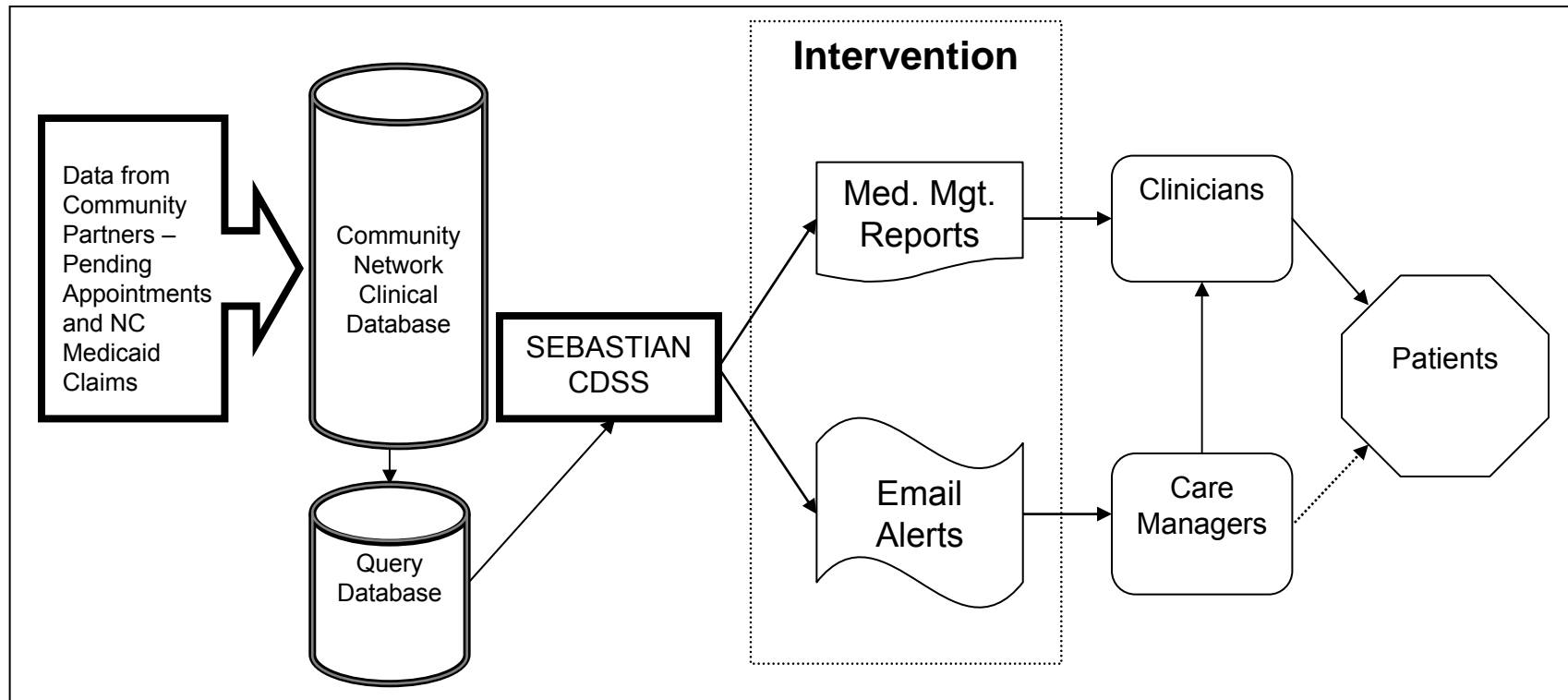
CDS for Medication Management

- Setting: 14 primary care practices and their affiliated care managers serving Medicaid beneficiaries
- Goal: To improve adherence to evidence-based pharmacotherapy for IOM priority conditions

Med. Mgt. Project Overview

- Point-of-care information about filled prescriptions
- Evidence based pharmacotherapy recommendations about 7 priority conditions (IHD, CHF, Htn, Stroke, Asthma, COPD, Diabetes)
- 14 clinic sites and notifications to care managers
- Report delivery beginning March 2009

Intervention Overview



Sample Medication Mgt. Report

Doe, Jane (Duke MRN 12345) MD: Smith, John Appointment Date: 7/17/07
 Medication Summary Appointment Time: 10:15am

PLEASE NOTE: The information below was generated from claims data and may be inaccurate or incomplete. Please verify the information, as the provider is acknowledged as the final authority for all care decisions.

IOM PRIORITY CONDITIONS DETECTED FROM BILLING DATA FOR THIS PATIENT:

1. Diabetes mellitus
2. Hypertension
3. Ischemic heart disease (post-MI)

PRESCRIPTIONS FILLED IN THE 12 MONTHS PRIOR TO 6/28/07 (EXCLUDING ANTIBIOTICS):^{A,B,C}

	% days covered	2007											
		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Cardiovascular													
Beta Blockers	87%												
Carvedilol 25 mg tab (30d Rx) (MD: Smith, John)	39%												
Metoprolol 100 mg tab (30d Rx) (MD: Smith, John)	52%												
ACE Inhibitors	!! 0%												
Statins	!! 47%												
Simvastatin 25 mg tab (30d Rx) (MD: Smith, John)	47%												
Diuretics	83%												
Torsemide 10 mg tab (30d Rx) (MD: Smith, John)	38%												
Torsemide 20 mg tab (30d Rx) (MD: Smith, John)	45%												
Diabetes Drugs													
Insulin	98%												
Humulin N 100 units/mL vial (30d Rx) (MD: Lee, David)	88%												
Humulin R 100 units/mL vial (30d Rx) (MD: Lee, David)	91%												
Oral Agents	85%												
Metformin 500 mg tab (30d Rx) (MD: Lee, David)	85%												
Other Drugs													
Colchicine 0.6 mg tab (30d Rx) (MD: Benson, Carol)	77%												
Loratadine 10 mg tab (30d Rx) (MD: Smith, John)	42%												

PATIENT-SPECIFIC, EVIDENCE-BASED MEDICATION SUGGESTIONS FOR IOM PRIORITY CONDITIONS:

1. Consider prescribing ACE inhibitor or angiotensin II receptor blocker (ARB), unless contraindicated.
 Indications that apply specifically for this patient: (1) diabetes in context of hypertension (ADA Diabetes guidelines, 2007)^P; and (2) ischemic heart disease in context of diabetes and hypertension (ACC/AHA ACS guidelines, 2002)^P. Some contraindications include pregnancy, renal artery stenosis, and allergy.

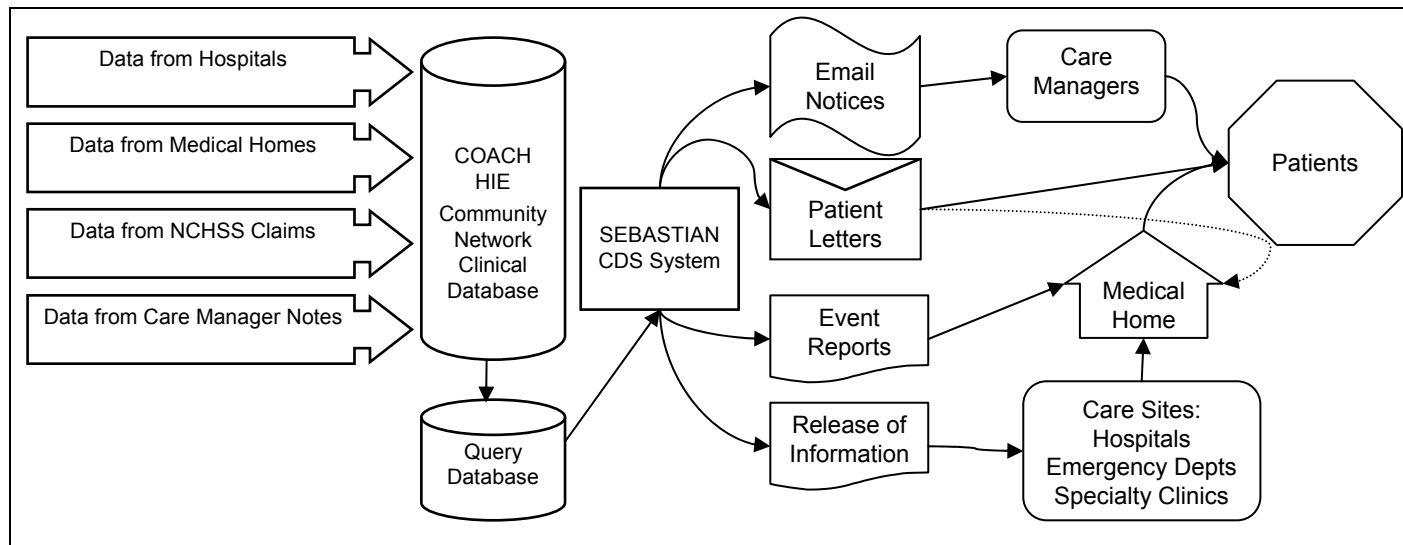
CDS for Care Transitions

- Setting: A 6-county regional health information exchange network serving Medicaid beneficiaries
- Goal: To increase awareness about care transitions and to augment information availability across these transitions

Project Description

- Identification of Care Transitions
 - Hospitalizations
 - ED visits
 - Specialty care consults
- Notification about Transitions
 - Medical homes
 - Patients
 - Care managers
- Request of Information
 - Discharge summaries
 - ED encounter notes
 - Specialty care consult notes

Intervention Overview



Sample Event Report

Notice of Hospitalization for Lincoln Community Health Center



Patient Information:

Name: **Smith, Sample P.** DOB: 8/17/1943 Age: 64 Gender: F
Phone #s on file: 919-111-1111 (h); 919-222-2222 (w)
Address on file: 1234 Maple Street, Roxboro, NC 27573
MRNs on file: Lincoln (B15304), Durham Regional Hospital (1849302), Medicaid (574829491S)

Hospitalization Information:

Date: **2/1/08 – 2/6/08**
Location: **Durham Regional Hospital**
Primary diagnosis: **congestive heart failure**
Secondary diagnoses: diabetes mellitus, type II; essential hypertension; obstructive chronic bronchitis
Procedures performed: right heart catheterization, echocardiogram, chest radiograph, electrocardiogram
Billing providers: Joshua Maynard, MD
Request for discharge summary: sent on 2/11/08

Pending Appointments:

2/25/08 Duke Cardiology Clinic

No pending appointment found for Lincoln Community Health Center

Recent Encounter History (past 12 months or 12 encounters):

<u>Date:</u>	<u>Type:</u>	<u>Location:</u>	<u>Provider:</u>	<u>Primary Diagnosis:</u>
02/01/08	In	Durham Regional Hospital	Joshua Maynard, MD	congestive heart failure
12/07/07	Sp	Duke Cardiology Clinic	Elizabeth Smith, MD	congestive heart failure
11/24/07	ED	Durham Regional ED	Angela Daniels, MD	congestive heart failure
10/15/07	PCP	Lincoln Com.Health Ctr.	William Donovan, MD	diabetes mellitus, type II
08/18/07	Sp	Duke Cardiology Clinic	Elizabeth Smith, MD	congestive heart failure
07/28/07	Sp	Duke Pulmonary Clinic	Terry Sanders, MD	chronic bronchitis

Sample Event Report (con't)

Recent Encounter History (past 12 months or 12 encounters):

<u>Date:</u>	<u>Type:</u>	<u>Location:</u>	<u>Provider:</u>	<u>Primary Diagnosis:</u>
02/01/08	In	Durham Regional Hospital	Joshua Maynard, MD	congestive heart failure
12/07/07	Sp	Duke Cardiology Clinic	Elizabeth Smith, MD	congestive heart failure
11/24/07	ED	Durham Regional ED	Angela Daniels, MD	congestive heart failure
10/15/07	PCP	Lincoln Com.Health Ctr.	William Donavan, MD	diabetes mellitus, type II
08/18/07	Sp	Duke Cardiology Clinic	Elizabeth Smith, MD	congestive heart failure
07/28/07	Sp	Duke Pulmonary Clinic	Terry Sanders, MD	chronic bronchitis
06/02/07	Sp	Triangle Ophthalmology	Dana Copeland, MD	diabetes mellitus, type II
05/02/07	PCP	Lincoln Com.Health Ctr.	William Donavan, MD	diabetes mellitus, type II
03/10/07	Sp	Duke Cardiology Clinic	Elizabeth Smith, MD	congestive heart failure
02/19/07	In	Duke Hospital	Donna Sullivan, MD	congestive heart failure
01/22/07	PCP	Lincoln Com. Health Ctr.	William Donavan, MD	diabetes mellitus, type II

Medical Home Information:

Most recent medical home provider: **William Donavan, MD** (last saw patient on 10/15/07, 5/2/07, and 1/22/07)

Patient also seen in last 24 months by Mary Langley, MD (on 4/22/06)

If you have any questions regarding this notice, please contact: Jan Willis, MS, MBA, project coordinator, Duke University Division of Clinical Informatics, at (919)684-2340.

PLEASE NOTE: The above information was generated from claims data and may be inaccurate or incomplete. Please verify the information, as the provider is acknowledged as the final authority for all care decisions.

Sample Care Manager Notice

COACH Alerts for Ms. Madeline Maturu

02/11/08 (Mon)

If you have any questions, please contact Jan Willis, MS, MBA, Duke University (jan.willis@duke.edu; 919-684-2340).




Patients requiring attention (highest priority patients listed first):

1. Smith, Sample P. (COACH link). 64 yr. old female, DOB 08/17/1943. Medical Home: Lincoln Comm. Health Ctr. Medicaid #: 574829491S Lincoln MRN: B15304 Priority: 5.0 1234 Maple Street, <u>Roxboro</u> , NC 27573 Home #: 919-111-1111
--

Hospitalizations that may require follow-up:

Hospitalization Discharge of Complex Patient. Location: Durham Regional Hospital. Date: 02/01/08 to 02/06/08. Primary diagnosis: congestive heart failure. # hospitalizations in past 12 months: 2. Pending appointment at medical home: None scheduled.

Sample Information Release

  	
Request for Release of Medical Information	
<u>To:</u> Durham Regional Hospital Attn: Medical Information Release Unit P.O. Box 3016 Durham, NC 27710	<u>From:</u> Lincoln Community Health Center 1301 Fayetteville St. P.O. Box 52119 Durham, NC 27717-2119 (919) 956-4000
<u>Information Requested For:</u> Name: Smith, Sample P. DOB: 8/17/1943 Gender: F Durham Regional Hospital MRN: 1849302	<u>Information Requested:</u> Discharge summary from hospitalization starting on 2/1/08
Please fax the above information to: Lincoln Community Health Center Attn: Claire Crenshaw, RN, clinic manager Re: Sample P. Smith, Lincoln MRN B15304, DRH discharge summary, PCP William Donovan Fax: (919)956-4001	
We are attaching a return fax cover sheet for your convenience. Please use the attached cover sheet if possible, as it will help us with internal routing of the information.	
If you have any questions or concerns, please contact: Claire Crenshaw, clinic manager, Lincoln Community Health Center, at (919)856-4000 extension 15.	

Project Challenges → Lessons



People

Working with diverse stakeholders



Politics

Working with systems, institutions and their policies



Pragmatism

What we wish we had known sooner

Lessons: People



- Controlling expectations
- Avoiding “Scope Creep”
- Securing buy-in from end users
 - Decision rules
 - Letter content
- Creating familiar associations
 - Letterhead from clinic sites

Lessons: Politics



- Obtaining data from partners
- Complying with HIPAA regulations
- Receiving IRB approval
- Working with community partners
- Working in the community setting
- Navigating the academic institution

Lessons: Pragmatism #1



- Limiting the volume of notifications
- Providing adequate content in notices
 - Dates
 - Values
- Accommodating flexibility
- Assuring accuracy of CDS information

Lessons: Pragmatism #2



- Enabling local configuration of CDS
 - End user control of notification distribution
 - Narrow scope of options
- Configuring CDS for individual patients
- Understanding the data
 - Accommodating data differences

Acknowledgments

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 - Connie Bishop, RN, MS
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 - Chet Orton
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 - Pam Phillips
 - Tia Simmons, MPH
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 - Eric Eisenstein, DBA
 - Vic Hasselblad, PhD
 - Paul Lee, MD, JD
 - Bob Rezzarday
 - Dwight Smith
 - Pete Woods
- Outside Collaborators
 - Richard Low (Topsail Technologies)



Project Publications

- Lobach DF, Kawamoto K, Anstrom KJ, Kooy KR, Eisenstein EL, Silvey GA, Willis JM, Johnson F, Simo J. Proactive population health management in the context of a regional health information exchange using standards-based decision support. *AMIA Annu Symp Proc.* 2007;473-477
- Lobach DF, Kawamoto K, Anstrom KJ, Russell ML, Woods P, Smith D. Development and Usability of a Point-of-Care Decision Support System for Chronic Disease Management Using the Recently-Approved HL7 Decision Support Service Standard. *MedInfo.* 2007; 861-865.
- Kawamoto K, Lobach DF. Design, implementation, use, and preliminary evaluation of SEBASTIAN, a standards-based web service for clinical decision support. *AMIA Annu Symp Proc.* 2005:380-384.
- Eisenstein EL, Anstrom KJ, Macri JM, Crosslin DR, Johnson FS, Kawamoto K, Lobach DF. Assessing the potential economic value of health information technology interventions. *AMIA Annu Symp Proc.* 2005:221-225.
- Lobach DF, Silvey GM, Macri JM, Hunt M, Kacmaz RO, Lee PP. Identifying and overcoming obstacles to point-of-care data collection for eye care professionals. *AMIA Annu Symp Proc.* 2005:465-469.

Thank you!

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Questions & Answers

Our Panel:

Ben-Tzion Karsh, PHD, MSIE, University of Wisconsin
Department of Industrial and Systems Engineering

Ross Koppel, PHD, MA, University of Pennsylvania
Department of Sociology, and Center for Clinical
Epidemiology and Biostatistics, School of Medicine

David F. Lobach, MD, PhD, Division of Clinical
Informatics, Department of Community and Family
Medicine, Duke University

Save the Date!

Our Next Event

A National Web Conference on How CDS Can Be Used to Monitor or Improve Population Health

Third teleconference in our four-part series on Clinical
Decision Support

November 18, 2008,
from 3:30 – 5:00 PM Eastern Time

Watch your inbox for information on how to register

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