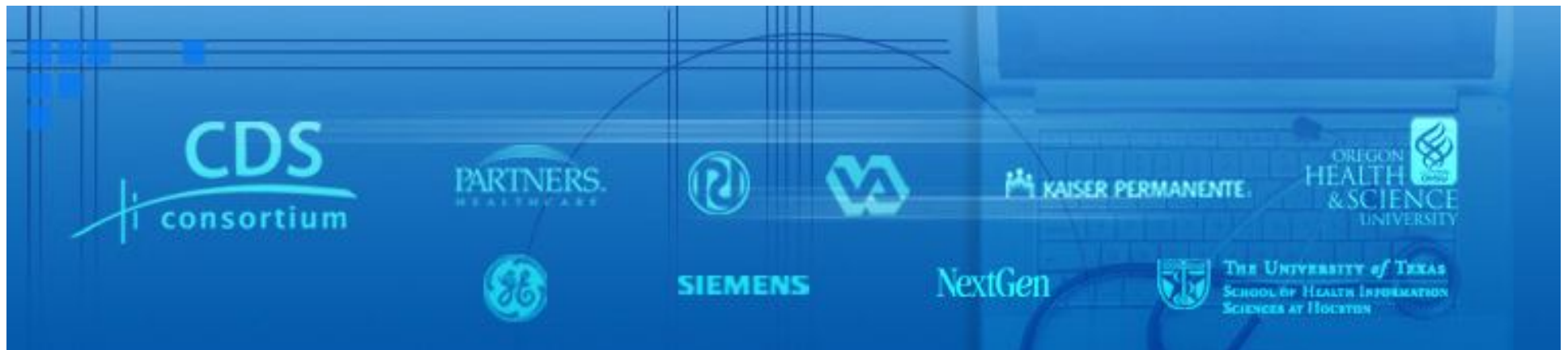


AHRQ Clinical Decision Support Consortium

April 5, 2009

Blackford Middleton, MD, MPH, MSc
Dean Sittig, PhD
Frank Sonnenberg, MD





Presenters

- **Blackford Middleton, MD, MPH, MSc**

Corporate Director of Clinical Informatics
Research & Development, and Chairman,
Center for IT Leadership, Partners
Healthcare System

- **Dean F. Sittig, PhD**

Associate Professor, The University of
Texas, School of Health Information
Sciences at Houston

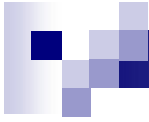
- **Frank A. Sonnenberg, MD**

Professor of Medicine and Medical
Director of Clinical Information Systems,
UMDNJ Robert Wood Johnson Medical
School



Learning Objectives

- Understand the research goals and objectives of the AHRQ Clinical Decision Support Consortium
- Understand the potential of clinical decision support to improve the quality and safety of the healthcare we deliver
- Understand the issues surrounding knowledge management for clinical decision support
- Compare and contrast with current clinical practice



CDS Consortium Goal

To **assess, define, demonstrate, and evaluate** best practices for knowledge management and clinical decision support in healthcare information technology at scale – across multiple ambulatory care settings and EHR technology platforms



Background

- Application of clinical decision support has many benefits
- Systematic reviews have shown that CDS can be useful across a variety of clinical purposes and topics
- Current adoption of advanced clinical decision support is limited due to a variety of reasons



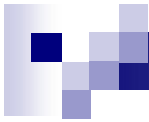
Barriers

- Limited implementation of EMR, CPOE, PHR, etc.
- Difficulty developing clinical practice guidelines
- A lack of standards
- Absence of a central repository or knowledge resource
- A limited understanding of organizational, and cultural issues relating to clinical decision support



CDSC: Member Institutions

- Partners HealthCare
- Regenstrief Institute
- Veterans Health Administration
- Kaiser Permanente
- Siemens Medical Solutions/NextGen
- GE Healthcare
- Oregon Health and Science University
- University of Texas, Houston



Six Specific Research Objectives

1. Knowledge Management Life Cycle		
2. Knowledge Specification	3. Knowledge Portal and Repository	4. CDS Public Services and Dashboard
5. Evaluation Process for each CDS Assessment and Research Area		
6. Dissemination Process for each Assessment and Research Area		



Guidelines To Implement

- Diabetes Mellitus

2007 Diabetes Management Standards of Care from the Clinical Practice recommendations of the ADA

- Coronary Artery Disease

ACC guideline on Antiplatelet Therapy; USPSTF recommendation on Aspirin for the Primary Prevention of Cardiovascular Events

- Hypertension

USPSTF recommendation on Screening for High Blood Pressure

Multilayered model

Precision and executability

Machine Execution
Abstract Representation
Semistructured Recommendation
Narrative Guideline

Flexibility and adaptability

Narrative Recommendation layer

Semi-Structured Recommendation layer

Abstract Representation layer

Machine Executable layer

- Knowledge encoded in a format that can be rapidly integrated into a CDS tool on a specific HIT platform

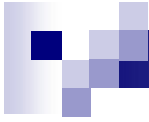
A E.g., rule could be encoded in Arden Syntax

A recommendation could have several different artifacts created in this layer, one for each of the different HIT platforms



Knowledge Pack

- **Data standard** (controlled medical terminology, concept definitions, allowable values)
- **Logic specification** (statement of rule logic)
- **Functional requirement** (specification of IT feature requirements for expression of rule, etc.)
- **Report specification** (description of method for CDS impact measurement and assessment)



Why Multilayered Representation?

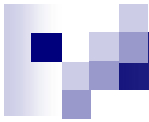
- Allows us to balance between the competing requirements for flexibility in representation for various environments and the ability to deliver precise, executable knowledge that can be rapidly implemented
- Provides a path to achieve logical consistency from the narrative guideline to the execution layer

The CDSC/POET team is multidisciplinary

- Joan Ash, PhD, MLS, MBA
- Ken P. Guappone, MD, PhD
- Richard Dykstra, MD, MS
- Josh Richardson, MS
- Emily Campbell, RN, MS
- Carmit McMullen, PhD
- Adam Wright, PhD
- Dean F. Sittig, PhD



Thanks to the National Library of Medicine, NIH, for funding
Grants LM06942, R56-LM006942 and ASMM10031

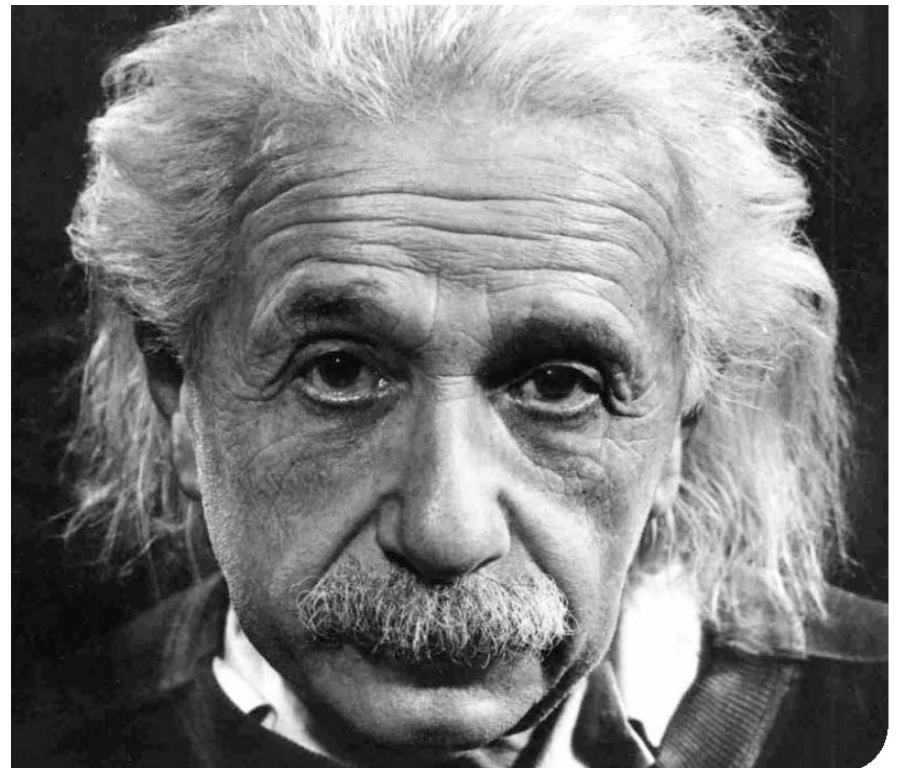


Conducted 5 site visits...

- Sites completed extensive CDS / KM survey
- Remote demo of the system
- Interviewed key stakeholders
 - Administrators, clinician leaders, IT professionals
- Observed clinicians as they worked
- Analyzed transcripts & field notes

Our qualitative, rapid,
ethnographies yield discoveries

"Not everything
that can be
counted counts,
and not
everything that
counts can be
counted."



Albert Einstein (1879-1955)

CDS means different things to different people

Users: anything that assists and guides them...

- Charting templates or default values
- Exchange of information, reports, notes, problem lists, and treatment plans is key
- Want to interact with other physicians about specific patients



Informaticists say...

Improving Outcomes with Clinical Decision Support: An Implementer's Guide

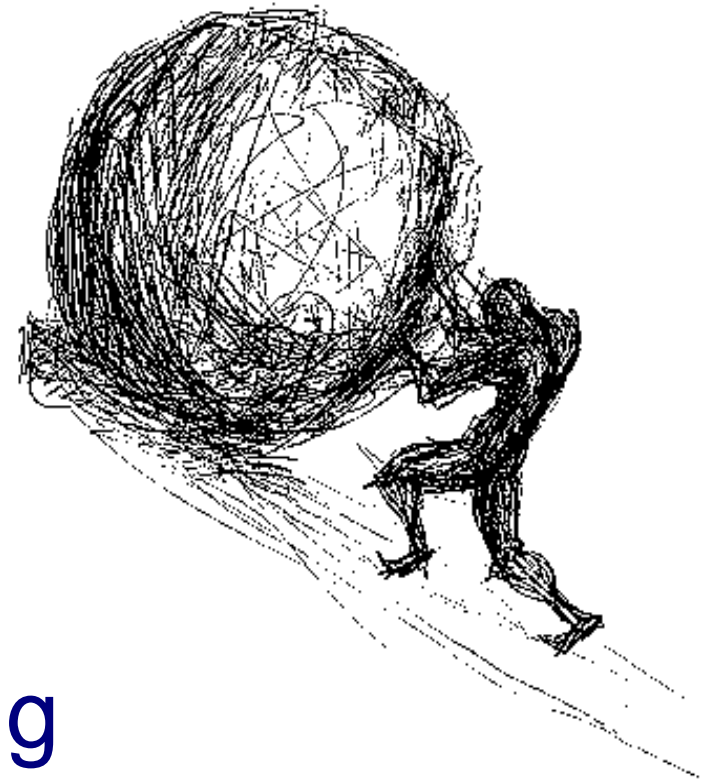
Jerome A. Osheroff, MD, ACP, FACMI
Eric A. Pifer, MD
Jonathan M. Teich, MD, PhD, FACMI
Dean F. Sittig, PhD, FACMI
Robert A. Jenders, MD, MS, FACP

HIMSS

- Documentation templates
- Relevant Data Presentation
- Order Creation Facilitators
- Pathway support
- Reference Information
- Alerts & Reminders

What can we do?

- Speak in user terms
- CDS can be threatening
- Emphasize value to clinical practice
- Observe and listen to clinicians



Labs

Meds

For patient-specific CDS,

you need DATA!

Demog

Orders

Vitals

History

Input Data Element	Rule Types	Rules
Laboratory result/observation	126	2,087
Drug list	108	4,752
Hospital unit	82	806
Diagnosis/problem	43	1,527
Age	39	3,131
Non-drug orders	15	694
Gender	12	1,595
Family history	10	10
Allergy list	9	649
Weight	8	1,310
Surgical history	8	8
Reason for admission	2	148
Prior visit types	2	2
Race	1	1

Content Library Management is necessary for CDS

- Standardize data across the environment
- Standardize knowledge and logic
- Organize knowledge maintenance



Multidisciplinary Team

A multidisciplinary team is responsible for creating and maintaining clinical content:

- Staff of dedicated knowledge engineers
- Subject matter experts
- Clinical content committees



An external repository of clinical content with web-based viewer



Keyword Search: Search

Search Criteria

Content Type...

Specialty

All Clinical Disciplines
Anesthesiology/Perioperative Medicine
Behavioral Medicine

Entity :

All Entities

es - PC

are

es

ory Care

Age Group :

Adult

All Patient Age Groups

Geriatric

Application :

All Applications

BICS Event Monitor

BICS Order Entry

Patient Safety :

Alerts and Notification

All Patient Safety

Consequent Order/Lab Display

Disease Management :

ADHD

All Disease Management

Asthma

Submit Filter Search

General Surgery
GI Colorectal Surgery
Hematology and Oncology
Infectious Disease
Nephrology
Neurology
Neurosurgery
Newborn/Neonatology
Obstetrics and Gynecology
Ophthalmology

An internet-based tool to facilitate content development

agree as it is (12 [REDACTED], 19 Sep 07 12:59pm) [icon]

In general agree... (12 [REDACTED], 22 Sep 07 5:50pm) [icon]

1 Oct 08 9:55pm

- How does everyone feel about this?
- Should we turn the reminder off for a shorter period of time if ***“Done Elsewhere”*** is chosen?

It is more specific, adding an extra inducement for us to get the facts straight with patients.

[REDACTED], regarding the 10-year interval, this is for patients at moderate-to-high risk and so the recommendation is q 5 years.

Knowledge engineers are “special people”



- Knowledge engineers (KEs) encode the logic in the CIS
- KEs manage the controlled clinical vocabulary used to drive the CDS
- KEs work collaboratively with experts to create clinical content for CDS
- KEs must be technically astute as well as clinically knowledgeable

Work to facilitate translation for collaboration

- Culture clash between developers & clinical information systems and users
- An US vs. Them culture exists
- Often physical separation, too!



The system, including the hardware, software and user interface must be easy to use and fast

- Users should not have to wait for CDS
- Users always want to see “everything” on “one-page”
- Organizations & users think they need to be able to customize CDS





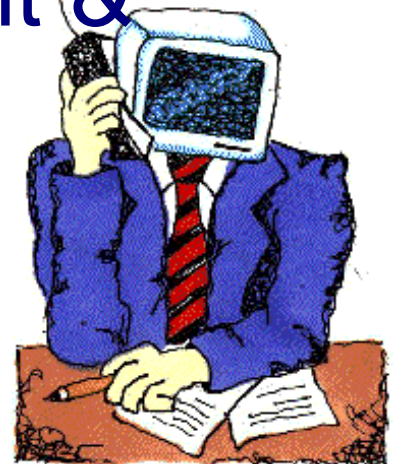
Workflow analysis must be a part of the organizational culture

- Must balance need for *standardization to improve quality & safety* with need for *individualized customization to improve workflow*
- 80% of workflow in a clinic can be anticipated prior to implementation*
 - Additional 10% can be accommodated within existing system capabilities
 - Final 10% requires major software/hardware reconfiguration

* Epic Systems Inc. Implementation Team at Kaiser Permanente

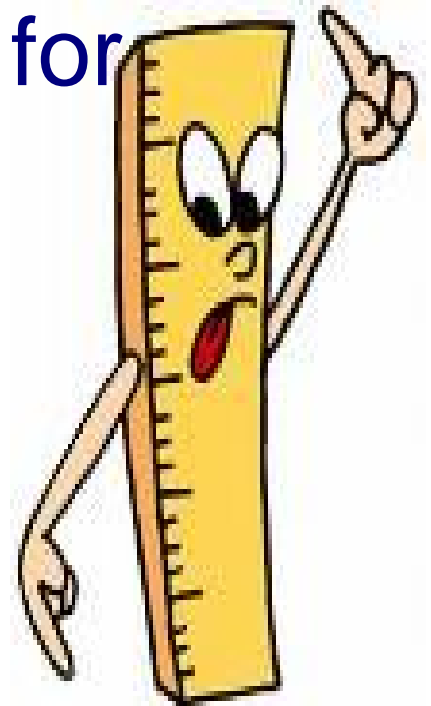
Communicating new CDS features and functions to clinicians is hard

- Most users learn about CDS by chance
- CDS developers do not get enough credit for the improvements
- Keeping clinical content current & accurate is difficult
- Communication about CDS must not add to “alert fatigue”



Metrics are necessary to monitor & manage the interventions

- Need to know raw usage figures for all CDS types
- Need to know override rates for alerts / reminders
- Need to review and act upon information



Nurture and support your clinical champions

- Clinical champions are key to successful CDS roll-outs
- Must work to maintain their energy and enthusiasm
- Need to channel their energy in positive ways
- Need an outlet to voice their concerns and ideas





Governance of clinical decision support is critical

- Must decide on CDS philosophical approach
- Need to set priorities for initiatives
- Assign responsibility and authority
- Provide & manage resources



CDSC and the Robert Wood Johnson Medical Group

- Lessons Learned from CDS Implementation
- The need for coded data
- Pitfalls
- How CDSC will help



Robert Wood Johnson Medical Group

- Over 500 physicians
- 400,000 ambulatory visits annually
- 300,000 inpatient visits annually
- GE Centricity EMR – in process of deploying to 44 separate practices

Decision Support is often implicit

Flow sheets

Templates

Tobacco Use:

☒ current ☐ quit ☐ never

Year started: 1975

Cigarettes ☒ yes ☐ no Amt: 3

Cigars ☐ yes ☐ no Amt:

Smokeless ☐ yes ☐ no Amt: per day

Counseled to quit/cut down ☒ yes ☐ no

Passive smoke exp: ☐ yes ☒ no

Drug use: ☐ yes ☒ no

HIV high risk behavior: ☐ yes ☐ no

Caffeine use (drinks/day):

Flowsheet: Enterprise/UMG/GIM/UMG GIM Diabetes

	Date	Value
HGBA1C	12/05/2007	6.8
MONOFILAM LF	12/15/2007	normal
MONOFILAM RT	12/15/2007	normal
MICRALB24H U		
MICROALB URN		
MICRALB RANU	12/05/2007	4
MICROALB/CRE		
DIAB EYE EX	08/30/2007	Dr. Robert Smith
CREATININE	12/05/2007	1.4

Order sets

☐ **Diabetes (LC)**

☐ HEMOGLOBIN A1C 83036

☐ ASSAY, ALBUMIN, URINE, MICROABLUMIN, QUAN 82043

☐ **Lipid Mgm't (LC)**

☐ CREATINE KINASE, TOTAL, SERUM 82550

☐ HEPATIC FUNCTION PANEL 80076

☐ LIPID PANEL 80061



Data are needed to implement clinical decision support

- Diagnoses
- Medications
- Clinical observations
- Diagnostic tests
- Laboratory tests
- Preventive treatments

Data must be in coded format

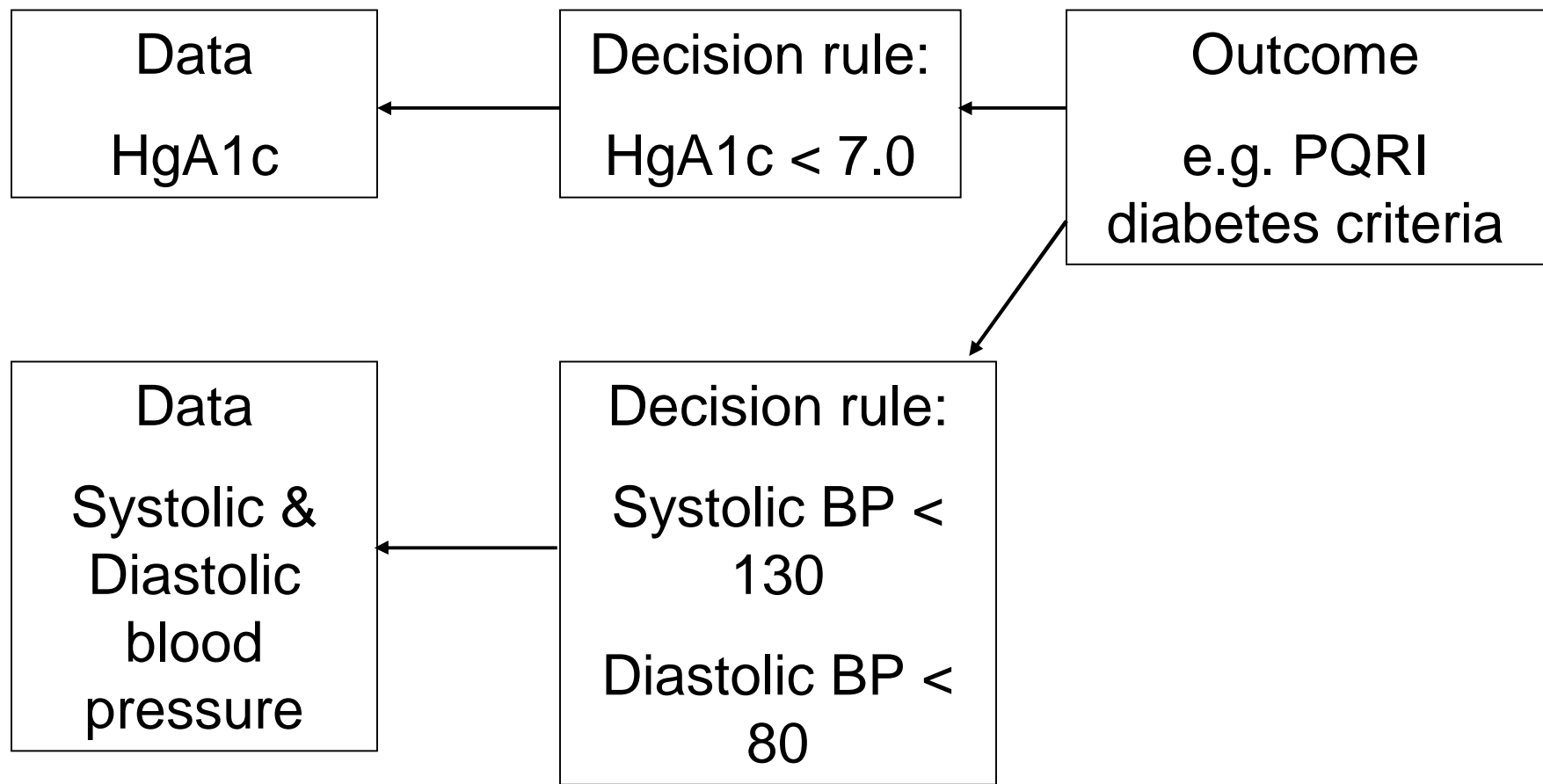
CDS is not a “field of dreams”

- You can't assume data will just magically appear...

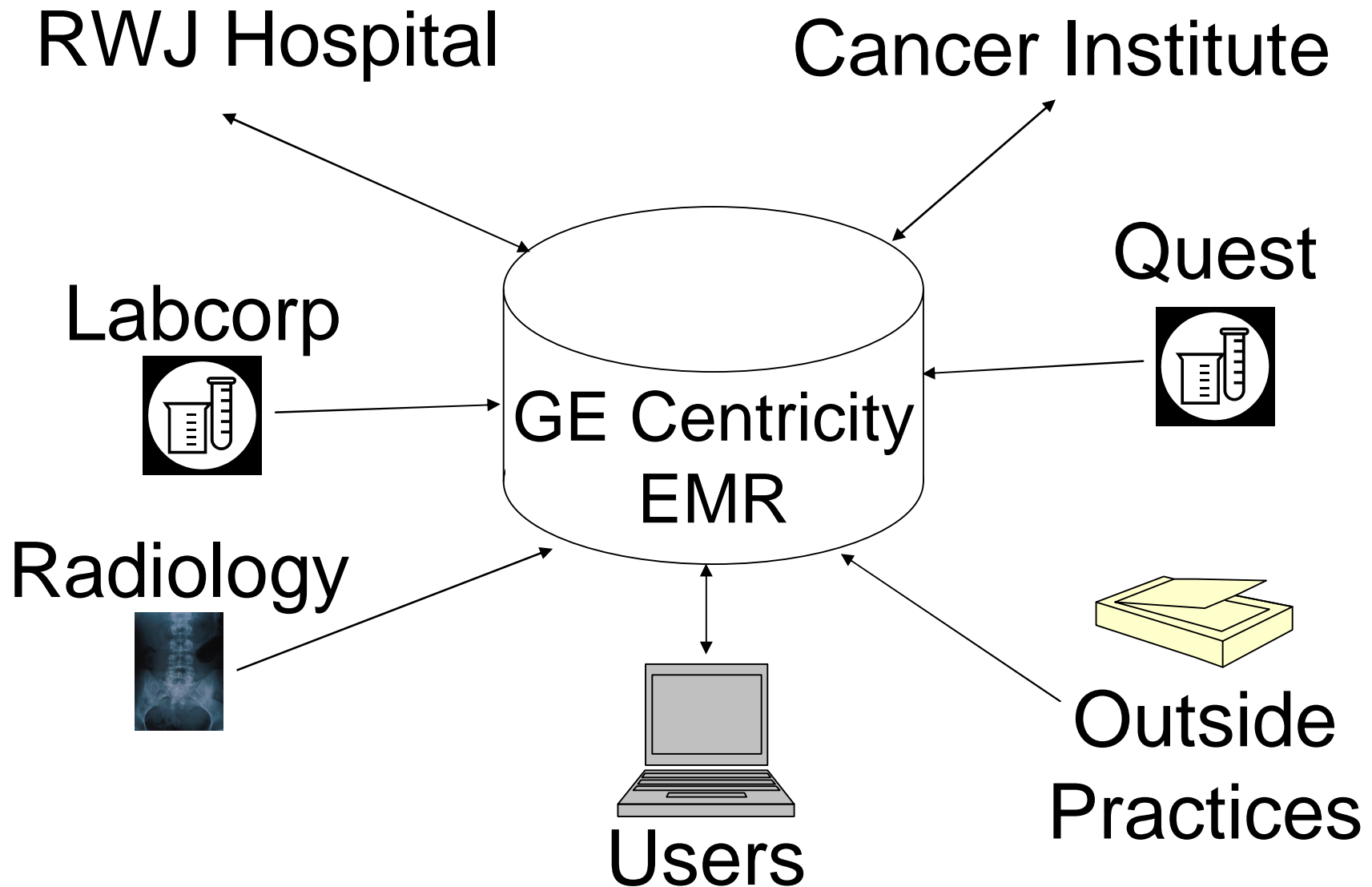


- If you build it, they won't necessarily come

Work backwards from outcomes to decision support to define data needed



Data sources



What to do about paper reports?

- Scanned images contain no data
- Link to flow sheet – unavoidable manual entry process

From Aculabs Run: 18 Feb 2009 04:43:44 PM EST Page 2 of 2

ACULABS INC
2 KENNEDY BLVD
SUITE 200
NEW BRUNSWICK, NJ 08901-2248
(732) 777-2288

RITA KHOURY MD
CLIA ID# 3101899710

Phys: **SONENBERG, FRANK MD MD** #104 Print: **217** DOB: Age: Sex: **F**
123 PATTERSON STREET
NEW BRUNSWICK, NJ 08901
(732) 777-2288
SONENBERG, FRANK MD MD ID# Race: O Page: 2

Accl: Call Date: 02/18/09 Recv Date: 02/18/09 Print Date: 02/18/09
Check Call Time: 02/18/09 Recv Time: 02/18/09 Print Time: 02/18/09
Flag reported on: Flag report date: 02/18/09

Test Name	Normal	Out of Range	Normal Range	Units
CHEMISTRY (Continued)				
HDL CHOLESTEROL	60.0	>0		mg/dL
These are the recommendations of the USCF (NCEP): < 40 --- Major risk for heart disease. > 60 --- Cardiovascular protective against heart disease.				
TRIGLYCERIDES	50	>100		mg/dL
These are the recommendations of the USCF (NCEP): 150 - 199 --- Borderline high. 200 - 499 --- High. ≥ 500 --- Very high.				
LDL CHOLESTEROL(CALC)		>100		mg/dL
These are the recommendations of the USCF (NCEP): 100 - 129 --- Near optimal/good. 130 - 159 --- Borderline high. 160 - 189 --- High. ≥ 190 --- Very high.				
VERY LOW DENSITY LIPOPROTEIN CHOLESTEROL RATIO	104	2.0	3.0	
THYROID FUNCTION TESTS				
THYROID STIMULATING HORMONE	3.12		0.004-5.00	μIU/mL
SPECIAL CHEMISTRIES				
GLYCOSYLATED HEMOGLOBIN (A1C)	6.0 H		4.0-5.9	PERCENT
Diabetes patients with HbA1c levels below 7% meet the goal of the American Diabetes Association. Therapeutic action is suggested at levels above 7%.				
MICROALBUMIN (RANDOM UR)	PENDING		0-29	mg/dL
MEDICAL DIRECTOR: KHOURY MD				
ACULABS Does not make any recommendations. Discuss results with Dr. R. P. Received To: Date:				

LDL CHOLESTEROL(CALC)

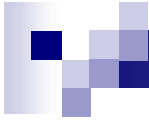
75.6

These are the recommendations
150 - 199 --- Borderline high.
200 - 499 --- High.
>500 --- Very high.

These are the recommendations
100 - 129 --- Near optimal/good.
130 - 159 --- Borderline high.
160 - 189 --- High.
>190 --- Very high.

VERY LOW DENSITY LIPOPROTEIN

104

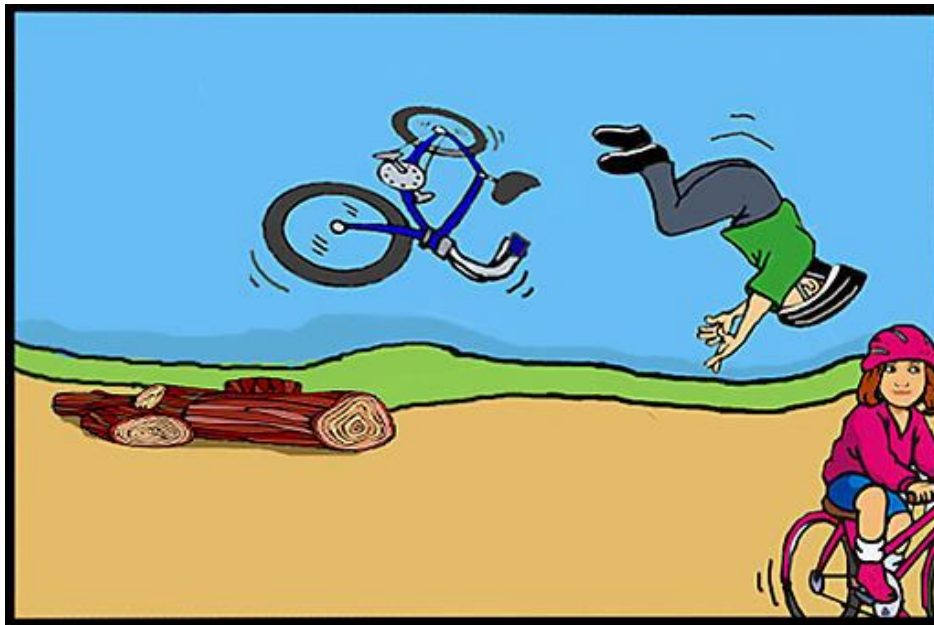


Data Capture Workflow

- Ensure that forms and templates capture necessary data
- Record data when/where it makes the most sense
- Maximize use of electronic data sources. A little effort can pay big dividends
- Coordinate data across practices

A Cautionary Tale

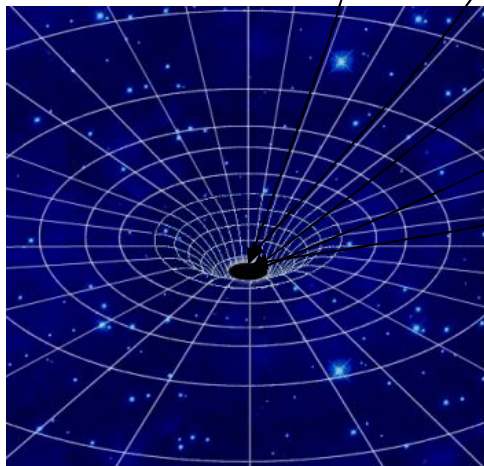
- Lack of specificity in ordering tests
- Interfaces that do not work together
- Failure to coordinate data across practices



Ordering the right test is key

Search by: description Search method: containing Search for: microalbumin Search

Type	Description ▲	Code
Test	Albumin Urine Microalbumin Quan	CPT-82043
Test	albumin urine microalbumin quan	CPT-82043
Test	Microalbumin	Test
Test	Microalbumin - urine	Test
Test	Microalbumin - 24 Hr Urine	Test
Test	MICROALBUMIN, RANDOM URINE	84822A
Test	Urine, Microalbumin	CPT-82044



Black Hole

Flowsheet: Enterprise/UMG/GIM/UMG GIM Diabetes

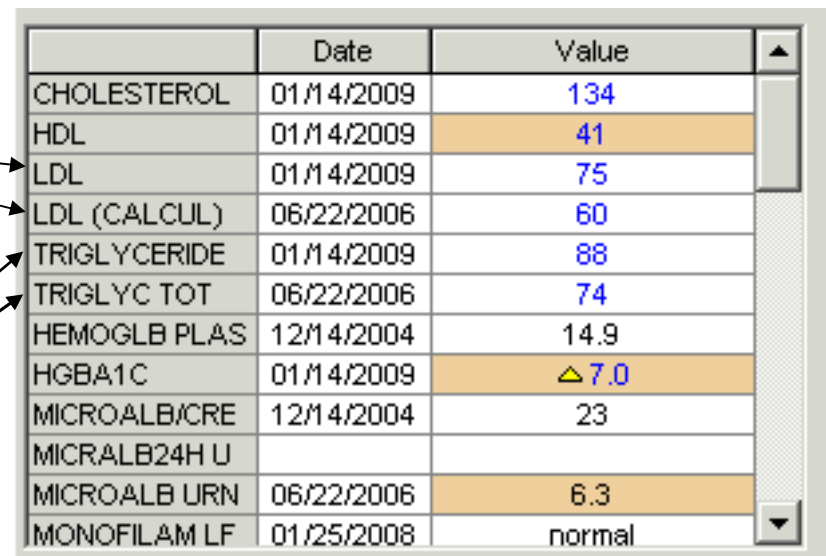
	Date	Value
HGBA1C	12/05/2007	6.8
MONOFILAM LF	12/15/2007	normal
MONOFILAM RT	12/15/2007	normal
MICRALB24H U		
MICROALB URN		
MICRALB RANU	12/05/2007	4
MICROALB/CRE		
DIAB EYE EX	08/30/2007	Dr. Robert Smith
CREATININE	12/05/2007	1.4

Data

Results must be mapped correctly

2 different LDL
variables

2 different TG
variables



The screenshot shows a table with three columns: Variable, Date, and Value. The table contains 13 rows of data. Two arrows from the text '2 different LDL variables' point to the 'LDL' and 'LDL (CALCUL)' rows. Two arrows from the text '2 different TG variables' point to the 'TRIGLYCERIDE' and 'TRIGLYC TOT' rows.

	Date	Value
CHOLESTEROL	01/14/2009	134
HDL	01/14/2009	41
LDL	01/14/2009	75
LDL (CALCUL)	06/22/2006	60
TRIGLYCERIDE	01/14/2009	88
TRIGLYC TOT	06/22/2006	74
HEMOGLB PLAS	12/14/2004	14.9
HGBA1C	01/14/2009	7.0
MICROALB/CRE	12/14/2004	23
MICRALB24H U		
MICROALB URN	06/22/2006	6.3
MONOFILAM LF	01/25/2008	normal

This can lead to errors in decision support



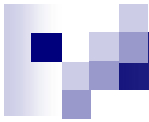
Collaboration and Governance

- Governance: buy-in from leadership
- Advisory Committee
- Collaborative teams



How CDSC will help

- Forum for collaborating to develop best practices for decision support
- Mechanism for sharing of CDS content in a platform independent format
- Decrease the need for customization
- Minimize duplication of effort across organizations
- Providers can focus more on workflow and less on technical details



Closing remarks

- CDS is critical to success, yet more difficult than expected to accomplish
- Knowledge centrally managed and readily available to implementers of HIT should help increase the value of HIT investments
- Collaborative knowledge engineering is more effective than each group implementing HIT doing it themselves
- Successful use of CDS requires careful attention to how clinical data are requested, collected and organized.



Thank you!

- **Blackford Middleton**
bmiddleton1@partners.org
- **Dean Sittig**
Dean.F.Sittig@uth.tmc.edu
- **Frank Sonnenberg**
sonnenbe@umdnj.edu

AHRQ contract HHSA290200810010



HARVARD
MEDICAL SCHOOL



FOUNDED BY BRIGHAM AND WOMEN'S HOSPITAL
AND MASSACHUSETTS GENERAL HOSPITAL