From Guidelines to Clinical Decision Support: a Unified Approach to Translating and Implementing Knowledge

AMIA 2012 Fall Symposium, Chicago, IL

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  Director, Knowledge Management & Mobilization, Univ. of Utah
- **Blackford Middleton, MD, MPH, MSc**
  Director, Clinical Informatics R&D, Partners HealthCare
- **Jacob Reider, MD**
  Acting Chief Medical Officer, Office of the National Coordinator for Health IT (ONC)
- **Doug Rosendale, DO, FACOS, FACS**
  Senior Physician Advisor, Clinical Informatics, Office of Health Information, Veterans Health Administration
- **Richard Shiffman, MD, MCIS**
  Associate Director, Yale Center for Medical Informatics

Introductions and Lineup

- Doug Rosendale, DO, FACOS, FACS (Moderator)
  - Senior Physician Advisor, Clinical Informatics, Office of Health Information, Veterans Health Administration, Washington, D.C.
- Richard Shiffman, MD, MCIS
  - Professor and Associate Director, Yale Center for Medical Informatics
  - P.I., GLIDES
- Kensaku Kawamoto, MD, PhD
  - Director, Knowledge Management & Mobilization, Univ. of Utah
  - P.I., OpenCDS
- Blackford Middleton, MD, MPH, MSc
  - Director, Clinical Informatics R&D, Partners HealthCare
  - P.I., CDS Consortium
- Jacob Reider, MD
  - Acting Chief Medical Officer, Office of the National Coordinator (ONC)
  - HHS/ONC perspective

Setting the Stage: WHY Clinical Decision Support (CDS)?

- Knowledge is Power – how do we harness information and knowledge to improve care?
- Health Complexity and Information Overload
- Various Potential Modalities
  - Alerts and reminders, Infobuttons, documentation templates, order sets, etc.
- Computational Science
- Learning Cycle of Knowledge Improvement
- Challenges
  - Including lack of unified model for CDS

Achieving Health IT Adoption and Effective Use: Approaches to Knowledge Sharing from the *CDS Consortium*

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Partners Healthcare System – Harvard Medical School
AMIA Fall Symposium, Nov. 4-7, 2012
Chicago, IL

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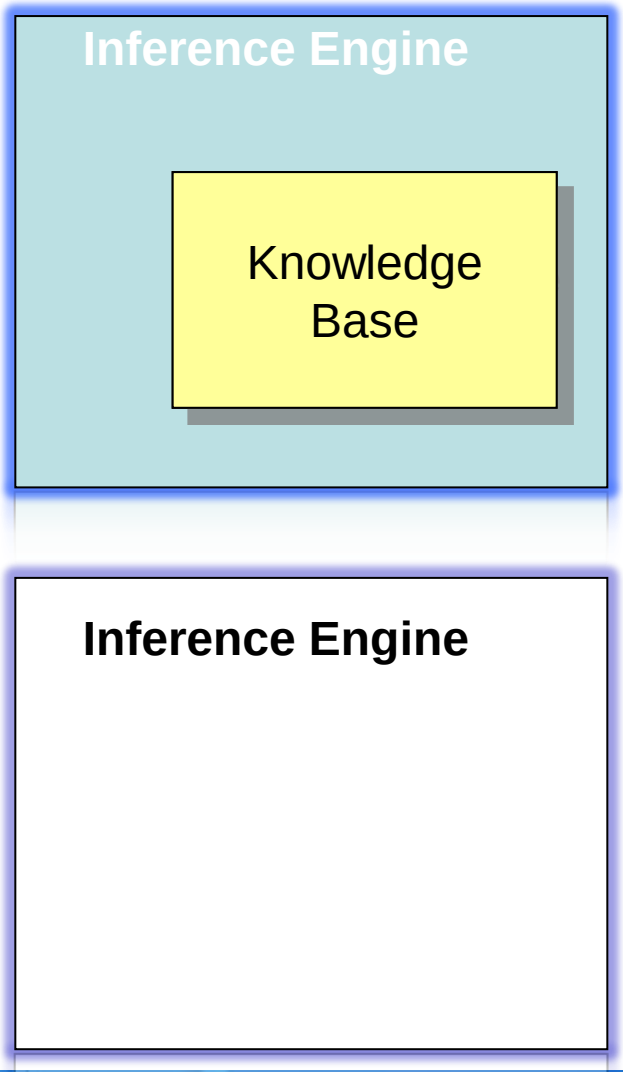
Inference Methods Used in Expert Systems

- Algorithmic
- Statistical
- Pattern Matching
- Rule-based (Heuristic)
- Fuzzy sets
- Neural nets
- Bayesian
- TBD…



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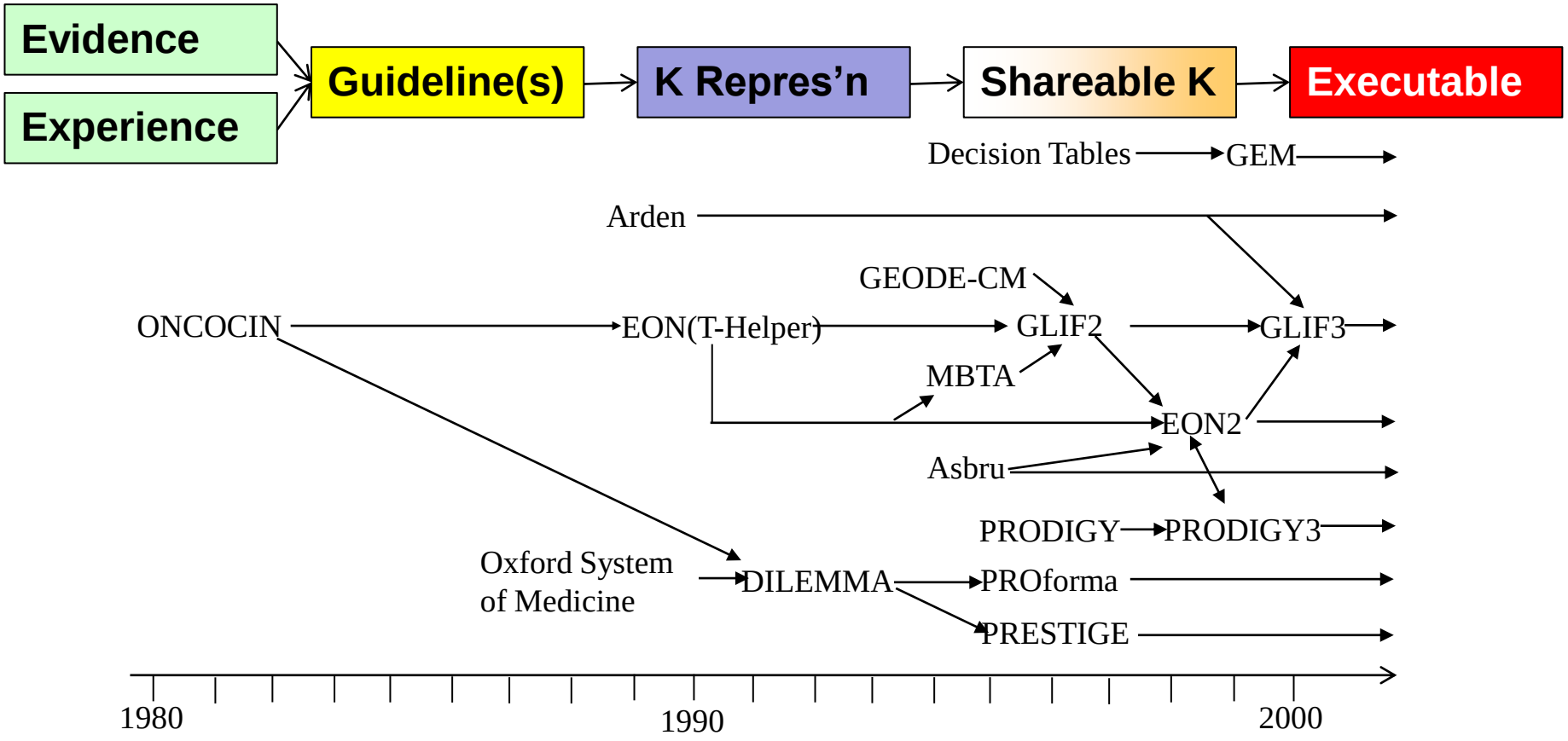
Knowledge Translation and Specification



P. L. Elkin, M. Peleg, R. Lacson, E. Bernstam, S. Tu, A. Boxwala, R. Greenes, & E. H. Shortliffe. Toward Standardization of Electronic Guidelines. *MD Computing* 17(6):39-44, 2000

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A perfect storm for Clinical Decision Support?

- Lots of clinical data going online
- Lots of genetic data coming
- Lots of personal/social data coming
- Lots of geospacial data coming
- More data exchange and interoperability
- Inexorable rise of Healthcare costs…
- Healthcare Reform

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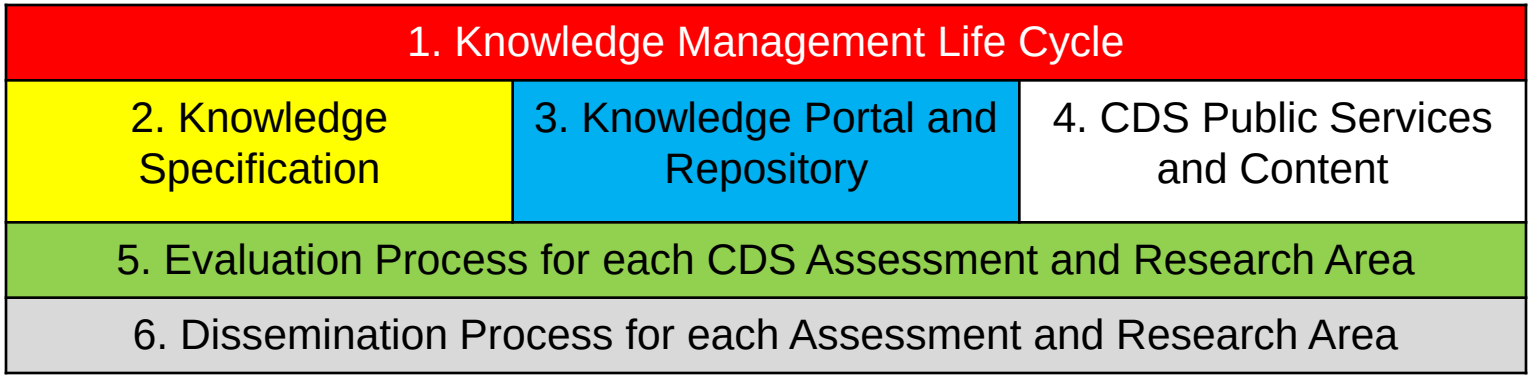
CDS Consortium: Goal and Significance

- **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.

- **Significance:** The CDS Consortium will carry out a variety of activities to improve knowledge about decision support, with the ultimate goal of supporting and enabling widespread sharing and adoption of clinical decision support.



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Clinical Decision Support Consortium

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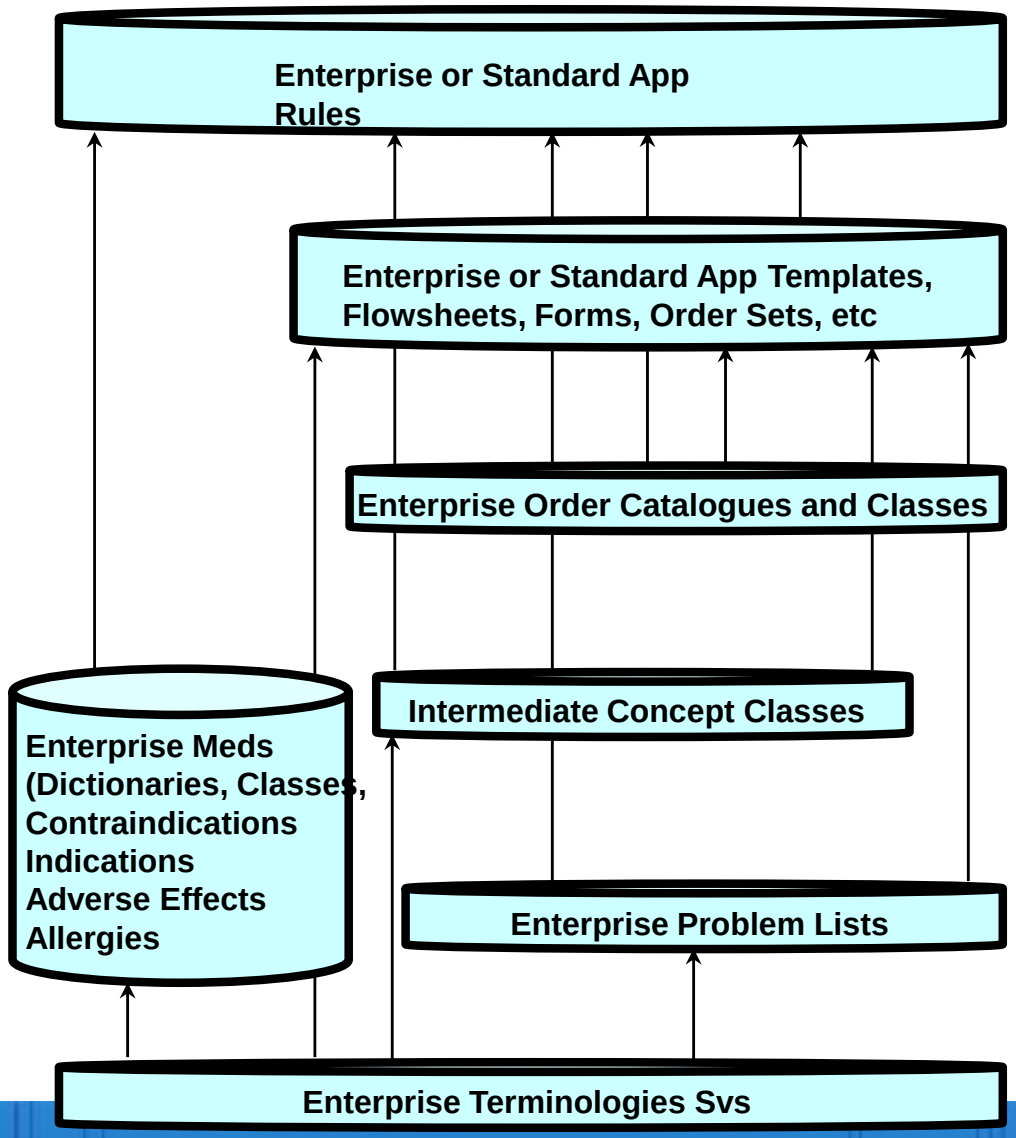
Knowledge is Like a Cake-Stack



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

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

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

Dorsalis Pedis Pulseà Present or Absent
Posterior Tibial Pulse à Present or Absent
Colorà Pink, Pale, or Rubor on Dependency
Ankle Brachial Index à range 0.7à1.0

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

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

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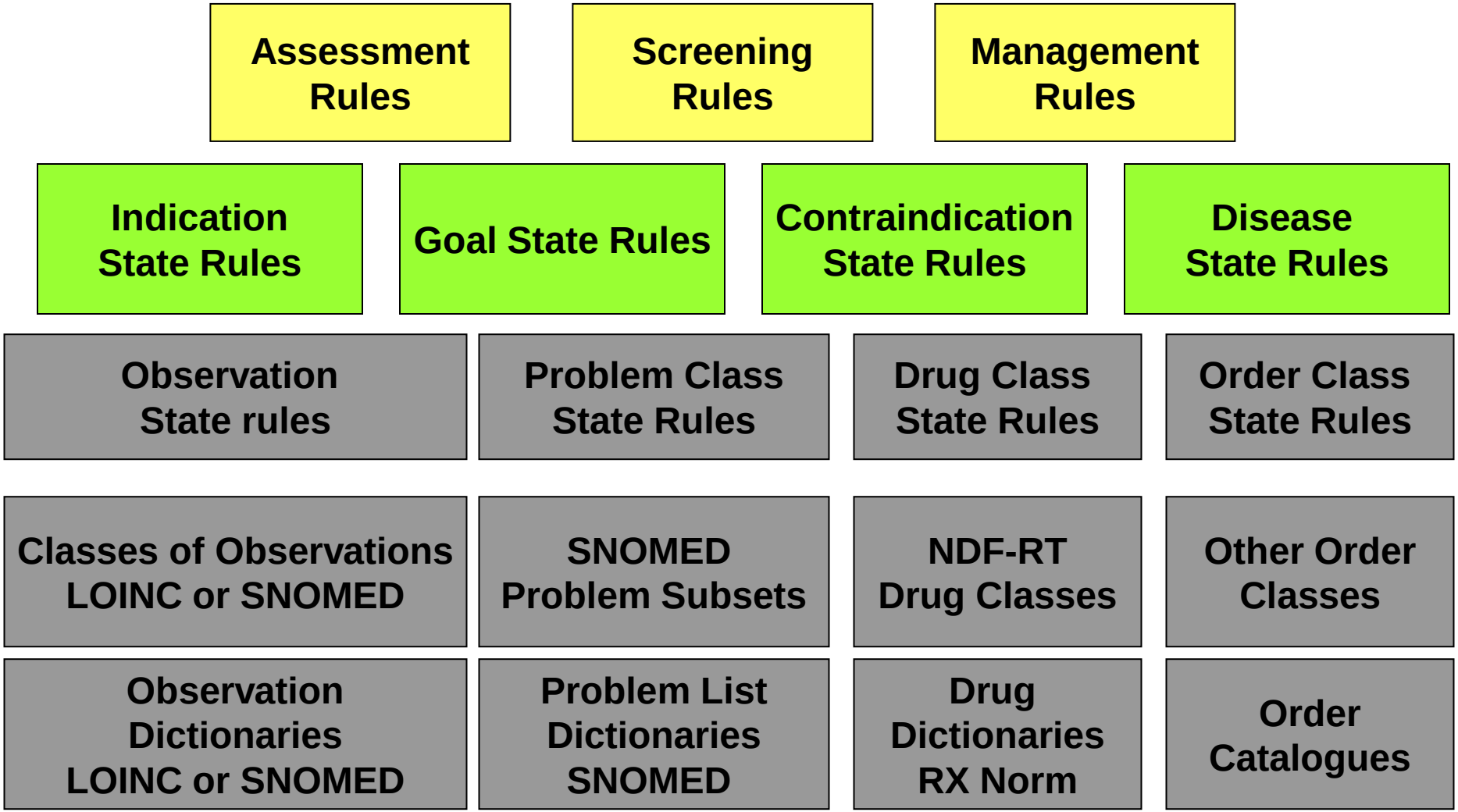
Building Blocks For Rule Modularity and Reusability



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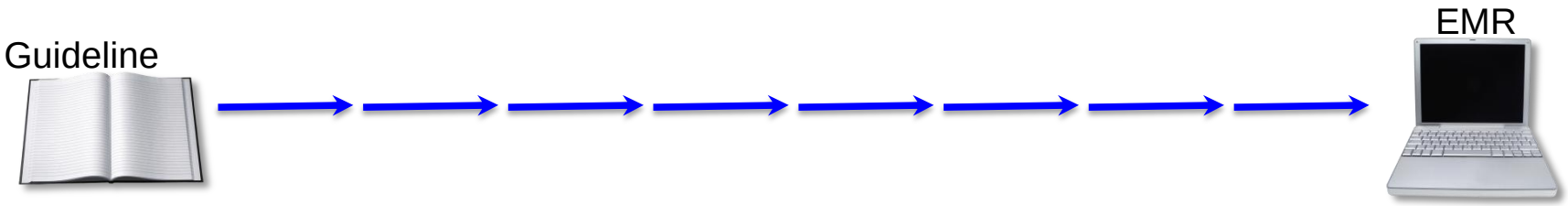
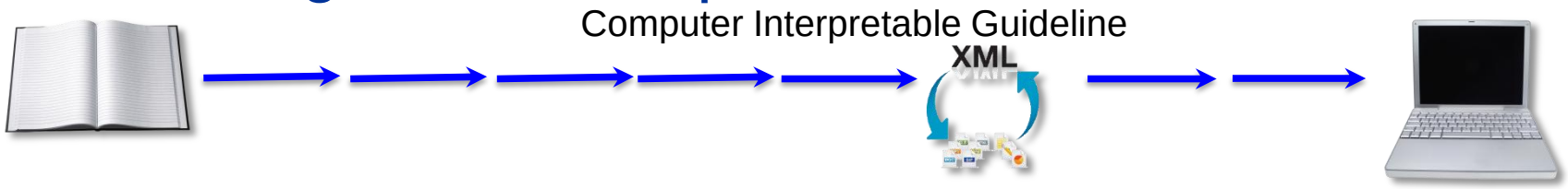
Three Models to Accelerate Knowledge -> Practice

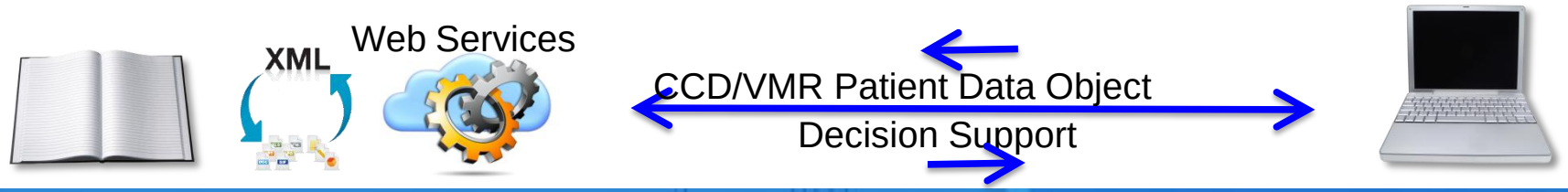
- Current paper-based approach



- Knowledge artifact import into EMR



- Cloud-based clinical decision support services



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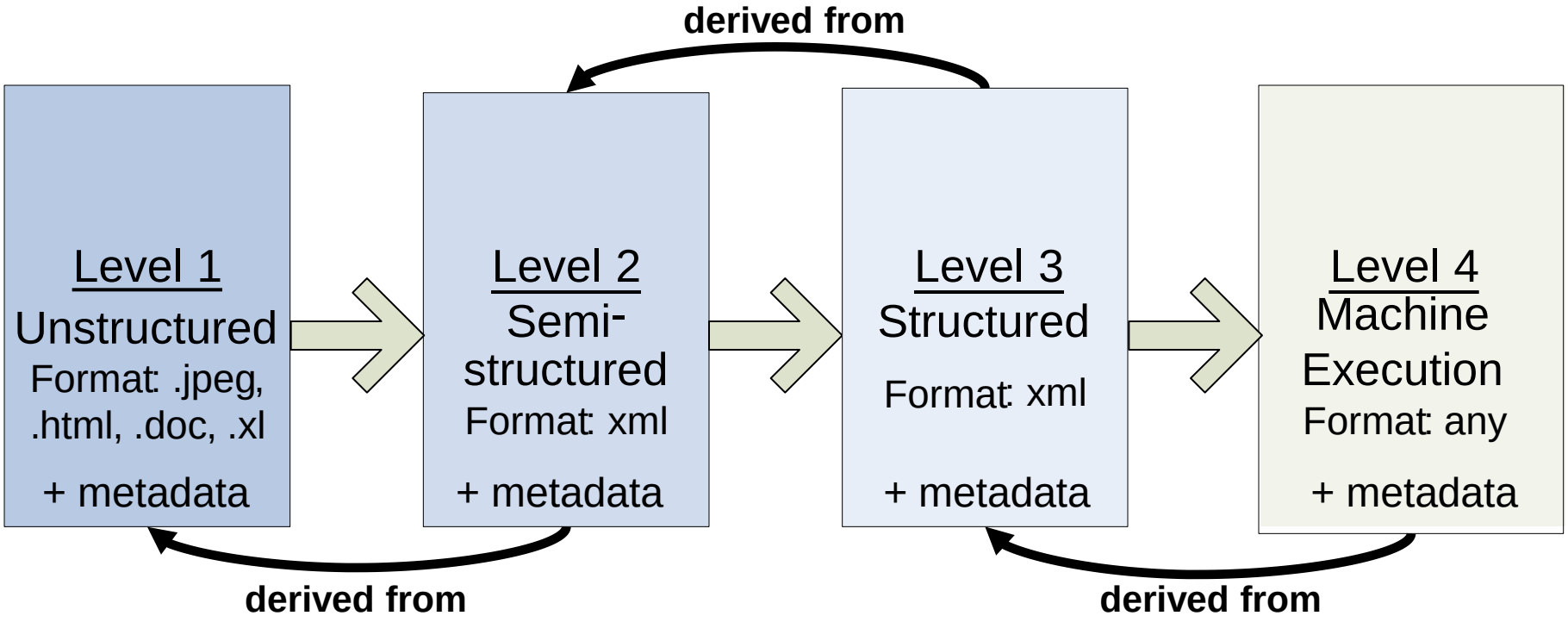
Knowledge Translation and Specification: Four-Layer Model



Initial evaluation results: Structured recommendation (L3) was considered *more implementable* than the semi-structured recommendation (L2).

Boxwala, A.A., et al. A multi-layered framework for disseminating knowledge for computer-based decision support. JAMIA 2011.doi:10.1136/amiajnl-2011-000334

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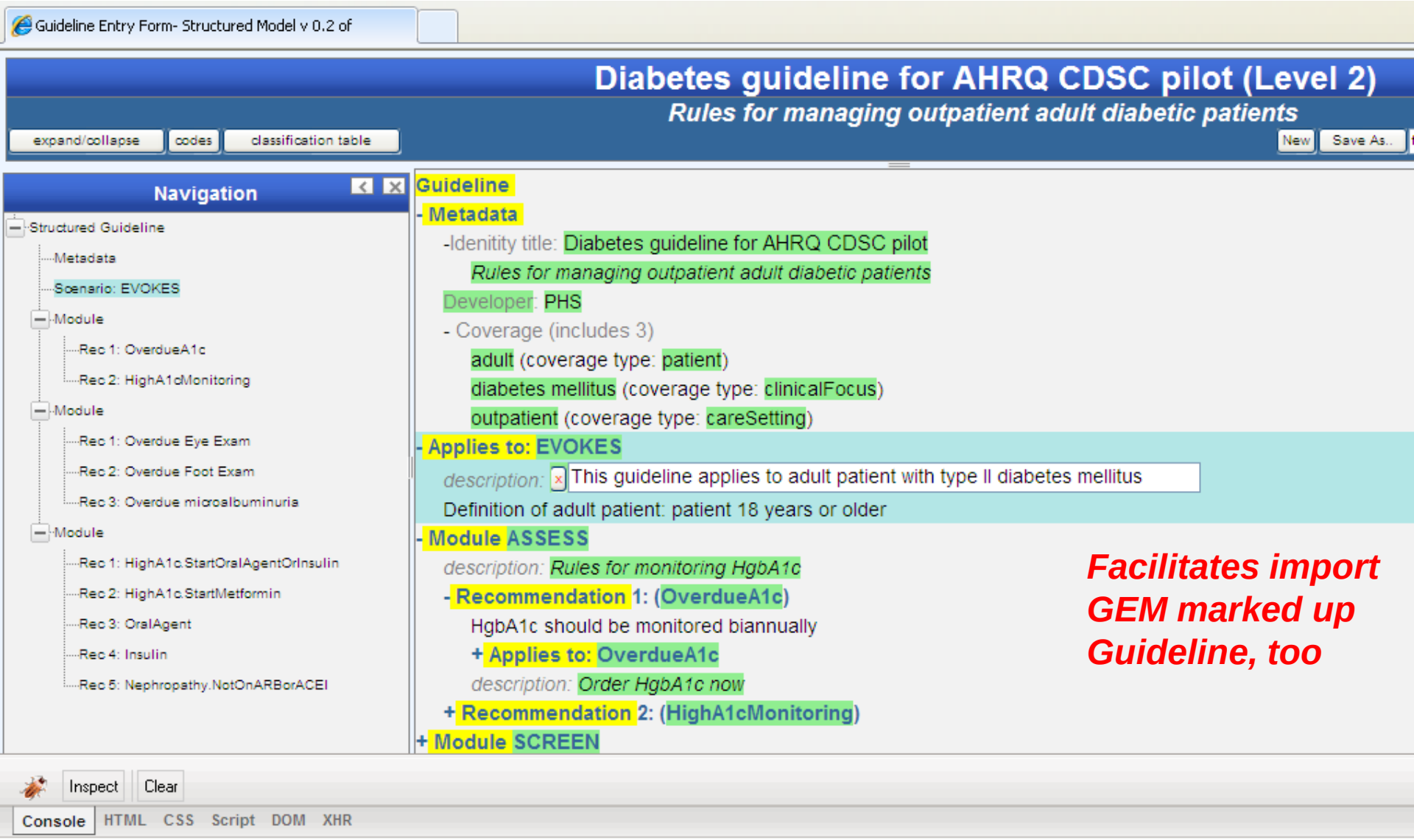
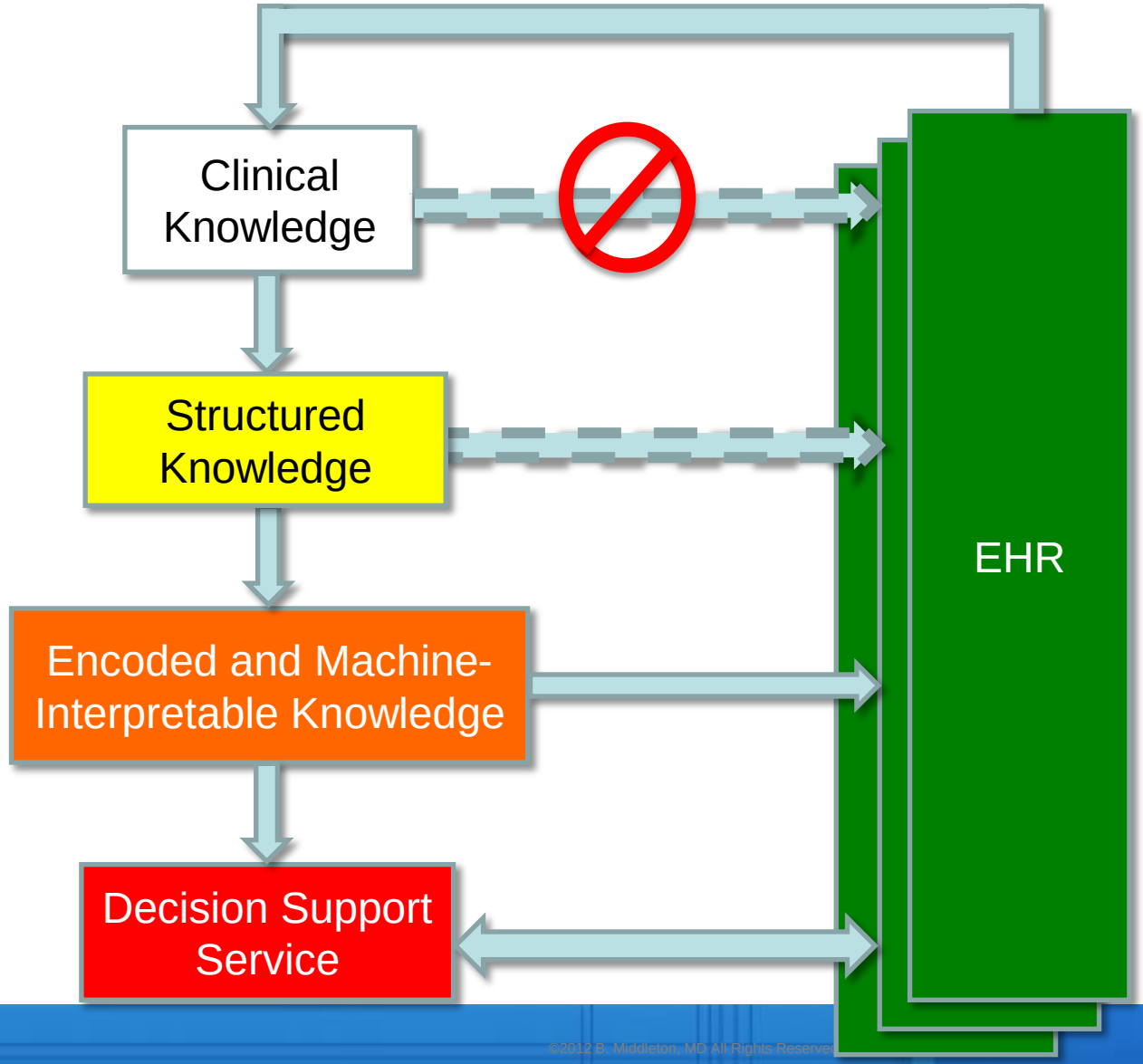
CDSC Knowledge Authoring Tool



Facilitates import GEM marked up Guideline, too

A Unified Theory for CDS



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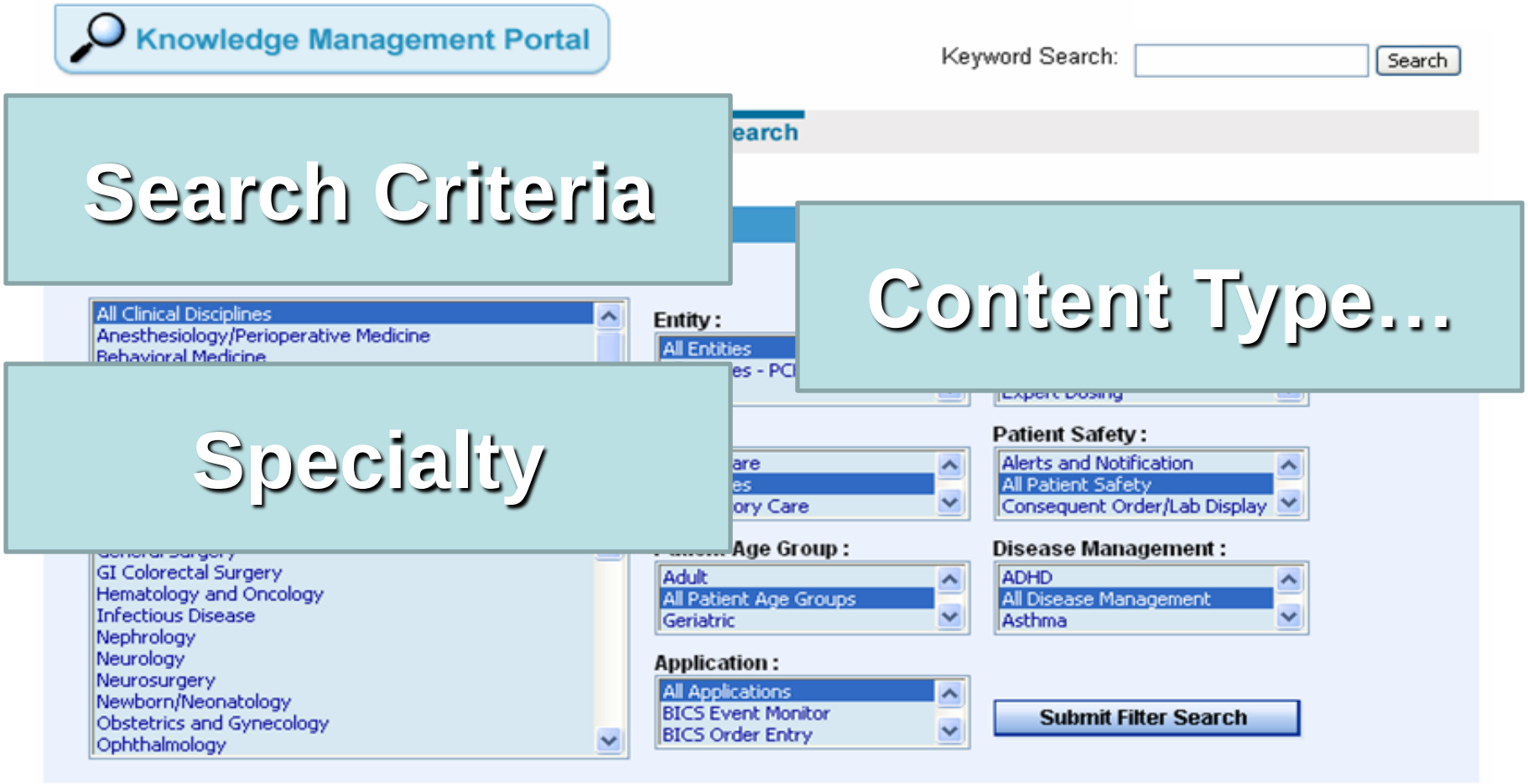
An external repository of clinical content with web-based viewer



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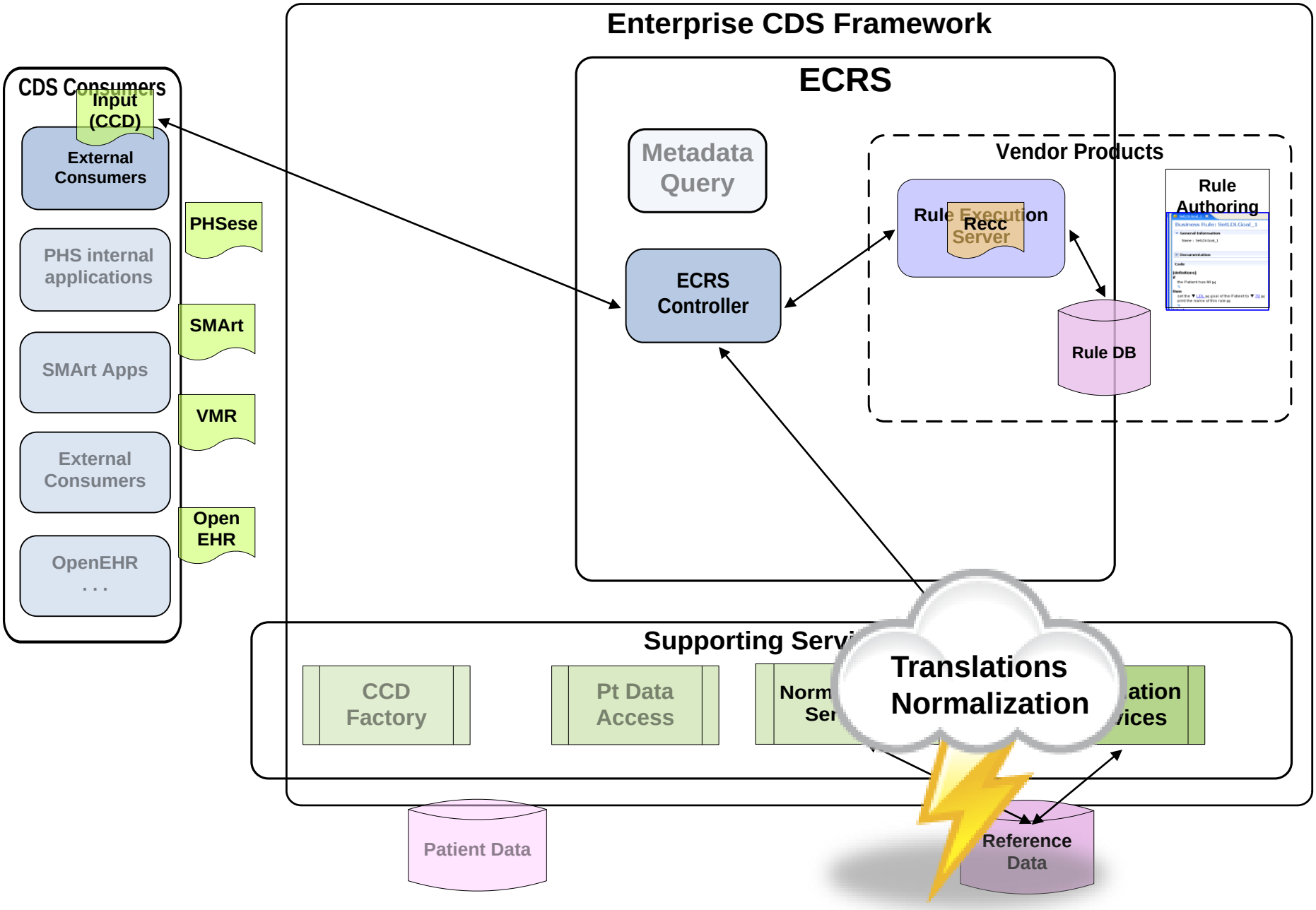
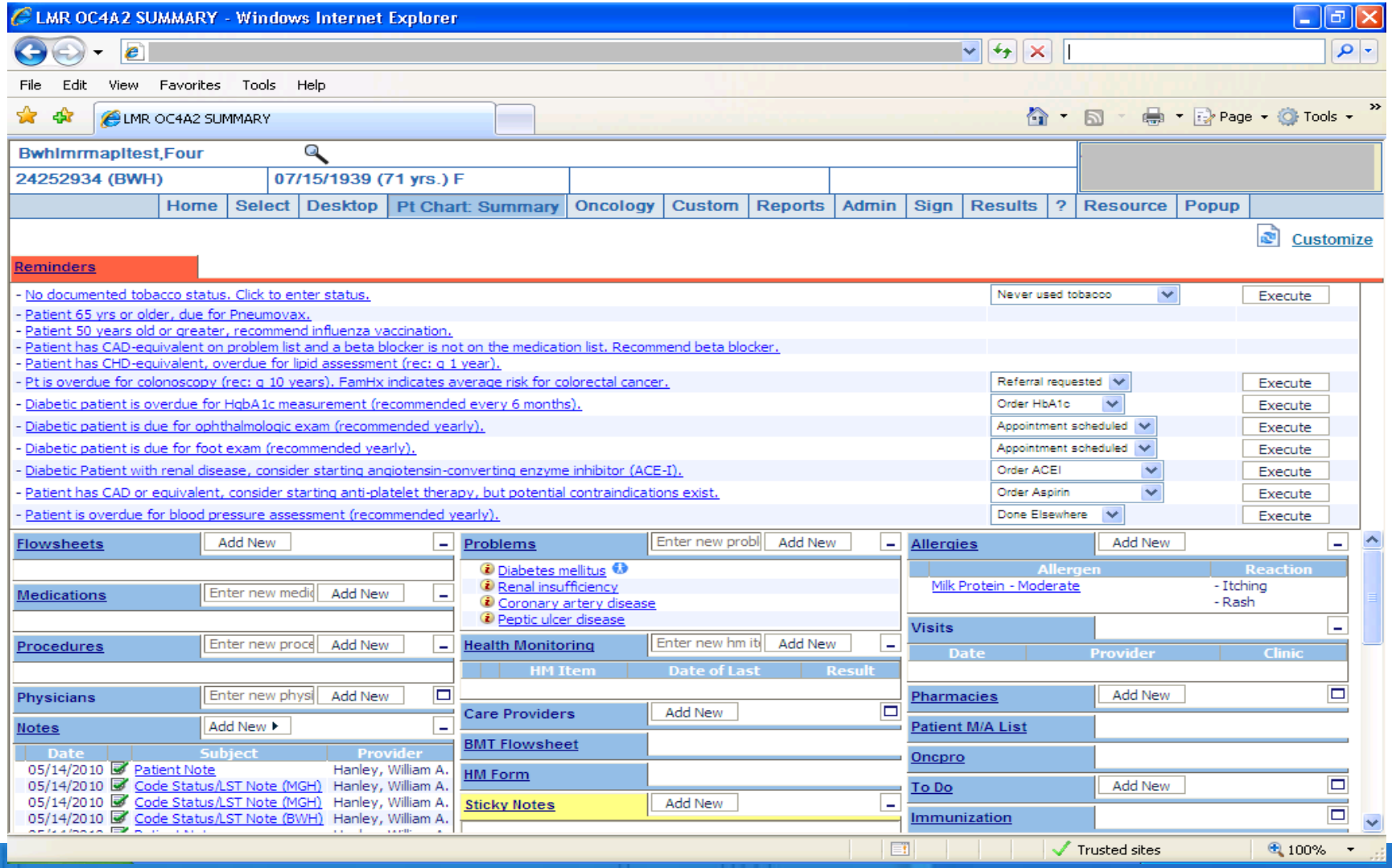
http://cdsportal.partners.org

CDS Consortium KM Portal Access

Document	Rank
Diabetes-Mellitus-SNOMED-Classification-Subset-L4	1
G6PD-deficiency-SNOMED-Classification-Subset-L4	1
Nephrotic-Syndrome-SNOMED-Classification-Subset-L4	3
Ischemic-Heart-Disease-SNOMED-Classification-Subset-L4	4
CDSC-Diabetes-L4	4
End-Stage-Renal-Disease-SNOMED-Classification-Subset-L4	5
ACDS-Response-Value-Set-L4-Diabetes-Not-on-Problem-List	6
ACDS-Response-Value-Set-L4	6


Enterprise CDS Framework
ECRS
CDS Consumers
Input (CCD)
External Consumers
PHS internal applications
SMArt Apps
External Consumers
OpenEHR . . .
PHSese
SMArt
VMR
Open EHR
Metadata Query
ECRS Controller
Vendor Products
Rule Execution
Recc Server
Rule Authoring
Rule DB
Supporting Servi
CCD Factory
Pt Data Access
Norm Ser
ation vices
Translations Normalization
Patient Data
Reference Data

CDSC Services in Partners LMR



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Regenstrief G3

Welcome to G3! | Relay Health | External Resources | Leave Feedback | Help

Inbox

Notifications - All Patients

New... Process View

Patient	Subject	Delivered
[redacted]	Patient is overdue for blood pressure assessment (recommended yearly).	28-Dec-2010 15:03
[redacted]	Diabetic patient is overdue for HgbA1c measurement (recommended every 6 months).	28-Dec-2010 15:03
[redacted]	Diabetic patient is due for foot exam (recommended yearly).	28-Dec-2010 15:03
[redacted]	Diabetic patient is due for ophthalmologic exam (recommended yearly).	28-Dec-2010 15:03

Sender:	USER, CARERULE	Priority:	low
Viewed:		Info Only:	true
Can Delete:	true	Can Forward:	true

Message:

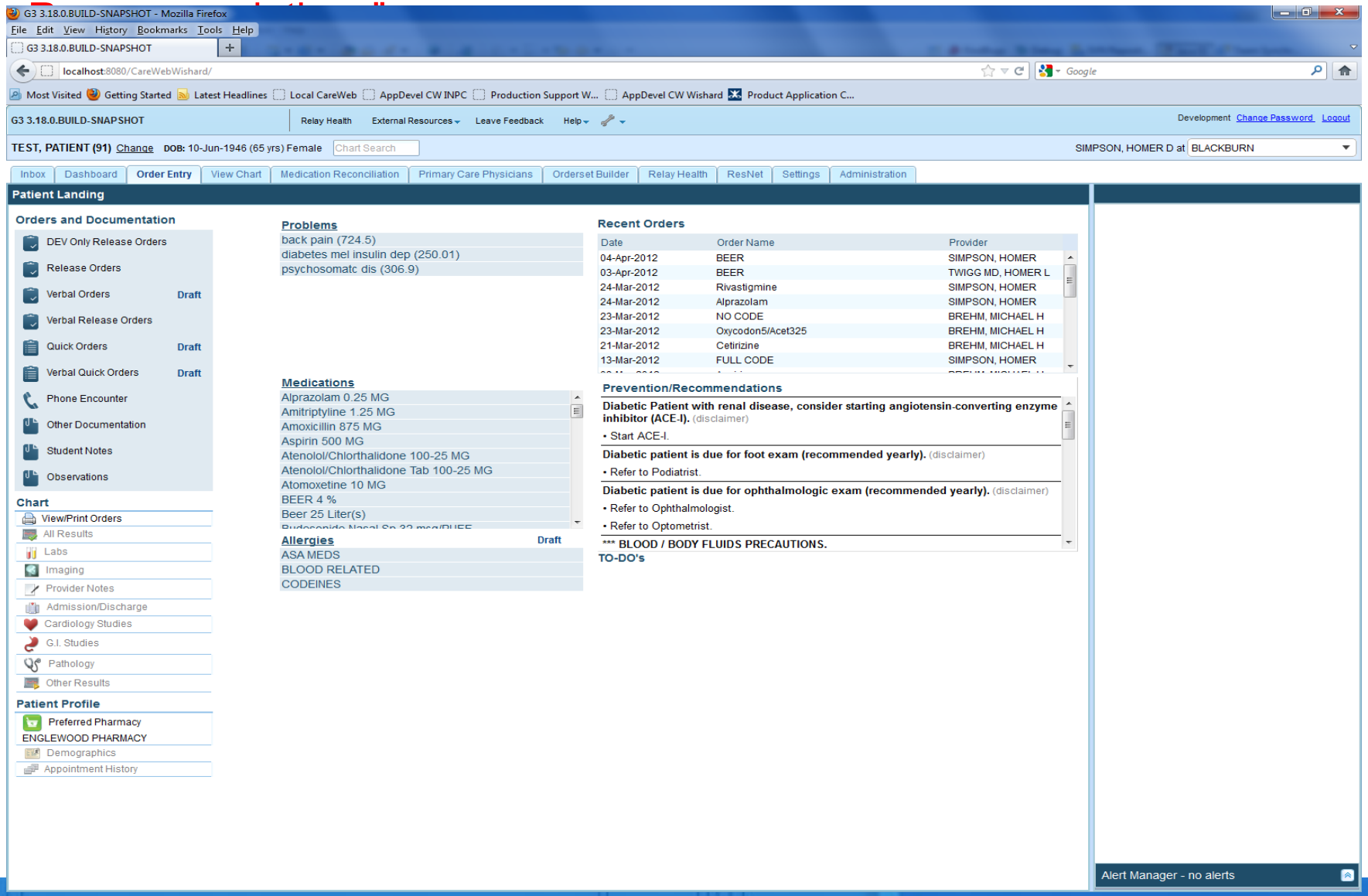
Diabetic patient is due for foot exam (recommended yearly).
Document the foot exam.
Refer to Podiatrist.
Recommend giving to the patient the handout 'Diabetic Foot'

DISCLAIMER
This decision support reminder may be inaccurate or based on incomplete data. The clinician should always use proper judgement while taking care of the patient, and should disregard this reminder if it seems clinically inappropriate. This decision support reminder is provided by the Clinical Decision Support Consortium as a component of a research study. It is based on the recommendations of the United States Preventive Services Task Force. For any questions please contact: Linas Simonaitis (email: lsimonaitis@regenstrief.org) (phone: 317-423-5535) or Brian Dixon (email: bdixon@regenstrief.org)(phone: 317-423-5582)

Inbox

Date Delivered	Patient	Subject
28-Dec-2010 15:03	[redacted]	Patient is overdue for blood pressure assessment (recommended yearly).
28-Dec-2010 15:03	[redacted]	Diabetic patient is overdue for HgbA1c measurement (recommended every 6 months).
28-Dec-2010 15:03	[redacted]	Diabetic patient is due for foot exam (recommended yearly).
28-Dec-2010 15:03	[redacted]	Diabetic patient is due for ophthalmologic exam (recommended yearly).

Screenshot of CDSC Reminders, now moved to the "Prevention/



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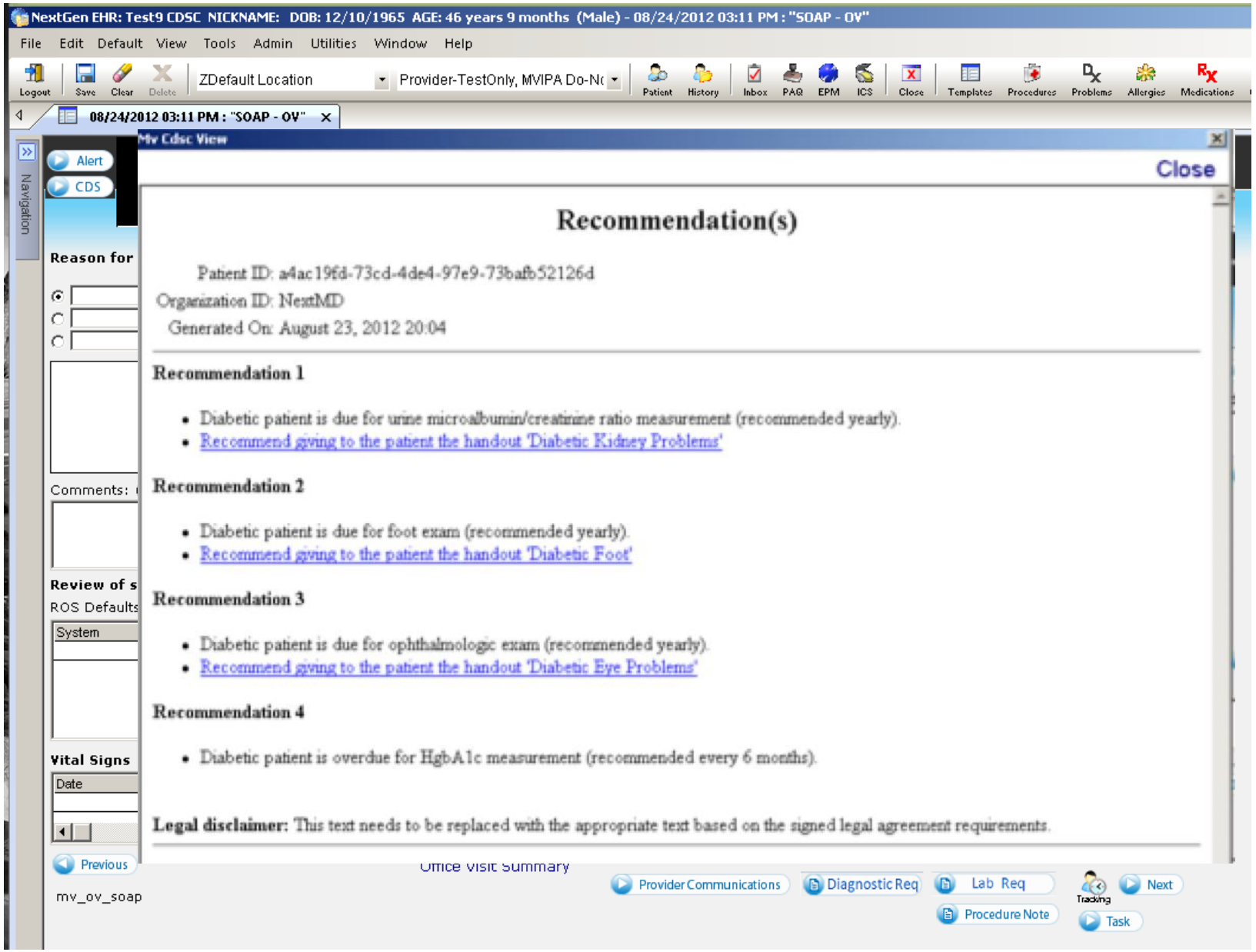
NextGen Integration



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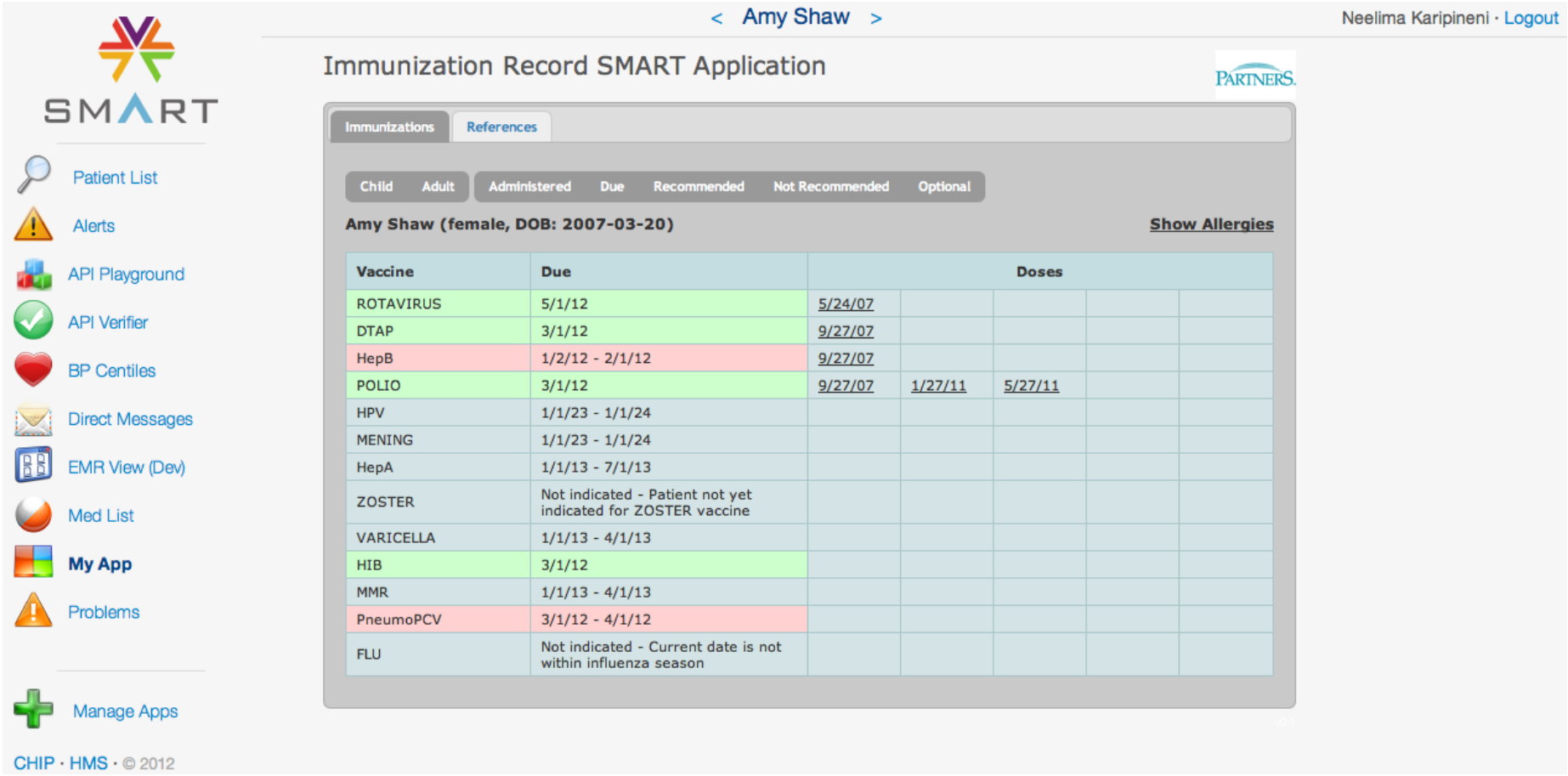
SHARP-C "SMArt" Container



Vaccine	Due	Doses				
ROTAVIRUS	5/1/12	5/24/07				
DTAP	3/1/12	9/27/07				
HepB	1/2/12 - 2/1/12	9/27/07				
POLIO	3/1/12	9/27/07	1/27/11	5/27/11		
HPV	1/1/23 - 1/1/24					
MENING	1/1/23 - 1/1/24					
HepA	1/1/13 - 7/1/13					
ZOSTER	Not indicated - Patient not yet indicated for ZOSTER vaccine					
VARICELLA	1/1/13 - 4/1/13					
HIB	3/1/12					
MMR	1/1/13 - 4/1/13					
PneumoPCV	3/1/12 - 4/1/12					
FLU	Not indicated - Current date is not within influenza season					

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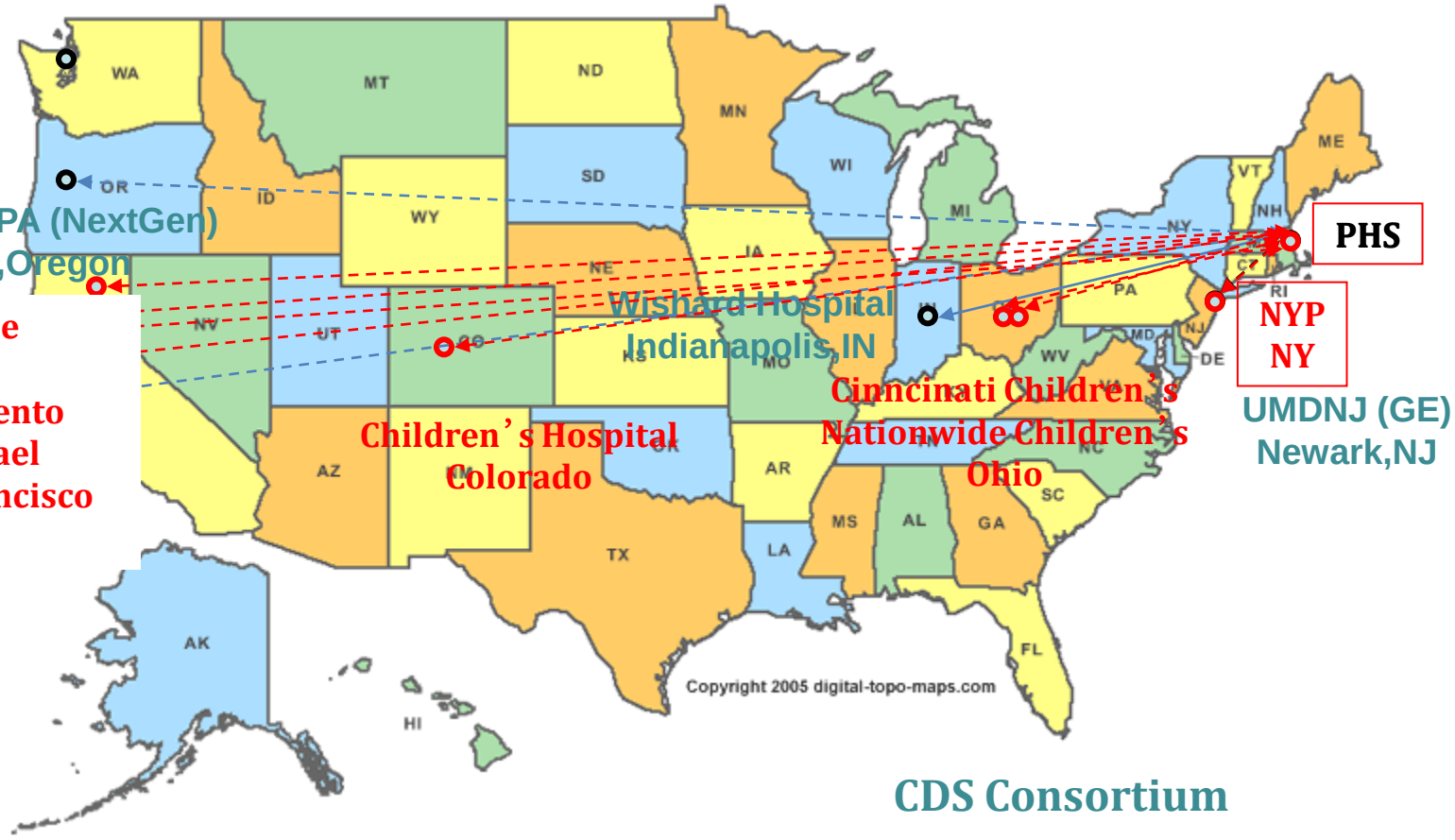
CDS Consortium Demonstrations

Toward a National Knowledge Sharing Service



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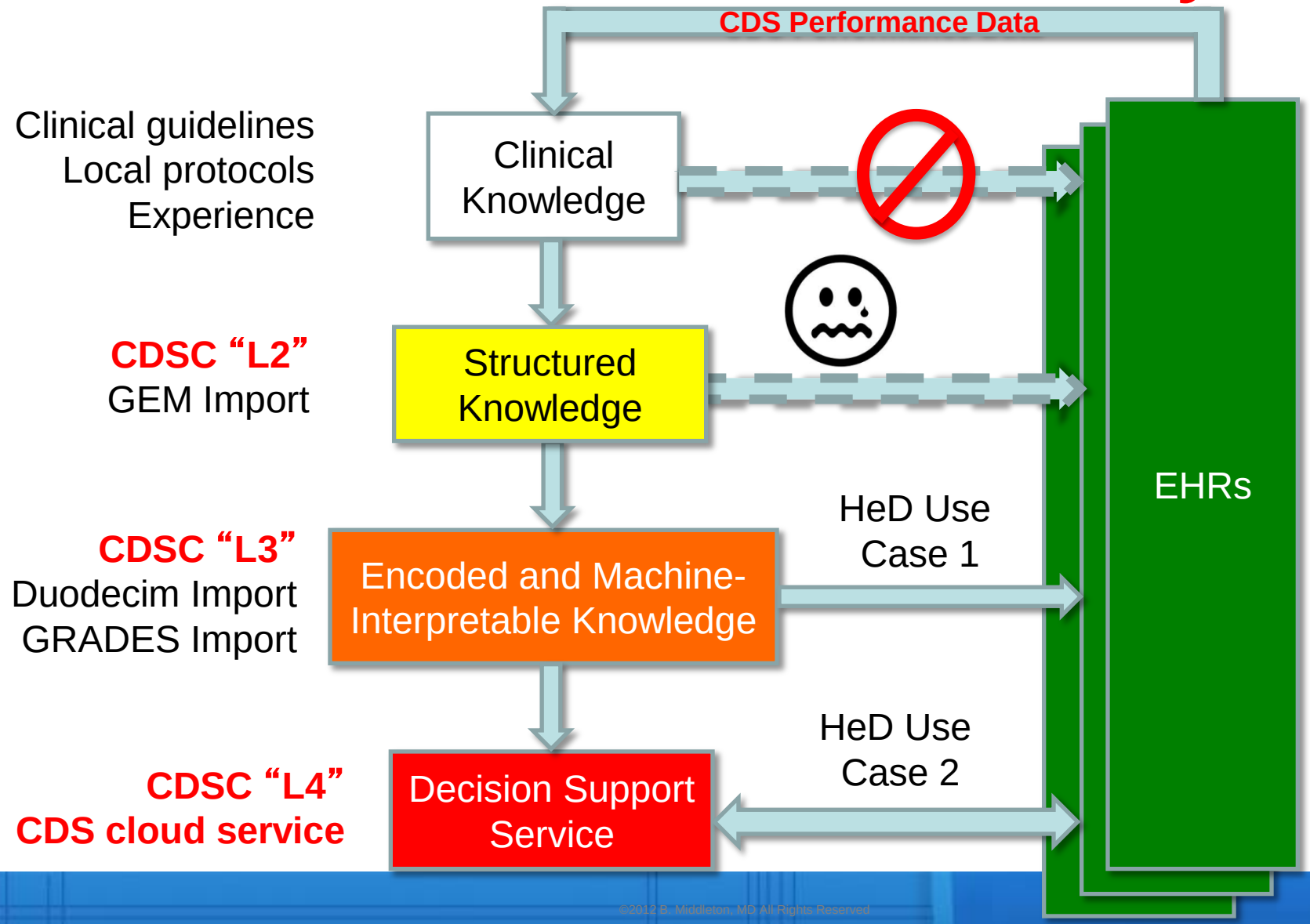
CDSC within Unified Theory



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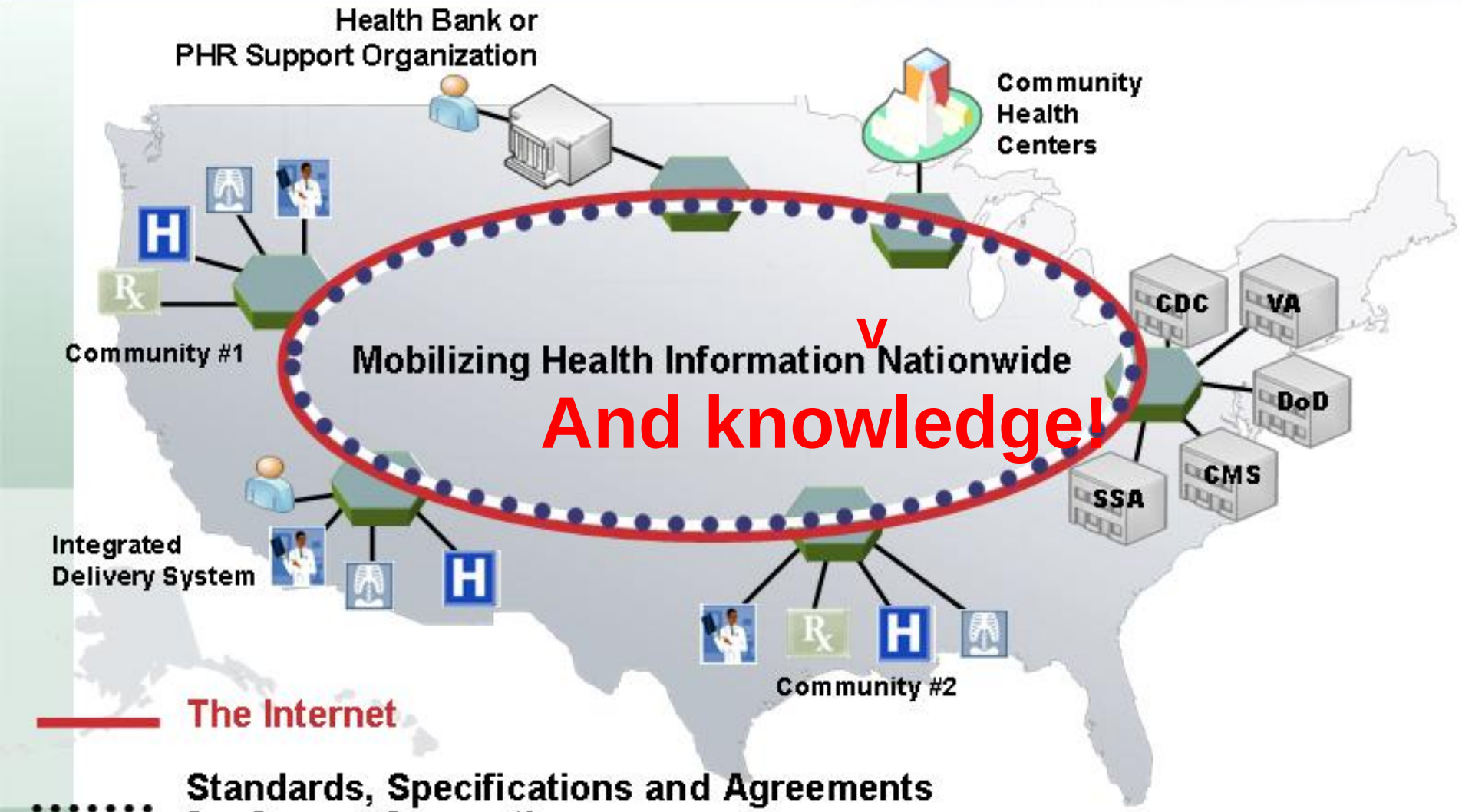
The Nationwide Health Information Network



Acknowledgements

AHRQ: HHSA290200810010

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Knowledge Translation and Specification Team: Aziz Boxwala, 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

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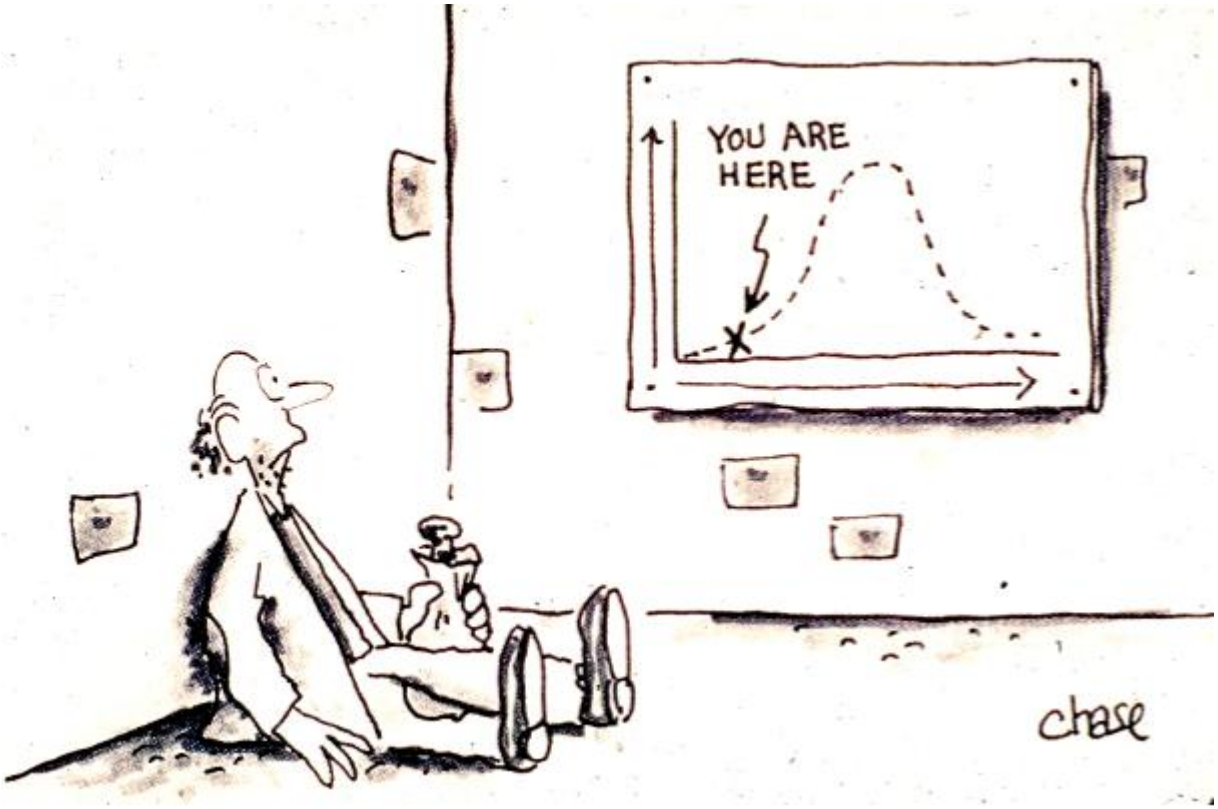
Where are we?



Thank you!

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Conclusions and Driving Questions

- **Need for common approach to CDS**
  - How do we united around an agreed upon approach so we can focus on providing VALUE to patients?
- **Critical role of HHS and ONC**
  - What more can the government do?
- **Need for academic-private-public collaboration**
  - How can we foster more productive collaborations?
- **Don’t let perfection be the enemy of the good**
  - How can we make progress today?
- **A perfect storm is coming**…
  - How can we best align with ARRA, HITECH, ACOs, payment reform, etc. to advance CDS and patient care?