Clinical Decision Support Computerized Provider Order Entry (CPOE)

Component 11 / Unit 3

There have also been some well-known "implementation failures"

- University of Virginia (Massaro, 1993)
  - Housestaff rebelled over system, which was implemented with very little of their input
- Cedars-Sinai Hospital, Los Angeles (Chin, 2003)
  - Users felt it significantly impeded their workflow
  - Was a home-grown (non-commercial) system implemented without adequate planning
  - Two years later, CPOE was still not reimplemented (Connolly, 2005)

As well as some negative results (and rebuttals)

- Koppell, 2005
  - Bates, 2005
    - Koppell, 2005
- Han, 2005
  - Del Baccaro, 2006
    - Ammenwerth, 2006
  - Jacobs, 2006
  - Phibbs, 2006
  - Sittig, 2006

Koppel, 2005

- Analysis of Technicon system (old version, no longer sold) was reported by users to introduce errors in 22 situations falling into two categories
  - Information errors – due to fragmentation of information or failure to integrate with other systems, e.g., medication discontinuations, immediate orders, conflicting or duplicate medications
  - Human-machine interface flaws – system functions do not correspond to work organization or usual behaviors, e.g., information scattered across multiple screens, inflexible screens making non-standard modifications difficult

Criticisms (Bates, 2005) and rebuttals (Koppel, 2005)

- Bates
  - Did not count errors or, more importantly, adverse events
  - Did not count errors that were prevented
  - Studied older version of software requiring multiple screens and long since updated
  - CPOE is a process requiring continuous improvement
- Koppel
  - System was old, but represented what might be found in commercial system (as opposed to home-grown systems studied by Bates)
  - Error types were stated by users based on their real experiences
  - Agreed in value of CPOE but called for it to be studied more thoroughly to identify potential to do harm

Han, 2005

- Retrospective pre (18 months) and post (5 months) analysis in a Children's Hospital of Pittsburgh
- Mortality rate increased from 2.80% to 6.57%
- Problems with CPOE noted to be
  - Inability to write orders before patient arrival
  - Time-consuming nature of order entry
  - Centralization of medications

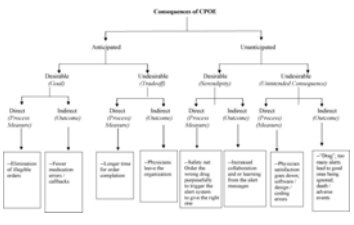
Rebuttals to Han study

- Others did not find increased mortality rates
  - University of Washington (Del Baccaro, 2006)
    - Comparison of this paper with Han paper by CPOE experts identified implementation differences (Ammenwerth, 2006)
  - Cincinnati Children's Hospital Medical Center (Jacobs, 2006)
- Before-after retrospective studies always have risk of confounders; could there be other explanations for outcome?
  - Inadequate wireless network, centralization of pharmacy, non-use of order sets (Phibbs, 2005)

Lessons learned from Han study (Sittig, 2006)

- Roll-out (hospitalwide in six days) too quick
- Order entry is possible before patient arrival – planning should have allowed
- Centralization of pharmacy a confounding factor and not requirement for CPOE
- Variety of communication issues, including keeping nurses and others at bedside
- Adequate network bandwidth essential
- Standardized order sets would have reduced large number of clicks (and time) per order
- Informatics expertise could have been helpful

There are also "unintended consequences" of CPOE



Unintended consequences – developed (Campbell, 2006), identified in 5 settings (Ash, 2007), and verified by survey in 176 more (Ash, 2007)
- New work/more work
- Workflow
- System demands
- Communication
- Emotions
- New kinds of errors
- Power shifts
- Dependence on technology

Can we reduce time for order entry?

- Concern about time described in more detail in segment 4.6
- Wizorder (Giuse, 2003) guides clinicians and anticipates next steps
- Lovis (2001) developed system to map entered text to actions in VA CPRS
  - e.g., *Ranitidine 50 mg IV q8*
  - Found time to enter admitting order set reduced from 17.7 to 16.1 minutes

Overrides of CPOE advice

- Bates (1999) study of redundant lab tests
  - 31% of suggestions for cancellation overridden
  - Only 41% were deemed justified by expert review
- Hsieh (2004) assessment of drug-allergy overrides
  - 80% of alerts overridden, usually due to "aware/will monitor" (55%) and "patient does not have this allergy" (33%)
  - Still resulted in 6% rate of ADEs in patients, although all were judged clinically justifiable
- In one VA study, only 20% of reasons given for drug-drug interaction overrides were deemed "clinically useful" by pharmacists (Grizzle, 2007)

Overrides (cont.)

- Study of 2872 clinicians in 3 states of 233,357 medication alerts (Isaac, 2009)
  - 6.6% of all prescriptions generated alerts
  - Clinicians only accepted 9.2% of drug-interaction and 23.0% of allergy alerts
  - Most interaction alerts were "high-severity" (61%), which were slightly more likely to be accepted
  - Alerts less likely to be accepted if patient was already on medication
- "Tiering" of alerts so only more critical situations generated work-stopping alerts led to increased accepting of more critical alerts (Paterno, 2009)

Other problems with CPOE

- About 1% of prescriptions have inconsistency between structured template and free-text field (Singh, 2009)
- Qualitative data from field observations and interviews shows impacts to clinical workflow from alteration of clinical activities and incomplete support for work activities (Campbell, 2009)
- Better attention to workflow may improve practice with CDS (Karsh, 2009)
- One quality advocate calls for priority of bar-coding over CPOE (Wachter, 2008)
- Need better use of clinical knowledge management tools (Sittig, 2010)

What about E-Prescribing?

- Growing call for all prescriptions to be electronic (eHealth Initiative, 2008; eHealth Initiative, 2008)
- National ePrescribing Patient Safety Initiative (NEPSI, www.nationalerx.com) provides free software for ambulatory E-Prescribing
  - But increasingly used within EHR systems
- Uptake increased substantially between 2008 to 2009 (Surescripts, 2010)
  - Number of prescriptions: 68 million to 191 million
  - Number of prescribers: 74,000 to 156,000 (one-quarter of all prescribers)
  - Surescripts could provide access to benefits and history of 65% of US patients
  - 85% of all pharmacies able to receive prescriptions electronically

Grand challenges for CDS (Sittig, 2008)

- Improve the effectiveness of CDS interventions
  - Improve the human-computer interface
  - Summarize patient-level information
  - Prioritize and filter recommendations to the user
  - Combine recommendations for patients with co-morbidities
  - Use free-text information to drive clinical decision support
- Create new CDS interventions
  - Prioritize CDS content development and implementation
  - Mine large clinical databases to create new CDS
- Disseminate existing CDS knowledge and interventions
  - Disseminate best practices in CDS design, development, and implementation
  - Create an architecture for sharing executable CDS modules and services
  - Create Internet-accessible CDS repositories (rules.gov?)