Beyond Alerts:
Clinical Decision Support with Evidence & Expertise

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Agenda

• Defining CDS
• Going beyond alerts
• The doctor’s perspective
• A CDS Success Roadmap for CIOs/IT Management
A 47-year old woman, previously healthy

Delay in diagnosis, developed uterine and colon cancer

Ultimately received treatment with multiple complications

30-day hospitalization with subsequent disability
Defining Clinical Decision Support
Clinical Decision Support (CDS)

CDS provides clinicians, staff, patients or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care.

CDS encompasses a variety of tools to enhance decision-making in the clinical workflow.
EHR adoption—*but not alone*

- Not associated with improvements in performance in health care quality (except surgical complications) and efficiency measures in US acute care hospitals.
- Exception: EHR with CDS (such as clinical practice guidelines and reminders) was associated with small quality gains.
Clinical decision support improves delivery of recommended care

Systematic review of randomized trials found that CDS was associated with use of recommended care:

- 1.4-fold increase in preventive care
- 1.7-fold increase in diagnostic studies
- 1.5-fold increase in treatment

The Universe of Clinical Decision Support

- Medication dosing support
- Order facilitators
- Alerts/reminders
- Workflow support
- Expert Systems
- Relevant Information display
The Universe of Clinical Decision Support

Clinical Decision Support Tools
- Medication dosing support
- Relevant Information display
- Order facilitators
- Expert Systems
- Workflow support
- Alerts/reminders
What are the benefits of Alert-based CDS?

Alerts and reminders—small benefits

- Multiple studies have found that these can improve clinical decision making, although the benefits have been modest and inconsistent across studies.

McCoy et al provided a framework for evaluating CDS alerts and responses (JAMIA 2012; 19:346-352)

<table>
<thead>
<tr>
<th>Alert Display</th>
<th>Provider Response</th>
<th>Provider Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate (Signal)</td>
<td>Successful alerts</td>
<td>Provider non-adherence (inappropriate overrides)</td>
</tr>
<tr>
<td>Inappropriate (Noise)</td>
<td>Justifiable overrides</td>
<td>Unintended adverse consequences</td>
</tr>
</tbody>
</table>

Overriding an alert may or may not be an appropriate provider response; cannot just look at the override rate.
Over a recent four-year period:

**560 alarm-related deaths**
--U.S. *Food and Drug Administration database*

**80 alarm-related deaths**

**13 serious alarm-related injuries**
--The Joint Commission's sentinel event database

*An Alert-Centric View Diminishes the Potential of CDS*
Time for CDS to go “Beyond Alerts”
Doctors Have Clinical Questions

Unanswered clinical questions impact patient management decisions

Approximately 2 out of 3 clinical encounters generate a question

Physicians have approximately 11 clinical questions a day

60% of questions go unanswered

Answering all clinical questions could change 5 to 8 patient management decisions each day

Clinical Decision Support: Getting It Right

- **Context & Format**: Clinicians find useful
- **The Right Guidance**
- **At the Right Time**
- **The Right Decision**
The Universe of Clinical Decision Support

Clinical Decision Support (CDS) & Meaningful Use Frequently Asked Questions

- Medication dosing support
- Order facilitators
- Alerts/reminders
- Workflow support
- Relevant Information display
- Expert Systems
A Closer Look at CDS “Expert Systems”
Features of CDS systems that correlate with improved patient care

- Integrated into the workflow
- Electronic based
- Provide decision support at the time and location of care rather than prior to or after the patient encounter
- Provides recommendations for care, not just assessments

Knowledge-based CDS Built on Evidence & Expertise

Evidence:
• Review and synthesis of hundreds of research journals
• Rigorous peer-reviewed editorial process

Expertise:
• Comprehensive coverage of specialties
• Full-time MD experts
• Contributor community with global perspective
• → Graded recommendations
The research continues to grow...

Evidence-based CDS is extensively researched.

For example, over 60 studies on UpToDate alone.
Researchers at Harvard University Find Clinical Decision Support Associated with Improved Outcomes

Improved Quality
- Every condition on Hospital Quality Alliance Metrics

Shorter Lengths of Stay
- 372,000 days over 1 year

Lower Mortality Rates
- 11,500 lives over 3 years

Researchers at *Singapore’s National University Hospital* report that bedside use of UpToDate led to changes in patient care decisions 37% of the time.
Improvements increased with increased use

UpToDate usage levels and impact on complications, patient safety, and length of stay

Improvement in Risk Percent

- Complications
- Patient Safety
- Length of Stay

The impact of evidence-based recommendations on treatment plans

Data from UpToDate CME survey responses

- 62%: This reinforced my plan
- 29%: This modified my plan
- 9%: I need more information
270+ Million Topic Views in 12 months

516 topic views per minute—potentially 150 changed decisions
Clinicians save time when using CDS

- South Africa: 96%
- US: 91%
- UK: 92%
- Brazil: 94%

2012 UpToDate Subscribers' Survey
Based on data analysis, users are able to search, locate, and review the information they need in approximately 1 minute.

**Median mobile session**

57 seconds

**Median web session**

67 seconds
Economic Impact of CDS at Salford Royal NHF Foundation

Forrester Research found Salford Royal NHS Foundation Trust (SRFT) recovered the costs of a leading Clinical Decision Support System in 90 days.

Benefits Included:

- Staff productivity
- Diagnostic test efficiencies
- Improvements in the quality of care

ROI = 90 days

Source: November 2011, Forrester Research: The Total Economic Impact Of UpToDate’s Clinical Decision Support System For Healthcare Institutions: A Case Study Of Salford Royal NHS Foundation Trust in the UK
Scalable Solutions to Increase the Impact on Care

- National Access
- Hospital System/Group/Region
- Hospital
- Care Team
- Individual Doctor
CDS is Key to Standardizing Public Healthcare

UpToDate has national contracts with the governments of Norway, Spain, Saudi Arabia, Iran and Jordan to standardize public healthcare on UpToDate.

In countries such as the Netherlands, Switzerland and Luxembourg, UpToDate is used country-wide.

In major metropolitan health systems including New York City Health & Hospitals and Brasilia, quality care is supported by UpToDate CDS.
The Doctor’s Perspective: A Knowledge-Based CDS Case Study
A 47 year old notes new bleeding between her periods. She is otherwise healthy and takes no regular medications but is allergic to penicillin.

She also complains of occasional chest pain occurring mostly after eating.

Her primary care provider recommends a follow-up visit in one year but no other testing.

One-year later, she is referred to a gynecologist who diagnoses endometrial cancer and recommends surgery to remove her uterus and ovaries.
During preoperative testing, a cardiac stress test is ordered to evaluate her chest pain, the results are unclear, her primary care physician recommends that she undergo cardiac catheterization before surgery to be sure her chest pain was not caused by a heart condition.

Her catheterization is essentially normal but she has noted some mild, nagging numbness in her fingers since the procedure.
Surgery is performed, the patient is found to have stage I uterine cancer but also has stage III colon cancer.

12 hours after surgery, she develops a fever for which she is given Tylenol. Seven hours later, a nurse calls the covering physician because the patient looks ill. Her blood pressure is lower than normal.

She is transferred to the intensive care unit with sepsis and is started on antibiotics, one of which is related to penicillin.

She recovers after one month in the ICU where she suffered multiple complications including the need to amputate one of her toes.
# Impacting Care: A Case Study

<table>
<thead>
<tr>
<th>Condition</th>
<th>Outcome</th>
<th>How knowledge-based CDS could have helped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal Bleeding</td>
<td>Delay in diagnosis</td>
<td>CDS would have led to earlier diagnosis</td>
</tr>
<tr>
<td>Hereditary Cancer</td>
<td>Patient and family may be at risk for colon and uterine cancer. A proper family history was not obtained</td>
<td>CDS would have provided correct guidance</td>
</tr>
<tr>
<td>Catheterization</td>
<td>Possibly unnecessary preoperative work-up with complication</td>
<td>CDS guidance might have prevented</td>
</tr>
<tr>
<td>Sepsis</td>
<td>Diagnosis was delayed and condition was likely not managed optimally</td>
<td>Guidance from CDS could have helped</td>
</tr>
<tr>
<td>Choice of Antibiotics</td>
<td>Penicillin given to allergic patient</td>
<td>Knowledge-based and drug interaction CDS provide correct choices.</td>
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A *CDS Success* Roadmap for CIOs/IT Management
“...many of these errors are due to man’s limitations as a data processor...

Thus, I conclude that though the individual physician is not perfectable, the system of care is, and the computer will play a major part...”
Clinicians’ Most Valuable HIT Initiative for Patient Care

Which IT initiative produces the greatest benefit to the quality and safety of patient care?

Proportion ranking each initiative a 9 or 10 on a 10 point scale (n = 17,127)

- Knowledge-based CDS (UpToDate): 54.31
- EHR system: 37.39
- eRx: 36.28
- Alerts/reminders: 33.41
- Patient education: 32.68
- CPOE: 31.35
- Order sets: 26.53

Source: UpToDate individual subscriber survey 2012
Checklist for Robust Clinical Decision Support

✓ **Knowledge Base**
  ✓ Current, comprehensive, evidence-based
  ✓ Summary & detail presentations
  ✓ Expert recommendations
  ✓ Rich & dynamic content: graphics, video, calculators

✓ **Advanced Search**
  ✓ Intuitive, auto-complete
  ✓ Filters for content type (e.g., adult vs pediatric)
  ✓ Multi-lingual search and navigation

✓ **Context**
  ✓ Patient context: integrates EHR data re: patient
  ✓ Location context: available at the point of care
Effective decision support requires maximal integration in the clinical workflow - at the point of care.

**Mobile Apps:**
- Cellular network
- Wi-Fi
- Download

**EHR:**
- Link
- Search field
- HL7 InfoButton
- Patient-specific data
HL7 Infobutton Example

Commonly inserted in Diagnoses, Problem List, Medication List, or Order Entry
Overview of hypertension in adults
Where is CDS Headed?

The evolution of Clinical Decision Support capabilities

**Passive**
- Highlighting relevant patient info
  - *Dashboard*

**Active**
- Clinical guidelines
- Clinical pathways
- Therapy protocols
- Knowledge systems with Search/Filter functionality

**Interactive**
- “Intelligent” data acquisition and contextual interaction
- Decision monitoring

Where is CDS Headed?
A CIO’s Roadmap for CDS Success

- Evaluate CDS in a partnership between HIT and clinical leaders
- Ensure that CDS is an integral part of the clinical workflow
- Think holistically about EHR in terms of user needs
- mHealth is here to stay - position CDS in your mHealth strategy
Thank You

Questions and Answers