COMPUTERIZED PHYSICIAN ORDER ENTRY (CPOE)

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Outline

- Definition and context
- Why CPOE?
- Advantages of CPOE
- Disadvantages of CPOE
- Outcome measures and examples
- Same system other outcome
- Summary

What is CPOE

- Computerized physician order entry (**CPOE**) is:
- the process where a medical professional entering orders or instructions electronically
- Computerized Provider Order Entry or Computerized Provider Order Management (CPOM)
- a process of electronic entry of medical practitioner instructions for the treatment of patients
- the process of capturing a physician's instructions for a patient's care electronically to improve the efficiency of care delivery.

What is Computerized Physician Order Entry (CPOE)?

- Ordering of tests, medications, and treatments for patient care using computers
- Involves electronic communication of the orders
- Often use rules-based methods for checking appropriateness of care

Definitions

- Information system can be defined as, an arrangement and integration of:
  - Data
  - Processes
  - People
  - Technology

  which interact to collect, process, store, and provide as output the information/task needed to support the organization.

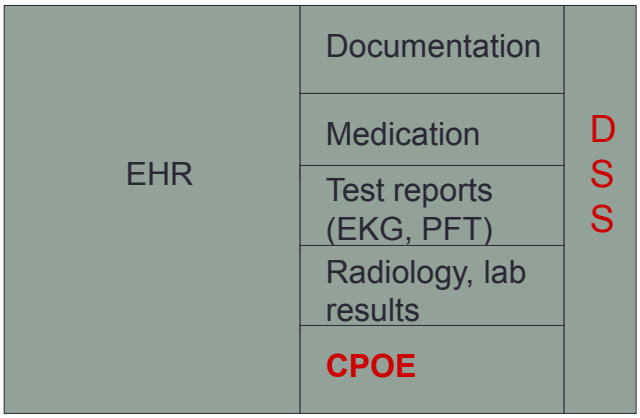
CPOE:

Computerized physician order entry (CPOE) is a solution to a current human system problems, that focuses on achieving improved quality and safety for all patients

Technical Infrastructure

- EHR
- Drug information database
- DSS
- Others

CPOE, EHR and DSS



Example DSS in CPOE – medication prescription

- Allergy
- Age (check drug name and dose)
- Duplicate drugs on active orders, not one-time
- Severe drug interactions
  - Drug-drug, drug-food
- Dose maximum
- Drugs with opposite actions

What Is It?

- CPOE is a computer solution that accepts physician orders
  - Meds
  - Laboratory Tests
  - Diagnostic Studies
  - Ancillary Support
  - Nursing Orders
  - Consults

Why Now?

- November 1999:

  Report from the Institute of Medicine

  To Err is Human: Building a Safer Health System
  - 44,000-98,000 patient deaths/year in U.S. hospitals due to medical errors
- Increased focus on patient safety and on quality of care
- CPOE is viewed as an important tool to improve patient safety and quality of care delivered

Patient Safety

- Institute of Medicine
  - Report on medical errors released 1999
  - Estimated that between 44,000 and 98,000 hospital deaths/year are due to medical errors
  - Some question the accuracy of the estimates but has raised public awareness and concern

Top 10 Causes of Death 1998

1.	Heart Disease	724,269
2.	Cancer	538,947
3.	Stroke	158,060
4.	Lung Disease	114,381
5.	Medical Errors	98,000*
6.	Pneumonia	94,828
7.	Diabetes	64,574
8.	Motor Vehicle	41,826
9.	Suicide	29,264
10.	Kidney Disease	26,295

* Estimated

CPOE

- Bobb A, et al. The epidemiology of prescribing errors: The potential impact of CPOE. Arch Intern Med 2004;164:785 – 792.
  - A CPOE with an advanced level of CDS is needed to prevent many of the prescribing errors with the greatest potential to lead to patient harm.
    - Basic = drug-allergy, drug-drug interaction & duplicate therapy checking, basic dosing guidance, formulary decision support
    - Advanced = dosing for renal insufficiency and geriatric patients, guidance for medication-related lab testing, drug-pregnancy and drug-disease contraindication checking

Reasons for CPOE

- **Order Communication**
  - **Clarity** of Orders
  - Ease of Identifying the Ordering **Physician**
- **Standardization of Care**
  - Clinically validated order sets
    - Clinical **diagnoses**
    - **Procedures**
    - Situations (post-op order sets)
- **Alerts and Reminders (Real Time Decision Support)**
  - Drug **Safety** Database (Conflict Checking)
  - Clinically validated **rules**

Adverse Drug Reaction (ADE's)

- Several studies have found a serious medication error in 3.4%-5.3% of inpatients
- The cost of a single preventable ADE is $4,685
  - $1.3 million annually for an average 300 bed hospital

Bates et al. *JAMA* 1997;277:307-311
Bates et al. *JAMA* 1998;280:1311-1316
Bates et al. *J Am Med Informat Assoc* 1999;6:313-321
Lesar et al. *Arch Intern Med* 1997;157:1569-1576

Medication Errors

- Two recent Harvard studies found that physician ordering errors accounted for 56%-78% of all preventable Adverse Drug Events

Bates et al. *JAMA* 1997;277:307-311
Kaushal et al. *JAMA* 2001;285:2114-2120

Medication Errors

- Physician drug ordering errors are most often due to one of two causes:
  1. Lack of **knowledge** about the drug
     - Wrong **dose**
     - Wrong **frequency**
     - Drug-drug **interaction**
  2. Incomplete patient information
     - Documented **allergies**
     - Recent lab **results**

CPOE Can Help Reduce Errors

- Brigham and Women's Hospital launched its first CPOE in 1993
- Since then, they have documented a **54%** reduction in serious medication errors
- Resulted in **62%** reduction in preventable ADE's

Improved Quality

- CPOE allows for physician reminders of best practice or evidence-based guidelines
- Indiana University study
  - Pneumococcal vaccine in eligible patients
    0.8% → 36.0%
  - Heparin prophylaxis
    18.9% → 32%

Improved Efficiency

- Maimonides Medical Center (Bronx, NY)
- 700 bed teaching hospital
- After CPOE, found substantial reduction in order processing time
  - Physician order to receipt by pharmacy
    - 3.4 hours → 0.5 hours
  - Physician order to Delivery to Patient Care Area
    - 4.6 hours → 1.4 hours
- Estimate of 12% ↓ in LOS following CPOE

IOM

- "the science and technologies involved in healthcare -- the knowledge, skills, care interventions, devices and drugs – have advanced more rapidly than our **ability** to deliver them **safely**, **effectively**, and **efficiently**"
  - IOM. 2001. Crossing the Quality Chasm: A New Health System for the 21st Century.

Current Objectives

- **Endorsement** of CPOE
- Establish CPOE as an Institutional Commitment and **Goal**
- Identify CPOE as a Quality and Safety Improvement **Initiative**

Definitions

- EMR (Electronic Medical Record) – the set of databases (lab, pharmacy, radiology, clinical notes, etc.) that contains the health information for patients within a given institution or organization
- CDS (Clinical Decision Support) component - software that makes relevant information available for clinical decision-making (clinical data, references, clinical guidelines, situation-specific advice)
- CPOE (Computerized Physician Order Entry) component – enables clinicians to enter orders (tests, meds, dietary, etc.)
- CCR (Computerized Clinical Reminder) – just-in-time reminders at the point of care that reflect evidence-based medicine guidelines

Advantages

- Improve communications
- Make knowledge more readily accessible
- Assist with calculations
- Perform checks in real time
- Assist with monitoring
- Provide decision support
- Require key pieces of information (dose, e.g.)

CPOE

- In 2005, only **4%** of hospitals are in full compliance with CPOE; 17% have made good progress.
- Government and larger teaching hospitals are more likely to have implemented CPOE.

Source: Cutler EM, Feldman NE, Hurwitz JR. US Adoption of Computerized Physician Order Entry Systems. Health Affairs 2005 Nov/Dec;24(6):1654 – 1655.

Example CPOE improves adherence to guideline

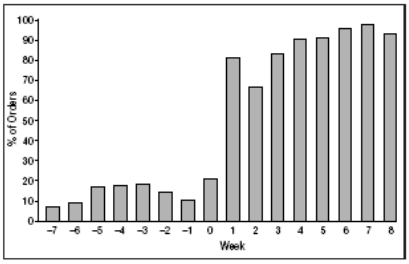


Figure 3. *Change in use of nizatidine, as a percentage of all oral histamine$_2$-blocker orders, after the computer intervention was introduced (Week 0).*

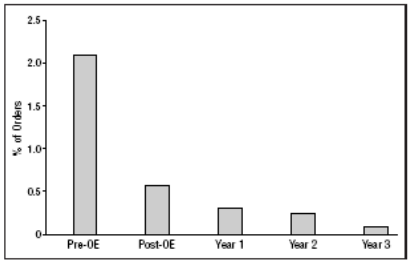
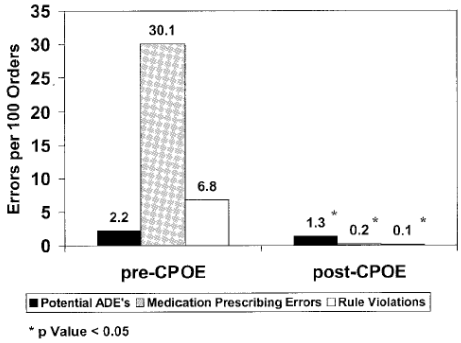


Figure 5. *Percentage of medication orders with doses exceeding the recommended maximum.*

Teich JM et al. Arch Intern Med. 2000 Oct 9;160(18):2713-4.

Example CPOE reduce errors

- Potts studied ADE rates in 13,828 medication orders before/after CPOE implementation at Vanderbilt Children's PICU:



Potts AL, Barr FE, et al. Pediatrics. 2004 Jan;113(1 Pt 1):59-63.

CPOE

- Effective in reducing the rate of serious medication **errors**.
- Reduction in antibiotic-related **ADEs** after implementation of decision support for these drug.
- **Length** of stay at Wishard Memorial Hospital in Indianapolis fell by 0.9 days, and hospital charges decreased by 13% after implementation of CPOE.
- A study at Ohio State University also identified substantial reductions in pharmacy, radiology and laboratory turn-around **times**, and there was a reduction in length of stay in one of the two hospitals studied.
- Research estimates that implementation of CPOE systems at all non-rural U.S. hospitals could prevent **three** million adverse drug events each year.

Example CPOE introduces errors

- Brigham and Womens' Hospital, Boston introduced a CPOE

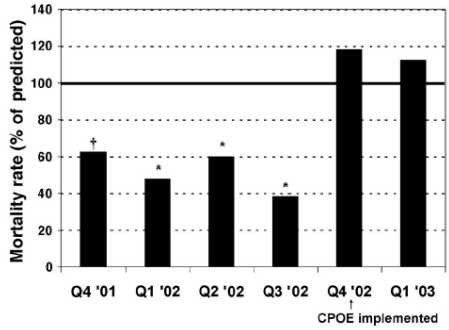
	pre	period1	period2	period3
Potential ADEs/1000 pt-days	15.8	31.3	59.4	0.5

- After implementation, the rate of intercepted Adverse Drug Events (ADE) doubled!
- Reason: The system allowed to easily order much too large dosages of potassium chloride without clear indicating that it should be given in divided doses.

- Bates et al The impact of computerized physician order entry on medication error prevention. JAMIA 1999, 6(4), 313-21.

Example CPOE introduces errors

- Association with increased PICU mortality:
  - 2.8% 14 months before CPOE
  - 6.4% 5 months after CPOE



Han YY, Carcillo JA, et al. Pediatrics. 2005 Dec;116(6):1506-12.

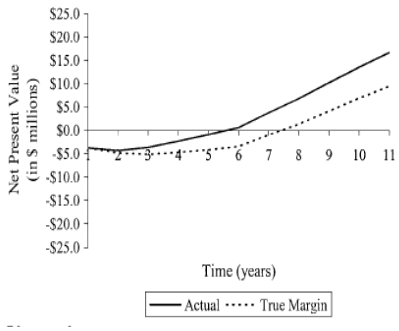
Duplicate medication ordering errors increased after CPOE implementation

- (pre: 48 errors, 2.6% total; post: 167 errors, 8.1% total; p<0.0001). 4147 patient-days pre-implementation & 4013 patient-days post-implementation.
- identical order or the same medication. (1) provider ordering practices and computer availability, e.g., two orders placed within minutes by different providers on rounds; (2) communication and hand-offs, e.g., duplicate orders around shift change; (3) CDS and medication database design, e.g., confusing alert content, high false-positive alert rate, and CDS algorithms missing true duplicates; (4) CPOE data display, e.g., difficulty reviewing existing orders; and (5) local CDS design, e.g., medications in order sets defaulted as ordered.

Example CPOE reduce costs

Brigham and Women's Experience: Cost-Effective

- $3.7 million implementation
- $ 600,000 to $1.1 million operational costs
- Results:
  - Decreased drug costs
  - ADE cost is approximately $4,700
  - The return on initial investment has been $5 to $10 million in annual savings.



Kausal R et al. J Am Med Inform Assoc. 2006; 13(3): 365-7

- Full implementation of computerized physician order entry and medication related quality outcomes: a study of 3364 hospitals in 2013
- Only 8% of US hospitals have fully implemented CPOE systems.

Challenges

- The upfront **cost** of implementing CPOE is one major obstacle for hospitals. At Brigham and Women's Hospital, the cost of developing and implementing CPOE was approximately $1.9 million, with $500,000 maintenance costs per year since.
- **Installation** of even "off the shelf" CPOE packages requires a significant amount of **customization** for each hospital and can be very expensive.
- **Integration** with other systems, cost, time, technical
- **Cultural** obstacles to CPOE implementation. For example, some physicians resist utilizing computerized decision-support tools, relying instead on practice experience

CPOE: Lessons From Other Institutions

1. Leadership
   - Physicians need to lead the effort as the primary users
   - However, CPOE is an interdisciplinary project that requires input and coordination with all clinical groups (nursing, PT/OT, Case Management, Pharmacy, Lab, Radiology, etc.) and I.T.
2. Commitment
   - CPOE affects the workflow and process of **all** caregivers and ancillary departments, not just physicians
   - Success requires commitment to change at all levels
3. Support
   - Responsiveness and Flexibility are key
   - Must be ongoing, not just at rollout

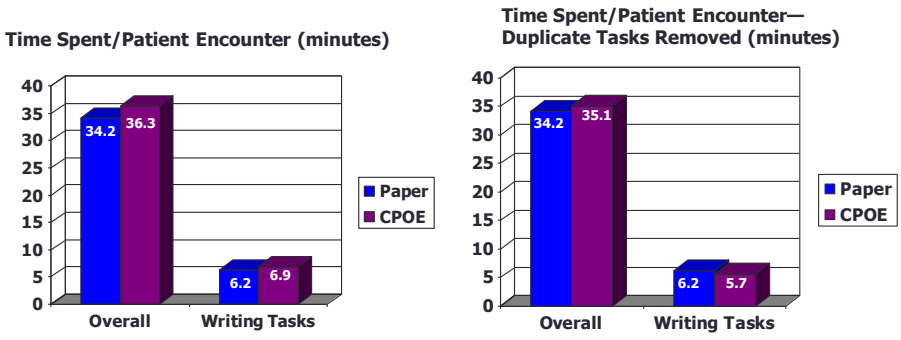
The Need for CPOE

- Improved patient safety
- Improved quality
- Improved efficiency
- Reducing operating costs

CPOE

Physicians are concerned that CPOE will take too much time

Does CPOE Take More Time?



Evidence shows that CPOE adds less than one minute to the time physicians spent writing orders and overall only added 1-2 minutes per patient encounter. As physicians gained experience with the system, the time for orders actually decreased.

(Overhage JM, et al *J Am Med Informatics Associ* 2001;8:361-371)

CPOE

The clinical benefits for improved patient care clearly outweigh the perceived concerns.

What Is Needed For Success?

- Clinicians
  - End-users (clinicians) must be willing to champion the implementation of CPOE
  - Clinicians must be involved in design and implementation of the system
  - Clinicians must be flexible and willing to change workflow processes

What Is Needed For Success?

- Information Technology (I.T. Department)
  - Ensure fast, reliable, and easily accessible system
  - Provide ongoing support
  - Train, educate users
- Institution
  - Commitment to workflow changes

What CPOE Does?

- Provides Decision Support
- Warns of Drug Interactions
  - Drug-Drug
  - Drug-Allergy
  - Drug-Food
- Checks Dosing
- Reduces Transcription Error
- Reduces number of lost orders
- Reduces duplicative diagnostic testing
- Recommends therapeutic alternatives
- Cost effective.

CPOE--Summary

- CPOE is a key component to improve Patient Safety and Quality of Care
- The focus needs to be on workflow and process of care changes that are necessary for optimal patient care, Not on implementing a new computer system
- Commitment from clinicians to help with process design and implementation is critical for success.

CPOE--Summary

CPOE is a clinical based process development to improve patient care, **not** an I.T. project

Thank you and best wishes

بالتوفيق و النجاح باذن الله