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Usability of Implementing a Tablet-Based Decision Support and Integrated Record-Keeping (DESIRE) Tool in the Nurse Management of Hypertension in Rural Kenya

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Abstract

In sub-Saharan Africa (SSA), cardiovascular disease (CVD) is the leading cause of death among individuals over the age of 30. Hypertension, a major risk factor for CVD, contributes significantly to the CVD burden in SSA. In order to address the human resource challenge of managing hypertension in low- and middle-income countries (LMICs), task-shifting hypertension care from physicians to nurses has been proposed. To support this task-shifting strategy, the Academic Partnership Providing Access to Healthcare (AMPATH) has developed an Android tablet-based electronic Decision Support and Integrated Record-Keeping (DESIRE) tool to record patient data and assist with clinical decision-making. We investigated the usability of the DESIRE tool in the setting of nurse management of hypertension in rural western Kenya through the use of “mock patient” encounters and “think aloud” exercises. Fiftyseven critical incidents were identified and twenty-three design changes were suggested. Optimization of the tool has the potential to broadly impact treatment of non-communicable diseases in LMICs by providing a model of electronic decision-support in task shifting.

Keywords

Decision Support Systems; Clinical; Electronic Health Records; User-Computer Interface; Root Cause Analysis

Methods

Usability testing was conducted with target users of the DESIRE tool, nurses employed by the government of Kenya in nurse-run clinics. The DESIRE tool is a data entry system with branching logic featuring decision support, alerts and reminders. The tool has ability to retrieve and display historical data derived from the electronic health record stored on a central data server. It securely transmits data to and from the central server via a mobile phone network.

Five nurses were equipped with an Android tablet-computer (IDEOS, Huawei Device Co., Ltd.) and were each subject to one “mock patient encounter” and one “think aloud” exercise. Usability testing with five subjects has been shown to detect over 80% of usability issues.⁴

Content analysis was used to analyze the qualitative data, focusing on information regarding DESIRE’s effectiveness and efficiency. Critical incidents, defined as “incidents that significantly impact the usability of DESIRE,” were identified and ranked according to severity. Incidents that resulted in the inability to continue the encounter were deemed to be “Task Failures”, while incidents that resulted in a disruption but did not end the encounter were deemed to be “Serious Problems”. A source-of-error analysis was used to develop design change suggestions based on the identified critical incidents.

Results

Fifty-seven critical incidents were identified, twenty-two of which were unique. A severity ranking of the critical incidents found five incidents resulting in Task Failure:

- Inability to activate onscreen keyboard
- Inability to locate program icon
- Difficulty selecting form
- Inability to save form
- Use of hardware button exits form

Eleven critical incidents were found to be Serious Problems. Most frequent Serious Problems:

- Field pre-filled with incorrect data
- Uncertainty advancing page when field is not applicable
- Difficulty recalling clinical information during encounter

A source-of-error analysis resulted in twenty-three design change suggestions.

- User interface changes: 7
- Rewording of text: 6
- Software logic changes: 3
- Feature additions: 3

- Other: 4

Conclusion

The use of a participatory, iterative human-centered design process uncovered many previously unknown usability issues in a tablet-based decision support tool for use in hypertension care by nurses in a resource limited setting. The critical incidents identified resulted in substantive design and development change suggestions, highlighting the importance of usability testing as part of implementing mHealth systems in LMICs.