BAYLOR NURSES' STUDY:

HEURISTIC EVALUATION OF ELECTRONIC MEDICAL RECORD (EMR) IN INTENSIVE AND PROGRESSIVE CARE UNITS

(IRB#010-056)

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Goal of the Study

- To discover the extent to which the user interface of an electronic medical record conformed to established principles of usability and good design, known as heuristics.

Objectives

- Describe heuristic violations in an electronic medical record.
- Discuss the assessment of severity of identified heuristic violations.
- Outline recommendations for EMR improvement based on an heuristic evaluation.

Background

- The electronic medical record is a very complicated technology.
  - Consists of millions of lines of code typically authored by multiple programmers
  - Sometimes designed by people who may not fully appreciate the view of the end user
  - 1995, the Food and Drug Administration acknowledged that improper design and testing of software-driven products could result in errors, increased healthcare costs, and patient harm
- Thus, EMR design based on sound principles and objective evaluation is important

Definitions

- Heuristics - a set of recognized usability principles or general rules that describe desired properties of human computer interfaces.

Heuristic Evaluation

- Heuristic evaluation is one of the most commonly used inspection techniques due to its low cost and low skill requirements.
- The technique requires that a small set of experts evaluate a user interface based on their knowledge of interface design rules of thumb (heuristics).
- Once the violations of the heuristics are identified, experts rate the problems in terms of severity on a scale from 1, indicating a cosmetic problem (fix can wait), to 4, indicating a catastrophic problem (immediate fix).

Benefits

- Heuristic evaluations are generally good at exposing the majority of usability problems within an interface.
- However, heuristic evaluations cannot reveal all problems, and the strength of the test lies in uncovering local problems.
- Using this technique along with other techniques will reveal both local and global problems.

Methodology

Model – Zhang's Heuristics

- Consistency and standards
- Visibility of system state
- Match between system and world
- Minimalist
- Minimize memory load
- Informative feedback
- Flexibility and efficiency
- Good error messages
- Prevent errors
- Clear closure
- Reversible actions
- Use user language
- Users in control
- Help and documentation

Inclusion Criteria

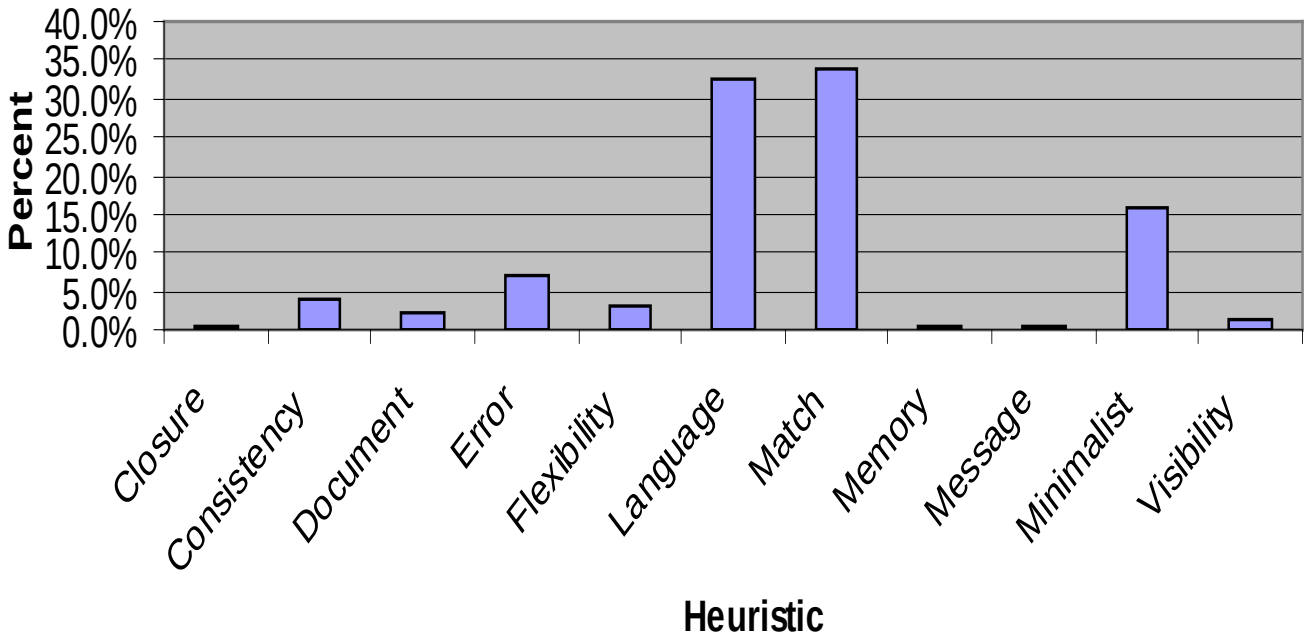
- Single vendor EMR
- Nursing documentation screens
  - Admission assessment
  - Daily assessment and documentation
  - ICU/PCU

Method

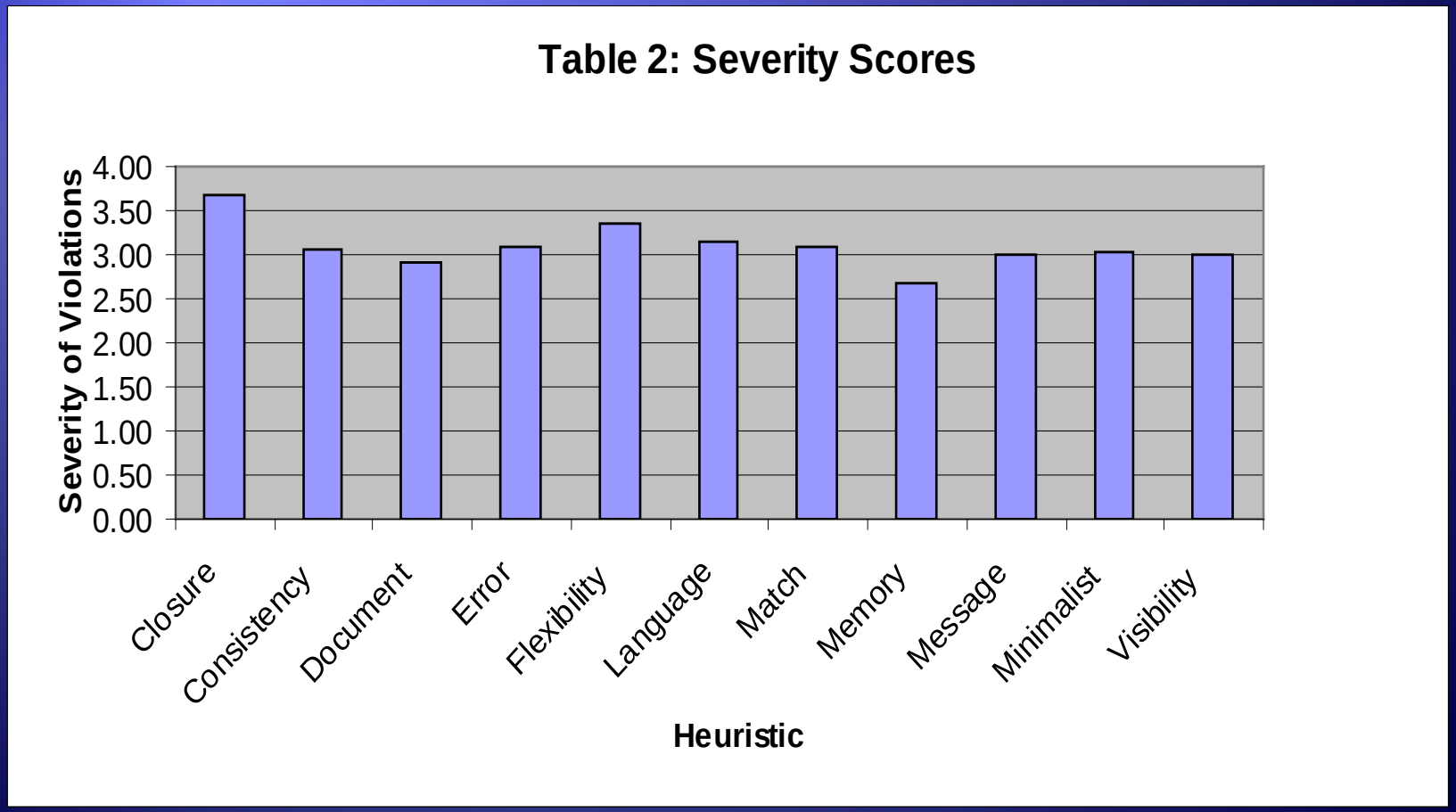
- Extraction
  - Data was extracted by independent researchers on admission assessment and daily documentation screens of the EMR
- Compilation
  - Findings were compiled to create a comprehensive list of heuristic violations
- Severity
  - Severity of heuristic violations was determined by independent researchers
- Compilation
  - Severity scores were then compiled and averaged

Findings

Heuristic Violations



Severity of Violations



Examples

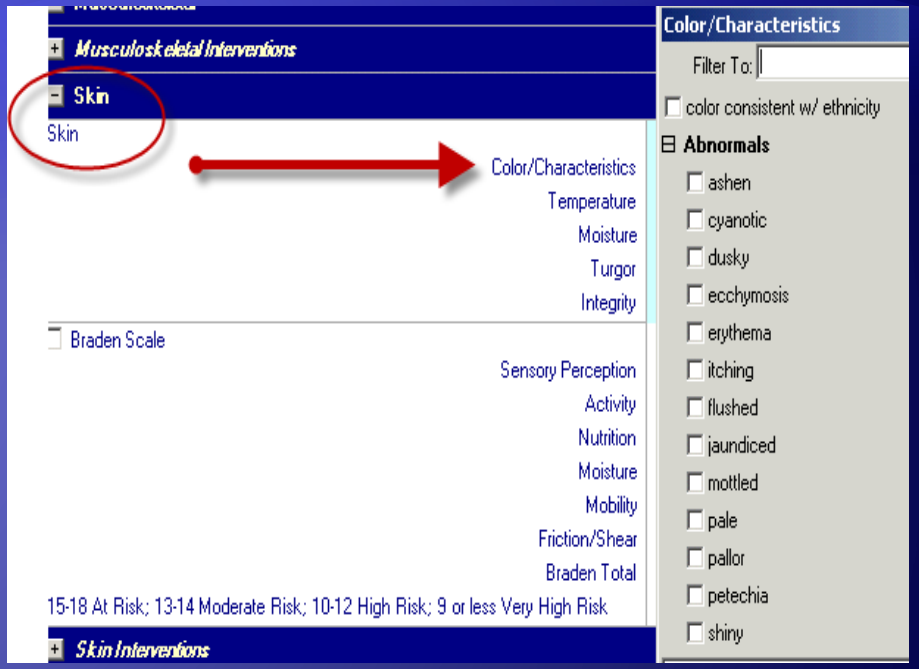
- Words
  - Misspellings
    - Accomodation versus Accommodation

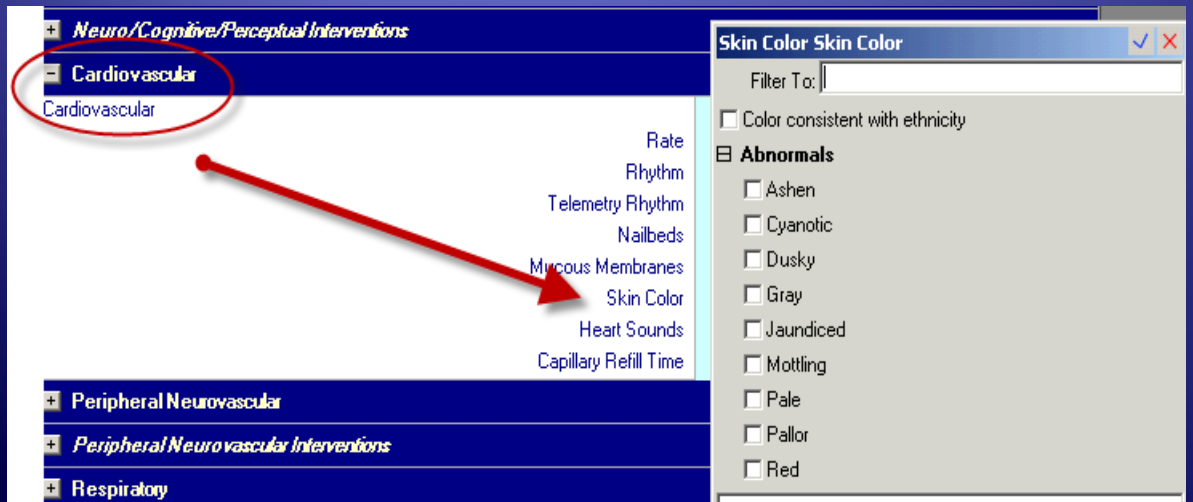
  - Synonyms
    - Pupils - Reaction
      - Slow
      - Sluggish

  - Missing words
    - Decerebrate but no decorticate
    - $ScVO_2$

More Examples

- Duplicates
- Duplicates that don't match
- Synonyms
  - Ashen, dusky, gray



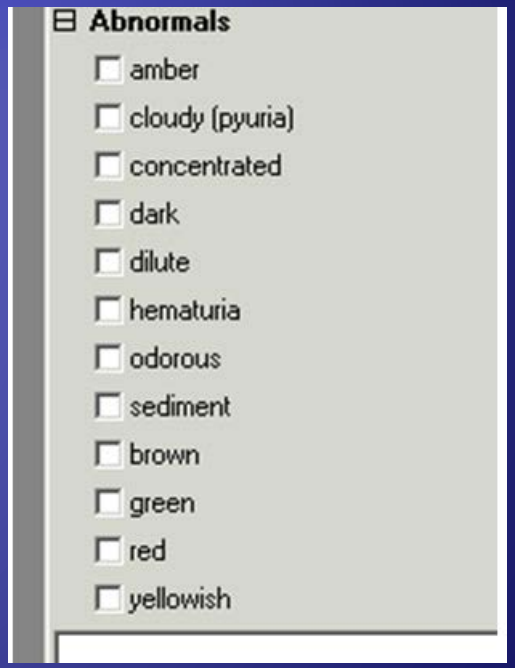


Still More Examples

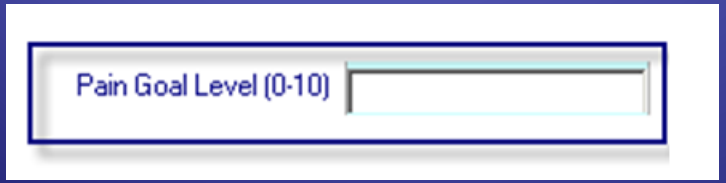
- Header
  - Name, age and gender far apart
  - Numbers on header but no identifying information
  - Colors – blue and black words on blue background
  - Icons – small and similar

Even More Examples

- Lists of words
  - No logical sequencing
    - Not hierarchical
    - Not alphabetized



- Goal not logical



  - Who gets a pain goal of 10? 9? 8?

Next to Last Examples

- Lists
  - Can choose all items when should only select one
- Data entry
  - Allows you to input future dates for past surgeries
- Nonspecific
  - Select (or don't select) "Thrombus prevention measures"
  - Does not describe interventions

Last Examples

- Unfamiliar words/terms
  - Not in Google, SNOMED, Medline, CINAHL
- Examples
  - Functional rest positioning
  - Circulatory protection
  - Stomal patency promotion
  - Comprehensive Patient Profile

Conclusions

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- Heuristic evaluation should occur during design prior to implementation – afterwards is helpful too
- Research team with diverse expertise –

  end-user, management and informaticists –

  yields rich data from heuristic evaluation
- Cannot capture all opportunities for improvement through heuristic evaluation – can capture many

References

- Johnson CM, Johnson TR, Zhang J. A user-centered framework for redesigning health care interfaces. *J Biomed Inform.* 2005;38:75–87.
- Zhang J, Johnson TR, Patel VL, Paige DL, Tate K. Using usability heuristics to evaluate patient safety of medical devices. *J Biomed Inform*. 2003,36:23-30.

EMR