Clinical Decision Support Computerized Provider Order Entry (CPOE)

Component 11 / Unit 3

CPOE

- Definition
- Rationale
- Best Practices for Implementation
- Usage
- Efficacy
- Challenges

Definition of CPOE

- From CPOE.org: "a computer system that allows direct entry of medical orders by the person with the licensure and privileges to do so"
  - Clinical decision support (CDS) is usually viewed as an essential component of CPOE to obtain its full potential
- E-Prescribing is a subset of full CPOE, with order entry limited to prescribing

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CPOE exemplifies everything we have discussed about informatics

- It is about information, not technology
- It is used at the place where CDS can have the most impact – the writing of medical orders
  - "The single most expensive piece of hospital equipment is the doctor's pen." (Rosenthal, 1984)
- Issues essential in implementation relate to organizational structure, attention to workflow, provider autonomy, etc.
- But yes, technology is important! – System usability, response time, etc.

Rationale for CPOE

- Medical errors and patient safety
  - Common cause of injury and death (Kohn, 2000)
  - Up to two-thirds of the 62.4 prescribing errors per 1000 medication orders can potentially be detected and intercepted with CPOE (Bobb, 2004)
- Early decision support without full CPOE showed benefits
  - Test ordering reduced by displaying past results (Tierney, 1987) and costs (Tierney, 1990)
  - Antibiotic Assistant at LDS Hospital showed improved antibiotic selection, decreased costs, decreased ADEs, and decreased hospital length of stay (Evans, 1998)

Potential benefits of CPOE

- Improving health care processes (Kuperman, 2003)
  - Streamline order entry process
    - Doses from menus, complete orders required
  - Provide information
    - Show relevant lab results, guidelines, and guided dose algorithms
  - Perform checks
    - e.g., drug-drug, drug-allergy, drug-lab, dose ceiling, and drug-patient characteristic

## Best practices for implementing CPOE

- From Bates (2003) "Ten Commandments" for CDS
  - Speed is everything
  - Anticipate needs and deliver in real-time
  - Fit into workflow
  - Little things make a big difference
  - Physicians resist stopping – offer alternatives
  - Changing direction is easier than stopping
  - Simple interventions work best
  - Ask for only additional information that is needed
  - Monitor impact, obtain feedback, and modify
  - Manage and maintain knowledge

Best practices in organizations

- Organizational readiness essential, including (Kuperman, 2003)
  - Technology must be ready
  - Clinician buy-in, involvement, and training
  - Adequate support, especially at go-live
  - Prompt attention to problems
- Tool for readiness (Stablein, 2003)
- Previous adages against "big bang" (i.e., entire hospital going live at once) are being replaced by recognition that well-planned wide-scale rollouts can be successful (Thomas, 2006)
  - Though implementation of advanced CDS might be better if phased (Kuperman, 2007)

Other best practices

- Order sets (Payne, 2003; Bobb, 2007)
  - Streamline order entry by reducing steps for their input
  - Consist of directions, tests, and treatments for patient care based on diagnosis, treatment, or medical specialty category
  - Have ability to provide guideline-based (and evidence-based) care
  - Must be modifiable for local practices
  - Best managed at departmental and not institutional or individual level – can get clinicians to communicate better about consensus practices

CPOE screen from VA CPRS (Payne, 2003)
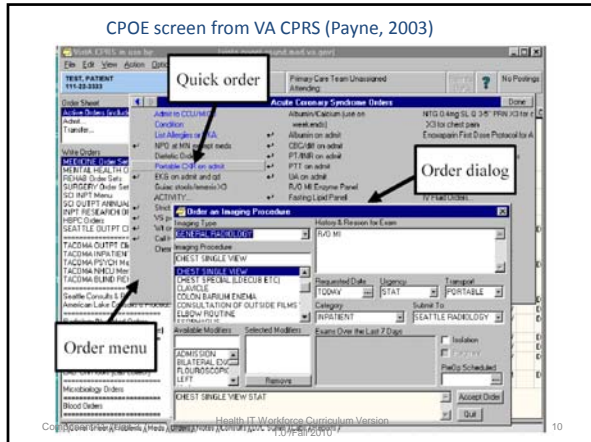
Challenges of implementing CPOE

- CPOE is not a mere computer application; it takes a whole organization to implement
  - Consensus statement: Ash, 2003
- Implementation success dependent on "special people" (Ash, 2003)
  - Administrative leadership
    - CEO – provides top-level support and vision
    - CIO – select champions and possesses vision
    - CMIO – interprets for and influences peers
  - Clinical leadership
    - Champions – individuals who support process
    - Opinion leaders – provide balanced view
    - Curmudgeons – naysayers who can be constructive
  - Bridge/support staff – work for results

Usage of CPOE

- How measured
  - Availability – for use by physicians
  - Inducement – voluntary or required?
  - Participation – % of physicians using
  - Saturation – % of orders entered
- Most recent large-scale survey shows still modest (Ash, 2004)
  - Survey of 964 hospitals with 65% response rate
  - Availability – 10% complete, 6% partial, 84% not
  - Inducement – for those that had it, 46% required, 54% optional

Clinical benefits of CPOE

- Some early studies
  - 12.7% decrease in total charges, 0.9 days shorter length of stay (Tierney, 1993)
  - Nonintercepted serious medication errors decreased 55%, from 10.7 events per 1000 patient-days to 4.86 events; preventable adverse drug events (ADEs) were reduced by 17% (Bates, 1998)
  - Reduction in redundant laboratory tests (Bates, 1999)
  - Improved prescribing behavior of equally efficacious but less costly medications (Teich, 2000)
  - Improved use of "corollary orders" by 25% (Overhage, 1997)

Clinical benefits (cont.)

- Since then, a more mixed picture has emerged
  - In Pediatric Critical Care Unit, prescribing errors were nearly eliminated but many potential ADEs not detected by CDS still occurred (Potts, 2004)
  - In highly computerized Salt Lake City VA, found higher-than-expected incidence of ADEs (due to better monitoring?), with 27% attributed to the type that CPOE and CDS were supposed to eliminate (Nebeker, 2005)
  - In pediatric patients, commercial CPOE reduced nonintercepted serious errors by only 7%, with no change in injury rates, and numerous user interface problems identified (Walsh, 2008)

Clinical benefits (cont.)

- Analysis of six Massachusetts hospitals (Adams, 2008)
  - Baseline rate of preventable ADEs was 10.4%
  - CPOE with CDS estimated to reduce by 80%
  - Annual savings in average hospital could be $2.7 million
  - With investment ($2.1 million) and annual maintenance of CPOE ($435K), hospital could break even in 26 months
- Systematic review of all published studies (Ammenwerth, 2008)
  - 23 of 25 studies have shown relative reduction in error rate from 13-99%
  - 6 of 9 studies have shown relative reduction in potential ADEs by 35-98%
  - Studies of "home-grown" systems have achieved better results
- Another systematic review raised concerns that studies suffer from methodological problems, including internal and external validity (Weir, 2009)

Other research results of note

- Prescribers and pharmacists in VA centers had generally positive view of drug-drug interaction alerts but felt they should be accompanied by management alternatives and more information (Ko, 2007)
- Physicians express skepticism about the ability of CDS to reduce errors and concern about its impact on workflow (McAlearney, 2007)
- Formulary decision support systems lead to higher rate of use of "preferred" medications, including those equally efficacious but costing less (Fischer, 2008)
  - Estimated to save $845K per 100,000 patients

CPOE must include patient-specific CDS to be effective

- CPOE for drug-laboratory monitoring alerts found no difference in adhering to advice for intervention (CPOE) and control groups (Palen, 2006)
  - Alerting was passive and not targeted to specific actions (Wu, 2006)
- Clinical practice guidelines without patient specificity did not increase adherence in CPOE system (Asaro, 2006)