Research Paper ■

Usability Testing Finds Problems for Novice Users of Pediatric Portals

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Abstract **Objective:** Patient portals may improve pediatric chronic disease outcomes, but few have been rigorously evaluated for usability by parents. Using scenario-based testing with think-aloud protocols, we evaluated the usability of portals for parents of children with cystic fibrosis, diabetes or arthritis.

Design: Sixteen parents used a prototype and test data to complete 14 tasks followed by a validated satisfaction questionnaire. Three iterations of the prototype were used.

Measurements: During the usability testing, we measured the time it took participants to complete or give up on each task. Sessions were videotaped and content-analyzed for common themes. Following testing, participants completed the Computer Usability Satisfaction Questionnaire which measured their opinions on the efficiency of the system, its ease of use, and the likability of the system interface. A 7-point Likert scale was used, with seven indicating the highest possible satisfaction.

Results: Mean task completion times ranged from 73 (± 61) seconds to locate a document to 431 (± 286) seconds to graph laboratory results. Tasks such as graphing, location of data, requesting access, and data interpretation were challenging. Satisfaction was greatest for interface pleasantness (5.9 ± 0.7) and likeability (5.8 ± 0.6) and lowest for error messages (2.3 ± 1.2) and clarity of information (4.2 ± 1.4). Overall mean satisfaction scores improved between iteration one and three.

Conclusions: Despite parental involvement and prior heuristic testing, scenario-based testing demonstrated difficulties in navigation, medical language complexity, error recovery, and provider-based organizational schema. While such usability testing can be expensive, the current study demonstrates that it can assist in making healthcare system interfaces for laypersons more user-friendly and potentially more functional for patients and their families.

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Introduction

Electronic access to health information, medical records, and health care providers can support new partnerships between patients and providers by promoting self-care, enabling informed decision-making, promoting information exchange and enhancing social support.[1] One promising method for providing such access is the personal health record (PHR), defined by the Markle Foundation as an "electronic application through which individuals can access, manage, and share their health information, and that of others for whom they are authorized, in a private, secure, and confidential environment."[2] While PHRs take many forms, the American College of Medical Informatics concluded that PHRs integrated with electronic health records (EHRs) were likely to provide greater benefits than stand alone records.[3] These integrated systems have typically been called gateways or patient portals.[2]

Patient portals have been developed for primary care records[4–8] and for specific patient populations, especially those with chronic conditions[9] such as diabetes mellitus[10,11] and heart failure.[12,13] These systems are feasible, secure, and well accepted by patients.[4,5,7,9,10,12,14–16] Although usability[17,18] is likely to have a major impact on uptake and effectiveness of PHRs, usability has been studied less extensively and mostly by questionnaire or interview rather than by performance testing. In those studies, systems were perceived to be generally easy to use,[4,5,10,12,14,15,19] although there was some variation in preferences for information presentation.

We located only four performance or scenario-based studies of PHR usability. In a 2004 UK study, patients systematically

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viewed each aspect of their National Health Service Record for the first time while engaging in a semi-structured interview. The majority found it easy to use and useful.[16] Kim et al. investigated the performance of 11 patients entering data related to care of their thyroid disorder, such as free text entry of diagnosis and prescriptions. Free text entry was more accurate for diagnosis than for therapy goals or prescriptions.[20] Marchionini et al. compared presentation to patients of medical test results using bar charts and tabular formatting. Bar charts demonstrated consistently faster task completion times than tables, and inconsistently better accuracy.[21] Finally, Tran et al. used scenarios to investigate a prototype of a locally developed PHR at the University of Washington and found difficulties with jargon which were improved in a subsequent iteration.[22]

Other performance-based studies related to electronic health information use by patients may inform PHR design. A 2005 study investigated participants' preferences for Web sites providing information about cancer diagnosis and treatments. After completing four scripted tasks, participants favored the prototype they felt was easiest to navigate and most clearly organized compared to a more "graphically appealing" Web site or one that was difficult to navigate and offered too many choices.[23]

In addition, scenario-based usability studies that had children and adolescents as the end-users revealed specific needs and preferences for an electronic system. Children completing an online physical activity questionnaire did not use provided directions, but they did not have any problems entering information from drop down menus or selecting activities from a rolling list of options.[24] Finally, two studies assessed electronic diaries for tracking pain of children with juvenile idiopathic arthritis (JIA). In one study, children were randomized to a paper or electronic diary. After 1 week of use, both paper and electronic diaries were acceptable and easy to use, but electronic diaries were significantly more complete and accurate than paper diaries.[25] A subsequent study by Stinson et al. demonstrated the utility of usability testing in correcting ease of use issues. After entering pain data on a hand-held electronic device, adolescents reported several design issues that made the program difficult to use. Once the issues were addressed, no more ease of use issues were reported in a second round of testing.[26]

Since usability is so important to effective electronic health applications[27] and has been infrequently studied with regard to PHRs, we undertook scenario-based usability testing of three condition-specific patient portals designed specifically for parents of children with chronic illnesses. Our primary goal was to improve the usability of these applications, but we also expected to provide more generalized information to inform interface design for other PHRs.

Methods

This study took place at Cincinnati Children's Hospital Medical Center (CCHMC). The study was approved by CCHMC's Committee for the Protection of Human Subjects. Participants were parents of children with chronic illnesses and were paid $50 for their participation.

Description of Portals

The targeted system, MyCare Connection, is a secure web-based application developed at CCHMC. It allows clinicians and families to view key elements of the medical record as well as exchange secure electronic messages. Currently, three MyCare Connection portals are in use: juvenile idiopathic arthritis (JIA), diabetes mellitus (DM), and cystic fibrosis (CF) portals.[28]

Each portal has features customized for the chronic condition it serves in a disease-specific tab. For example, the JIA tab contains quality of life scores which are not captured for other chronic illnesses, and the CF tab contains pulmonary function tests. Functions found in all portals include: demographic and contact information; laboratory, radiology, and pathology reports; inpatient and outpatient encounters; medications; secure, electronic messaging. Each function appears on a separate page, and navigation is guided by tabs for each function arranged across the top of the page (see Figure 1).

Participants complete confidentiality and system use agreements and are granted a user name and password. Multiple improvements to the portal interface were previously made based on formal and informal user feedback and heuristic usability testing.

Recruitment

Parents of children seen in the JIA, DM, and CF clinics were considered potential subjects if they had never enrolled in any MyCare Connection portal and were not computer or healthcare professionals. Participants were recruited by phone following an introductory letter from their clinicians.

Procedure

Participants were audio and video recorded while using the portal on a laptop computer with Internet Explorer to complete scripted tasks (detailed in Table 2, available as an online data supplement at http://www.jamia.org) on a prototype portal specific to their child's disease. Usability specialists moderated tasks and acted as primary observers. Prior to portal testing, participants self-reported demographics and verbally responded to questions about their computer abilities, amount of time spent on a computer at home and work, and familiarity with their child's condition. Participants' computer skills were not tested. Then, a researcher demonstrated the "think-aloud" technique using a popular shopping Web site and asked participants to think-aloud as they attempted each task. Thinking aloud slows the thought process and increases mindfulness, which might prevent errors that might have normally occurred.[29] However, when users are asked to perform simple tasks, the method has been shown to have no effect on user performance.[30] Since the tasks used in this test are not considered complex, we chose to use the think-aloud method.

Scenarios were designed to test various areas of the portal reflecting expected use cases (uses of the site). Context was given to the use cases to create scenarios with which users were expected to easily identify and relate. The tasks were chosen because they were representative of what portal using parents had previously told us through surveys and interviews were most important and common. Test, rather

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