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- The record will not be published or distributed.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

<table>
<thead>
<tr>
<th>Time</th>
<th>(m)</th>
<th>Topic</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30a</td>
<td>30’</td>
<td><strong>Continental breakfast</strong></td>
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<tr>
<td>8:00</td>
<td>15’</td>
<td><strong>Welcome and Introductions</strong></td>
<td>Gordon Jones, Lynda Applegate, Blackford Middleton</td>
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<td></td>
<td></td>
<td>• Design of the Day</td>
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<tr>
<td></td>
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<td>• Around the room introductions</td>
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<td>• Goals for the Day</td>
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<tr>
<td>8:15</td>
<td>60’</td>
<td><strong>CDSC Overview / Sustainable Business Model</strong></td>
<td>Blackford</td>
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<tr>
<td></td>
<td></td>
<td>• Clinical Decision Support in Healthcare</td>
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<td></td>
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<td>• CDSC Products, Services and Value proposition</td>
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<td>• Research and Development Roadmap. Looking beyond research funding</td>
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<td>9:15</td>
<td>60’</td>
<td><strong>Amazon Case Study</strong></td>
<td>Lynda</td>
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<tr>
<td></td>
<td></td>
<td>• Defining a business model and building an ecosystem</td>
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<td>• Creating a platform for sustained value creation</td>
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<td>(stakeholder engagement, resources)</td>
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<td>• Managing business model evolution</td>
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<td>• Leading the innovation lifecycle</td>
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<tr>
<td>10:15</td>
<td>15’</td>
<td><strong>Break</strong></td>
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<tr>
<td>10:30</td>
<td>90’</td>
<td><strong>Facilitated Session - Building a Business Model for CDSC</strong></td>
<td>Lynda</td>
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<tr>
<td></td>
<td></td>
<td>• Who are the stakeholders? What are their expectations?</td>
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<td></td>
<td>• What offerings could be provided by CDSC to which stakeholders?</td>
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<td></td>
<td>• What offerings do the stakeholders provide to CDSC?</td>
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<td></td>
<td></td>
<td>• What value does each stakeholder create and what value do they receive?</td>
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<td></td>
<td>• What resources will be required to make the model work?</td>
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<td></td>
<td>• Where do the resources come from? Are there alternative models?</td>
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<td>12:00p</td>
<td>45’</td>
<td><strong>Lunch Break</strong></td>
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<tr>
<td>Time</td>
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<td>Topic</td>
<td>Speaker</td>
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<td>12:45</td>
<td>45'</td>
<td><strong>Break Out #1 – Building the CDSC Business Model</strong></td>
<td>By stakeholder group: Work at your tables – Please identify a Team Representative to report back</td>
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<tr>
<td></td>
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<td>• What is (are) the key value proposition(s) to each stakeholder?</td>
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<td></td>
<td></td>
<td>• What changes are required to execute on the model?</td>
<td></td>
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<td></td>
<td></td>
<td>• What resources are needed?</td>
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<tr>
<td>1:30</td>
<td>45'</td>
<td><strong>Report outs</strong> from break out 1 (3’ for each table) and Debrief/Discussion</td>
<td>Team Representatives and Lynda</td>
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<tr>
<td>2:15</td>
<td>15’</td>
<td><strong>Break</strong></td>
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<tr>
<td>2:30</td>
<td>45'</td>
<td><strong>Break Out #2 – Engaging in the CDSC Sustainability Model</strong></td>
<td>Mixed stakeholder groups: Work at your tables - Please identify a Team Representative to report back</td>
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<tr>
<td></td>
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<td>• What do you need to do to participate in the CDSC Consortium?</td>
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<td>Obstacles?</td>
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<td></td>
<td>• What needs to happen you your organizations to participate in CDSC?</td>
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<td></td>
<td>• How do you derive value from the CDSC?</td>
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<td>• What are the next steps we need to take?</td>
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<tr>
<td>3:15</td>
<td>45'</td>
<td><strong>Report outs</strong> from break out 2 (3’ for each table) and Debrief / Discussion</td>
<td>Team Representatives and Lynda</td>
</tr>
<tr>
<td>4:00</td>
<td>60’</td>
<td><strong>Facilitated Discussion - Key lessons and next steps</strong></td>
<td>Lynda, Blackford</td>
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<tr>
<td></td>
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<td>• Review Key Messages</td>
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<td></td>
<td>• Define core value proposition for CDSC</td>
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<td></td>
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<td>• Next Steps and follow up</td>
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<tr>
<td>5:00</td>
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<td><strong>Sessions end for the day</strong></td>
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</table>
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
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.

<table>
<thead>
<tr>
<th>ADA Guideline</th>
<th>Compliance</th>
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</thead>
<tbody>
<tr>
<td><strong>On average, Patients receive 54.9% of recommended care</strong></td>
<td></td>
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<tr>
<td>Least annually and during pregnancy.</td>
<td>23.62%</td>
</tr>
<tr>
<td>Dilated and comprehensive <strong>eye exam</strong> at diagnosis of Type 2 and annually.</td>
<td>14.21%</td>
</tr>
</tbody>
</table>

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

The Biomedical Informatics Fundamental Theorem

\[(\text{brain} + \text{computer}) > \text{brain}\]

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

www.partners.org/cird
The future is already here... it is just not evenly distributed*...

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


*William F. Gibson The Economist, Dec. 4, 2003
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

High Velocity Medicine -

Organization and Meaning

Wisdom
Internalization
Correct, personal choice whether to climb Mt. Everest

Knowledge
Mental Application
Memorizing a report on the practical, best way to reach Mt. Everest's peak

Information
Processed Data
A book on geological characteristics of Mt. Everest

Data
Discrete Elements
The height of Mt. Everest
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.

AHRQ contract HHSA290200810010  http://www.partners.org/cird/cdsc/
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

Level 1
Unstructured
Format: .jpeg, .html, .doc, .xl
+ metadata

Level 2
Semi-structured
Format: xml
+ metadata

Level 3
Structured
Format: xml
+ metadata

Level 4
Machine Execution
Format: any
+ metadata

Knowledge Sharing Portal

Search Criteria

Content Type...

Specialty
Knowledge is Like a Cake-Stack

Enterprise or Standard App Rules

Enterprise or Standard App Templates, Flowsheets, Forms, Order Sets, etc

Enterprise Order Catalogues and Classes

Intermediate Concept Classes

Enterprise Meds Dictionaries, Classes
Contraindications
Indications
Adverse Effects
Allergies

Enterprise Terminologies Svcs

- 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

CDS Consumers
- Input (CCD)
- External Consumers
- PHS internal applications
- SMART Apps
- VMR
- External Consumers
- OpenEHR 

Supporting Services
- CCD Factory
- Pt Data Access
- Normalization Services

Translations and Normalization

Vendor Products
- Rule Execution Server
- Rule DB

ECRS
- Metadata Query
- SMART Apps
- OpenEHR

External Consumers
- PHSese
- SMART
- VMR

OpenEHR

Reference Data
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

Regenstrief Medical Record System®
CDS Reminder Dashboard

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

Mid-Valley IPA (NextGen)
Salem, Oregon

PHS
Newark, NJ

UMDNJ (GE)
Newark, NJ

CDS Consortium
PECARN TBI CDS

Wishard Hospital
Indianapolis, IN

Mid-Valley IPA (NextGen)
Salem, Oregon

Kaiser Roseville
UC Davis
Kaiser Sacramento
Kaiser San Rafael
Kaiser San Francisco
California

Cincinnati Children’s Hospital
Nationwide Children’s Hospital
Ohio

Children’s Hospital Colorado

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
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)
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

Blackford Middleton, MD
bmiddleton1@partners.org

Where are we?

Thank you!