A Usability Analysis Framework for Healthcare Information Technology

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ABSTRACT

Healthcare organizations are investing in healthcare information technology (HIT) to improve quality and outcomes. However, HIT has also been known to introduce unintended consequences and adverse effects. The adverse effects range from process changes to serious clinical errors. In order to ensure the safety of healthcare information technologies, the authors propose a usability analysis framework for healthcare information technology that can help identify, classify, and prioritize potential errors. Such a framework can help design better usability studies specifically targeted at studying technology-induced errors and therefore help in the design of safer healthcare information technologies.

Keywords: Healthcare Information Technology (HIT), Medical Errors, Unintended Consequences of Technology, Usability, Usability Analysis Framework

1. INTRODUCTION

Healthcare organizations continue to invest in healthcare information technology (HIT) such as electronic medical records, clinical decision support systems and various hospital information systems to reduce healthcare costs, improve quality of care and outcomes (Monegain, 2009; Pizzi, 2007). In order to justify the continued investment in HIT, there is a need to conduct empirical studies to evaluate the impact of healthcare information systems on quality of care and costs. While several studies have identified the positive impacts of healthcare information technology (Chaudhry et al., 2006), recent studies have also documented cases where healthcare information technology introduces unintended consequences and adverse effects (Ash et al., 2007; Harrison, Koppel, & Bar-Lev, 2007).

The unintended consequences of healthcare information technology include changes in work and communication patterns, changes in organizational structure and resource requirements, and errors induced due to poor usability of HIT systems (Ash et al., 2007). In this paper, we focus on the errors introduced due to poor design of HIT systems that could potentially

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have a serious impact on patient safety and clinical outcomes (Koppel et al., 2005; A. Kushniruk, Triola, Stein, Borycki, & Kannry, 2004; Nebeker, Hoffman, Weir, Bennett, & Hurdle, 2005).

Given the critical nature of healthcare and the potentially serious consequences of errors in the healthcare setting, healthcare information technologies need to be thoroughly evaluated to prevent the introduction of new errors. In addition, to ensure the intended quality outcomes, health information technologies need to be made safer and tested for usability and errors. Specifically, there is a need to design HIT-specific usability tests that can detect the potential for errors in a clinical work context.

While several studies have looked at usability in the healthcare context (Borycki, Kushniruk, Kuwata, & Kannry, 2006; Rose et al., 2005; Santiago et al., 2006; Ziemkowski, Kalamazoo, & Gosbee), and a few recent studies have observed and documented technology-induced errors in the healthcare setting (Ash, Sittig, Dykstra, Campbell, & Guappone, 2008; Koppel et al., 2005; A. W. Kushniruk, Triola, Borycki, Stein, & Kannry, 2005; Nebeker et al., 2005), there is limited literature that focuses on classifying usability errors in the healthcare context. Identification and classification of the errors that can take place in a healthcare setting is necessary to design usability tests that can help evaluate safety and efficacy of HIT systems. Given the limited literature on classifying usability errors in the context of healthcare information technologies, there is a need for a framework that can help identify, classify and prioritize errors in the healthcare context.

In this paper, we study past theoretical and conceptual work on usability problems and usability errors and its application in various contexts to build a HIT-specific framework of usability errors. The proposed framework can be used for identifying, classifying and prioritizing errors in the context of healthcare information technologies. The objective of the framework is to help design usability studies that can identify potential technology-induced errors in a healthcare setting, and help evaluate the cause and effect of those errors. We begin with a review of relevant work in usability problems and technology-induced errors, followed by an overview of our proposed framework in the following section. We then present an evaluation plan and conclude with an overview of future work.

2. LITERATURE REVIEW

Different frameworks and classification schemes have been proposed to identify usability problems in human-computer interaction research. (Keenan, Hartson, Kafura, & Schulman, 1999) propose a usability problem taxonomy to classify usability problems. The authors categorize usability problems into five primary categories; three of those categories relate to the artifact components, while the remaining two relate to the task component. The categories under artifact component include visualness, language and manipulation and focus on usability problems that arise when the user interacts with individual user interface components. The categories under task component include task-mapping and task-facilitation and focus on usability problems that arise as a user moves through a task. (Hartson, Andre, Williges, & Rens, 1999) propose a User-Action Framework for classifying usability problems. In this framework, the authors extend the usability problem classifier to include a new decision branch that identifies when a usability problem occurred prior to classification.

Sutcliffe, Ryan, Doubleday, and Springett, (2000) propose a “model mismatch method to identify usability design flaws and missing requirements from user errors.” The model mismatch method includes a walkthrough analysis and taxonomic analysis of observed usability problems and causes of error. The taxonomy of genotype causes of usability problems used by the authors include task fit problems due to missing functionality, poor task support or inadequate functionality, poor location and predictivity of prompts, cursor manipulation problems, missing or inadequate feedback,
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