Human Factors Engineering: Tips and Tools for Medication Safety

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Disclosure and Funding Acknowledgement

Portions of this presentation are based on work that Dr. Russ conducted in the Department of Veterans Affairs (VA). Views expressed in this presentation are those of Dr. Russ and do not necessarily represent the views of the Department of Veterans Affairs or U.S. Government.

Funding was provided by:
- Veterans Affairs, Veterans Health Administration, Health Services Research and Development Service, CIN# 13-416.
- Dr. Russ was supported in part by a VA HSR&D Research Career Development Award (CDA 11-214).

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Outline

I. Overview of human factors

II. To train or not to train?

III. Human factors: practical tools

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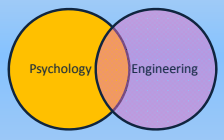
I. Human factors science…

- discovers and applies information about human capabilities, limitations, and other characteristics to design better technologies, tools, and systems (Gurses 2012, Russ 2013)

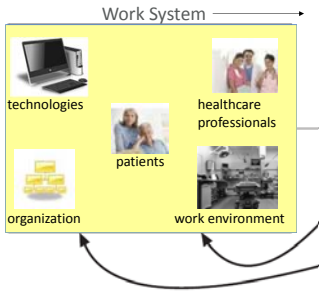


Goals of Human Factors

- Fit system design(s) to characteristics of people, rather than making people try and adapt.
  - ↑ performance
  - ↑ efficiency
  - ↑ satisfaction
  - ↑ safety

Wickens 2004, Saleem 2009, Russ BMJQS 2013

Systems Engineering to Improve Patient Safety (SEIPS) Model



Adapted and redrawn from SEIPS model, Carayon et al. 2006, Holden 2013

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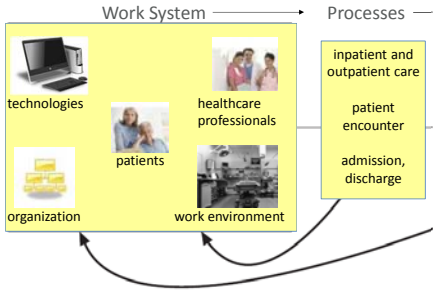

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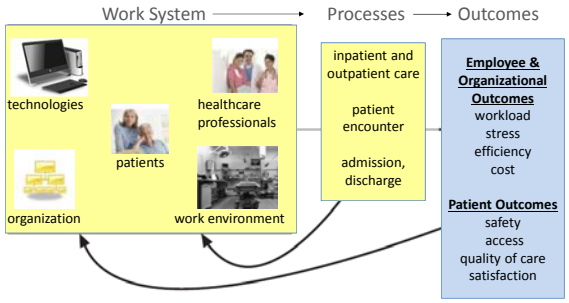

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Exercise #1: Think, Pair, Share (3 min)

1. **Think/share about a patient safety incident at your organization.**

2. **What aspects of the work system might have contributed to that safety incident?**
   (hint: 'human error' is not an answer!)

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Wickens 2004, Saleem 2009, Russ BMJQS 2013

II. To Train or Not to Train?

Audience Question

- Based on human factors, which one is **TRUE**?

a. Training is a strong defense against patient safety risks
b. Training is often an effective strategy to reduce errors that are occurring across multiple people
c. Training is very important for new employees and when new technologies are introduced

Train when…

- System aspects already considered and modified
- Goal is to gain familiarity with new technologies, processes
- Testing procedures via realistic scenarios
  - e.g., computer downtimes/back-up plan

Adapted from Russ, BMJQS 2013

Training is often ineffective when…

- other aspects of system not considered first
- errors are occurring across many people
- already trained and problem persists
- 'stop using it in the wrong way'
- 'be more vigilant'

➢ Indicates system design does not support human characteristics
  - modify system design, policies, produces, layout

Adapted from Russ, BMJQS 2013

III. Practical Tools

A. Hazard control hierarchy

B. Strategies to deepen root cause analysis

Hazard Control Hierarchy

Risk Reduction Strategy	
Eliminate:	design out the source of the hazard to remove the risk
Safeguard:	add a barrier or change the pathway to harm to reduce risk
Warn or Train:	educate individuals about the risk
Legislation:	develop policies or procedures that describe how to avoid the risks
Accept Risk:	do nothing

Adapted from Wickens 2004

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Example

Risk: Bear attack at campsite

Safety Strength

Strategy	Example
Eliminate:	• Camp in a region where no bears exist • Stay in a hotel
Safeguard:	• Hang all food in a tree at least 100 yards from tent (change path of bear)
Warn or Train:	• Add signs around the campsite to warn about bears • Educate the public about bears
Legislation:	Develop a policy that states all campers must follow precautions
Accept Risk:	Do nothing

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Exercise #2:

Risk: ordering inappropriate look-alike drug via CPOE

Safety Strength

Strategy	Example
Eliminate:	
Safeguard:	
Warn or Train:	
Legislation:	
Accept Risk:	Do nothing

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Deepening Root Cause Analysis

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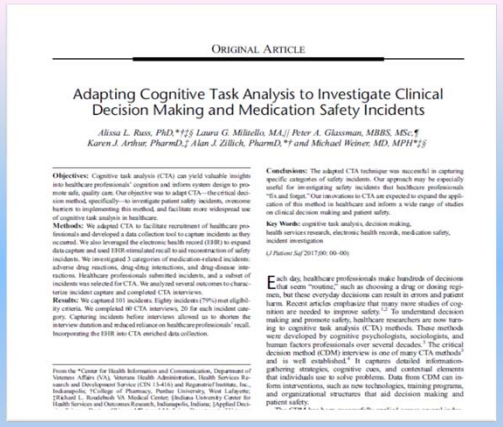

ORIGINAL ARTICLE

Adapting Cognitive Task Analysis to Investigate Clinical Decision Making and Medication Safety Incidents

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Objectives: Cognitive task analysis (CTA) can yield valuable insights into healthcare professionals' cognition and inform system design to promote safe, quality care. Our objective was to adapt CTA—the critical decision method, specifically—to investigate patient safety incidents, overcome barriers to implementing this method, and facilitate more widespread use of cognitive task analysis in healthcare.

Methods: We adapted CTA to facilitate recruitment of healthcare professionals and developed a data collection tool to capture incidents as they occurred. We also leveraged the electronic health record (EHR) to expand data capture and used EHR-stimulated recall to aid reconstruction of safety incidents. We investigated 3 categories of medication-related incidents: adverse drug reactions, drug-drug interactions, and drug-disease interactions. Healthcare professionals submitted incidents, and a subset of incidents was selected for CTA. We analyzed several outcomes to characterize incident capture and completed CTA interviews.

Results: We captured 101 incidents. Eighty incidents (79%) met eligibility criteria. We completed 40 CTA interviews, 20 for each incident category. Capturing incidents before interviews allowed us to shorten the interview duration and reduced reliance on healthcare professionals' recall. Incorporating the EHR into CTA enriched data collection.

Conclusions: The adapted CTA technique was successful in capturing specific categories of safety incidents. Our approach may be especially useful for investigating safety incidents that healthcare professionals "fix and forget." Our innovations to CTA are expected to expand the application of this method in healthcare and inform a wide range of studies on clinical decision making and patient safety.

Key Words: cognitive task analysis, decision making, health services research, electronic health records, medication safety, incident investigation

(*J Patient Saf* 2017;00: 00–00)

Each day, healthcare professionals make hundreds of decisions that seem "routine," such as choosing a drug or dosing regimen, but these everyday decisions can result in errors and patient harm. Recent articles emphasize that many more studies of cognition are needed to improve safety.[1,2] To understand decision making and promote safety, healthcare researchers are now turning to cognitive task analysis (CTA) methods. These methods were developed by cognitive psychologists, sociologists, and human factors professionals over several decades.[3] The critical decision method (CDM) interview is one of many CTA methods[3] and is well established.[4] It captures detailed information-gathering strategies, cognitive cues, and contextual elements that individuals use to solve problems. Data from CDM can inform interventions, such as new technologies, training programs, and organizational structures that aid decision making and patient safety.

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Methods

- Adapted one type of cognitive task analysis
  - Critical decision method (CDM)
- CDM interview steps:
  - 2 min overview + "3 sweeps"
  - construct timeline w/ about 5 steps
  - go back through timeline, ask Qs to fill in details
  - go back through again; 'what if' questions

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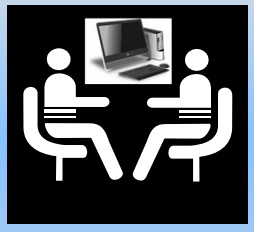
EHR-Stimulated Recall

Timeline/event reconstruction

- Memory aid for participant
- Medication dose
- EHR documentation
- Orders started/stopped
- Pt age, lab values, history



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Example Qs

Focus on "What?" questions (not "How?")

1. What made this patient case tricky? Challenging?
2. What factors influenced your choice of [this medication]?
3. What information, if anything, did you want for this patient but did not have?
4. What were your thoughts when you learned _____?
5. What, if any, information in the EHR was confusing?

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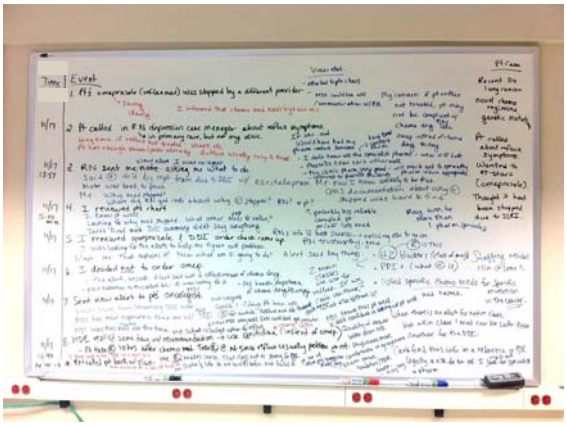

Exercise #3: Think, Pair, Share (2 min)

Recall your patient safety incident from excerise #1 and share one new "what" question you to ask in your organization to uncover more about the safety incident.

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Deepening RCA: Significance

- Methods may be useful for:
  - investigating 'common' safety events
  - less 'memorable' incidents
- Integrating EHR into incident interviews may yield more accurate, rich information
- Incorporating cognitive task analysis methods in healthcare may strengthen patient safety efforts

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Summary

- Human factors adapts systems to people!
- Training is important, but rarely a strong, 'first-line' safety mechanism. (Russ, BMJQS 2013)
- Human factors: practical tools
  - Hazard control hierarchy
  - Methods to inform RCA (Russ, JPS 2017)

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Questions?

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