Abstract

As population aging continues, increasing numbers of individuals are needed to act as informal caregivers to older adults. Many of these caregivers, however, bear high levels of burden caused by factors such as stress, geographic separation, and high costs in terms of both time and money.

To reduce burden and increase involvement, we are currently developing a smartphone app to assist caregivers. Using the results and recommendations of a previously conducted needs assessment, a list of requirements was generated and an initial design was created based on established usability guidelines. This design was then used to create an interactive prototype in HTML5/JavaScript using the JustInMind prototyping application. We are conducting usability testing with 15 users (3 iterations with 5 users per cycle) with a group of peers, usability experts and caregivers. Each user is given a series of commonly performed tasks within the application and asked to complete them while following a “think-aloud” protocol. After each iteration, changes are made to the prototype based on user suggestions and researcher observations. After testing is completed, the data will then be summarized as a list of lessons learned and design implications for future caregiver applications.

Introduction

As the process of “population aging” continues to unfold, the problems associated with caring for unprecedented numbers of older adults become increasingly apparent. Unparalleled strain will be placed on the US healthcare system, with the cost of providing institutionalized long term care being expected to rise from $123 billion in year 2000 to $346 billion in 2040. These increased caregiving costs will likely result in the burden of care being placed increasingly upon family members, friends, and neighbors of older adults. Currently, these individuals, often referred to as informal caregivers (due to the fact that they are not paid for providing care) actually provide the majority of caregiving for America’s elders. Recent estimates have suggested that, in the USA alone, 34 million informal family caregivers provide an average of 21 hours of care each week, with the estimated economic value of their service exceeding $375 billion. Many have suggested that informatics solutions may play a vital role in increasing caregiver involvement and effectiveness, yet limited research has been conducted in this area. After conducting an initial needs assessment, we then proceeded with the design of a smartphone application for remote informal caregivers. Here, we discuss our efforts to test the usability of our prototype application.

Setting

As part of an ongoing health-coaching project, approximately 50 older adults live in smart homes that use sensors to collect data regarding activities such as sleep, cognitive exercise, socialization, medication adherence, and physical exercise. Due to the large amount of activity data available to us, the remote caregivers of these older adults were the target users for our prototype app.

Methods

Initially, a static mockup interface was developed as part of our study regarding caregiver information needs. The results of this study were then used to improve the original mockup and develop an interactive prototype application. Prototype development was conducted using a combination of HTML5/JavaScript and the JustInMind prototyping application. As recommended by Nielson, we elected to conduct 3 rounds of discount usability testing with 5 users per round. In congruence with our incremental approach, we elected to test the prototype with graduate students in round 1, and then with usability experts and remote informal caregivers in rounds 2 and 3 respectively. This approach allowed for the quick identification of obvious usability issues in round 1 and allowed us to rectify these issues before testing the application with subjects that were more representative of our target user group.
To assess usability, subjects were presented with an Apple iPhone 4S running the prototype application and asked to complete a series of 5 commonly performed tasks (e.g. In your recent discussions with Jack, he seems to have been more tired. Look to see if Jack has been getting a good night’s rest). As they completed each task, they were asked to follow a think aloud protocol in which they voiced their thoughts and impressions as they used the app. Data were recorded through written notes that documented the subjects’ interactions with the prototype and any corresponding thoughts from the think aloud protocol. After all tasks had been attempted, short debriefing interviews were conducted to obtain any thoughts or recommendations that may not have arisen previously.

At the conclusion of each round, usability violations were identified and mapped to established usability principles. We then used these findings to develop solutions to these violations for inclusion in the next round of testing. We are currently collecting data in the final round of testing.

**Preliminary Results**

As shown in figure 2 above, our iterative approach resulted in a large number of changes to the prototype. While a full analysis of our findings will not be conducted until the conclusion of data collection, our initial results less are presented in table 1 below.

**Table 1.** Positive feedback and suggested improvements after 2 rounds of usability testing

<table>
<thead>
<tr>
<th>Positive Feedback</th>
<th>Suggested Improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color scheme is appropriate</td>
<td>Improve data type descriptions</td>
</tr>
<tr>
<td>App icon is easily recognizable</td>
<td>Add normal ranges on graphs</td>
</tr>
<tr>
<td>Clean overall layout/structure</td>
<td>Minimize data shown per graph</td>
</tr>
<tr>
<td>Pan/zoom on graphs is useful</td>
<td>Use standard abbreviations</td>
</tr>
<tr>
<td>Alerts easily understood</td>
<td>Increase visibility of “tappable” items</td>
</tr>
<tr>
<td>Icons are easy to understand</td>
<td>Add a list of actionable items</td>
</tr>
</tbody>
</table>

**Conclusion**

Overall, we found that an iterative approach to design and usability testing can be an effective strategy to identify potential usability problems and that our prototype caregiver app is generally easy to use and well received by users.

**References**


