Challenging EHR Designs: Heuristic Evaluation of an eMAR/BCMA System

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Speaker

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Today's Presentation

- Discuss challenging areas in health IT design

- Present findings of a research study on an evaluation of an eMAR in a BCMA system

- Analyze implications

Staggers, N., Iribarren, S., Guo, J.-W., & Weir, C. (2015). Evaluation of a BCMA's Electronic Medication Administration record, *Western Journal of Nursing Research. e-pub ahead of print Jan 18, 2015.*

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Challenging EHR Designs

- Information synthesis
  - Across patients, areas, systems
  - Single patients
    - Trends
    - What's new with this patient?
    - Within episodes, encounters
    - eMARs

Information Synthesis

- Electronic Medication Administration Records (eMARs)

    - Complex, interesting

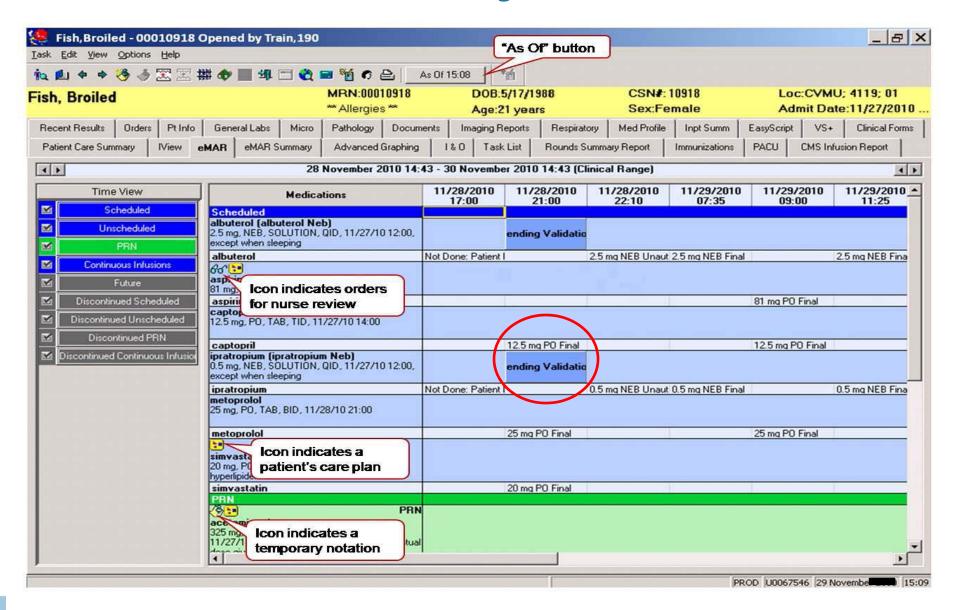   - Tasks belie the complexity

    - Nurses' decision making

Background

- eMARs

  - Support medication management by nurses

  - Should support error reduction, improve patient safety, workflow efficiency

  - Poor eMAR usability can result in poor outcomes

- Used by interdisciplinary team members

  - Especially by nurses, respiratory therapy

  - Tasks are distinct for different disciplines

Previous eMAR Study

Background

- BCMA systems with eMARs in over 30% of hospitals, in all 150 of Veterans Administration (VA) hospitals

- Socio-technical issues are common
  - Work-arounds
  - Increases in workflow

- Nurses profoundly affected by eMARs

- Little focus of research or evaluations

- No studies on eMARs in BCMA

Purpose

- Identify current usability problems in the VA's eMAR/BCMA system

  – Categorize problems using heuristics

- Explore how these might impact nurses' situation awareness

Methods

- IRB approval
- VA in the western U.S.
  - Offers tertiary care, specialty services
- VA is the largest health system in the U.S.
  - 9 million veterans
  - 80,000 nurses
- BCMA installed in 1995-2000
- Part of the VA's EHR

Methods

- Heuristic evaluation (plus additions)
    - 8 eMAR tasks and
    - Known screen design guidelines and
    - Technical adequacy
- Situation awareness assessment
    - Perception, comprehension and projection
    - How did identified problems affect SA?

Methods

- Three evaluators
    - Dual domain experts
    - PhD-prepared nurses
    - Trained in heuristic evaluation
    - Completed previous usability studies
    - One was a BCMA expert with 10 years of experience in BCMA use
- Results verification
    - Two BCMA coordinators

Procedure

- Completed standardized training
- Used 10 tasks/categories to assess eMAR/BCMA for usability problems
- Created usability problem list
- BCMA site coordinators reviewed the list, clarified issues
- Categorized problems using Zhang, et. al, (2003) list of 14 heuristics
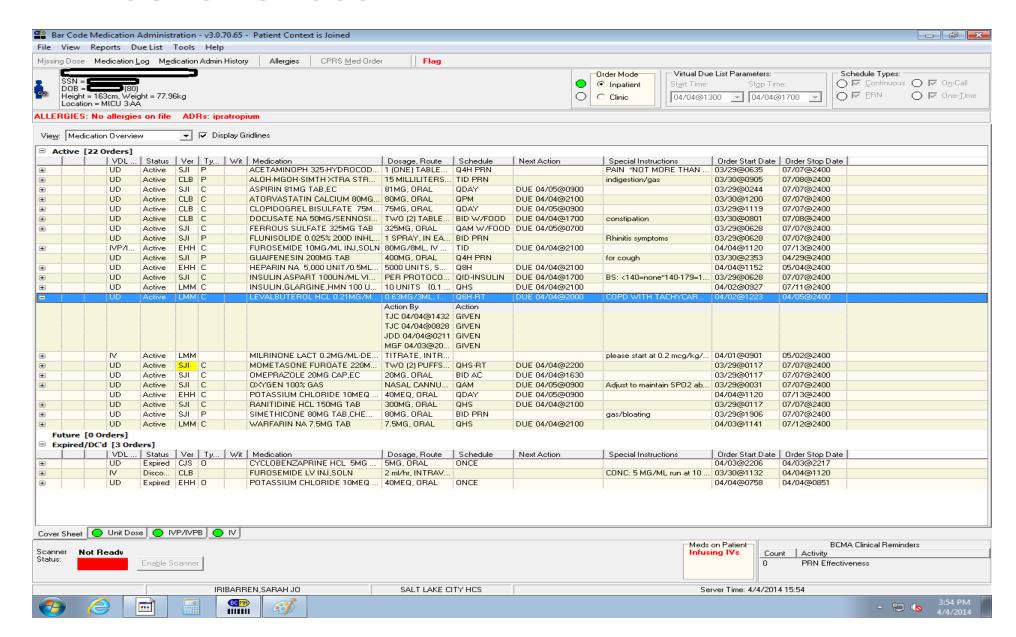- Rated the severity of usability problems

  (0-4)

Results
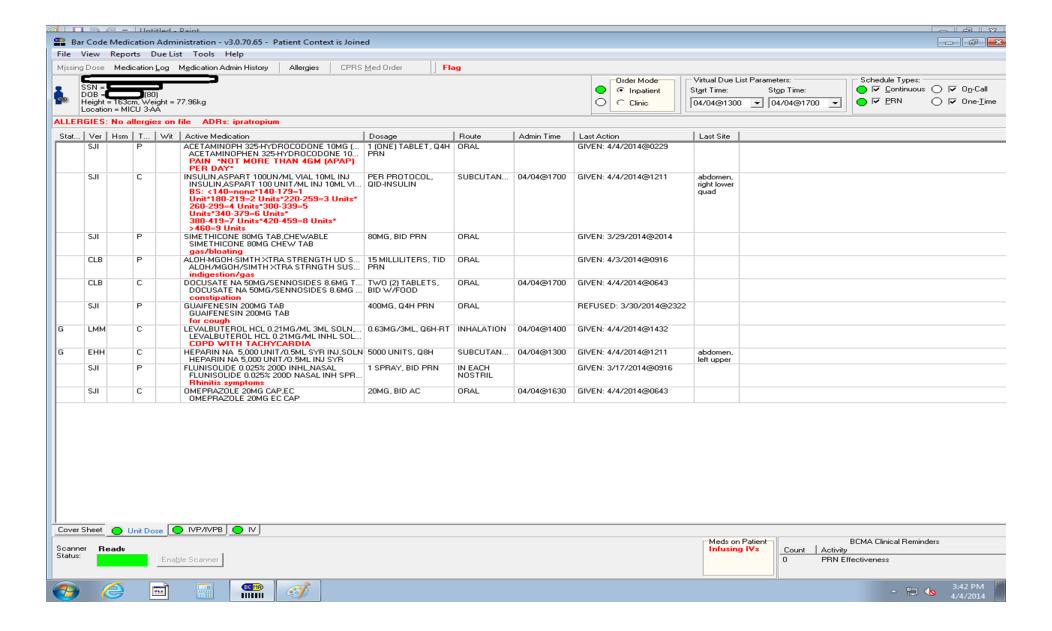
- Overview – 4 major functions
  - Cover sheet with orders
  - eMAR screen with 3 tabs
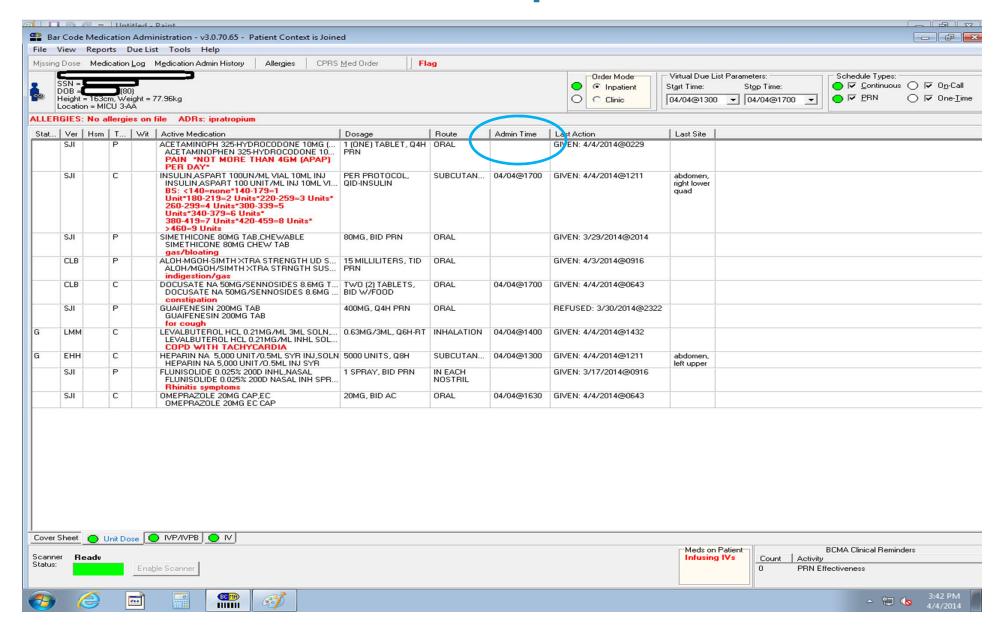   - Scheduled meds (unit dose), IVPB, IVs
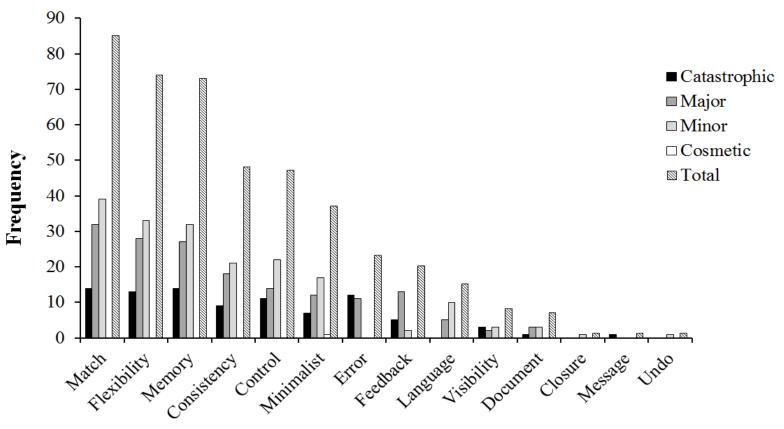
Cover Sheet

eMAR

Results

- 99 usability problems

- 440 Heuristic violations

  - Most in "match with the real word" category

- 80% of problems in these tasks

  - Prepare medications

  - Administer and chart medications

  - Screen design principles
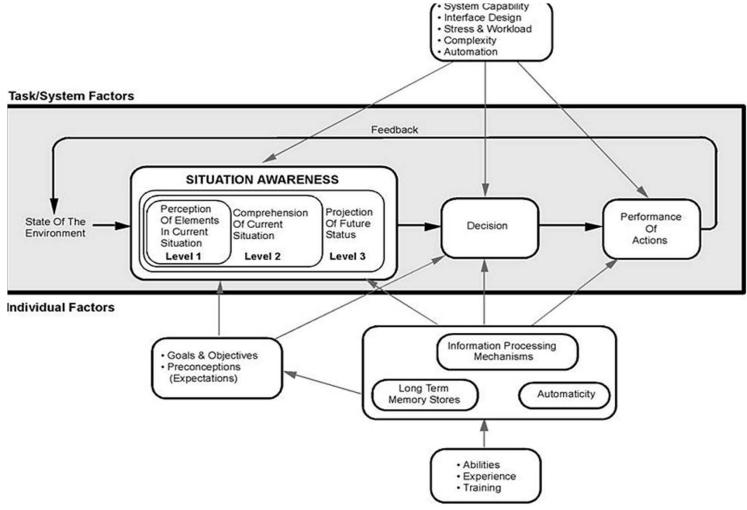
- Example: Preparing medications

eMAR – Match Example

Heuristic Violations and Severity

Situation Awareness

Endsley MR, Jones DG. *Designing for Situation Awareness*, 2nd ed. Boca Raton, FL: CRC Press. 2004

Situation Awareness Levels

- Overall: Information necessary to make appropriate decisions and take appropriate actions

- Level 1 Perception

  – Users' awareness of the state of the system and activities

- Level 2 Comprehension

  – Users understand the meaning of the elements in the situation through integrating information

- Level 3 Projection

  – Users anticipate future events, consequences

Situation Awareness

- Level 1 - Perception

  – Basic screen design issues

  – Perceiving what is due, what has been administered, what was missed, what is needed for medication preparation

    - Toggling through the 4 screens, memorizing what is needed

    - Special case: missed meds

Basic Screen Design

List of meds is in no particular order

Non-intuitive terms
Stat=status
Ver=verified
Hsm=hospital supplied medication
T=type
Wit=witness

Sliding scale order is jumbled

Truncated words

Nearly duplicate information, different format

Inconsistent case (sometimes all caps or lower case) and non-meaningful color

Have to memorize terms
G=Given
P=PRN
C=Continuous

All caps, slows "at a glance" detection and comprehension

Medication information separated into four tabs

Green color

Red text

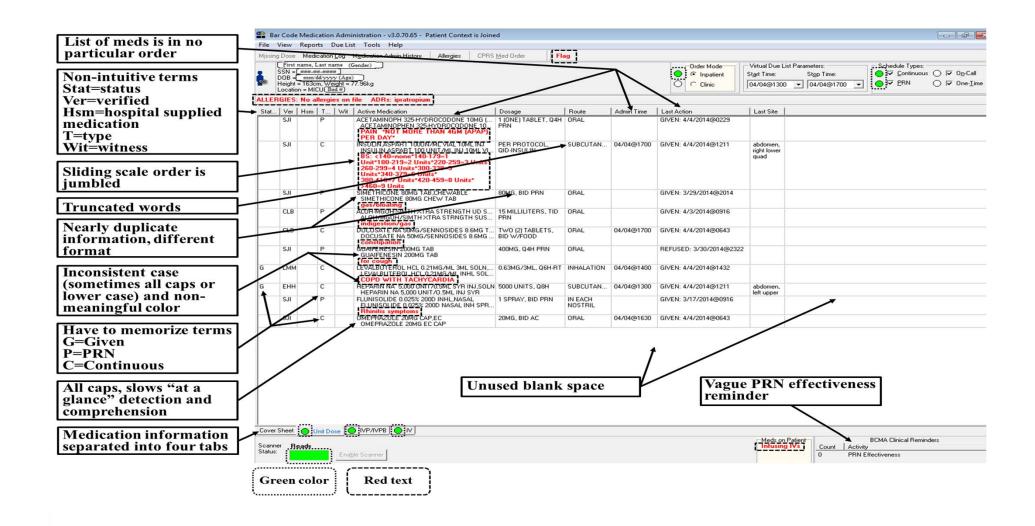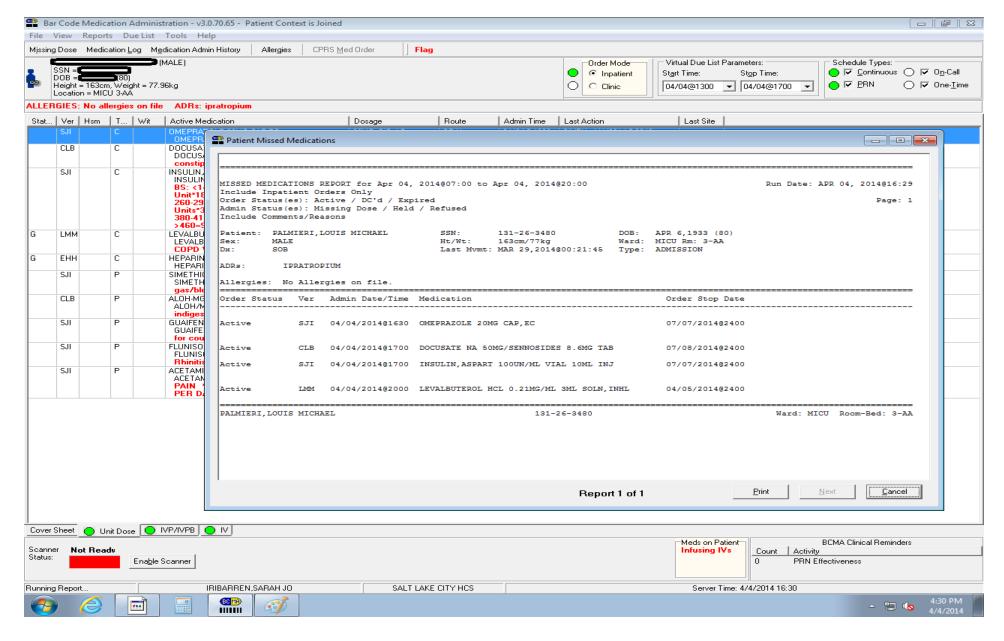**Unused blank space**

Vague PRN effectiveness reminder

Situation Awareness

- Level 1 - Perception
  - Basic screen design issues
  - Perceiving what is due, what has been administered, what was missed, what is needed for medication preparation
    - Toggling through the 4 screens, memorizing what is needed
    - Special case: missed meds

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eMAR – Missed Meds

Situation Awareness

- Level 1 - Perception
  - Basic screen design issues
  - What is due, administered, missed
    - Toggling through the 4 screens, memorizing needed
    - Special case: missed meds
- Level 2 - Comprehension
  - Meaning of changes
  - Getting the "big picture"
  - Lack of integration
- Level 3 - Projection

Implications

- High level of usability problems

  – Surprising technical issues

- Problems impact situation awareness, patient safety and nurses' efficiency

- The design does not match the way that nurses think and work

- Improvements needed

  – Full picture of medications

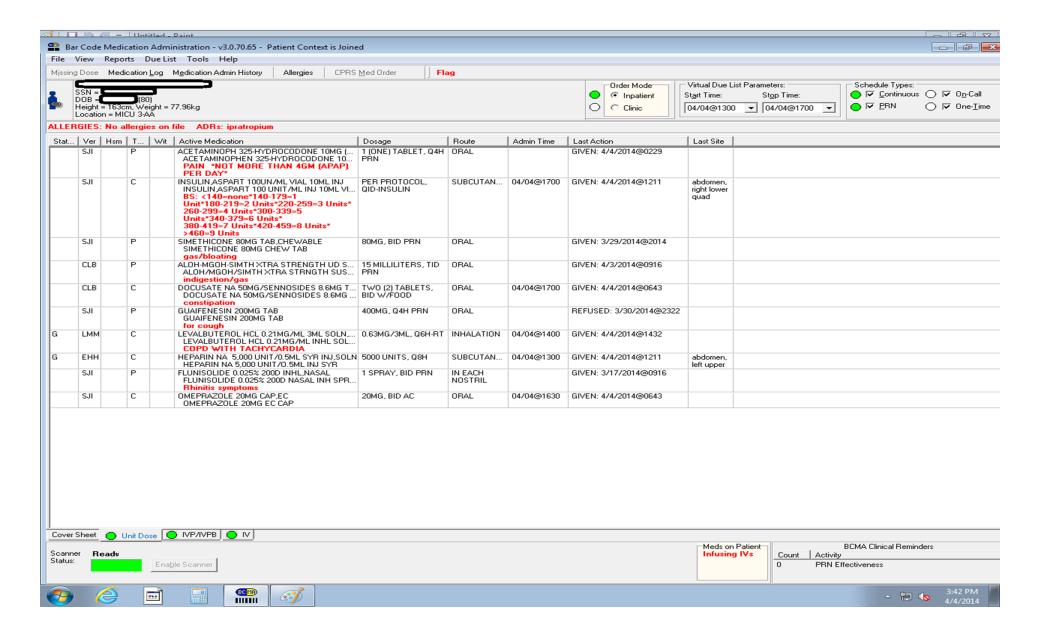 – Medications needing verification

  – Missed meds

User Interface Redesign

- Screen design principles are known

- Should be a "no brainer" part of design

- Need to understand cognitive tasks before design

- Vendor scan at HIMSS

    – No one vendor solves known issues with eMARs

    – New solutions could greatly impact effectiveness and efficiencies of nurses

Crucial Info Related to the Task

Modified Methods

- Modified HE worked
  - Dual domain experts
  - Adding unique categories
  - Verification with clinical experts (BCMA coordinators, clinical staff nurses)
- Found more serious issues
  - Past criticism of the method
- Recommend evaluators consider these modified methods

Conclusions

- Methods can be used in other settings, for other systems

  - Most helpful for BCMA coordinators to review

- Technical issues were surprising

  - 30-60 minute downtime x 2 each day

  - Lack of interoperability

- Current cognitive burden is great

  - Resources needed to compensate

- Situation awareness is impaired

- Solutions are possible!

Request for Case Studies/Stories

Nurses are uniquely qualified to provide valuable insight into improving the usability of healthcare technology and care delivery processes. The HIMSS HIT User Experience Community & Committee is looking for real world stories or case studies regarding nurses' interactions with technology, software applications, point-of-care devices, and care delivery processes that have prevented the efficient and or effective delivery of care, may have resulted in creating errors, or are simply "difficult to use." We are also looking for success stories in which usability issues were identified, and how you, your team, or others worked to solve them.

We are collecting these stories/case studies to help us better hear the voice of nursing on usability. We will use select stories as examples of usability issues in nursing. Any identifying data will be removed.

Please submit your story or case study, highlighting key details in a maximum of 700 words.

Just log onto:
https://surveys.himss.org/checkbox/Survey.aspx?s=0b34c8cb932349a8859c28359cbacfc7.

Questions? Write to janerhunt@comcast.net or nancystaggers@sisna.com

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