

# Harvard Business School: Innovation Lab

## *Clinical Decision Support Consortium: Business Modeling Workshop*

Lynda Applegate, PhD  
Gordon Jones  
Blackford Middleton, MD, MPH, MSc

May 22, 2012

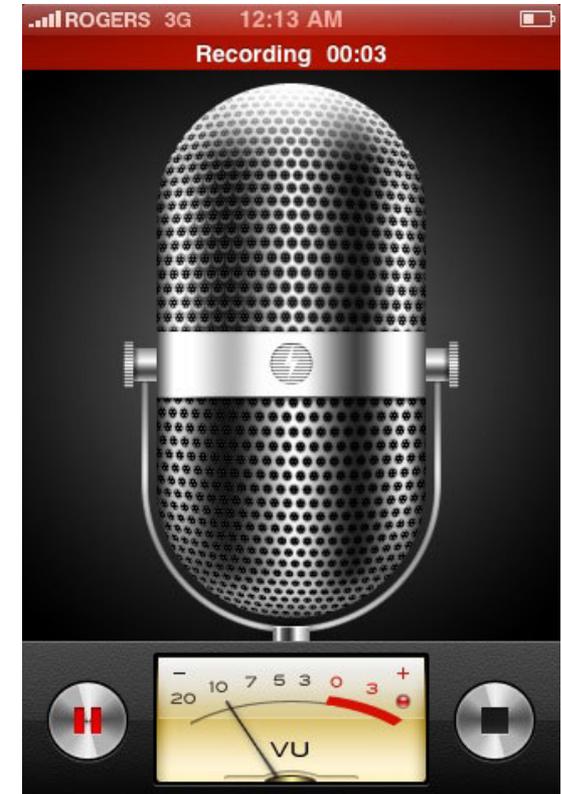


Harvard innovation lab



# Recording Information

- This workshop session will be recorded for further internal, analytic purposes only.
- The record will not be published or distributed.
- Please let us know now if you have any objections to being recorded.



# High Level Goals of the Session

1. Understand opportunity for clinical decision support in healthcare, and the CDS Consortium
2. Achieve High level conceptual framework for a business model
3. Engagement of the stakeholder groups and understanding of roles, value proposition, and what needs to happen inside each stakeholder group to make the vision a reality
4. Next steps for how to get started on the journey with key milestones

# Agenda for the Day

Time	(m)	Topic	Speaker
7:30a	30'	<b>Continental breakfast</b>	
8:00	15'	<b>Welcome and Introductions</b> <ul style="list-style-type: none"> <li>• Design of the Day</li> <li>• Around the room introductions</li> <li>• Goals for the Day</li> </ul>	Gordon Jones Lynda Applegate Blackford Middleton
8:15	60'	<b>CDSC Overview / Sustainable Business Model</b> <ul style="list-style-type: none"> <li>• Clinical Decision Support in Healthcare</li> <li>• CDSC Products, Services and Value proposition</li> <li>• Research and Development Roadmap. Looking beyond research funding</li> </ul>	Blackford
9:15	60'	<b>Amazon Case Study</b> <ul style="list-style-type: none"> <li>• Defining a business model and building an ecosystem</li> <li>• Creating a platform for sustained value creation (stakeholder engagement, resources)               <ul style="list-style-type: none"> <li>▪ Managing business model evolution</li> <li>▪ Leading the innovation lifecycle</li> </ul> </li> </ul>	Lynda
10:15	15'	<b>Break</b>	
10:30	90'	<b>Facilitated Session - Building a Business Model for CDSC</b> <ul style="list-style-type: none"> <li>• Who are the stakeholders? What are their expectations?</li> <li>• What offerings could be provided by CDSC to which stakeholders?</li> <li>• What offerings do the stakeholders provide to CDSC?</li> <li>• What value does each stakeholder create and what value do they receive?</li> <li>• What resources will be required to make the model work?</li> <li>• Where do the resources come from? Are there alternative models?</li> </ul>	Lynda
12:00p	45'	<b>Lunch Break</b>	

# Agenda for the Day (cont.)

Time	(m)	Topic	Speaker
12:45	45'	<b>Break Out #1 – Building the CDSC Business Model</b> <ul style="list-style-type: none"> <li>• What is (are) the key value proposition(s) to each stakeholder?</li> <li>• What changes are required to execute on the model?</li> <li>• What resources are needed?</li> </ul>	By stakeholder group: Work at your tables – Please identify a Team Representative to report back
1:30	45'	<b>Report outs</b> from break out 1 (3' for each table) and Debrief/Discussion	Team Representatives and Lynda
2:15	15'	<b>Break</b>	
2:30	45'	<b>Break Out #2 – Engaging in the CDSC Sustainability Model</b> <ul style="list-style-type: none"> <li>• What do you need to do to participate in the CDSC Consortium? Obstacles?</li> <li>• What needs to happen you your organizations to participate in CDSC?</li> <li>• How do you derive value from the CDSC?</li> <li>• What are the next steps we need to take?</li> </ul>	Mixed stakeholder groups: Work at your tables - Please identify a Team Representative to report back
3:15	45'	<b>Report outs</b> from break out 2 (3' for each table) and Debrief / Discussion	Team Representatives and Lynda
4:00	60'	<b>Facilitated Discussion - Key lessons and next steps</b> <ul style="list-style-type: none"> <li>• Review Key Messages</li> <li>• Define core value proposition for CDSC</li> <li>• Next Steps and follow up</li> </ul>	Lynda, Blackford
5:00		<b>Sessions end for the day</b>	

# CDS Consortium: Toward a Sustainable Business Model

Blackford Middleton, MD, MPH, MSc  
*CDSC Principal Investigator*

May 22, 2012



# Agenda

1. Motivation for Clinical Decision Support in Healthcare
2. CDS Consortium Overview
3. Value proposition for CDS Consortium Products and Services

## SPECIAL ARTICLE

## The Quality of Health Care Delivered to Adults in the United States

Elizabeth A. McGlynn, Ph.D., Steven M. Asch, M.D., M.P.H., John Adams, Ph.D.,  
Joan Keesey, B.A., Jennifer Hicks, M.P.H., Ph.D., Alison DeCristofaro, M.P.H.,  
and Eve A. Kerr, M.D., M.P.H.

ADA Guideline

Compliance

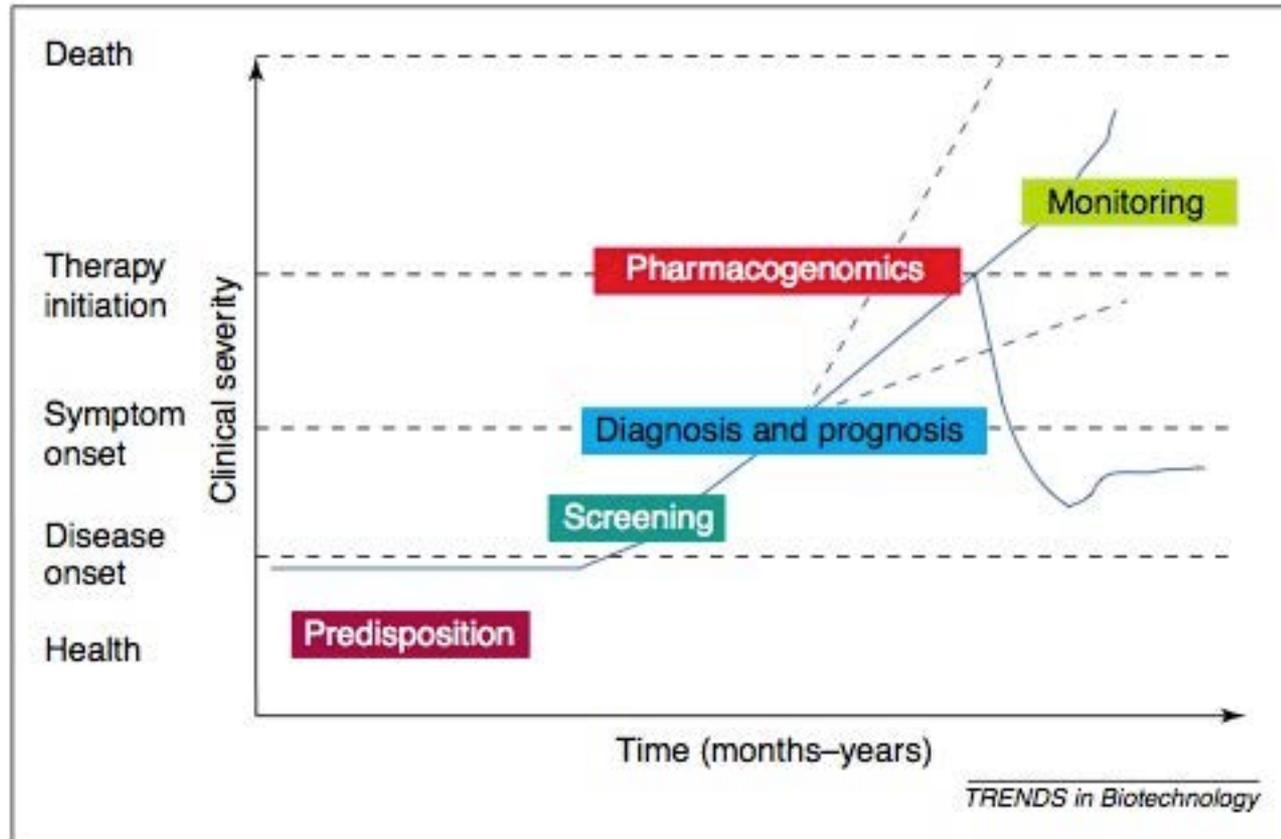
**On average, Patients receive 54.9%  
of recommended care**

least annually and during pregnancy.	23.62%
Dilated and comprehensive <b>eye exam</b> at diagnosis of Type 2 and annually.	14.21%

# What is Clinical Decision Support?

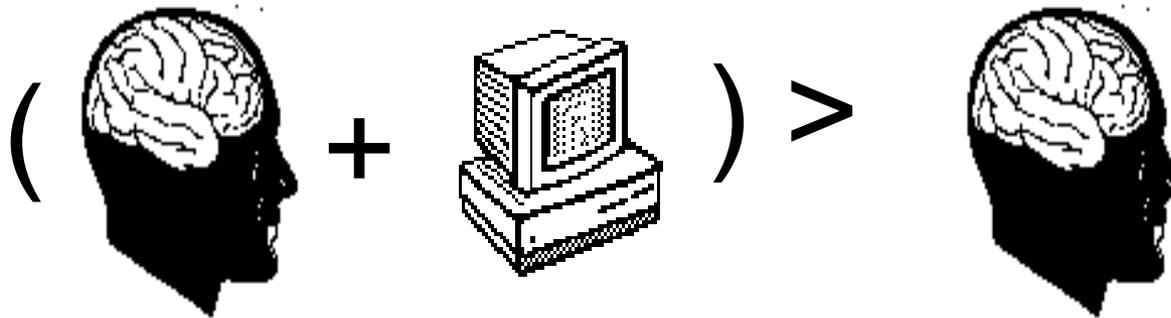
- Now...
  - Reminders/alerts, order-sets, templates, flow sheets, infobuttons
  - If-then (else) rules
- And in the Future...
  - Personalized, Predictive, Precision, Proactive
  - Ubiquitous...
  - Life-long care pathways

# New care paradigm



Ginsburg G. Personalized medicine: revolutionizing drug discovery and patient care. *TRENDS in Biotechnology* 2001.

# The Biomedical Informatics Fundamental Theorem



*Friedman, C. P. (2009). A “fundamental theorem” of biomedical informatics  
JAMIA, 16(2), 169–170.*

# CITL Health IT Value Assessments

**Net US could save \$150B with HIT adoption, or approximately 7.5% of US Healthcare Expenditure**

- The Value of Ambulatory Computerized Order Entry (ACPOE)
  - \$44B US nationally; \$29K per provider, per year
- The Value of HealthCare Information Exchange and Interoperability (HIEI)
  - \$78B/yr
- The Value of IT-enabled Chronic Diabetes Management (ITDM)
  - \$8.3B Disease Registries; Advanced EHR \$17B
- The Value of Physician-Physician Tele-healthcare
  - \$19B
- The Value of Personal Health Records
  - \$20B

# The future is already here... it is just not evenly distributed\* ...



Regenstrief Institute



Brigham & Women's Hospital /  
Partners HealthCare



VA Healthcare System



Intermountain Healthcare

...a 2006 systematic review in *Annals of Internal Medicine* found that 25% of all studies on CDS took place at the above four institutions.

# Barriers to CDS

**Current adoption of advanced clinical decision support is limited due to a variety of reasons, including:**

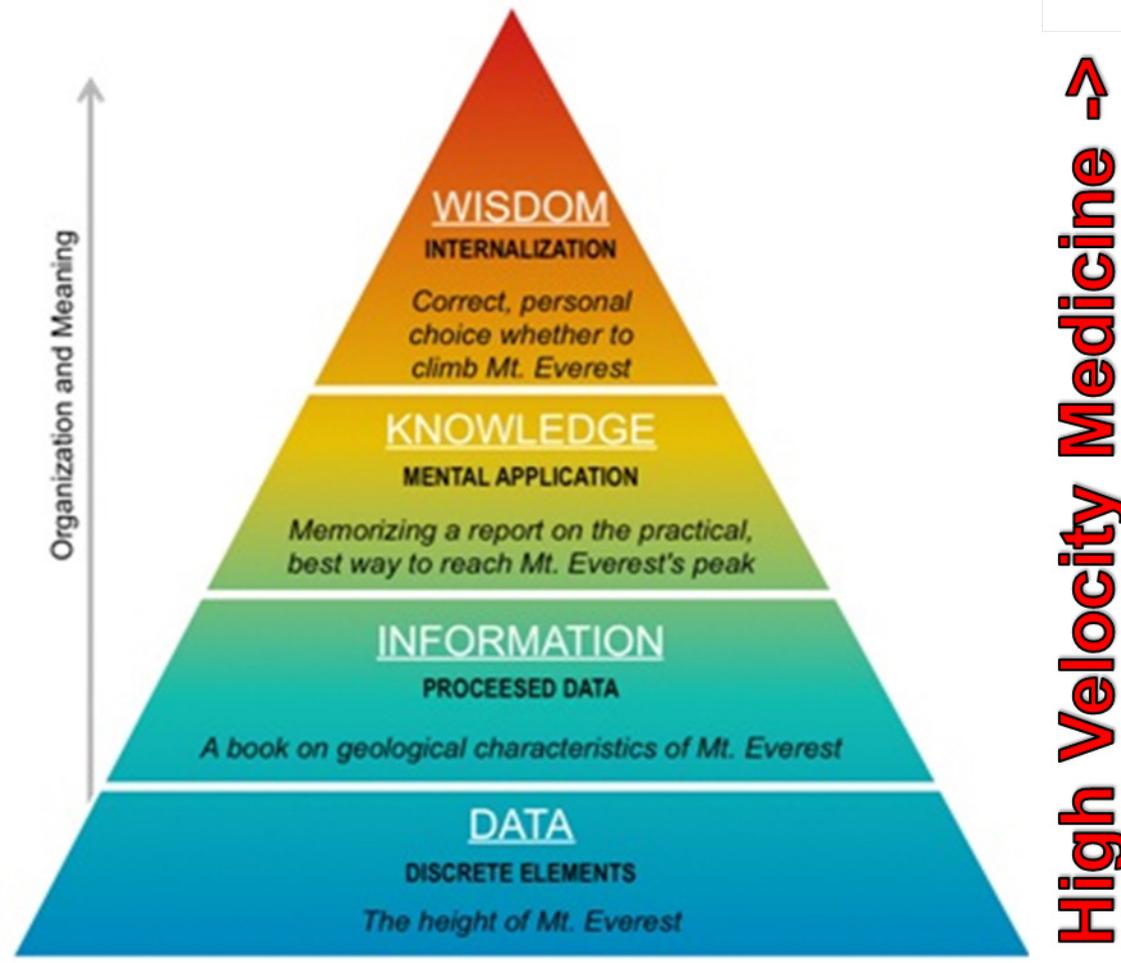
- ✓ – Limited implementation of EMR, CPOE, PHR, etc.
- Difficulty developing CDS from clinical practice guidelines.
- ✓ – Lack of standards for data exchange
- ✓ – Lack of standards for knowledge representation.
- ✓ – Functional limitations of CDS in commercial EHRs.
- ✓ – Challenges in integrating CDS into the clinical workflow.
- ✓ – Absence of a central knowledge resource.
- ✓ – A limited understanding of organizational and cultural issues relating to clinical decision support and governance

# A Perfect Storm for CDS?



- Living in a data, and knowledge, tsunami
- Lots of clinical data going online
- Lots of genetic data coming
- Lots of personal/social data coming
- Lots of geospatial data coming
- Inexorable rise of Healthcare costs...
- Healthcare Reform Part I – HIT and payment reform
- Healthcare Reform Part II – cost containment, value not volume

# The DIKW Pyramid



# Problem and Opportunity Statements

- Problem
  - Most doctors, hospitals, and health systems will not have the capacity to perform knowledge engineering for CDS
  - Thus they fail to maximize the value of their HIT
- Opportunity
  - The best proven knowledge artifacts from leading centers can be shared and monetized
  - Collaboration affords expansion of the knowledgebase
- The win-win-win
  - Sharing, crowd sourcing, and optimization (learning) amplifies the knowledge investment for all participants

# The CDS Consortium's 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.

# What is the CDS Consortium?

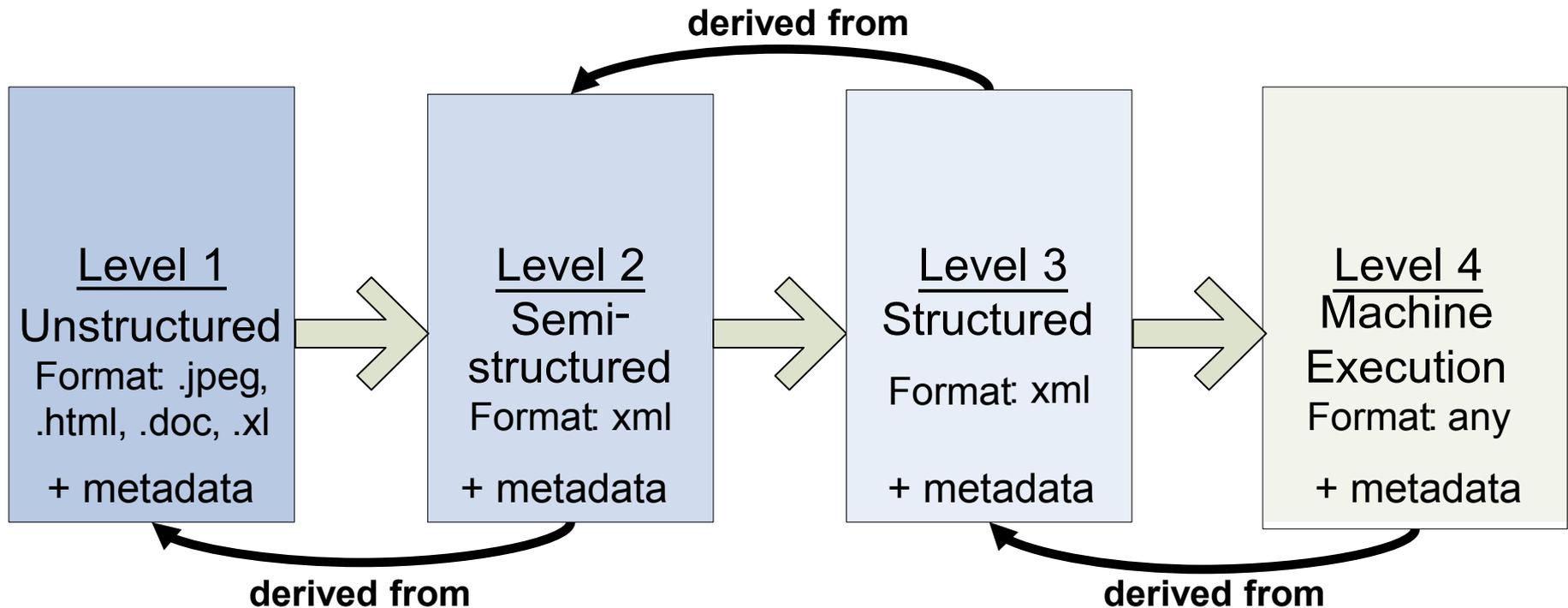
- Multi-stakeholder collaboration dedicated to the accelerated translation of knowledge into practice
  - Innovation Partners
    - Health IT, Content, or Platform Players
  - Academic Trial Sites
  - Collaborators
  - Observers



# CDSC Products, Services, Activities

- Cloud-based CDS services (prototypes, pilots, clinical trial support, production support)
- CDS Core Content: Value Sets, Clinical State Definitions, and Interventions library
- Collaboration and knowledge engineering platform
- *In vivo* R&D lab
- Education and consulting (courses, site assessments and recommendations)
  - Best practices for KM and CDS
  - Organization and governance
  - Policy and standards

# Knowledge Translation and Specification: Four-Layer Model



Boxwala AA, et al. A multi-layered framework for disseminating knowledge for computer-based decision support. *JAMIA* 2011;18 Suppl 1:i132–9.

# Knowledge Sharing Portal

Knowledge Management Portal

Keyword Search:

**Search Criteria**

**Content Type...**

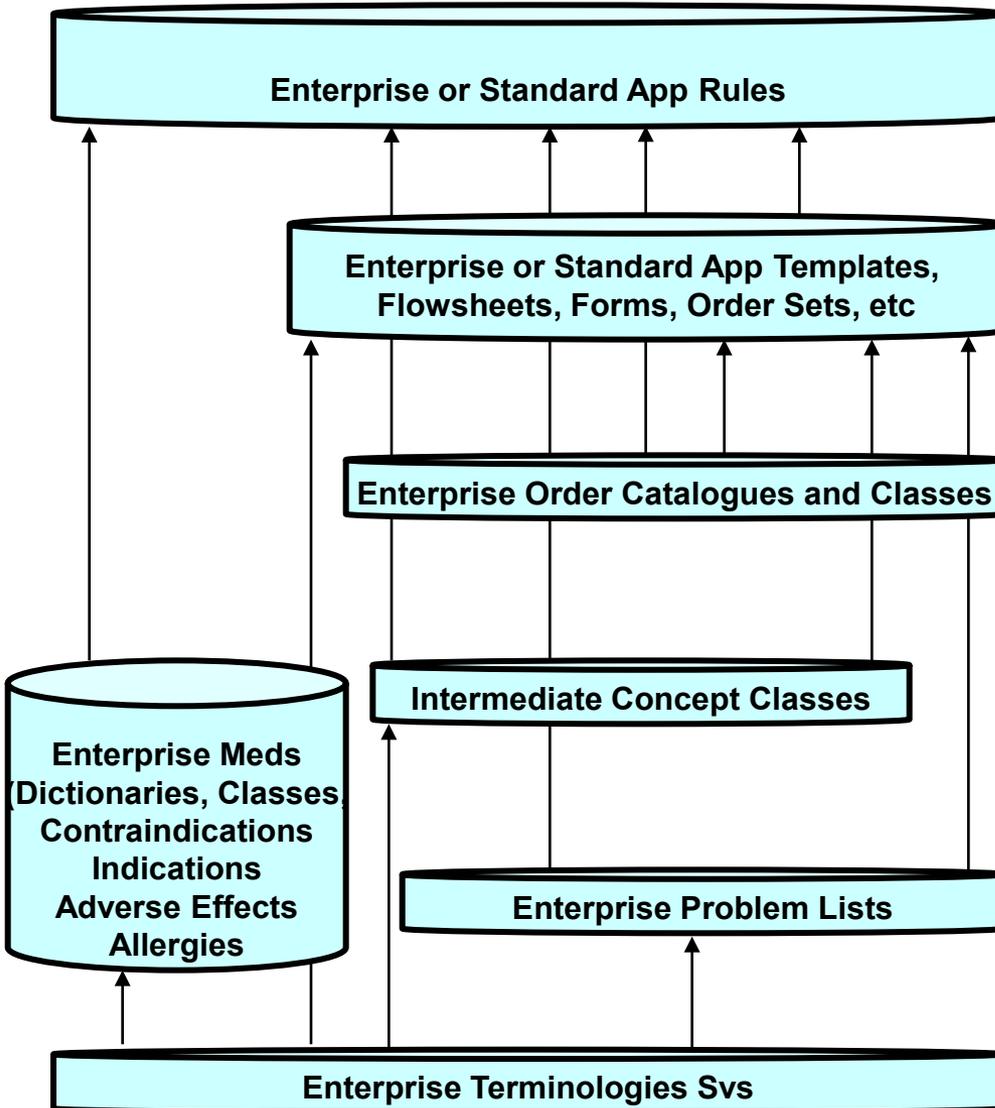
**Specialty**

The screenshot shows a search interface with several filter sections:

- Specialty:** A dropdown menu with options: All Clinical Disciplines, Anesthesiology/Perioperative Medicine, Behavioral Medicine, General Surgery, GI Colorectal Surgery, Hematology and Oncology, Infectious Disease, Nephrology, Neurology, Neurosurgery, Newborn/Neonatology, Obstetrics and Gynecology, Ophthalmology.
- Entity:** A dropdown menu with options: All Entities, ...es - PCI, ... Expert dosing.
- Patient Safety:** A dropdown menu with options: Alerts and Notification, All Patient Safety, Consequent Order/Lab Display.
- Disease Management:** A dropdown menu with options: ADHD, All Disease Management, Asthma.
- Age Group:** A dropdown menu with options: Adult, All Patient Age Groups, Geriatric.
- Application:** A dropdown menu with options: All Applications, BICS Event Monitor, BICS Order Entry.

At the bottom right, there is a button labeled "Submit Filter Search".

# Knowledge is Like a Cake-Stack



If Braden Score < 11  
 → Low Air Loss Bed, etc  
 If Abn Vasc Exam → Vascular Consult

Collections of Concepts –  
 Braden Assessment → Full Nursing Assessment  
 Collections of Orders – Order Sets

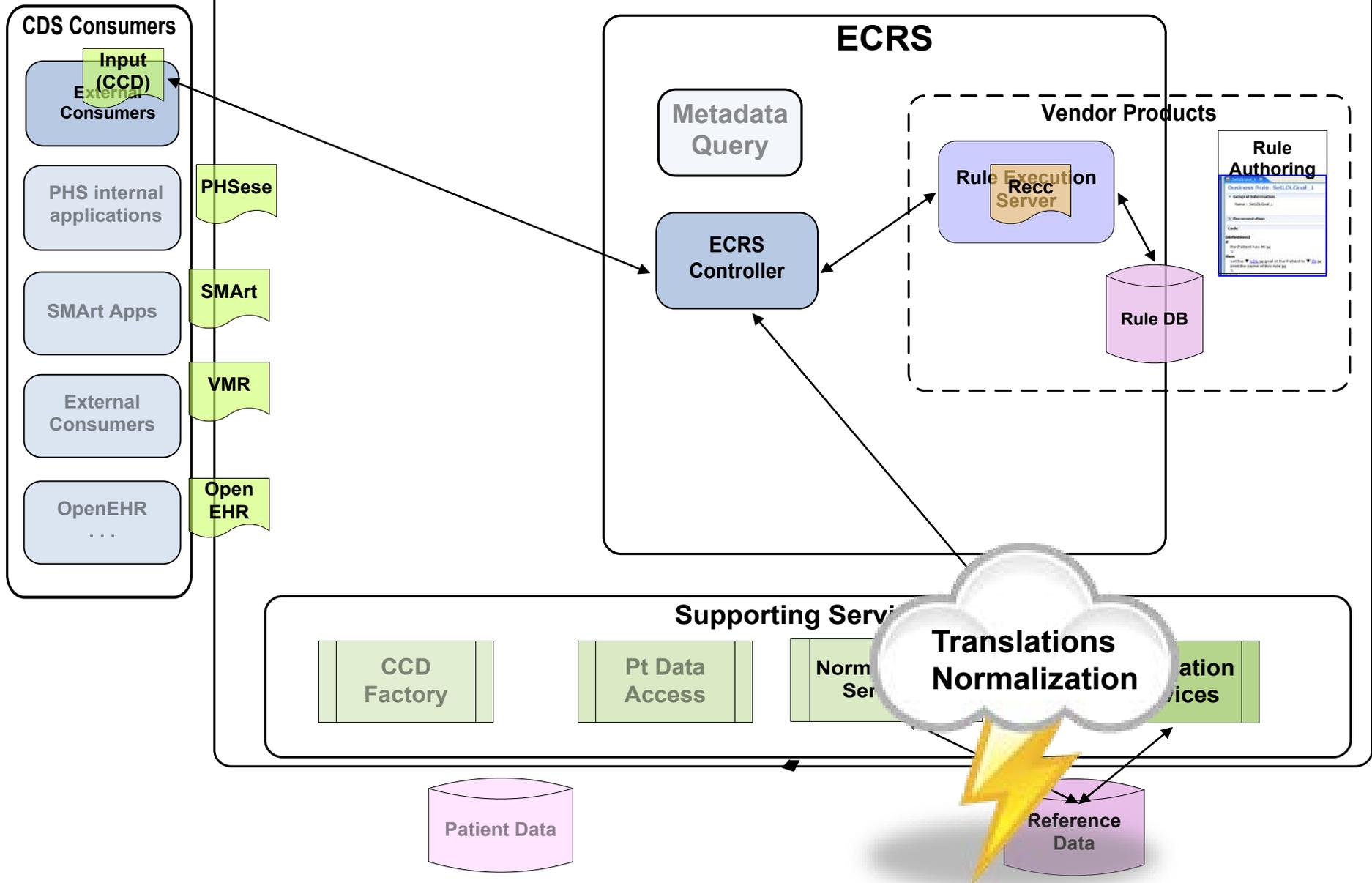
Med Orders, Special Beds, Topicals  
 Consults -Neurology or Vascular

Dorsalis Pedis Pulse → Present or Absent  
 Posterior Tibial Pulse → Present or Absent  
 Color → Pink, Pale, or Rubor on Dependency  
 Ankle Brachial Index → range 0.7 → 1.0

Taxonomies of Problems such as  
 CAD, Diabetes, Peripheral Vascular DZ

Taxonomies of Terms such as  
 Skin Exam, Decub Ulcer, Pulse, Skin Turgor

# Enterprise CDS Framework



## Examples

The following are examples of ECRS providing decision support within the ambulatory medical records of two members of the CDS Consortium.

### Partners HealthCare EHR

**Reminders**

- Patient 65 yrs or older, due for Pneumovax.
- Patient 50 years old or greater, recommend influenza vaccination.
- Pt is overdue for colonoscopy (rec: a 10 years). Famhbc indicates average risk for colorectal cancer.
- Diabetic patient is overdue for HgbA1c measurement (recommended every 6 months).
- Diabetic Patient with renal disease, consider starting angiotensin-converting enzyme inhibitor (ACE-I).
- Patient has CAD or equivalent, consider starting anti-platelet therapy, but potential contraindications exist.
- Patient is overdue for blood pressure assessment (recommended yearly).

**Reminders**

- Patient 65yrs or older, due for Pneumovax
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- Patient has CAD or equivalent, consider starting anti-platelet therapy, but potential contraindications exist
- Patient is overdue for blood pressure assessment (recommended yearly)

### Regenstrief Medical Record System®

**AMRADERMO, TESTER**

Diabetic patient is overdue for HgbA1c measurement (recommended every 6 months)

Order HgbA1c

DISCLAIMER: This decision support reminder may be inaccurate or based on incomplete data. The clinician should always use proper judgement while providing care of the patient, and should consult with the appropriate research study. It is based on a Statewide Preventive Services Task Force. For any questions please contact \_\_\_\_\_ (email: \_\_\_\_\_@...)

Patient	Subject
AMRADERMO, TESTER	Diabetic patient is overdue for HgbA1c measurement (recommended every 6months)
<b>Sender</b>	USER, CARERULE
<b>Viewed</b>	
<b>Can Delete</b>	TRUE
<b>Priority</b>	Low
<b>Info only:</b>	TRUE
<b>Can forward:</b>	TRUE
<b>Message</b>	Diabetic patient is overdue for HgbA1c measurement (recommended every 6months) Order HgbA1c DISCLAIMER This decision support reminder may be inaccurate or incomplete data. The Clinician should always use proper judgment while providing care of the patient, and should consult with the appropriate research study. It is based on a Statewide Preventive Services Task Force. For any questions please contact _____ (email: _____@...)

# CDS Reminder Dashboard

Report: CDS Dashboard - Reminder Designer View  
 Report Run For: EINBINDER, JONATHAN SETH, M.D., M.B.A.

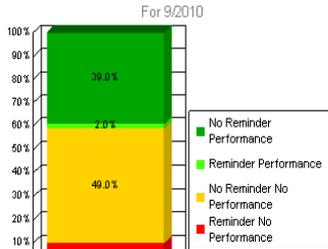
Single Month View For Month: 9/2010

Condition: Diabetes  
 Measure: Diabetes, HbA1C completed in the past 6 months

Reminder: Patient with DM overdue for HbA1C (rec: q 6 months)

Date Range: 9/2010

### Reminder Performance By Category



Total Acknowledged	151
NNTR - 1 X per month	5.90
NNTR - Total Reminders	16.44
Patients Where Reminder Displayed	10,722
Total Count Displays	29,880
Pts with Reminders & Perf	1,818
Pts with Reminders & no Perf	8,904
Pts with no reminders and no perf	43,940
Pts with no reminders and perf	34,975
Performing Total	36,793
N	89,637

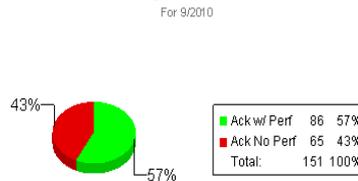
### Reminder Performance



### Reminder Acknowledgement

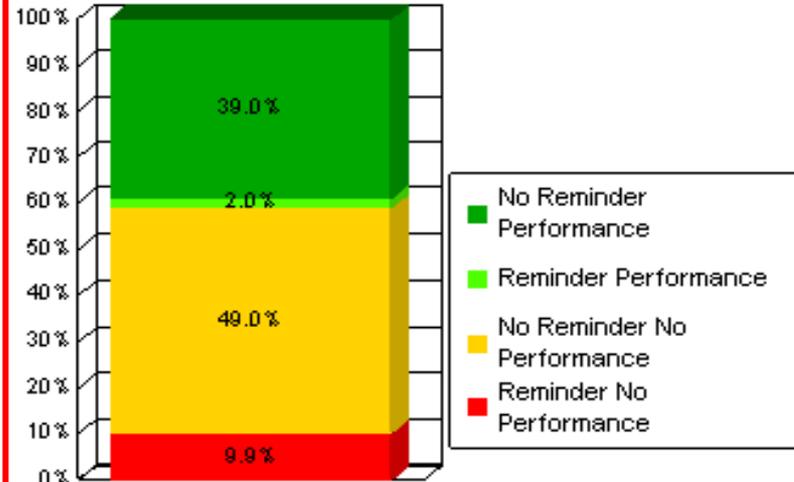


### Acknowledgement Performance



## Reminder Performance By Category

For 9/2010

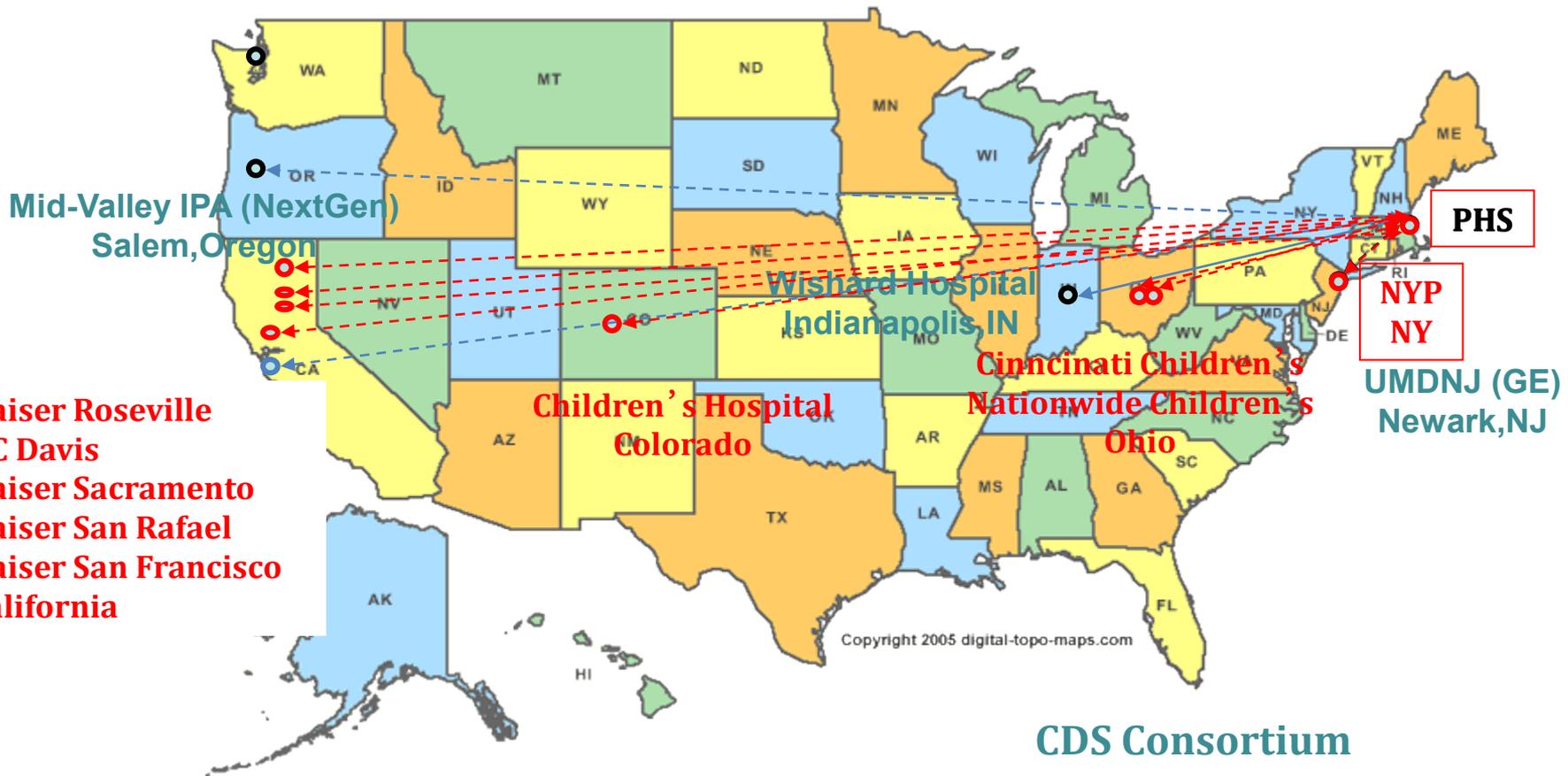


Total patients	89,637
Performing total	36,793
Patients where reminders displayed	10,722
Total count of displays	29,880

**NNTR 5.9**

# CDS Consortium Demonstrations

*Toward a National Knowledge Sharing Service*



CDS Consortium

PECARN TBI CDS

# Core Value Propositions

- KM Portal – a library of proven content
  - Vetted/tested CDS knowledge content
  - Standardized and normalized for sharing in human readable, or executable forms
  - Basic, and cutting edge content
- Cloud-based CDS Services
  - Standards-based, scalable knowledge transactions
  - Performance feedback loop, continuous learning
- R&D in a pre-competitive collaboration environment

# Service Models

3d Party Service Provider

EMR Factory

CITY CLINIC



CDSC KM Portal



CDSC Inside-Vendor



CDSC Inside-3d PSP



CDSC Direct



CDSC Inside-Hybrid



# Summary Cost Estimates

- Implementing a CDSC Rule-Set
  - represents between 30 clinical rules and may include 200+ new terminology concepts
- Two Components
  - *Knowledge Management process*
    - \$60,000 initial year 1, \$30,000 ongoing
  - *Implementing CDS Services @100,000 transactions*
    - \$67,000 initial year 1, \$50,000 ongoing
- Total
  - Year 1: \$1.27/knowledge transaction
  - Ongoing: \$0.80/knowledge transaction

*Presented numbers are NON-BINDING and only illustrative*

# Benefit-Cost Ratio

- What is the value of a single CDS rule?
  - TBD (it depends on performance of rule)
- CITL and BWH Studies suggest benefit of approximately \$30K per doctor per year with advanced CDS-enabled HIT
  - Value of EMR savings potential:
    - \$6/patient visit, CDS \$3/pt visit
  - If 2 rules fired -> saving \$1.50 per transaction
- **Goal: cost/transaction < savings/transaction**

# CDSC Potential Customers

1. Healthcare service providers
  - Large institutions (hospitals and systems)
  - Small institutions (community)
2. Payers
3. EHR and content vendors



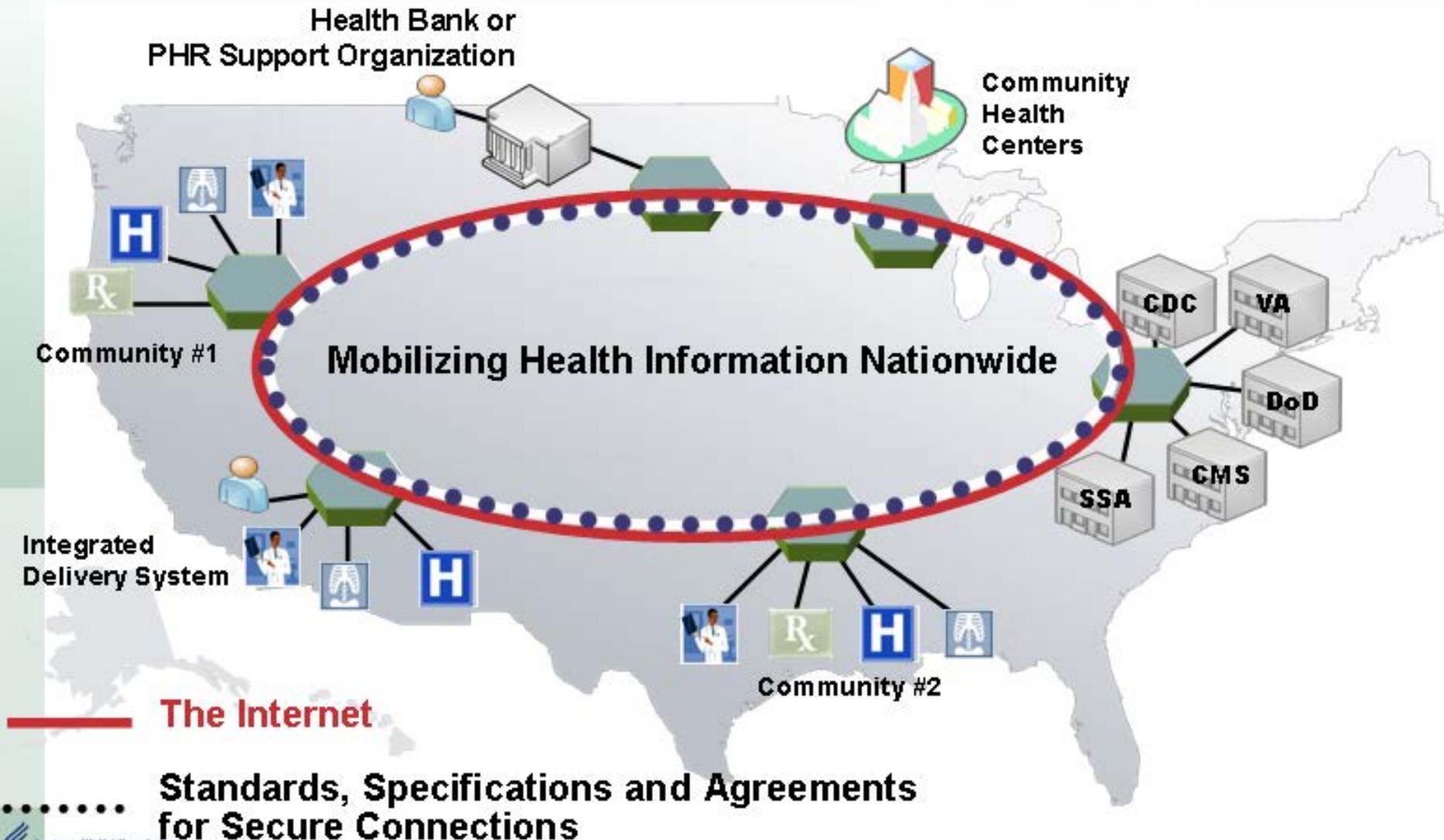
## Other Stakeholders

1. HIT community (guidelines developers, specialty societies)
2. Government and non-profit foundations, fulfilling their mission and supporting CDS requirements

# CDS Consortium: Phase II Development Roadmap

- Expand content offerings
  - Meaningful use, chronic disease, preventive care services
  - Immunizations (adult and pediatric)
  - Pharmacogenomics
- Expand services offerings
  - More vendors, plug-and-play
  - SMARt platform
  - Stateful CDS
  - CDS Analytics (P4 Medicine)

# The Nationwide Health Information Network



# Key Collaborators

**Principal Investigator:** Blackford Middleton, MD, MPH, MSc

**CDSC Team Leads:**

**Research Management Team:** Lana Tsurikova, MSc, MA

**KMLA/Recommendations Teams:** Dean F. Sittig, PhD

**Knowledge Translation and Specification Team:** Aziz Boxwala, MD, PhD

**KM Portal Team:** Tonya Hongsermeier, MD, MBA

**CDS Services Team:** Howard Goldberg, MD

**CDS Demonstrations Team:** Adam Wright, PhD

**CDS Dashboards Team:** Jonathan Einbinder, MD

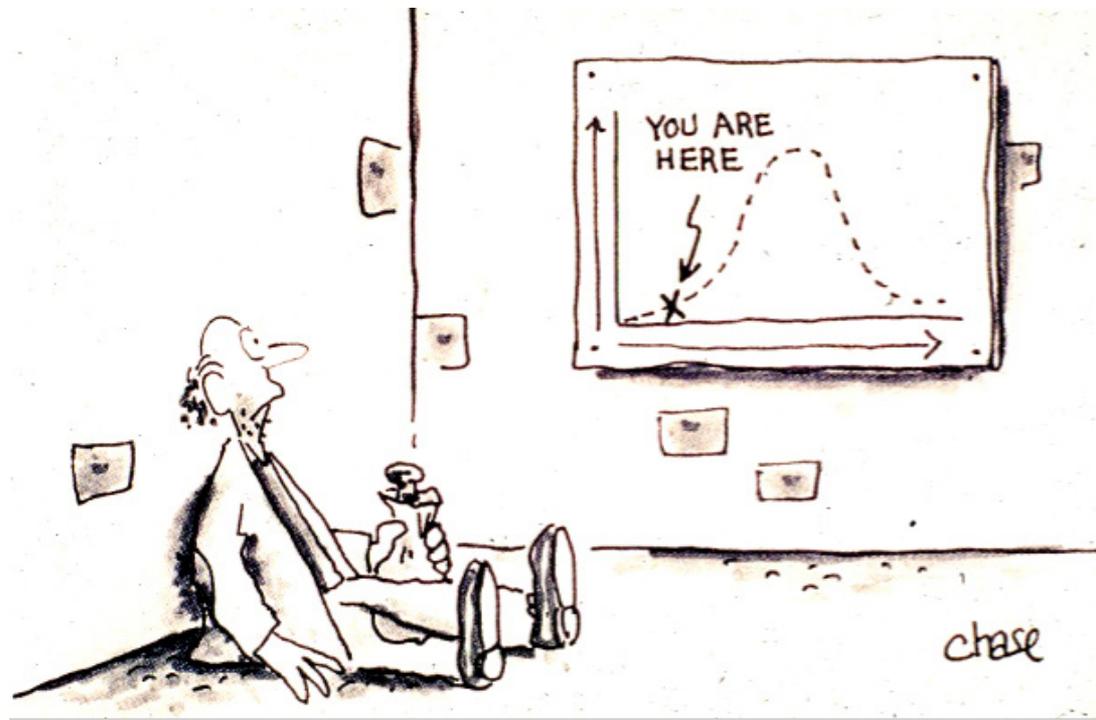
**CDS Evaluation Team:** David Bates, MD, MSc

**Content Governance Committee:** Saverio Maviglia, MD, MSc

*“I conclude that though the individual physician is not perfectible, the system of care is, and that the computer will play a major part in the perfection of future care systems.”*

*Clem McDonald, MD NEJM 1976*

# Where are we?



*Thank you!*

**Blackford Middleton, MD**  
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