

Dealing with the Unintended Consequences of CPOE

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OHSU
Informatics



Unexpected Increased Mortality After Implementation of a Commercially Sold CPOE System Han et al. *Pediatrics*.2005

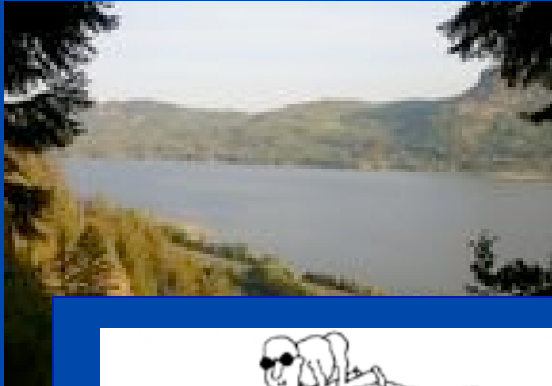
Clinical Information Systems are my life.

- Ph.D. Medical Informatics, Univ of Utah, LDS Hosp
- Yale - Intelligent Cardiovascular Monitors
- Vanderbilt - Enterprise clinical systems
- King Faisal Specialists Hospital - CIS, Internet
- Partners Healthcare - B&W, MGH –
 - Clinical Application design & development
- WebMD - Consumer health informatics
- Kaiser Permanente, Northwest
 - Applied Research
 - Guide to Clinical Decision Support
- 20th AMIA meeting

- www.informatics-review.com
- www.clinfowiki.org



This presentation focuses on the unintended adverse consequences surrounding CPOE.



Review CPOE Landscape



Describe out study methods



**Identify and describe
Unintended Consequences
of CPOE**

Computer-based Provider Order Entry (CPOE) occurs when the provider directly enters orders.



- CPOE is usually part of a suite of integrated clinical applications... results review, clinical documentation, message transmission, etc.
- 4 • Often accompanied by real-time clinical decision support.

Jha et al. < 25% of ambulatory physicians were using EHRs and < 10% of hospitals have CPOE.

**HEALTH
AFFAIRS**

How Common Are Electronic Health Records In The United States? A Summary Of The Evidence

by Ashish K. Jha, Timothy G. Ferris, Karen Donelan, Catherine DesRoches, Alexandra Shields, Sara Rosenbaum, and David Blumenthal

Health Affairs 25 (2006): w496–w507;

We identified 9 major types of unintended adverse consequences associated with CPOE.

Expert panel identified over 80 UACs and methods to identify them.



We identified over 300 UACs based on transcripts and field notes.



Created several UACs typologies to explain our findings.



CPOE systems create new work for physicians, administration and IT professionals.



- **Enter new data**
- **Respond to alerts**
- **Expend extra time in completing non-routine, complex orders.**

CPOE highlights mismatches between intended and actual work processes.

Shed light on clinical roles.

May not accommodate integrated clinical workflow.

Work shifting.



Users require more hardware, software, and training to meet their never ending demands.

Pardon us ...

We're improving our computer system so we can provide you with better service and care. While we get up to speed, we apologize for any inconvenience.



**CPOE systems evolve; upgrades & maintenance never end.
System changes lead to more unintended consequences
and more work.**

The key to going “paperless” is to decrease the dependency on ineffective processes that create barriers to optimal healthcare delivery.



Paper used as temporary, handwritten data storage system.

Paper used as portable, disposable, computer display interface.

1.6 million pieces of paper per month - printed or copied –half is related to clinical care...we destroy 40% of that paper.”

**Your hospital will be paperless, the same day
my bathroom is...**

Michael Shabot, M.D.

RUSSELL C. COILE, JR.

**THE PAPERLESS
HOSPITAL**
HEALTHCARE IN A
DIGITAL AGE

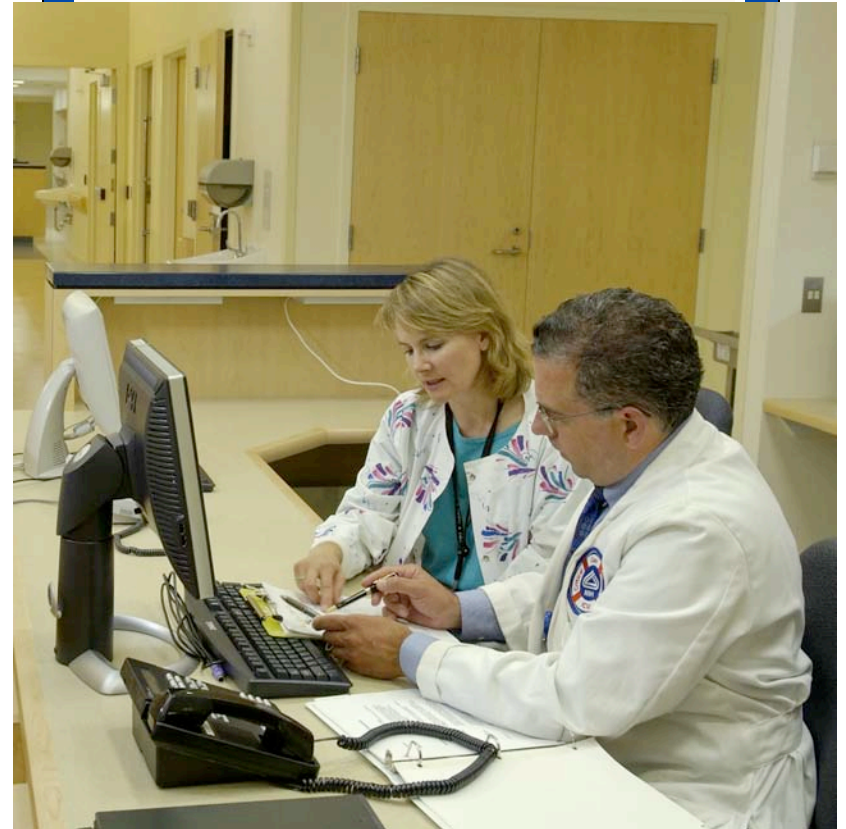


CPOE alters communication among providers, ancillary services, and clinical departments.

Causes reductions in face-to-face communication.

**“illusion of “communication”
belief that CPOE ensures
that the proper people will
see it and act upon it.**

**Emergent orders placed using
CPOE... also phoned in to
assure immediate action.**



“Collaborative charting”...the patient participates by editing and suggesting changes.



“He turns the patient instructions on the screen to the patient and they go over it line by line, clarifying any questions...”

“Patient finds error”

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Shifting from paper-based ordering to CPOE evokes strong emotional responses.



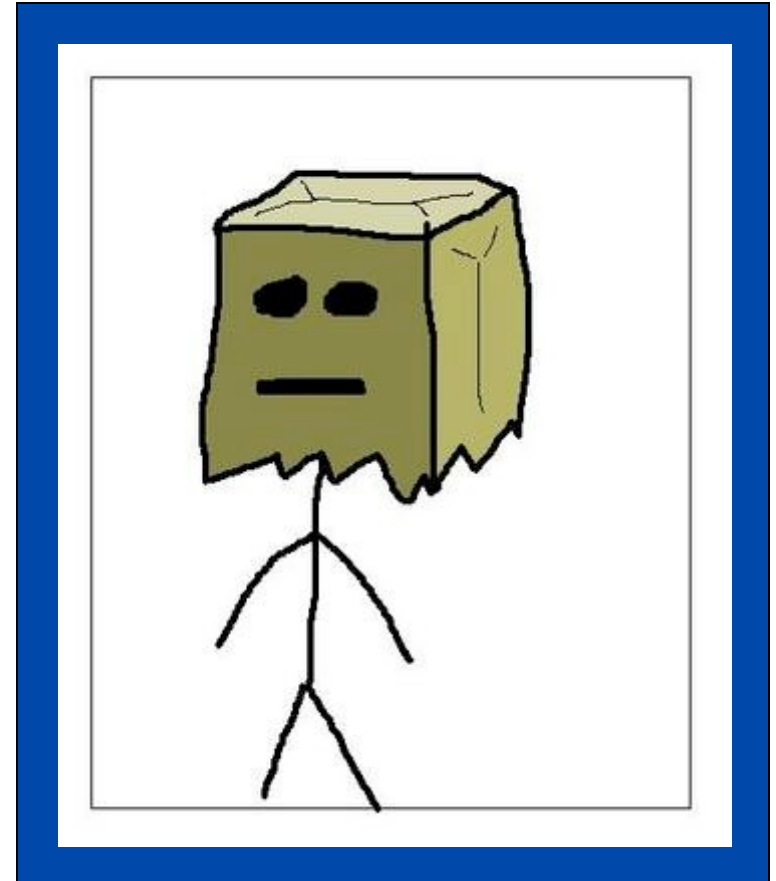
- Emotional responses to change are inevitable.
- Can point out significant problems with design... lead to solutions.
- Good system design, training and open communication promotes understanding... may reduce the negative emotional responses.

Users often react differently than system designers expect...

When asked...

“Do you want to document your actions to satisfy this alert?”

“We take these alerts personally, and they’re like a slam. It’s like, “Well, they [the patient] just got here and I haven’t even had a chance to do anything and I’m getting the ALERTS!”



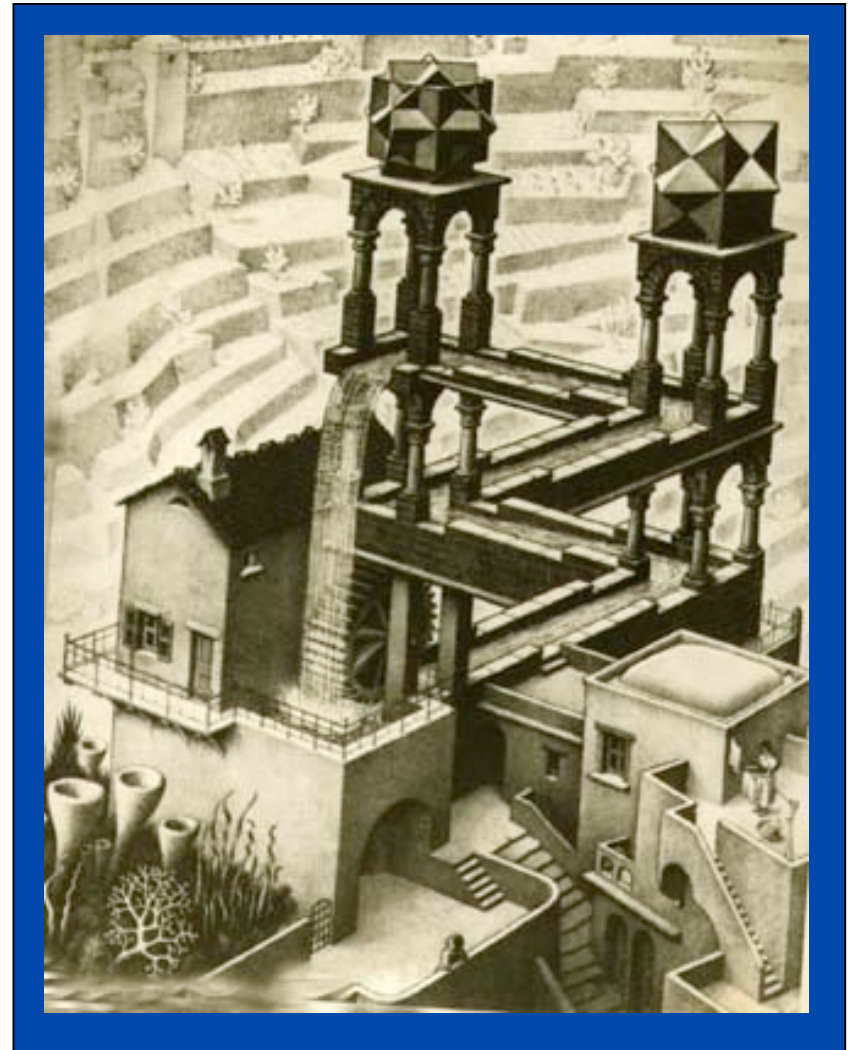
CPOE prevents some types of errors while introducing or propagating new types.

CIS changes the organizational Safety Net

Inaccurate or missing data / information / knowledge

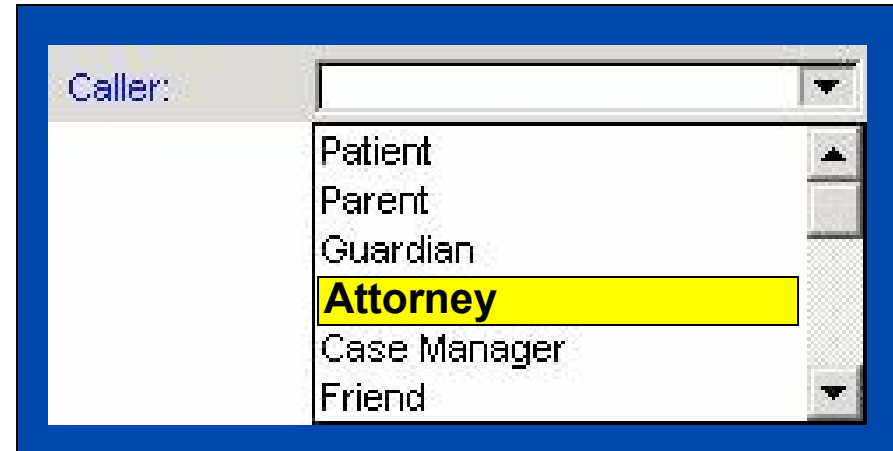
System interface issues

Asynchronous recording of events












Juxtaposition errors result from incorrect selection of adjacent menu items.

“I ordered the test that was right next to the one I thought I ordered, you know, right below it. My little thingie had come down and I clicked and I'm lookin' at this one but in fact I clicked on the thing before. By that time I turned my head and I'm hitting return and typing my signature and not seeing it”



CPOE changes the “power structure” within the organization.

| Box A Referral criteria from primary care to secondary care: women likely to be at more than moderate risk (see top page 1) | | |
|---|--|--------------------------|
| Is there at least one of the following present in family history? <i>A tick in any box indicates a positive referral</i> | | |
|  | Female breast cancers only One 1st degree relative <i>and</i> one 2nd degree relative diagnosed before average age 50 | <input type="checkbox"/> |
|  | Two 1st degree relatives diagnosed before average age 50 | <input type="checkbox"/> |
|  | Three or more 1st or 2nd degree relatives diagnosed at any age | <input type="checkbox"/> |
|  | Male breast cancer One 1st degree male relative diagnosed at any age | <input type="checkbox"/> |
|  | Bilateral breast cancer One 1st degree relative where 1st primary diagnosed before age 50 <i>For bilateral breast cancer, each breast has the same count value as one relative.</i> | <input type="checkbox"/> |
|  | Breast and ovarian cancer One 1st or 2nd degree relative with ovarian cancer at any age <i>and</i> one 1st or 2nd degree relative with breast cancer at any age (<i>one should be a 1st degree relative</i>) | <input type="checkbox"/> |
| Box B Referral criteria from primary care to secondary care: women likely to be at moderate risk (see top page 1) | | |
| Is there one of the following present in family history? | | |
|  | Female breast cancers only One 1st degree relative diagnosed before age 40 | <input type="checkbox"/> |
|  | One 1st degree relative <i>and</i> one 2nd degree relative diagnosed after average age 50 | <input type="checkbox"/> |
|  | Two 1st degree relatives diagnosed after average age 50 | <input type="checkbox"/> |

Unusual cancers

- Bilateral breast cancer
- Male breast cancer
- Ovarian cancer
- Sarcoma at younger than age 45 years
- Glioma or childhood adrenal cortical carcinoma
- Complicated patterns of multiple cancers at young age

¹ Women with Jewish ancestry are around 5–10 times more likely to carry *BRCA1* or *BRCA2* mutations than women in non-Jewish populations.

Information to remember when taking a family history

All relatives must be on same side of family and be blood relatives of the consultee and of each other.

First-degree relatives:
mother, father, daughter, son, sister, brother

Second-degree relatives:
grandparents, grandchildren, aunt, uncle, niece and nephew; half sister and half brother

Third-degree relatives:
great grandparents, great grandchildren, great aunt, great uncle, first cousin, grand nephew and grand niece

Paternal history:
two or more relatives diagnosed with breast cancer on father's side of family



Can prevent MDs from ordering tests or medications they prefer.
 CISs limit clinician's narrative flexibility...structured rather than free-text clinical documentation

Alert fatigue -- too many or the wrong kinds of alerts.



“an administrator could think that it’s good, it’s okay to send out twenty alerts if there’s one that’s gonna be right on target but if you ask the physicians to vote on that and if they’re not employed by the institution they’re not gonna vote on a twenty to one ratio.”

Change in Power: Loss of clinician autonomy



**Dr. K: I expect
to die in prison**

**Cherished by clinicians:
whether by gov't, payers or
CPOE they resist**

**Clinical decision support can
“tell Dr.’s how to practice”**

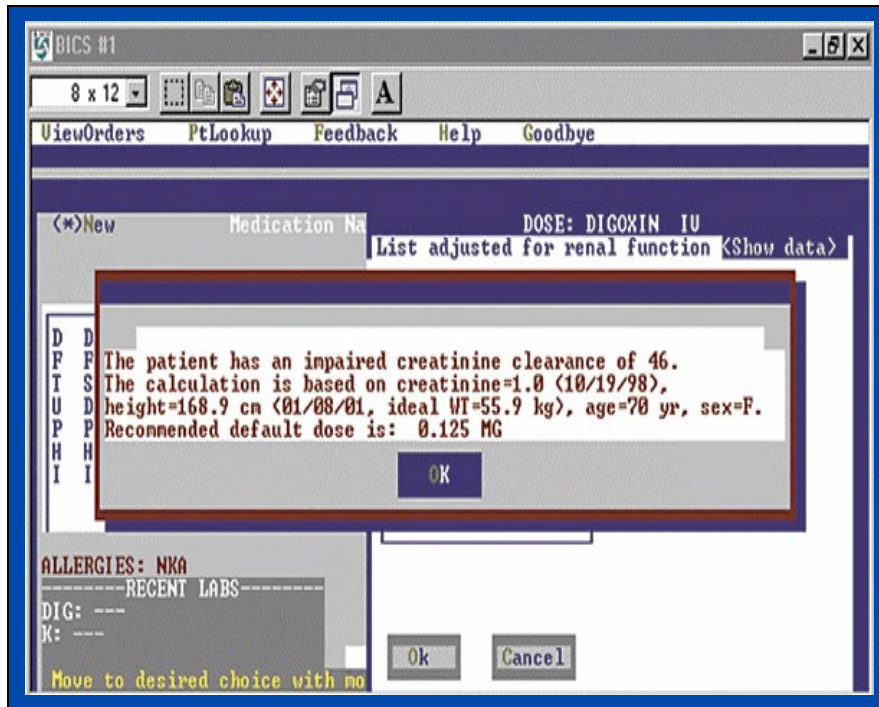
**Dr: “we were *in control of
the hospital and practice of
medicine in that
community*”**

Coalitions gain power following CPOE implementation.



“There are committees to create order sets for each specialty based on “best practices” and they say “this is what you’ll use” and there is very little way to get around that...and I don’t trust them!”

High-quality, efficient clinical care becomes over dependent on the computing infrastructure.



The cockpit of a Boeing 737-700.

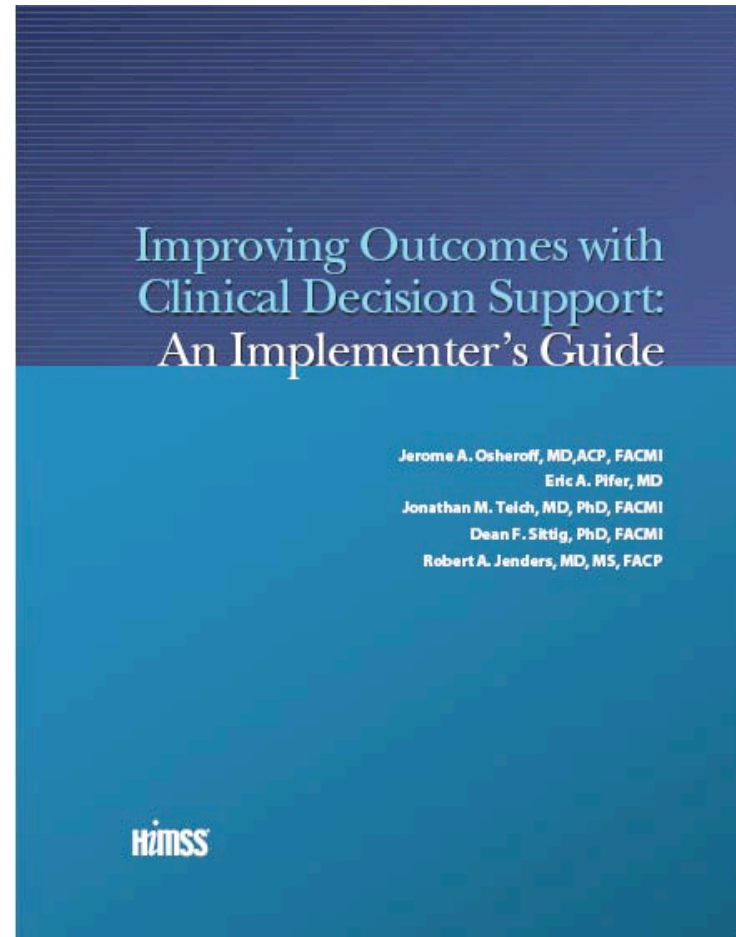
- System failures wreak havoc unless good downtime procedures exist.
- Reliance on clinical decision support may reduce learning.

22 ***“If its in the computer it must be right!”***

Real-time clinical decision support can be a major factor in many of these unintended consequences.



- CDS is not consistently useful.
- CDS can be impractical to maintain.
- CDS is not 100% reliable especially in complex situations, i.e., when it is really needed!



Our goal is to discover & understand these consequences so others can prevent or manage them.

- **Difficult to predict.**
- **Result from many factors.**
- **Never occur in isolation.**
- **Not all types occur.**

- **Reduce negative impacts CPOE has on providers, patients, and administrators.**



Thank you.

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