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Remote Usability Testing to Facilitate the Continuation of Research

LeeAnne B. Sherwin, PhD, MS, FNP-BC[a], Justina Yevu-Johnson, MSN[a], Michelle Matteson-Kome, PhD[b], Mathew Bechtold, MD[b], and Blaine Reeder, PhD[a, c]

[a] Sinclair School of Nursing, University of Missouri, Columbia, Missouri, USA
[b] Department of Gastroenterology, MU Health Care, Columbia, Missouri, USA
[c] MU Institute for Data Science and Informatics, University of Missouri, Columbia, Missouri, USA

Abstract

Usability testing has historically been an in-person activity where test participants and evaluation researchers are co-located. Recruiting participants into usability studies can be a challenging endeavor especially when potential participants are concerned about time commitments and social distancing. The global COVID-19 pandemic has driven the development of remote usability testing methods. In this paper, we describe remote usability testing as it evolved during a pre-pandemic research study. We adapted our in-person usability evaluation methodology for a commercially available mHealth app to a remote usability testing methodology to accommodate potential participants during a more convenient participant-identified time. In doing so we met the needs, preferences, and availability of our participants and maintained research progress. Adapting to patient-centered needs through remote usability testing has the potential to facilitate continued research and engage potential participants due to its convenience, flexibility, and decrease constraints presented by geographic limits.

Keywords:

Mobile Applications, Usability Evaluation, Digital Technology

Introduction

Medication adherence in those who suffer from chronic diseases is poor and has a direct negative impact on patient outcomes and healthcare costs.1 In our previous work, we found that 92% of patients taking a short-term antibiotic missed at least one daily dose and on average took 5 days longer to complete their prescription.2 Mobile health (mHealth) technology has grown over the last decade. mHealth applications (apps) have consistently evolved resulting in a myriad of apps.3 Interventions to increase medication adherence that are delivered via mHealth apps have the potential to provide the much needed patient-centered support to enhance medication self-management.4–6

Usability testing is an important step that can provide insight and value to mHealth interventions. Historically, usability testing has been conducted via in-person interactions where usability test participants and evaluation researchers are co-located in the same setting. Examples of usability test methods are cognitive walk-throughs with think-aloud protocols, surveys to capture perceptions of usability, and usability inspections conducted by the design experts. Cognitive walk-throughs combined with think-aloud protocols are conducted with test participants who step through system interfaces to complete goals and "think aloud" about their experiences during their interactions.7–9 The System Usability Scale is an example of a validated usability survey tool that is typically administered as a post-test instrument in either lab- or field-based usability tests.10,11 Usability inspections, or heuristic evaluations, are conducted by small groups of experts or researchers who apply checklists of design principles to assess whether system interfaces violate usability guidelines.9,12–14 All of these methods were originally developed through and for in-person interactions.

Recent efforts driven by the global COVID-19 pandemic have begun to develop remote usability methods.15 Our adaptations of in-person to remote usability testing was driven by project needs in a pre-pandemic research study. Prior to the COVID-19 pandemic our research participants expressed concern for in-person usability evaluation thus we revised our approach to a remote usability testing methodology to accommodate participant schedules and to maintain an active research study protocol. Therefore, the objective of this report is to describe our experience with the adaptation of in-person usability evaluation methodology of a commercially available medication reminder app to remote evaluation to accommodate participant preferences and availability. This report contributes to and informs the emerging remote usability literature.

Methods

This report is a secondary analysis of the in-person and remote usability factors identified from experiences during our mHealth app study whose primary outcomes have been previously reported elsewhere.[16] Briefly, the study enrolled English-speaking adult dyads, ages 18 – 65 years old, the patient-participant was newly prescribed a short-term, thrice-daily medication and a member of their social support network (Medfriend). Participants owned a smartphone with internet access and available data. The patient-participants were asked to download the MediSafe medication reminder app (free app available for both iOS® and Android®) to facilitate medication adherence and invite their Medfriend via the app.

The initial task-based user evaluation protocol required participants to download the app on their individual smartphone, establish an account, complete a task list that included input of medication name, dose, frequency, reason for taking, set alarm reminders, invite a "Medfriend" (social support designates willing to participate in the study with them), and provide feedback

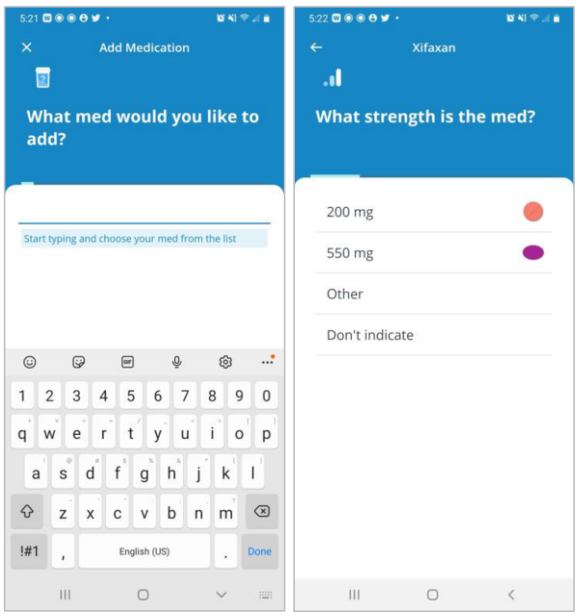

Figure 1. MediSafe mobile app interfaces

regarding the download, set-up, and invitation process in-person in the clinic. Figure 1 shows example interfaces from the MediSafe medication reminder app. Troubleshooting and usability observations were also part of this protocol. Participants expressed concern for length of time necessary to complete the 'set-up' and user evaluation protocol and requested to complete the process at home. Additionally, Medfriends were not always present in the clinic thus requiring an alternative remote onboarding process.

All study procedures in the study were approved by University of Missouri-Columbia Institutional Review Board (#2014050). Participants and Medfriends consented to the study.

Setting and Participants

Twenty participants were recruited from a university based gastrointestinal specialty clinic using convenience sampling technique. Each patient-participant was newly prescribed a fourteen-day anti-diarrheal medication with a thrice-daily dosing pattern. Their Medfriend was a designated member of their social support network that agreed to download and evaluate the app thus they also possessed a smartphone with internet access and available data.

Procedure

The study team consisted of a nurse researcher (principal investigator-PI), two clinicians (MD, PhD prepared Nurse Practitioner), one PhD student, and an information science and learning technologies professor (Associate Professor) with expertise in user-experience research. The study team became aware that potential participants were reluctant to enroll due participants personal time constraints. Additionally, the availability of study rooms was limited and, on a few occasions, unavailable. As a result, we created an alternate task-based user evaluation option through videoconferencing so that participants could complete the usability task list evaluation at a more convenient time.

Prior to leaving the clinic, participants identified a preferred time that they were available to meet with the PI via videoconferencing session to complete the task-based user evaluation. Participants were emailed a zoom invitation for the identified time. This session occurred prior to the participant initiating medication treatment. Medfriends were offered similar option however no Medfriends agreed to meet prior to downloading and using the app. Medfriends were sent via email a waiver of written consent, study information sheet, and the PI's contact information.

At the initiation of the zoom session the PI requested that the participant angle their webcam so that the smartphone screen was visible, audio was on, and the participants followed the written task list provided to them prior to their leaving the clinic. At the end of the zoom session participants were asked their opinions/perceptions regarding the download, set-up, and Medfriend invitation process.

Usability of the mHealth app was assessed with 1) the Usefulness, Satisfaction, and Ease of Use questionnaire (USE)[17] and 2) user experience was solicited through semi-structured interview regarding impression of the app, the download, medication input, alarm set-up, Medfriend invitation processes, and general day to day usage and function.[16] Text boxes were included in the USE questionnaire so that additional feedback details specific to each section and overall views could be provided. Participants completed the USE questionnaire online. Additional information regarding the process for completing the task-based user evaluation via zoom was solicited via a semi-structured interview at the completion of the task list. Initial task-based user evaluation session questions included 1) Tell me your thoughts about downloading this app, 2) Was there anything you liked or didn't like, 3) How useful do you think this app will be for helping you remember to take your medication? 4) Have you downloaded any medication reminder apps before? How did this download and set up compare to others you have downloaded and set up in the past? 5) Did the Medfriend invitation process work the way you thought it would? If not, what was the problem? 6) Tell me your thoughts about doing this visit by Zoom.

Data analysis

Descriptive statistics were calculated using SAS/ACCESS® software, version 9.4 (SAS Institute Inc, Carey, NC) with a significance level of 0.05 for results from the USE questionnaire. Semi-structured interviews resulted in qualitative data that was audiotaped, transcribed verbatim, and analyzed using inductive content analysis. The de-identified transcripts were checked for errors (LBS), coded manually (JYJ, LBS), identified categories that were then analyzed by groups. The resultant qualitative data provided additional insights to the user experience.

Results

Twenty participants consented;14 completed the usability study (n = 10 patient-participants, n = 4 Medfriends). Patient-participants (n = 8) and Medfriends (n = 4) were female, held a college degree, and employed at least part-time. Two Medfriends accepted the invitation to become a Medfriend however they did not complete the required questionnaires or interviews. Four Medfriends declined to participate.

Initiating App usage

The original protocol planned that the PI would meet with the patient-participant in-person after their clinic visit to perform the task-based user evaluation. This meeting would be audio recorded. During this meeting the patient-participant would be directed to follow a task list directing them to download the app, input the medication (dose, frequency, reason for taking), set alarms, and invite a Medfriend to participate. Additionally, the

patient-participant would be encouraged to 'talk through' the process and express their thoughts and perceptions regarding the process. The PI would be present throughout the process and provide guidance as needed.

When it became evident that patient-participants did not want to stay after their scheduled office visit, despite their initial willingness to participate, the study team adopted a remote testing method utilizing Zoom, a software platform for web-based meetings to perform the task-based user evaluation visit. Patient-participants were receptive to Zoom and enrollment continued with both in-person and remote options available. More than half of the patient-participants (n = 7) initial visit was a virtual visit and all of the final usability interviews were conducted by phone.

Participants Perceptions Regarding the Initial Virtual Visit

Participants spoke positively of the videoconferencing option for the initial task-based user evaluation experience. Participants reported no difficulties with positioning their webcam so that the PI could visualize their smartphone screen. Additionally, the audio was clear and patient-participants provided feedback on the tasks when they were performed. Additional open-ended questions were asked at the completion of the task list. Generally, patient-participants appreciated the option to complete the initial visit via Zoom. A few participants were quoted as saying "*It is great I can do this by Zoom. I did it on my time. I had to get back to work so this worked out better*", "*I felt more comfortable at home, I forgot you were online with me*", and "*I couldn't stay after my visit, I really wanted to participate, so that was good!*"

Discussion

Pivoting to a remote evaluation methodology for mHealth app usability testing was successful for both participant satisfaction and facilitating protocol recruitment. Our team experienced no major initial challenges upon instituting the participant-driven remote testing methodology experienced however, upon completion of the protocol our team realized valuable information that could have been obtained such as comparison and benefits of participant preferences (e.g., in-person, remote, or mixture of methods) would have strengthened the findings. Understanding these preferences has the potential to enhance participant recruitment for future studies as well as validate the need for continued use. Instituting the remote design usability evaluation methodology directly contributed to the success of the project through flexibility in accommodating participants thus maintaining project continuity.

There were limitations to this study. One limitation was that we did not compare participant preferences regarding an in-person usability evaluation experience to those who completed a remote evaluation thus we cannot conclude the superiority of one method over the other. Additionally, we did not inquire about participants perceptions of the in-person user evaluation as compared to an 'audio only' follow-up interview. Nor did we solicit participants perceptions regarding video-conferencing and 'audio only' follow-up interviews. A second limitation is that our sample size was small and limited diversity. The decision to migrate to a remote usability evaluation was made based on a few participants recommendations and realization of recruitment challenges from the research team. Although our remote user evaluation methodology did not experience difficulties with movable webcam and screen visibility, the research team has identified this may be a potential challenge in future work.

Conclusions

We have demonstrated that remote usability testing, whether driven by project needs based on circumstances of a public health crisis like the current global COVID-19 pandemic or by the needs, preferences and availability of participants, is a viable option to facilitate and maintain research progress. Flexibility and efficiency were two main reasons we identified for success. Although the pivot to remote research was initiated by participant preference it prepared us for unforeseen and necessary modifications due to social distancing and COVID-19 disruptions. As usability research moves forward in the post-pandemic era, it is likely that remote usability testing will become part of the range of methods available to researchers to engage participants because it is cost effective, convenient, and has far-reaching benefits.

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Address for correspondence

LeeAnne B. Sherwin,
sherwinl@missouri.edu
Assistant Professor
University of Missouri