Design a User-Centered Voluntary Patient Safety Reporting System:
Understanding the Time and Response Variances by Retrospective Think-aloud Protocols

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Outline

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Introduction

Medical incidents
- Medical errors, adverse events and near misses
- Cause patient’s death or injuries
  - “To err is human” (1999) : 44,000 – 98,000
  - DHHS report (2010) : 1 of 7 Medicare pts

Computerized reporting systems in hospitals
- Rapid growth since 2000
- Wide implementation in 26 states in the US as of 2008
Introduction: challenges

Safety Event Reports

- Facts
  - Underreporting 50% - 96% (2006)
  - Low-quality of reported data

- Reporting barriers
  - Culture & community
  - Individual discrepancies
  - Systems’ usability
    - Usable
    - Useful
    - Satisfying
“To Err is Human” Released
Congress Funding
More on IT Development
Patient Safety and Quality Improvement Act
Patient Safety Rule
Prototype v1 (Medinfo 10)
Prototype v2 (Medinfo 13)
Prototype v3 (Health 2.0 Competition)
Prototype v4
AHRQ Quality Improvement and Patient Safety Center Established
Common Formats (CFs) Version 0.1 beta
CFs v1.0
CFs v1.1
CFs v1.2
Background: prototypes

- Prototype V1 (Sep. 2009) reported at Medinfo 2010:
  - Heuristic evaluation (3 experts)
  - Cognitive task analysis (2 subjects)
- Prototype V2 (Sep. 2010) reported at Medinfo 2013:
  - Think-aloud protocols (10 subjects)
  - Cognitive task analysis (2 subjects)
- Prototype V3 (Aug. 2012):
  - Health 2.0 Developing Challenge Competition
- Prototype V4 (To present, working in process):
  - In English and Chinese
  - A tailored system with design features to be investigated
  - Performance measurements and comparison (52 subjects)
Study objectives

Prototype V2 pilot testing

- Investigate cognitive performance and difficulty in reporting
  - Execution time on steps and individual questions
  - Responding consistency
  - Reflective attitudes
- Propose hypotheses for in-depth quantitative studies
  - Whether certain features have significant impacts on user’s performance
  - Whether learning/carry-over effects are mediated by the design
  - Overall whether the system interfaces are easy to use, easy to learn and accepted by the users
Methods

Retrospective think-aloud user testing

- Ten subjects, each reported three patient fall cases using the prototype
- All sessions were audio and video recorded by Camtasia Studio 7
- Asked to verbalize while reviewing the video recording of the reporting process
- Execution time and responses on steps/questions were extracted manually (limitation)
- Verbalization transcribed and classified by a coding schema
- Analyzed time and responding inconsistencies by usability codes
Results

Retrospective think-aloud user testing

- Generated 30 reports in total
- Mean of completion time: 283.9 seconds
  - The most time consuming step was asking for case details in the Common Format checklist, 102.2 seconds (36.0%)
- 57 coded comments extracted from 15 pages of transcribed verbatim
  - Into 9 categories
    - Language (26.3%, 10 subjects), match (22.8%, 8 subjects), memory (15.8%, 6 subjects), visibility (12.3%, 6 subjects) and feedback (8.8%, 5 subjects) were the most frequently referenced usability categories
Discussion

Findings in general

- Case-independent questions
  - Patient demographics, clinical location and settings; reporter’s info
    - Issues about visibility, error and data integration
  - Case-dependent multiple choice questions (MCQs) and text field
    - Harm score, CFs checklist and a commentary text field
      - Issues on language and memory
  - Overall issues on feedback and mismatched conceptual models
Select findings

- Data entry cues on side panels might significantly increase the quality of reported data (hypothesis 1)
- Properly arranging the questions into a logical hierarchy would enhance the learning/carry-over effects (hypothesis 2)
Work in progress

Performance comparison

- Hypothesis 1:
  - Cuing functions improve the quality of reports
- Randomized controlled testing
  - 52 senior nurses randomly allocated to two groups
  - Two sets of user interfaces w/ or w/o cuing features
  - Report five cases for data quality comparison
- Preliminary results
  - Data quality was consistent on untreated questions across the two sets of UIs
  - Data quality significantly varied upon the provision of cues
Limitations

Generalizability
- Findings were limited to a specific domain
- Subjects were inexperienced users
- The study used an obtrusive method

Reliability & Validity
- Number of subjects is small
- Retrospective think-aloud often identifies fewer problems than concurrent think-aloud technique
- Whether the data analysis introduced significant human errors was not further investigated
Conclusion

Regarding the system

- Usability does matter to user’s performance in patient safety event reporting
- CFs may lead to a number of cognitive difficulties when used in a computerized reporting application
- Further usability studies of the system are needed

Regarding the think-aloud method

- Investigation from a perspective of efficiency, effectiveness and satisfaction
- A quantitative experiment pilot serving as a basis for hypotheses and performance measurements
Thank You

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