Informatics Team Notes

The following slides are the original lectures. Only notes were added and they're mostly additional information. 431 team notes are in purple color and this year's notes are in green color.
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COMPUTERIZED PHYSICIAN ORDER ENTRY (CPOE)

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Outline

- Definition and context
- Advantages of CPOE
- Disadvantages of CPOE
- Outcomes and examples
- Same system other outcome

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

It's primarily used by physicians then other health care workers like nurses...

Definitions

- Information system—an arrangement of—
  - Data
  - Processes
  - People
  - Technology

 interaction to collect, process, store, and provide and process the information needed to support the organization.

CPOE CPEO + plug in with every application (it doesn't stand alone, comes with pharmacy, lap tests...)

comprised physician order entry

CPOE is a solution to a current human system problem that focuses on achieving improved quality and safety for patients

One of the biggest problems in technology, and it's usually seen in programs like CPOE.., is that it can have a negative impact if there was no proper implementation and failure...

CPOE, EHR and DSS

DSS (medical)--> vertical
Basic information + discharge report (health)--> horizontal
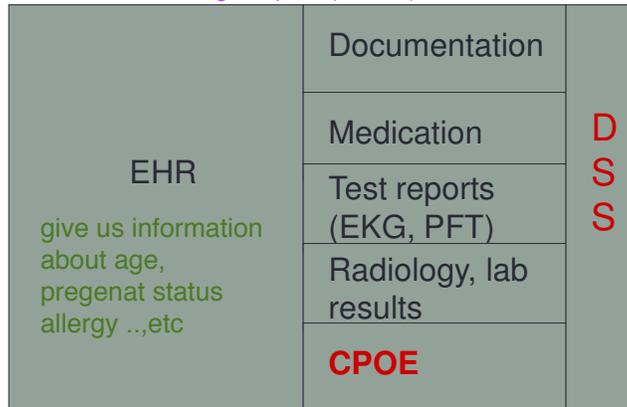
documentation: had to be structured.
for example: if the patient is pregnant (system will consider that as a "yes") ==>
will provide you an answer as: don't request x-ray
* the system can't recognize text. it has to be structured data.

EHR	Documentation	D
	Medication	S
give us information about age, pregenat status allergy ..,etc	Test reports (EKG, PFT)	S
	Radiology, lab results	
	CPOE	

CPEO interacts with DSS

Technical Infrastructure

- EHR any information from labs, radiology .. etc. But it doesn't take any action.
- Drug information database Has the data of all drugs (KKUH purchases it annually)
- DSS for e.g. Radiation center: has DSS to estimate radiation, depth, duration and location.
- Others

Evidence based medicine:
1- clinical investigation
2- best evidence --> e.g. what's the best treatment for such a case. Usually obtained from systematic review of randomized clinical trials taken found in data bases.
3- patients values
Decision support support (DSS) e.g. Drug drug interaction library. .

Strategic Objectives
3 main Objectives of CPEO (solutions) to increase the usage.

1. Endorsement of CPOE
2. Establish CPOE as an Institutional Commitment and Goal
3. Identify CPOE as a Quality and Safety Improvement Initiative

Example DSS in CPOE – medication prescription

- Allergy *e.g. penicillin allergy*
- Age (check drug name and dose) *link the age to the dose you need*
- Duplicate drugs on active orders, not one-time
- Severe drug interactions
  - Drug-drug, drug-food
- Dose maximum
- Drugs with opposite actions

CPOE—National Perspective

Why?
- 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

WHY ? CPEO will support physicians in regards to time. for example, a physician has to see at least 7 patients in 1 hour, CPEO would make it easier.

- "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.

Know the difference between EHR (horizontal) and EMR (vertical)! e.g. when a patient goes to a different hospital he/she doesn't take the whole file (EMR) but a report from the hospital(EHR).
 side note: in EHR lecture it was writen that subnames of EHR: EMR and CPR

very Important!

1. Electronic health record: more than one hospital. provides essential information (e.g. allergy, recent 5 medication, important surgeries)
2. EMR: one hospital, all the events related to medication, all the details that are not essential to the patient (say after a simple surgery the hospital obtained: blood samples, x-rays, patient developed fever so they gave medication and again took blood samples)
Such information are not essential in the future and the most important notes are summarized in a discharge report (discharge report is the one added to EHR

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

gets the information you need in the time you need it. (e.g. avoid pacemaker when doing MRI)

Difference between CPOE and DSS?
- CPOE: function of placing an order which includes more then just decision support (collection of standards, rules and guideline that are embedded in CPOE.)
- DSS: it's a rule based (basic function/algorithms) e.g. A patient with certain allergies should not take this type of medication.

6

Medical Informatics tools can… advantages

- Improve communication
- 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

- CPOE is a computer application (function) that process physician orders
  - Meds
  - Laboratory Tests
  - Diagnostic Studies
  - Ancillary Support
  - Nursing Orders
  - Consults

CPOE—What It 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 cost effective, therapeutic alternatives

CPOE   slow progression

- In 2005, only 4% of hospitals in USA 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

(+) after implementation
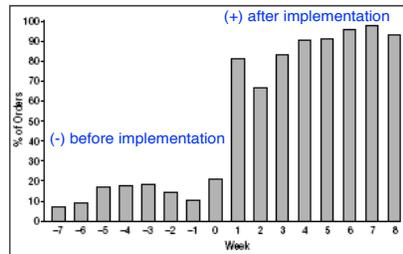
(-) before implementation

20%

Figure 3. *Change in use of nizatidine, as a percentage of all oral histamine₂-blocker orders, after the computer intervention was introduced (Week 0).*
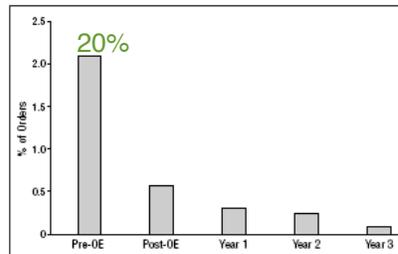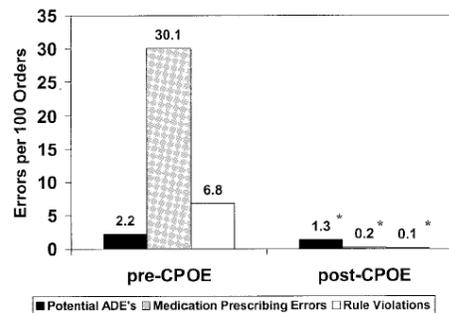
Figure 5. *Percentage of medication orders with doses exceeding the recommended maximum.*

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:

This shows how the % of errors decreased after implementing CPOE

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

Example CPOE introduces errors

Because there are people who don't know how to use the system

- Brigham and Womens' Hospital, Boston introduced a CPOE

	pre	period1	period2	period3
Potential ADEs/1000 pt-days	15.8	31.3 doupled eror	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 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.

i.e. side effects!
if the doctor is not well-trained at using CPEO, error may occur (e.g. orders an overdose.) But with training these side effects decrease.

Example CPOE introduces errors

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

Mortality rate after CPOE has increased then decreased again (at first many physicians weren't well trained, but with time, the benefits started to be noticed.)
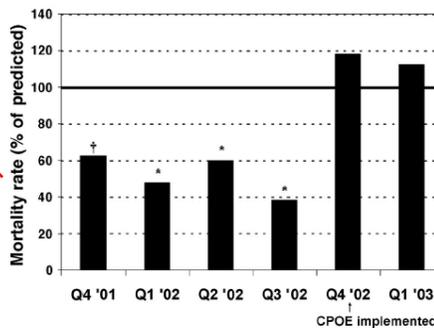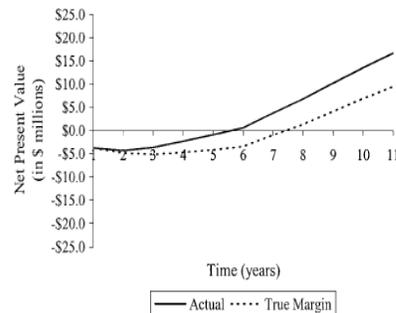

Han YY, Carcillo JA, et al. Pediatrics. 2005 Dec;116(6):1506-12.

Example CPOE reduce costs

Brigham and Women's Experience: Cost-Effective

- Cost:
  - $3.7 million implementation
  - $ 600,000 to $1.1 million operational costs
- Results:
  - Decreased drug costs
  - ADE cost is approximately $4,700

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

CPOE: Lessons From Other Institutions

not imp

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

- 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

CPOE

not imp

- Campbell EM, Sittig DF, Ash JS, Guappone KP, Dykstra RH. Types of unintended consequences related to CPOE. JAMIA 2006;13:547-556.
- Ash JS, Sittig DF, Poon EG, Guappone K, Campbell E, Dykstra RH. The extent and importance of unintended consequences related to CPOE. JAMIA 2007;14:415 - 423.

  - More/new work for clinicians
    - Reduce redundancy in info collection, display relevant info in logical locations, reduce keyboarding
      - 72% said it was a moderate to very important issue
  - Unfavorable workflow issues
    - Model clinical workflow wherever possible
      - 87% said it was a moderate to very important issue
  - Never ending system demands
    - Reassess quality assurance measures and user retraining
      - 82% said it was a moderate to very important issue

Reasons for CPOE Important

- **Order Communication**
  - Clarity of Orders
  - Ease of Identifying the Ordering Physician
- **Standardization of Care**
  - Clinically validated order sets for

    implementation and enforcement of guide lines (e.g. every month a diabetic patient should be referred to a nephrologist)

    - Clinical diagnoses
    - Procedures
    - Situations (post-op order sets)
- **Alerts and Reminders (Real Time Decision Support)**
  - Drug Safety Database (Conflict Checking)
  - Clinically validated rules

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

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
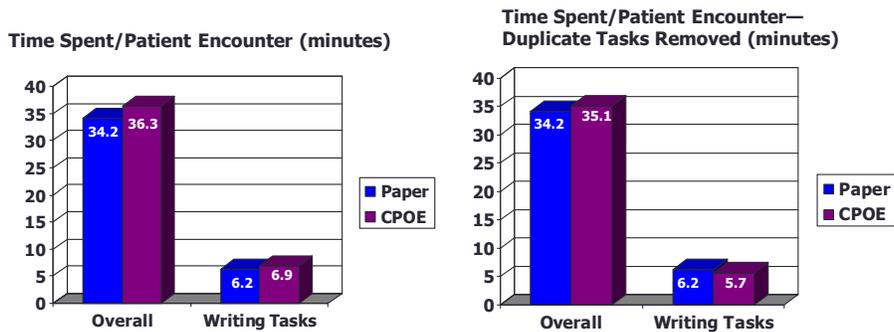   - Recent lab results

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 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

Does CPOE Take More Time?

Time Spent/Patient Encounter (minutes)

Time Spent/Patient Encounter—Duplicate Tasks Removed (minutes)

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

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 process to improve patient care, **not** an I.T. project

**Best luck with
Patients care**