Using IT to Improve Patient Safety

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Agenda

- Overview of EHR's role in patient safety
- Unintended consequences of EMR use
- Red-flags to help identify EMR-related safety concerns
- SAFER Guides: safe & effective EMR implementation and use
- Q & A

HIT can improve safety and effectiveness of healthcare

AMERICAN JOURNAL OF

Respiratory and Critical Care Medicine®

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VOLUME 188
NUMBER 6
SEPTEMBER 15 2013
www.thorack.org

Randomized clinical trial of pressure-controlled inverse ratio ventilation and extracorporeal CO2 removal for adult respiratory distress syndrome.

A H Morris, C J Wallace, R L Menlove, T P Clemmer, J F Orme,Jr, L K Weaver, N C Dean, F Thomas, T D East, N L Pace, M R Suchyta, E Beck, M Bombino, D F Sittig, S Böhm, B Hoffmann, H Becks, S Butler, J Pearl, and B Rasmusson

SACRAMENTO
BUSINESS JOURNAL

Sutter electronic records system crashed Monday

Aug 27, 2013, 2:57pm PDT | **UPDATED:** Aug 27, 2013, 6:13pm PDT

Kathy Robertson | Senior Staff Writer – *Sacramento Business Journal*

At about 8 a.m. Monday, the electronic health record system at seven East Bay hospitals, medical offices and clinics went dark. The meltdown continued through late afternoon or early evening, according to early reports from the California Nurses Association.

The electronic health record system at seven East Bay hospitals, medical offices and clinics went dark on Monday in an unplanned outage. The information technology system had been down for a planned upgrade Friday.

The incident left doctors and nurses without access to patient information — including medications and patient histories — at Alta Bates Summit Medical Center facilities in Berkeley and Oakland, Eden Medical Center in Castro Valley, Mills Peninsula Health Services in Burlingame and San Mateo, Sutter Delta in Antioch, Sutter Tracy, Sutter

Smokers prescribed Viagra to quit

The health board said no-one received Viagra

Smokers trying to quit the habit were mistakenly prescribed anti-impotence drug Viagra by doctors.

NHS Greater Glasgow and Clyde said the error was due to a computer glitch at two city GP practices.

When GPs selected anti-smoking pill **Zyban**, computers selected **sildenafil**, the generic name for **Viagra**.

A health board spokeswoman said: "At no time was patient care affected by this as all prescriptions are subject to stringent double checking."

The e-Formulary computer system used by GPs automatically selects a list of the most popular drugs when doctors fill out prescriptions.

Some patients went to the pharmacy with a prescription for the anti-impotence drug in of tablets to help them stop smoking.

Defining Major types of HIT-related Safety Concerns

Type of HIT-related safety concern	Examples
1. Instances in which **HIT fails during use or is otherwise not working** as designed.	Broken hardware or software "bugs"
2. Instances in which HIT is working as designed, but the design **does not meet the user's needs or expectations.**	Usability issues
3. Instances in which HIT is well-designed and working correctly, but was **not configured, implemented, or used in a way anticipated or planned** for by system designers and developers	Duplicate order alerts that fire on alternative PRN pain medications

Sittig Classen Singh J Am Med Inform Assoc. 2014 Oct 20.

Major types of HIT-related Safety Concerns

Type of HIT-related safety concern	Examples
4. Instances in which HIT is working as designed, and was configured and used correctly, but **interacts with external systems (e.g., via interfaces) so that data is lost or incorrectly transmitted or displayed**.	Order for extended release morphine changed to immediate release morphine by error in interface translation table
5. Instances in which specific safety **features or functions were not implemented or not available** (i.e., HIT could have prevented an issue).	Patient receives 5 grams of acetaminophen in 24 hours because max daily dose alert not available

Sittig Classen Singh J Am Med Inform Assoc. 2014 Oct 20

Evolution of safety (and risks) - Phases

Safe IT:

- Events unique/specific to HIT; more likely early in implementation

Using HIT safely:

- Unsafe or inappropriate use of technology
- Unsafe changes in the workflows that emerge from technology use

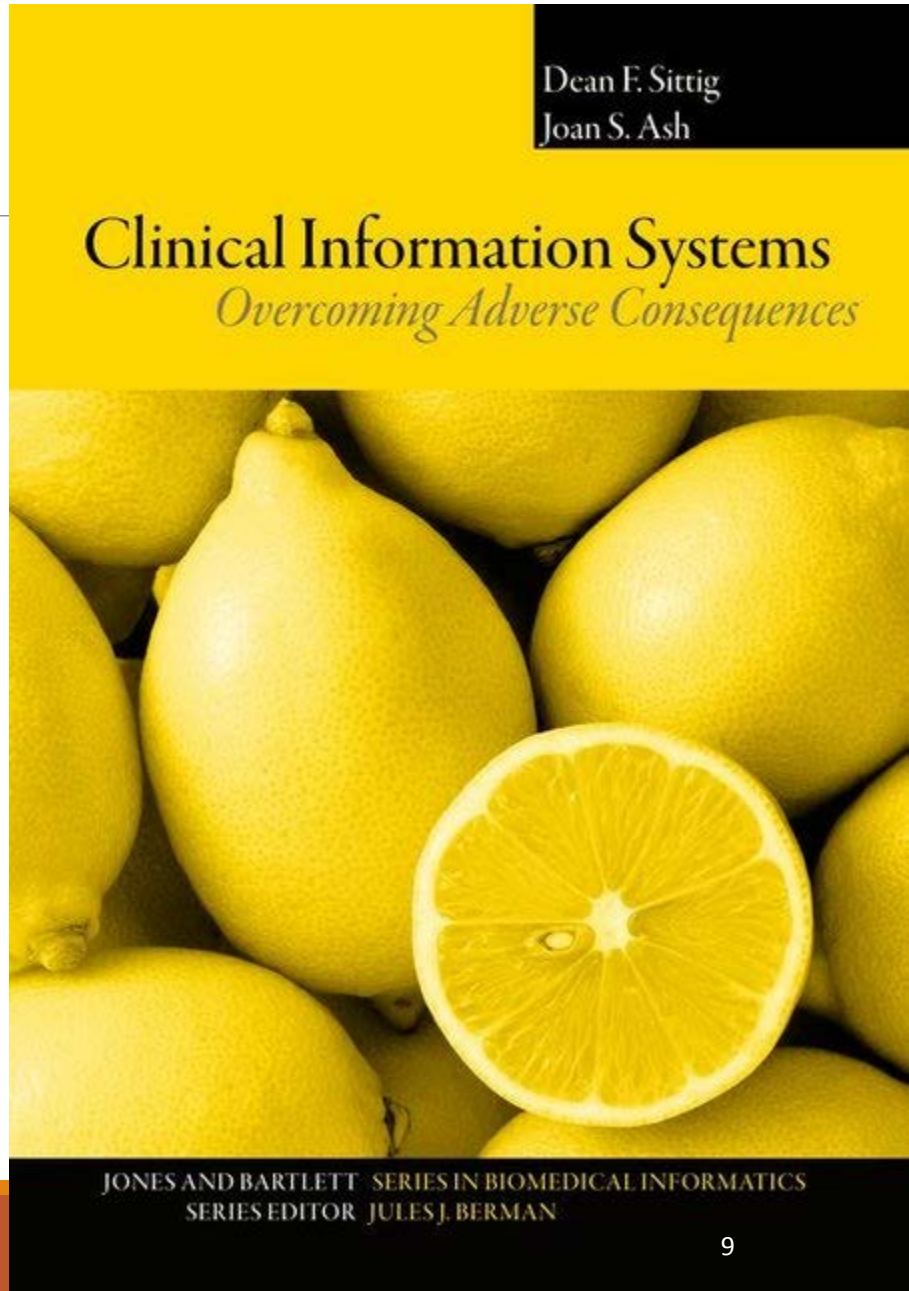
Using HIT to improve/monitor safety

- Monitor health care processes and patient outcomes to identify potential safety concerns before harm

Sittig & Singh N Engl J Med. 2012 Nov 8;367(19):1854-60

We use a comprehensive, socio-technical model to…

- Help us discover & understand
- Where and how EHR-related unintended consequences occur,
- So we can prevent or manage them



Campbell EM, et al. J Am Med Inform Assoc. 2006 Sep-Oct;13(5):547-56

8-dimension Socio-Technical Model of Safe & Effective EHR Use

Hardware & Software

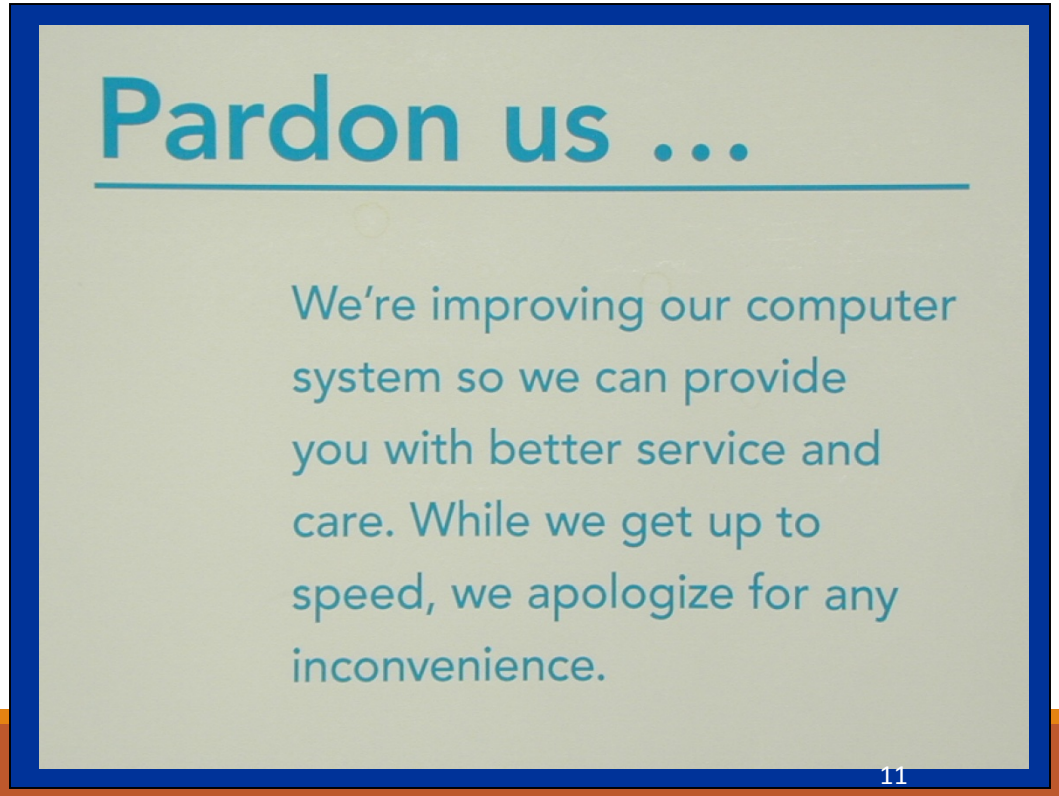
JAMA 2009; 302(10):1111-3
Quality & Safety in Healthcare 2010; 3:i68-74

We found failures of hardware to function as designed…

Hardware failures include:

- power losses
- server failure
- network outages
- voice-data outages

Users require more hardware to meet the their never ending demands



Failures in data input, storage, and retrieval can lead to patient harm

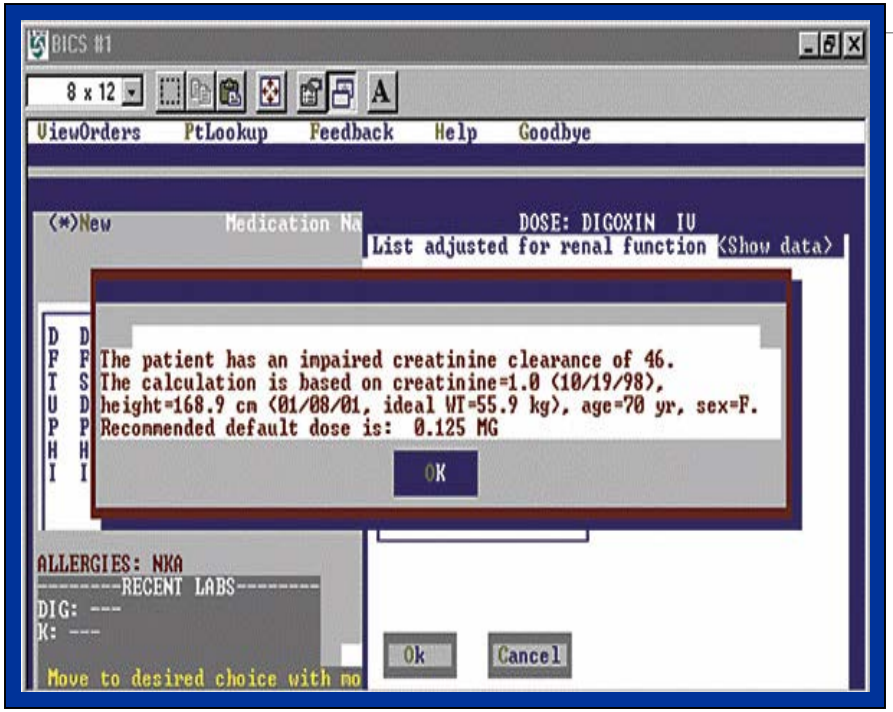
Software failures (or “bugs”)

- may affect the data in a single CIS or the transmission of data among CISs.

Poorly designed software leads to work-arounds

Both types can result in more or less complete information corruption or loss.

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.
- *"If its in the computer it must be right!"*

Sittig et al. Int J Med Inform. 2014 Nov;83(11):797-804.

Red flags: Indications that something may be wrong

- For example, a 60-year old healthy patient complains of fever and a cough for a week; given a diagnosis of upper respiratory infection; prescription for cough syrup
- If the same patient indicated he is **coughing up blood** and he just returned from **Liberia**, that would warrant special attention
- Ebola test, Chest x-ray, travel to Liberia and blood in sputum at that age are "red flag" that could suggest something much more serious, like Ebola or lung cancer

Upadhyay D, et al. Diagnosis 2014 DOI 10.1515/dx-2014-0064

Red flags: Extended EHR unavailability

- NO documented EHR downtime and reactivation procedures
- Critical hardware components not duplicated

Example Red Flags: Hardware & software…

Mean response > 3 seconds or any request >10 secs

Access to computers is poor:

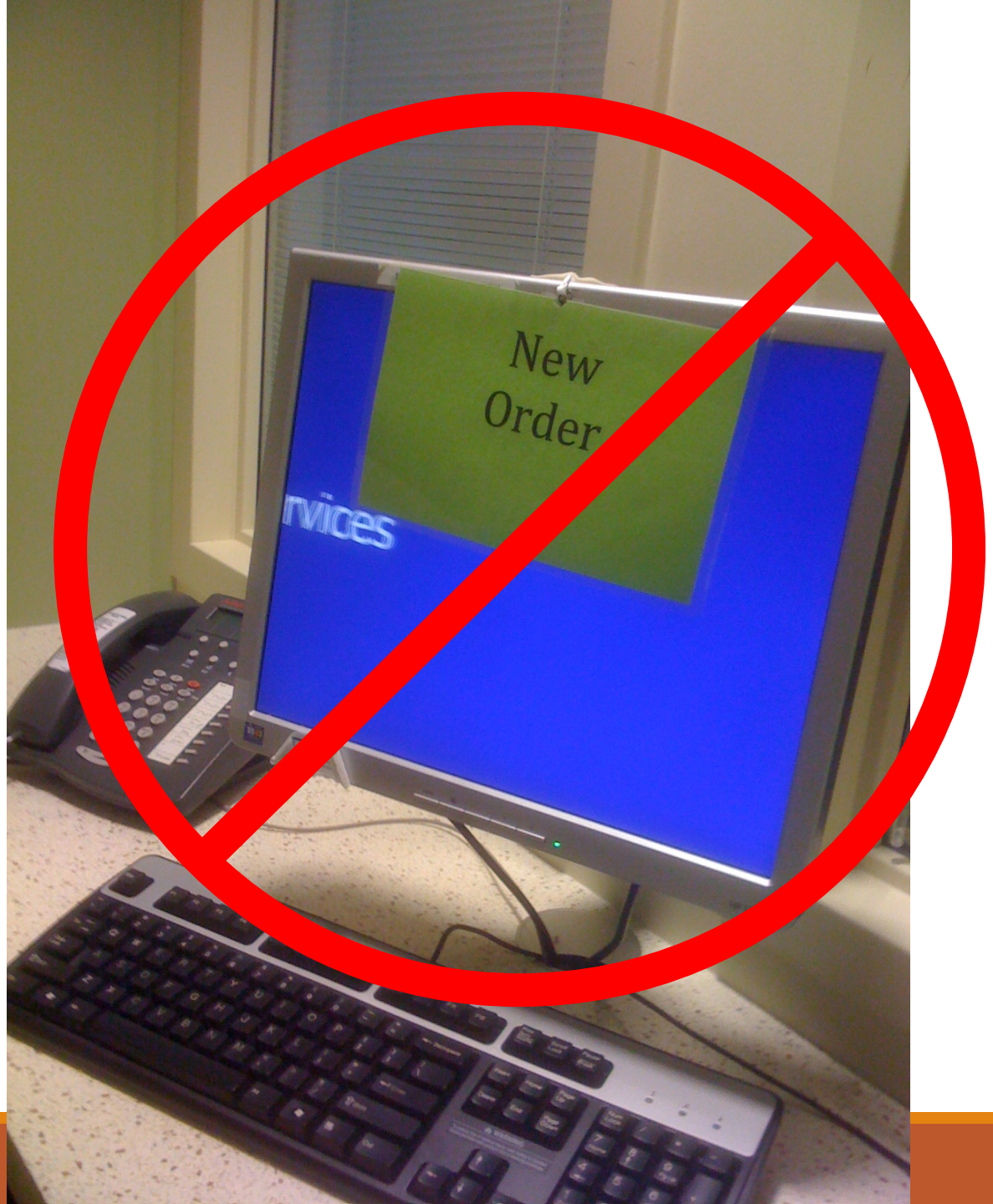
- > 2 clinicians waiting during peak usage
- clinicians must walk > 50 feet to find computer
- < 1 computer/staffed bed on an acute care unit
- < 2 computers per staffed bed in an ICU

Wireless network has "dead spots" on clinical units

No encrypted, offsite, daily backup, periodically tested

No computer-based method of notifying RNs of new orders or clinical results

Sittig & Singh. J Healthc Risk Manag. 2013;33(2):21-6


New
Order
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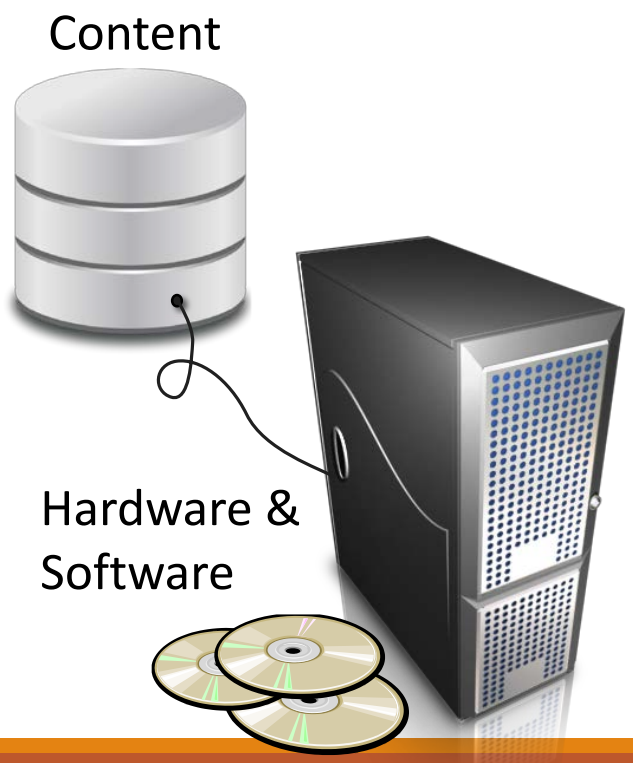
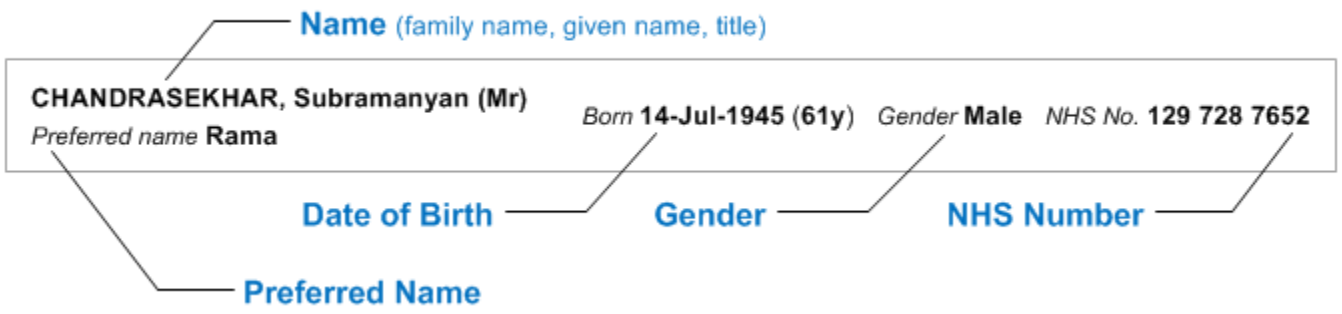
8-dimension Socio-Technical Model of Safe & Effective EHR Use



JAMA 2009; 302(10):1111-3
Quality & Safety in Healthcare 2010; 3:i68-74

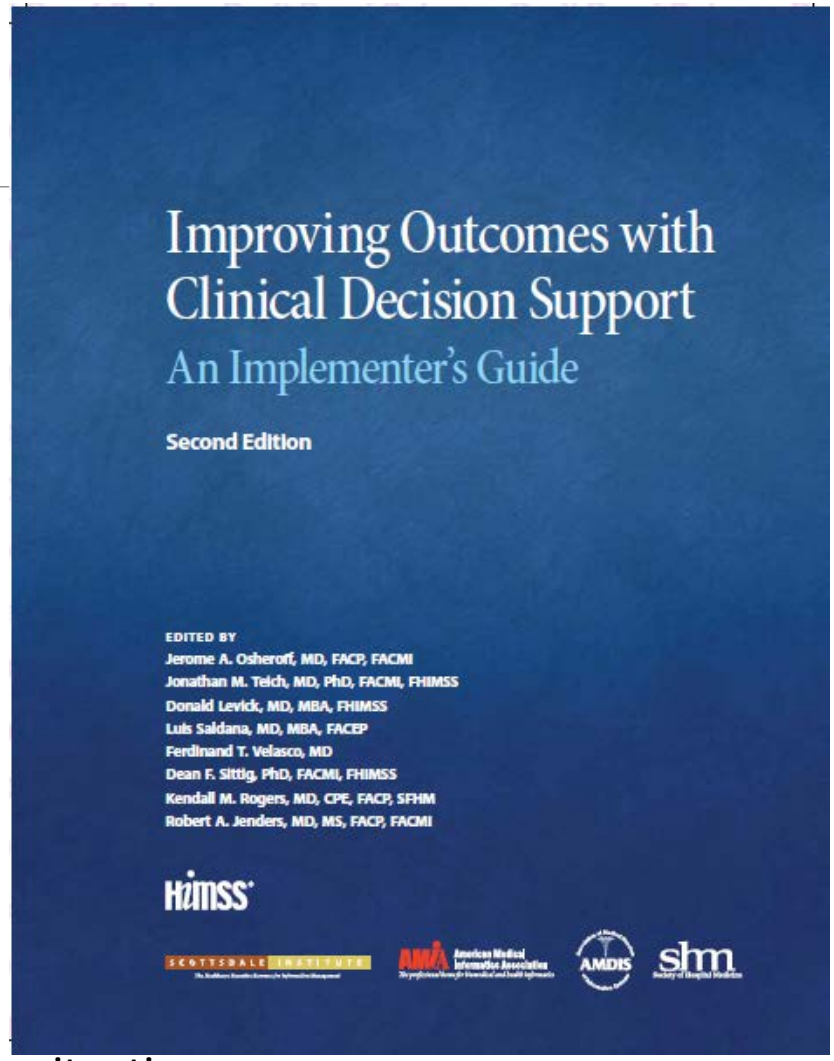
Red flags: Incorrect patient ID

Key patient identifying information missing from EHR screens or printouts



McCoy et al. BMJ Qual Saf. 2013 Mar;22(3):219-24.

Real-time clinical decision support can be a major factor in many of these hazards…



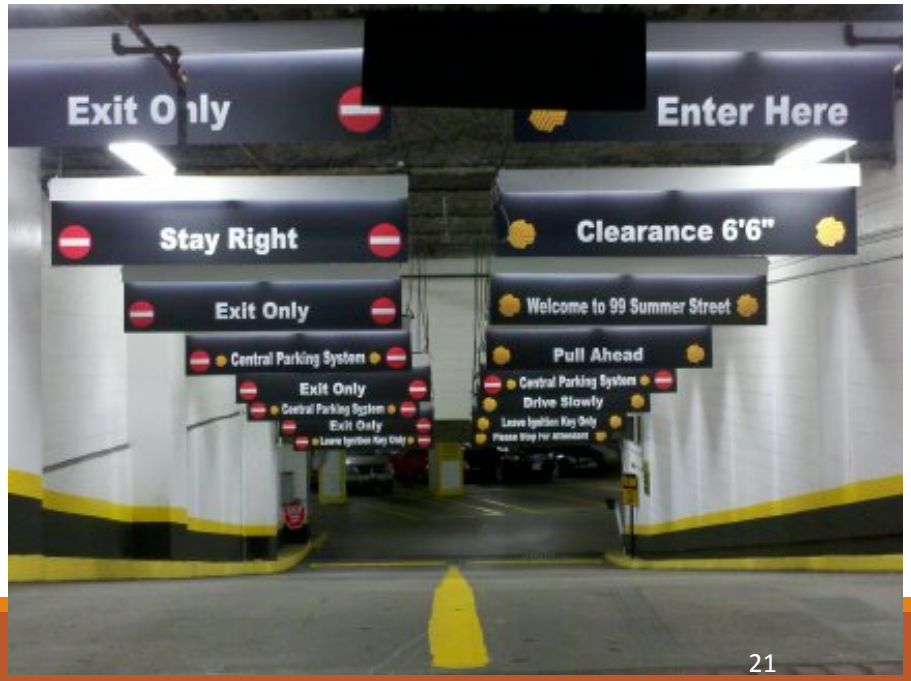
- CDS is not consistently useful.
- CDS can be impractical to maintain.
- CDS is not 100% reliable especially in complex situations, i.e., when it is really needed!

Red flags: failure to heed a computer-generated warning or alert

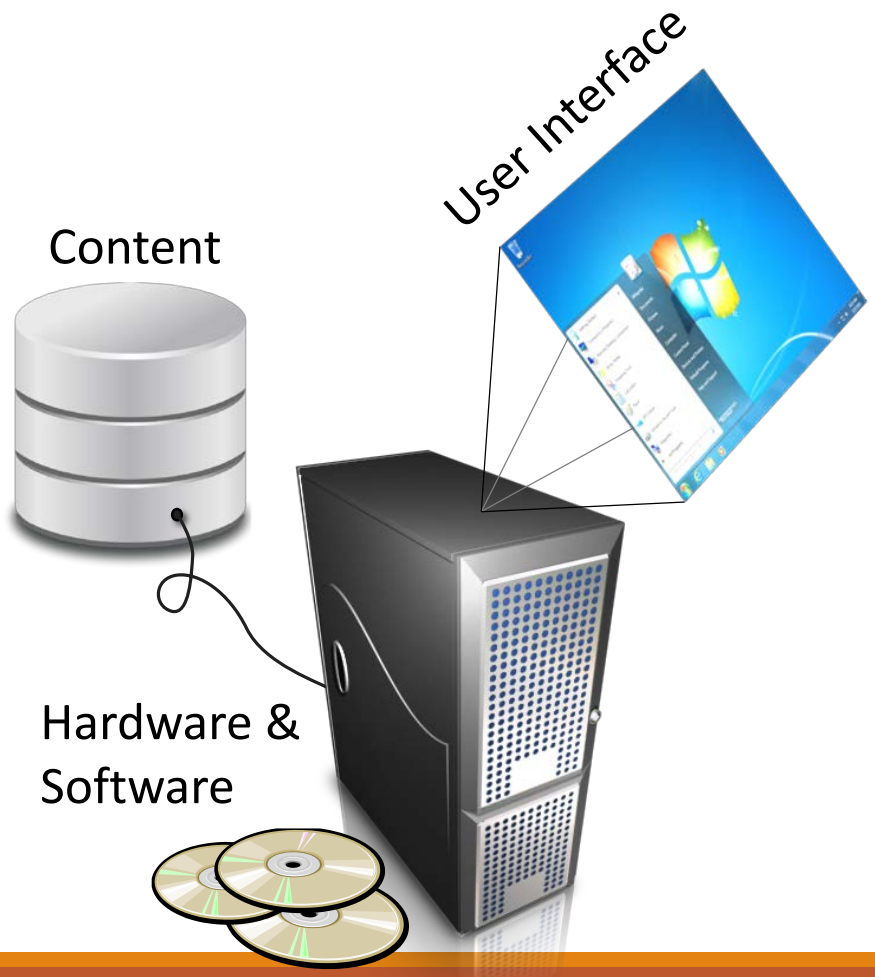
Widespread non-adherence to alerts

Clinicians report too many irrelevant alerts during order entry or as asynchronous messages

Clinicians report intrusive alerts that are not critical



8-dimension Socio-Technical Model of Safe & Effective EHR Use

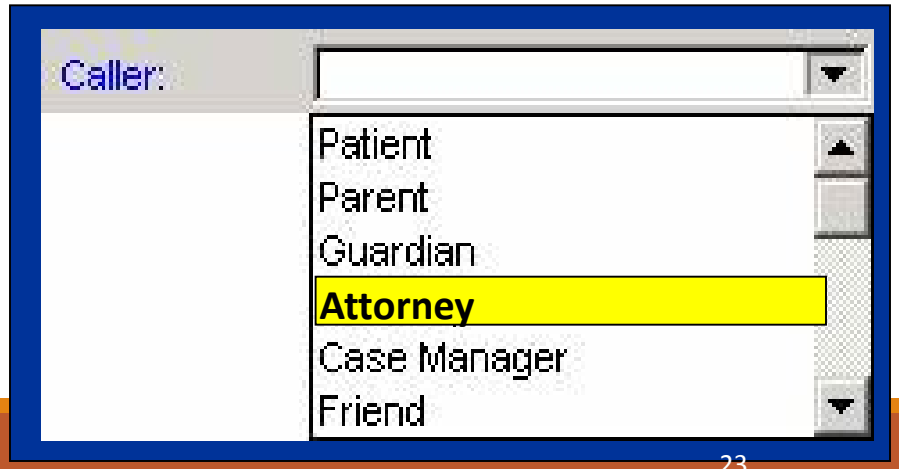


JAMA 2009; 302(10):1111-3
Quality & Safety in Healthcare 2010; 3:i68-74

Human – Computer Interface (HCI) can lead to hazards…

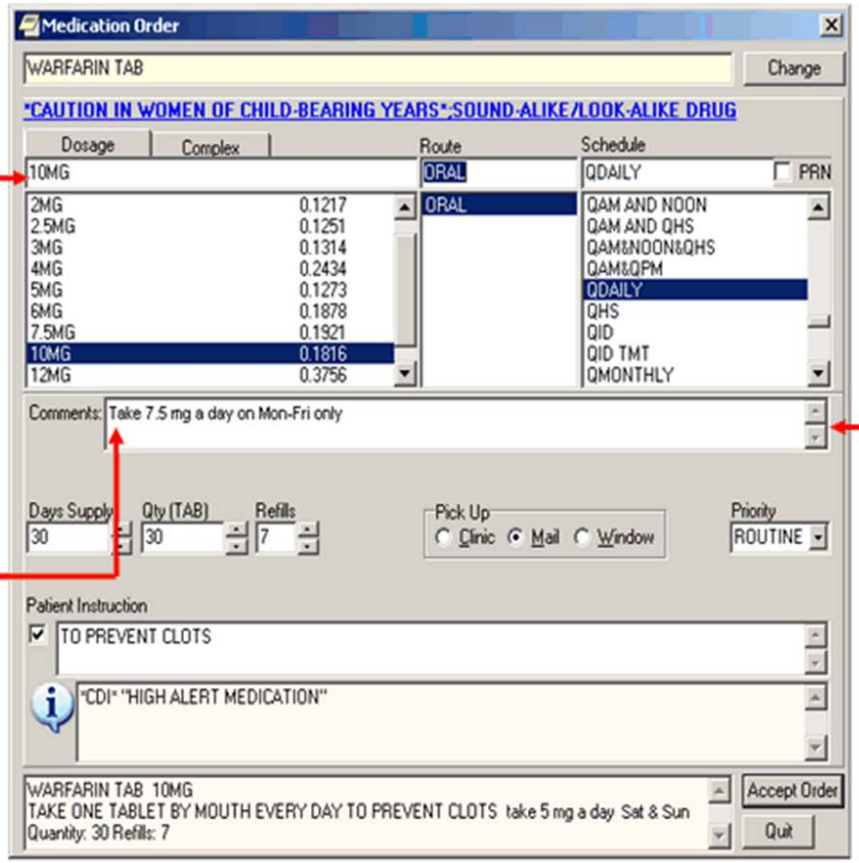
Areas of concern include:

- hazards caused by a mismatch between the user's mental model of a task and the software designer's mental model
- hazards that lead to a loss of situation awareness on the part of users
- hazards contributing to inadvertent selection of the wrong item from a pick-list.



Red flags: User interface errors

Clinicians report errors or inconsistencies between the structured data fields and free-text comments



However, this can lead to inconsistencies

Flexibility allo
for clarificati
through a fre
text commen
window.

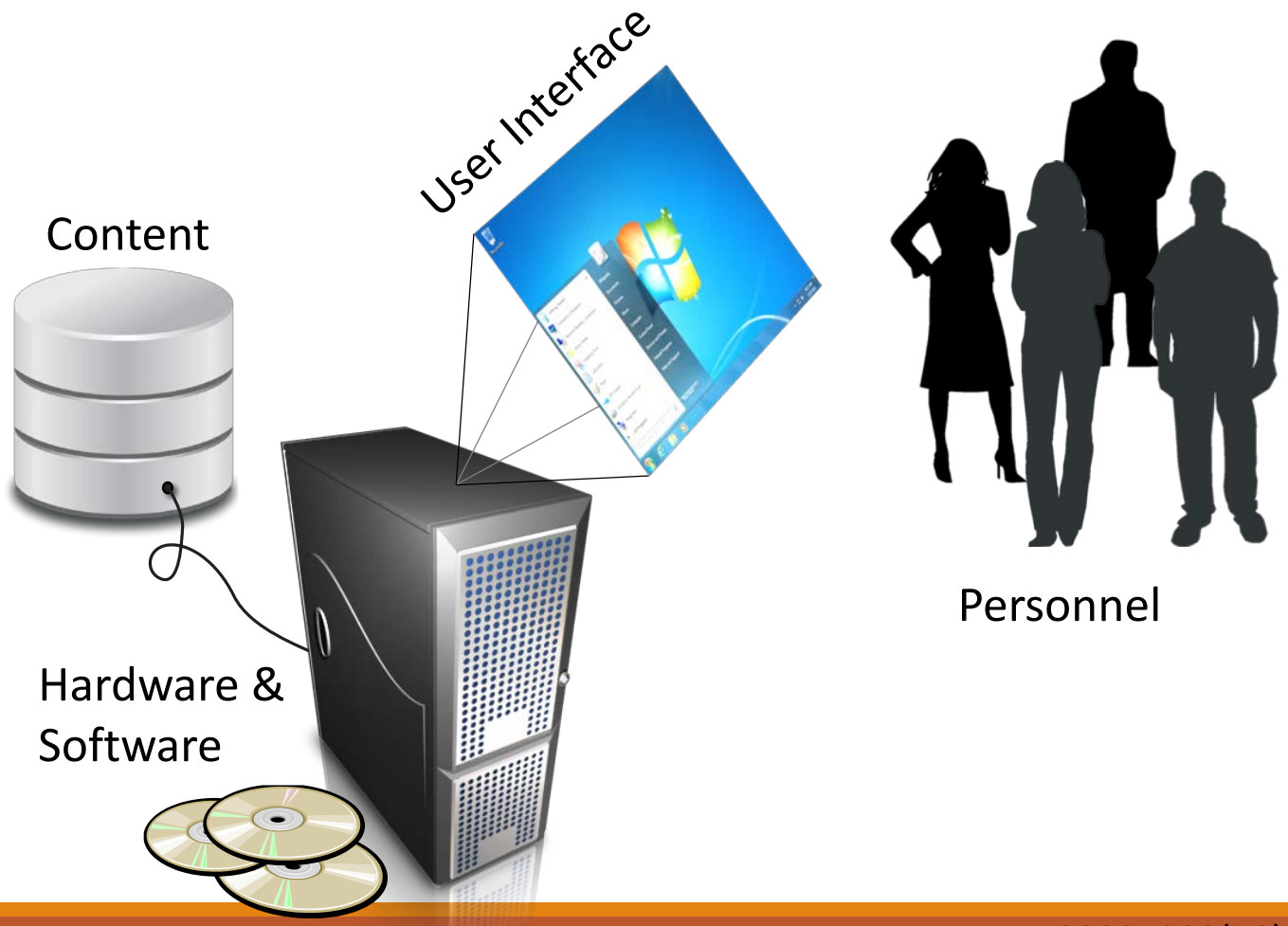
Singh et al. Arch Intern Med. 2009 May 25;169(10):982-9.

Red flags: incorrect item selected from a list of items

The EHR user interface has multiple cascading or fly-out submenus

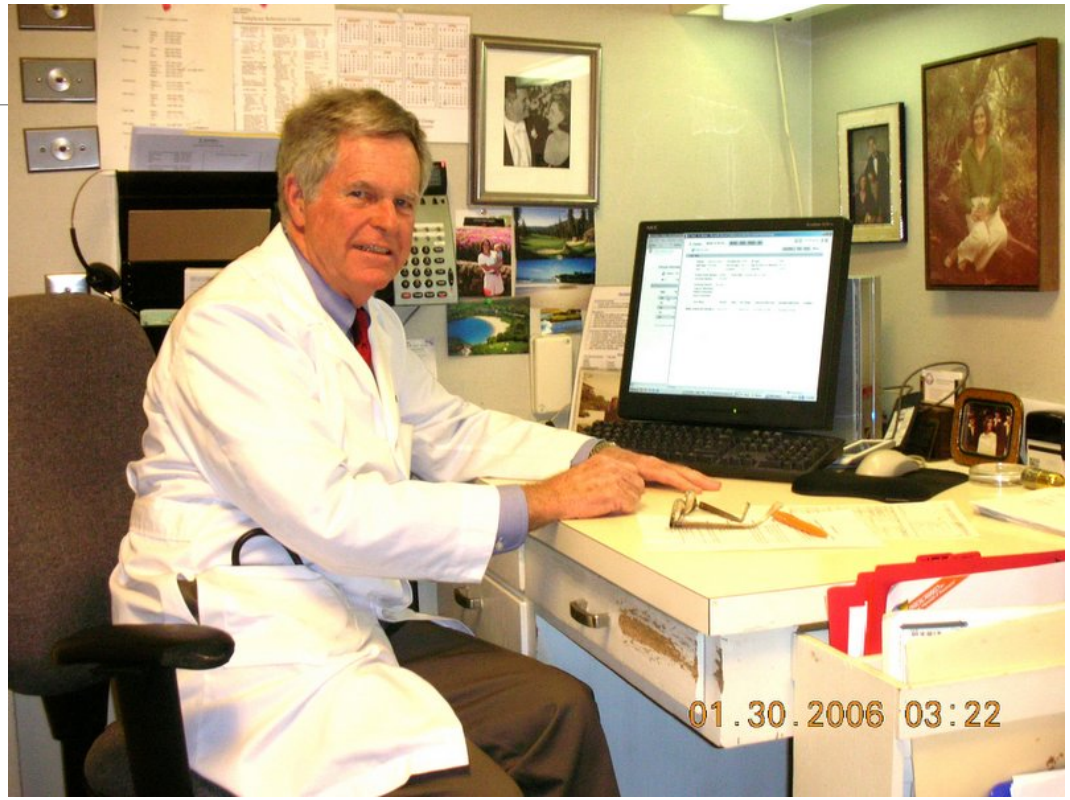
FIGURE 109. Fly-out menus

8-dimension Socio-Technical Model of Safe & Effective EHR Use



JAMA 2009; 302(10):1111-3
Quality & Safety in Healthcare 2010; 3:i68-74

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

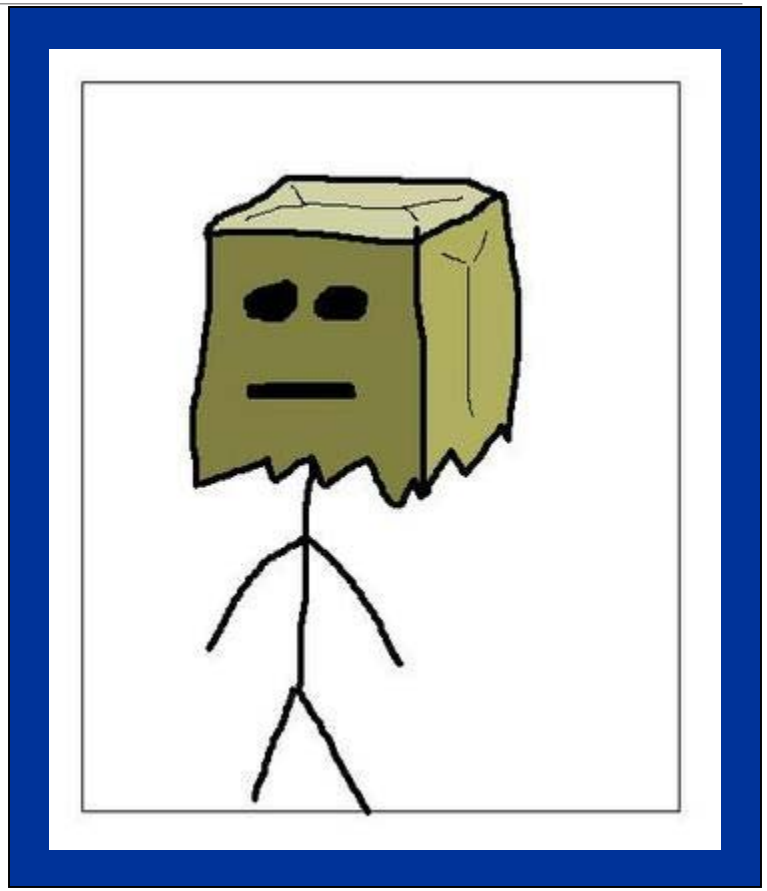


- **Enter new data**
- **Respond to alerts**
- **Expend extra time in completing non-routine, complex orders**
- **Training to use the system becomes a major issue**

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!"*



Sittig DF, et al. J Am Med Inform Assoc. 2005 Sep-Oct;12(5):561-7.

Personnel

- No record all clinicians have passed a test of basic EHR functions before getting their login
- No one with formal informatics training involved in the EHR design, configuration, training, or optimization efforts
- User audit log shows > 20% of active clinicians have not logged in to the EHR in the last month
- < 75% of clinicians asked about downtime policies or procedures answer all questions correctly
- No employees with extensive clinical experience in the clinical information systems department

Wright et al. J Am Med Inform Assoc. 2014 May-Jun;21(3):464-72.

8-dimension Socio-Technical Model of Safe & Effective EHR Use

JAMA 2009; 302(10):1111-3
Quality & Safety in Healthcare 2010; 3:i68-74

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.

Dykstra R. Computerized physician order entry and communication: reciprocal impacts. Proc AMIA Symp. 2002:230-4

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

Michael Shabot, M.D.

Dykstra RH, et al. Persistent Paper: The Myth of "Going Paperless". AMIA Fall Symposium, 2009.

CPOE highlights mismatches between intended and actual work processes.

Shed light on clinical roles.

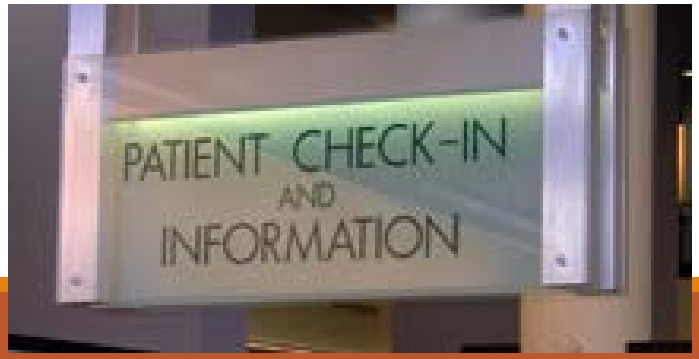
May not accommodate integrated clinical workflow.

Work shifting.

Campbell EM, et al.. Journal of General Internal Medicine, 2009 Jan;24(1):21-6.

Red flags: Incorrect patient ID

Absence of documented processes and procedures for checking patient ID at essential stages of a patient visit



We ID Campaign

A Patient Safety Initiative

Red flags: Incorrect patient ID

Nurses have copies of patient barcode ID bands taped to their clipboard to "facilitate" BCMA

8-dimension Socio-Technical Model of Safe & Effective EHR Use

JAMA 2009; 302(10):1111-3
Quality & Safety in Healthcare 2010; 3:i68-74

HIT changes the "power structure" within the organization.

- Can prevent MDs from ordering tests or medications they prefer

- CISs limit clinician's narrative flexibility…structured rather than free-text clinical documentation

- Han et al. limit ordering until patient has been registered… NO registration before arrival!

Ash JS, et al.. AMIA Annu Symp Proc. 2006:11-5.

Red flags: open or incomplete orders

Orders requiring co-signature are overdue according to the organization's policy

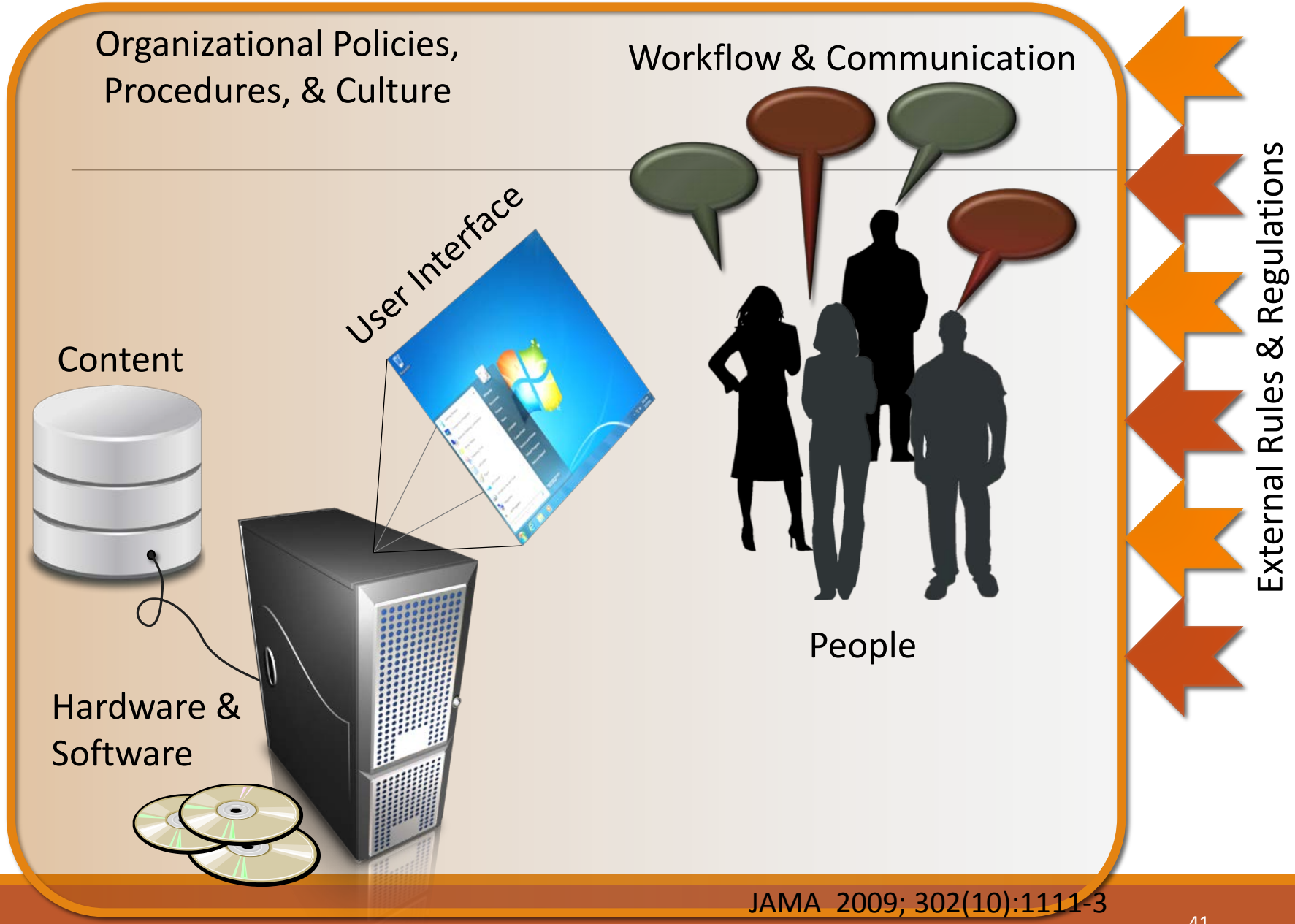
Red flags: EHR time measurement translational challenges

Routine tests, medications, or procedures ordered “daily” continue long after they are clinically indicated

Red flags: EHR time measurement translational challenges

Clinicians report that critical medications have been cancelled automatically with no notice to clinicians

8-dimension Socio-Technical Model of Safe & Effective EHR Use

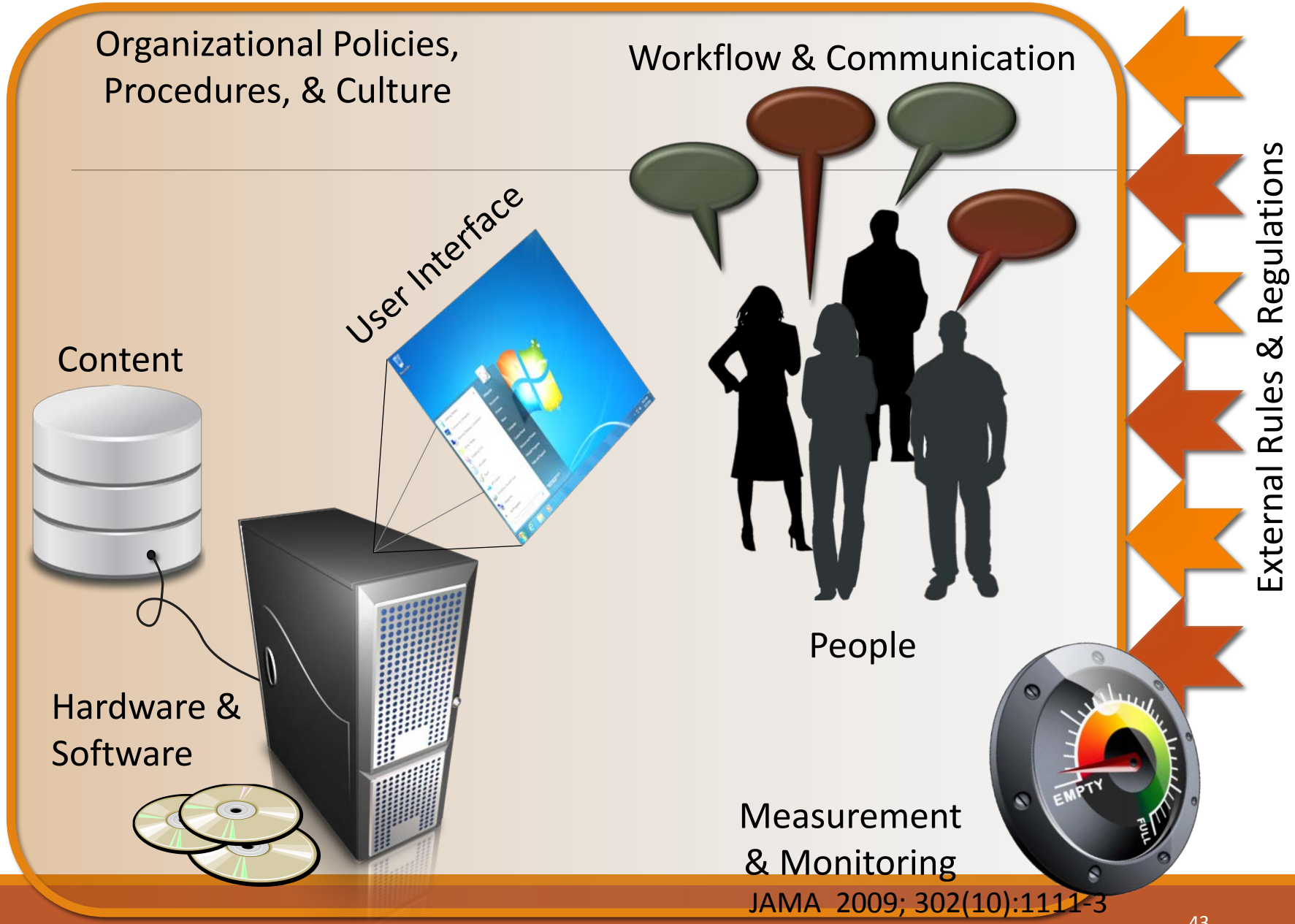


JAMA 2009; 302(10):1111-3
Quality & Safety in Healthcare 2010; 3:i68-74

State/Federal Rules & Regulations

- Regulations may act as barriers or facilitators for safe EHR use
- ARRA and "meaningful use" of EHRs
  - Legislation could result in suboptimal systems
- Patient privacy
- Policies must address safety and effectiveness of health information exchange across organizational boundaries
- State and federal governments should create an environment compatible with widespread use and interoperability

8-dimension Socio-Technical Model of Safe & Effective EHR Use



JAMA 2009; 302(10):1111-3
Quality & Safety in Healthcare 2010; 3:i68-74

Monitoring/Measurement

Reports have described serious errors related to the use or misuse of HIT…result of:

- Faulty system design,
- User configuration, or
- Implementation processes.

Organizations must continually evaluate the usability and performance of their systems after implementation,

- reliably measure benefits, and
- assess potential e-iatrogenic effects.

Use of a vendor-independent hazard reporting database

Sittig et al. AMIA Annu Symp Proc. 2007 Oct 11:671-5.

The SAFER Guides for Safe and Effective EHR Implementation and Use

School of Biomedical Informatics

6 principles in 3 phases

Phase 1 *Safe Health IT: Address Safety Concerns Unique to EHR Technology*

1. Data Availability
2. Data Integrity
3. Data Confidentiality

- **Phase 2** *Using Health IT Safely: Optimize the Safe Use of EHRs*

4. Complete/Correct EHR Use
5. EHR System Usability

- **Phase 3** *Monitoring Safety: Use EHRs to Monitor and Improve Patient Safety*

6. Safety Surveillance, Optimization, and Reporting

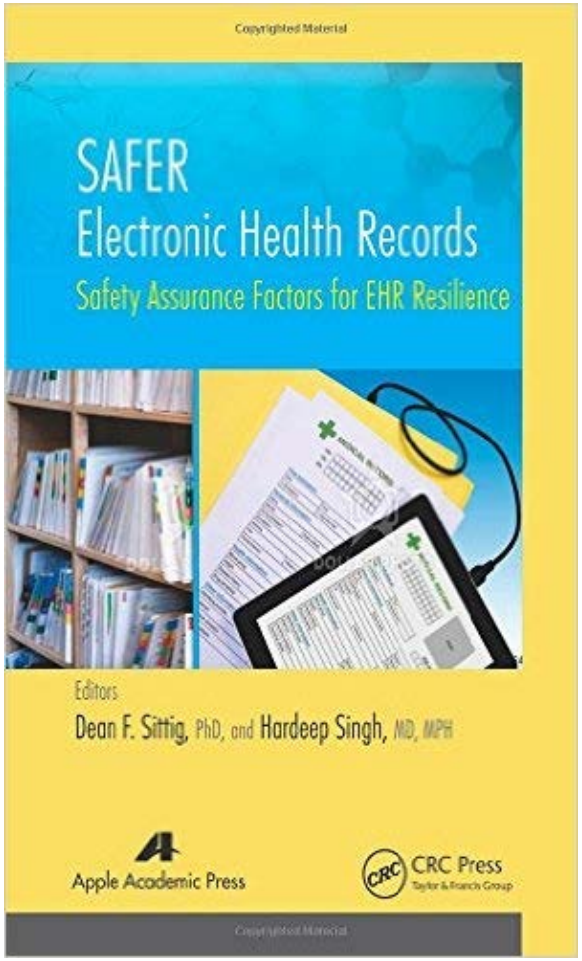
Sittig et al. J Am Health Inform Management Association, 2014

SAFER: Safety Assurance Factors for EHR Resilience
www.healthit.gov/safer/

Foundational Guides
- High Priority Practices
- Organizational Responsibilities

Infrastructure Guides
- System Configuration
- System Interfaces
- Contingency Planning

Clinical Process Guides
- Patient Identification
- Computerized Provider Order Entry with CDS
- Test Results Reporting and Follow-up
- Clinician Communication



Sittig, Singh, Ash. Am J Manag Care. 2014;20(5):418-423

SAFER checklists

SAFER Self Assessment High Priority Practices | Checklist

> Table of Contents | > *About* the Checklist | > Team Worksheet | > *About* the Practice Worksheets | > Practice Worksheets

Recommended Practices for ***Phase 1 — Safe Health IT***

			Implementation Status			
			Fully in all areas	Partially in some areas	Not implemented	
1	Data and application configurations are backed up and hardware systems are redundant.	*Worksheet 1*	○	○	○	reset
2	EHR downtime and reactivation policies and procedures are complete, available, and reviewed regularly.	*Worksheet 2*	○	○	○	reset
3	Allergies, problem list entries, and diagnostic test results (including interpretations of those results, such as "normal" and "high"), are entered/stored using standard, coded data elements in the EHR.	*Worksheet 3*	○	○	○	reset
4	Evidence-based order sets and charting templates are available for common clinical conditions, procedures, and services.	*Worksheet 4*	○	○	○	reset

SAFER Worksheet – Practice 3

SAFER Self Assessment High Priority Practices

Recommended Practice 3 Worksheet

Phase 1 – Safe Health IT

> Table of Contents | > *About* the Checklist | > Team Worksheet | > *About* the Practice Worksheets | > Practice Worksheets

Recommended Practice

3 Allergies, problem list entries, and diagnostic test results (including interpretations of those results, such as "normal" and "high"), are entered/stored using standard, coded data elements in the EHR.[7,12-21] Meaningful Use *Checklist*

Implementation Status

Rationale for Practice or Risk Assessment

Free text data cannot be used by clinical decision support logic[22] to check for data entry errors or notify clinicians about important new information.

Assessment Notes

Suggested Sources of Input

Clinicians, support staff, and/or clinical administration

EHR developer

Examples of Potentially Useful Practices/Scenarios

- RxNorm is used for coding medications and NDF-RT for medication classes.
- SNOMED-CT is used for coding allergens, reactions, and severity

SAFER Worksheet – Practice 3

SAFER Self Assessment High Priority Practices | Recommended Practice 3 Worksheet | *Phase 1 – Safe Health IT*

> Table of Contents | > *About* the Checklist | > Team Worksheet | > *About* the Practice Worksheets | > Practice Worksheets

Recommended Practice

Implementation Status

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SAFER Worksheet – Practice 3

SAFER Self Assessment High Priority Practices | Recommended Practice 3 Worksheet | *Phase 1 – Safe Health IT*

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Assessment Notes

SAFER Worksheet – Practice 3

Examples of Potentially Useful Practices/Scenarios

- RxNorm is used for coding medications and NDF-RT for medication classes.
- SNOMED-CT is used for coding allergens, reactions, and severity.
- SNOMED-CT, ICD-10, or ICD-9 is used for coding clinical problems and diagnoses.
- LOINC and SNOMED-CT are used for coding clinical laboratory results.
- Abnormal laboratory results are coded as such.

See the *Computerized Provider Order Entry with Decision Support Guide* and *Test Results Reporting and Follow-Up Guide* for related recommended practices.

Interactive section of worksheet

Follow-up Actions

Person Responsible for Follow-up Action

reset page

Click on a link below to view the topic online:

»References »Phases & Principles »Meaningful Use »HIPAA

SAFER Reference page

SAFER Safety Assurance Factors for EHR Resilience

The Office of the National Coordinator for Health Information Technology

References: High Priority Practices

References from the literature are included to support the recommended practices and to provide additional resources.

1. Ash JS, Berg M, Coiera E. Some unintended consequences of information technology in health care: the nature of patient care information system-related errors. *J Am Med Inform Assoc*. 2004;11:104-112.

2. Harrington L, Kennerly D, Johnson C. Safety issues related to the electronic medical record (EMR): synthesis of the literature from the last decade, 2000-2009. *J Healthc Manag*. 2011;56:31-43.

3. Singh H, Wilson L, Petersen LA, et al. Improving follow-up of abnormal cancer screens using electronic health records: trust but verify test result communication. *BMC Med Inform Decis Mak*. 2009;9:49.

4. Singh H, Thomas EJ, Mani S, et al. Timely follow-up of abnormal diagnostic imaging test results in an outpatient setting: are electronic medical records achieving their potential? *Arch Intern Med*. 2009;169:1578-1586.

5. Singh H, Thomas EJ, Sittig DF, et al. Notification of abnormal lab test results in an electronic medical record: do any safety concerns remain? *Am J Med*. 2010;123:238-244.

6. Sittig DF, Classen DC. Safe electronic health record use requires a comprehensive monitoring and evaluation framework. *JAMA*. 2010;303:450-451.

7. Sittig DF, Singh H. Electronic health records and national patient-safety goals. *N Engl J Med*. 2012;367:1854-1860.

Summary

- EHRs one of the most important tools to improve patient safety
- Without careful and continuous surveillance of these systems as implemented, safety concerns can arise
- Organizations can reduce EHR-related serious safety events by addressing these red flags
- SAFER Guides can help organization proactively assess their EHR safety

Thank you

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