Mobilizing Computable Biomedical Knowledge (MCKB 2018)

Panel: “State of the Art in Computable Biomedical Knowledge”

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National Library of Medicine
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Outline

• Introduce Semedy
• Summarize what Semedy has done as it relates to mobilization of CBK
• Identify how this work addresses the points in the CBK “Manifesto”
• Preview what attendees will see in the demonstration
Semedy, Inc. (US)

• Semedy AG since 2012
  • Boston subsidiary started operations in Nov 2017
• Multidisciplinary team
  • 6 FTEs involved with applied/practical informatics and knowledge management (KM)
  • 8 FTEs focused on software platform development
Semedy: team experience - healthcare

• **Operational responsibility** for KM and CDS activities at large IDNs → Intermountain Healthcare and Partners Healthcare

• Create and maintain **large collections of knowledge assets** → integrated with EHR systems

• Implement and manage **knowledge engineering** and asset **governance processes** → active and continuous clinical input and oversight

• Design and develop integrated **knowledge authoring** and **curation platforms** (software) → focus of the initial collaboration with Semedy
## Inventory of knowledge assets at Partners

<table>
<thead>
<tr>
<th>Knowledge Asset Collection</th>
<th>Collection Size</th>
<th>Asset Type</th>
<th>Asset Source</th>
<th>Asset Editor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemotherapy Prescribing Dictionary</td>
<td>2,800 concepts</td>
<td>Dictionary</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Drug Classification Subsets</td>
<td>2,500 classes</td>
<td>Dictionary</td>
<td>Custom</td>
<td>Local</td>
</tr>
<tr>
<td>Immunization Dictionary</td>
<td>620 concepts</td>
<td>Dictionary</td>
<td>Local</td>
<td>Vendor</td>
</tr>
<tr>
<td>Master Drug Dictionary (MDC): includes non-commercially available medications</td>
<td>11,000 concepts</td>
<td>Dictionary</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Medication Concept Mappings</td>
<td>15,700 mappings</td>
<td>Dictionary</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Oral Investigational Chemotherapy Dictionary</td>
<td>600 concepts</td>
<td>Dictionary</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Outpatient Neonatal Dosing Dictionary</td>
<td>60 concepts</td>
<td>Dictionary</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Problem List Classification Subsets</td>
<td>530 classes</td>
<td>Dictionary</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Problem List Dictionary</td>
<td>5,000 concepts</td>
<td>Dictionary</td>
<td>Custom</td>
<td>Local</td>
</tr>
<tr>
<td>Partners KnowledgeLink (Inclusion manager)</td>
<td>650 resource profiles</td>
<td>Reference</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Partners Handbook: portal of electronic clinical reference resources</td>
<td>600 external and 500 internal links</td>
<td>Reference</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Critical Laboratory Alerts</td>
<td>175 rules</td>
<td>Rule</td>
<td>Local</td>
<td>Vendor</td>
</tr>
<tr>
<td>Disease Management and Preventive Care Reminders</td>
<td>540 rules</td>
<td>Rule</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Drug Dosing in Elderly</td>
<td>320 dosing rules</td>
<td>Rule</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Drug Dosing in Renal Insufficiency</td>
<td>400 dosing rules</td>
<td>Rule</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Drug-Disease Alerts</td>
<td>510 rules</td>
<td>Rule</td>
<td>Custom</td>
<td>Local</td>
</tr>
<tr>
<td>Drug-Drug Interaction Alerts</td>
<td>10,000 rules</td>
<td>Rule</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Drug-Laboratory Alerts</td>
<td>440 rules</td>
<td>Rule</td>
<td>Custom</td>
<td>Local</td>
</tr>
<tr>
<td>Drug-Pregnancy Alerts</td>
<td>690 rules</td>
<td>Rule</td>
<td>Custom</td>
<td>Local</td>
</tr>
<tr>
<td>Drug-Utilization Alerts</td>
<td>15 rules</td>
<td>Rule</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>Duplicate Therapy Alerts</td>
<td>25 category rules</td>
<td>Rule</td>
<td>Custom</td>
<td>Local</td>
</tr>
<tr>
<td>Family History Reminders</td>
<td>25 algorithms</td>
<td>Rule</td>
<td>Local</td>
<td>N/A</td>
</tr>
<tr>
<td>Food-Drug Interaction Alerts</td>
<td>130 rules</td>
<td>Rule</td>
<td>Custom</td>
<td>Local</td>
</tr>
</tbody>
</table>

More than 20 different editors
- expensive maintenance
- manual dependency curation not possible

→ need for a centralized clinical knowledge management process

Semedy: activities

- **Knowledge Management (KM) solutions**
  - Preconfigured tools, content, and processes

- **Consulting services**
  - Operationalize KM processes and best practices

- **Content services**
  - Reference terminologies, ontologies, value sets, etc.

- **Software platform → “Clinical Knowledge Management System” or CKMS**
  - Customize, integrate, and extend existing and/or new KM activities
Integrate knowledge **across all content layers**
  - E.g., from reference terminologies to CDS rules

... and **across all content types**
  - Unstructured to structured
  - Shallow to deep (level of detail)
  - E.g., from PDFs to highly structured ontologies
Integration Across All Content Layers

CKMS

Terminologies & Ontologies

Data Definitions

Data Templates

CDS

alerts, reminders, pathways, order sets, medication warnings, duplication warnings, therapeutic alternatives, infobuttons, etc.

forms, flowsheets, documentation templates, data fields, calculators, etc.

data elements, value sets, information models (e.g. problems, medications, procedures, etc.)

master files, dictionaries, translation tables, and reference ontologies (e.g. SNOMED CT, ICD-10-CM, LOINC)

editors, portals, repositories, virtual collaboration tools, knowledge retrieval services, rule execution engines, testing and validation

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Common challenges

• **Silos of knowledge** (assets)
  • SharePoint and spreadsheets abound

• **Lack of enterprise-wide standards**
  • Multiple versions of similar/conflicting assets

• **Cannot see downstream impact of changes**
  • Inactivated asset inadvertently breaks other assets

• **Communication barriers**
  • Clinical subject matter experts frustrated with effort required to create new knowledge assets
Optimal scenario: learning system

- **Semedy’s role**: enable the systematic creation of interoperable knowledge assets that can be used by different applications and systems
  - High **quality** and with **tangible** benefits
  - Adequate **scale** and **complexity**
  - Low **cost of implementation** (and **replacement**)

- **Knowledge + data + terminology** engineering
  - Not only about writing a good CDS rule, but instead design a complete solution, including data definitions and values
CBK manifesto: alignment

• Available openly and widely
• Formats that can be shared and integrated into health information systems and applications
• Collaborative development, maintenance, and continued refinement
• Properly reflects the best and most current evidence and science
• Findable, accessible, interoperable, and reusable
CBK manifesto: points for discussion

- “Open” as in “interoperable format” versus “no licensing/cost” → cost of knowledge engineering and maintenance is substantial
- Collaborative approach has to accommodate localization and shared ownership
- Available standards have to be reconciled and unified → full scope & lifecycle of a “declarative” asset
- Process standardization is essential to enable distributed and systematic collaboration → agreement on how assets are authored, curated, and validated
- Asset-specific methods to validate correctness and utility, but also to validate compatibility with local resources
Semedy: platform demonstration

• KM software platform: **CKMS**
• Representation of different types of knowledge artifacts
• Versioning and lifecycle
• Structural and semantic integrity
• Alignment with standards
• Integration with upstream/downstream asset sources and consumers
Thank you!

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