

Pre- and Post-Redesign Usability Assessment of a Telemedicine Interface Based on Subjective Metrics

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Abstract

Usability problems in the interaction between patients and telemedicine platforms has been recognized as a deterrent in the public's acceptance and use of this alternative healthcare delivery method. Therefore, evaluating the usability of telemedicine provider websites, with a focus on potential patients' first interaction with telemedicine, is a critical research inquiry. To this end, a novel survey was developed to conduct an unmoderated remote usability test (URUT) of the Teladoc website. Teladoc is one of the largest providers of Direct-to-Consumer (DTC) telemedicine. The Teladoc Website Usability Survey (TWUS) instrument collected both objective task completion success metrics and subjective user feedback. A codebook was developed to categorize design features and user interface aspects that affected usability. The TWUS and codebook demonstrated value in identifying usability problems with the Teladoc interface and can be applied in other telemedicine or Health Information Technology (HIT) usability studies. Identifying and addressing usability issues is an important approach to increase the widespread acceptance and adoption of these healthcare delivery technologies.

Keywords:

Telemedicine, usability, health information technology

Introduction

Teladoc is one of the largest and most well-known Direct-to-Consumer (DTC) telemedicine providers globally [1]. DTC telemedicine, or virtual care, is the synchronous, real-time delivery of healthcare from physicians to patients through remote technology or digital methods [2]. Other telemedicine types are asynchronous and may not involve real-time physician-patient interaction [3]. Despite the ubiquitous use of telemedicine and other health information technology (HIT) in healthcare delivery, patients remain resistant to adopting and using these technologies [2,4].

The usability of HIT is recognized as a critical determinant of patients' safe and effective use of HIT [5-7], and correspondingly influences the widespread adoption of telemedicine [8-10]. Like many digital health tools, Teladoc serves an international population and markets the service through their consumer-oriented website [11,12]. Telemedicine websites, like other health information websites, are often the first port-of-call for consumers to gain awareness and knowledge of specific health conditions, treatments, and healthcare provision options [13,14]; therefore, must be usable for patients to be able to safely and effectively access remote healthcare. The usability

of telemedicine websites is likely a significant factor moderating the widespread acceptance and adoption of telemedicine [15-17].

Scope

Patients are able to access telemedicine from a variety of devices in nearly any location. However, each device often has a unique user interface. Usability tests situated in a real-life context of use have a high degree of fidelity [18] and are better able to elucidate the contextual and individual determinants of usability [19]. In this unmoderated remote usability test (URUT), a novel task-based questionnaire was developed to simulate a real-life context of use and interaction between a patient and Teladoc's website. In addition to quantitative data (task completion success rates), qualitative data was solicited from participants regarding the usability of the website. Survey methodology is extensively used to assess usability [20]. However, most standardized usability questionnaires are system agnostic and only capture users' perceptions of an interface using rating scales [21]. Typical usability questionnaires neither assess users' actual performance using a specific system nor their perspectives of what could be changed to improve system usability. Conversely, this study employed a novel remote delivery method using a survey to conduct a usability test that assessed participants' ability to perform certain tasks and activities using the Teladoc website, which differs from traditional usability testing where researchers may inadvertently impact participant's interactions. The purpose of this paper is to compare the qualitative findings from an URUT of the Teladoc website prior to and subsequent to their redesigning it. The feedback from the respondents was classified using a novel codebook developed using thematic data analysis. The final codebook characterizes user interactions with health information interfaces that may impact usability. Task-completion success rate results are not presented in this paper.

Methods

URUT allowed participants to perform in a context in which they would likely seek telemedicine and simulate a real-life interaction with the Teladoc website (i.e., in their home, office, or mobile). A total of 83 participants were recruited from Amazon Mechanical Turk to take part in a usability test of the Teladoc website either prior to or subsequent to a redesign. Amazon Mechanical Turk was used for recruitment because specific populations can be selected, thus, increasing participants' representativeness to potential patients [22].

The primary goal for using the telemedicine website for a patient is to be able to interact with the website successfully in order to “see” a doctor virtually. To this end, the novel Teladoc Website Usability Survey (TWUS) was developed to have participants attempt the typical tasks necessary to set-up a virtual physician visit. To explicate, participants had to attempt a task and then enter information into the survey to indicate successful task completion. For instance, participants needed to locate and enter the phone number to, “Talk to a Doctor,” and three health conditions that could be treated using telemedicine. The final question asked participants to provide open-ended feedback regarding the usability of the website. Thus, data collected from the TWUS instrument included task completion success rates and user-generated recommendations on how to improve the usability of the Teladoc website.

A total of 83 people participated in this URUT using the TWUS: 50 participants assessed the Teladoc website before the redesign, and the remaining 33 participants evaluated the redesigned Teladoc website (see Figure 1 for comparison illustration images of the Teladoc website pre- and post-redesign).

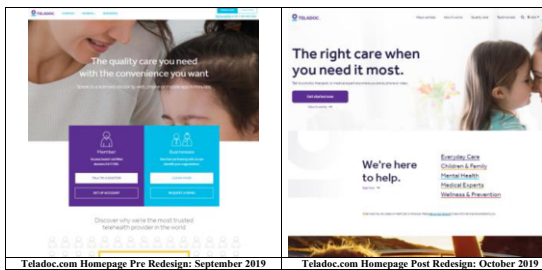


Figure 1: Teladoc Homepage (www.teladoc.com) pre- and post-redesign.

Participants’ usability recommendations were analyzed as textual data using thematic analysis. An a priori codebook established as heuristics for usable health information interfaces [23,24] was used as a starting point because it exhibited logical categories of usability dimensions involved in the interaction between humans and HIT. For instance, the category, Screens, regarded any user interaction with the homepage and registration that may impact usability. An inductive, directed coding approach was used to identify new categories of usability problems [25] not previously defined in the list. New codes were distinguished from the repetition of certain terms, such as, “contact number,” and, “detail,” or inferred from the participants’ overall statements [26,27]. Appropriate coding was applied to specific units of user-generated feedback when they fit the criteria provided by the original coding scheme [26,27]. This type of coding is interpretive [28], but constantly referring to the coding scheme strengthens the credibility of the findings [29]. Each main code or usability dimension had several subcodes that described more specific usability aspects. See Table 1 for a description of each main code category.

Table 1 – Codebook including Main Usability Dimensions and Descriptions

Main Usability Dimension / Code	Description
Screens	Refers to having a welcoming homepage and any function of the registration process.
Content	Refers to the content delivered and information displayed and how it is organized on the website.
Display	Refers to how the content is designed and presented on the website, including font type, size, and color.
Navigation	Refers to how easy specific information is to locate and access on the website, including having multiple, functional links to pages.
Interactivity	Refers to the inclusion of interactive features and new media on the website.
Performance	Refers to the speed in which pages load on the website.
No Usability Improvements Required	Refers to an easy-to-use, intuitively navigated website.

When a new code was added, a description was created to help identify when it should be assigned to respondents’ statements—these descriptions are not illustrated in this paper. The final codebook that emerged includes categories with descriptions of user interface design elements or human factors that interfere with the human-system interaction and obstruct the usability of telemedicine interfaces.

Results

Task completion success rates were calculated and the usability suggestions from participants were analyzed as described previously. The average rate of task completion success was 95% for the pre-redesign group and 94% for the post-redesign group; these findings are discussed in a companion paper [30]. See Table 2 for a summary of the results from the quantitative data analysis displaying the number of reported suggestions per category defined in the codebook.

Table 2 –Frequencies of Usability Suggestions Provided by Respondents on the TWUS Pre-and Post-Redesign

Usability Dimension / Code	Subcode	Pre-redesign of Teladoc Website (9/9/2019) (n=87 responses)	Post-redesign of Teladoc Website (11/5/2019) (n=60 responses)
Screens	Home Screen	2 (2.3%)	No Suggestions
	Registration	2 (2.3%)	No Suggestions
Content	Hierarchy	6 (6.9%)	5 (8.3%)
	Positive Tone	2 (2.3%)	1 (1.7%)
	Specific	1 (1.1%)	6 (10.0%)
	Spacious	1 (1.1%)	6 (10.0%)
	Cost / Pricing	9 (10.3%)	4 (6.7%)
	Restricted Access	2 (2.3%)	3 (5.0%)
	Privacy, Confidentiality, and Security	1 (1.1%)	No Suggestions
	Updated / Relevant Content	1 (1.1%)	1 (1.7%)
	Contact Phone Number Prominent on Homepage	No Suggestions	5 (8.3%)
	Provide Greater Detailed Content / Information	No Suggestions	2 (3.3%)
Display	Consistency	1 (1.1%)	No Suggestions
	Font	9 (10.3%)	1 (1.7%)
	Contrast	2 (2.3%)	No Suggestions
	Accessibility	1 (1.1%)	No Suggestions
	Screen Display Width Responsiveness	No Suggestions	1 (1.7%)
Navigation	Topics	3 (3.4%)	1 (1.7%)
	Orientation	8 (9.2%)	8 (13.6%)
	Back Button	4 (4.6%)	1 (1.7%)
	Linear Navigation	3 (3.4%)	No Suggestions
	Buttons	4 (4.6%)	1 (1.7%)
	Links	3 (3.4%)	3 (5.0%)
	Search	4 (4.6%)	No Suggestions
	Mobile-responsiveness	1 (1.1%)	No Suggestions
Interactivity	Multimedia	8 (9.2%)	4 (6.7%)
	New Media	3 (3.4%)	1 (1.7%)
Performance	Page Loading Speed	2 (2.3%)	No Suggestions
No Usability Improvements	Easy to Use or Intuitive	3 (3.4%)	2 (3.3%)

Figure 2 illustrates the distribution of user-generated recommendations collected during the pre- and post-redesign URUTs that were discovered to involve a specific user interface component or aspect of the user interaction that adversely impact usability.

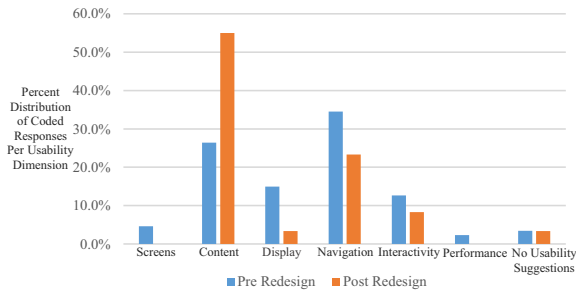


Figure 2 – Distribution of Usability Suggestions for Each Main Usability Category of the Telemedicine Website or User Interaction Pre-and Post-Redesign

Discussion

Results from the URUT of the pre- and post-redesigned Teladoc website suggest that the redesigned Teladoc website did successfully rectify some previously identified usability issues; however, appeared to introduce new usability problems. Figure 2 illustrates the distribution of coded responses for each category of the website or user interaction that was discovered to be problematic in terms of usability. In some aspects, the redesigned Teladoc website was more usable than the previous live website, such as the Navigation menu appeared more in line with how users would navigate the website. However, other aspects relating to the Content of the website, or lack thereof, made for poor usability.

Screens

No respondents mentioned disliking the homepage of the Teladoc website post-redesign suggesting that the Teladoc homepage was designed to be more inviting and aesthetically appealing to visitors. Registering for a Teladoc account was a problem for users pre-redesign, but appeared to have been made easier on the redesigned website. For example, “Get started now,” replaced, “SET UP ACCOUNT,” on the redesigned website, which may better convey to patients what they need to do to set-up a remote physician visit. Overall, the redesigned Teladoc website seemed to provide patients a more pleasant homepage and easy registration process.

Content

Literature on human-computer interaction (HCI) describes the gap in the conceptual model between designers and the human users of technology and this often results in flaws in the design and development of HIT [31,32]. Designers often think they are designing a system they think will be easily used, but they do not know how users actually interact with the system to achieve goals. This usability disparity was apparent from the usability problems that seemed to originate in the redesigned Teladoc website with regards to the content and information provided

on the website. This was inferred from the higher amount of subjective user commentary regarding the Content of the website. Not only did users of the redesigned Teladoc website ask for more specific information, but they also appeared to desire more detailed information, such as the Teladoc physician credentials and action steps to help walk them through the process of registering and setting up a virtual doctor visit. Prior to the redesign of the Teladoc website, it appeared this type of descriptive and instructional content regarding who the doctors are and how to set up a virtual doctor visit was provided because no respondents indicated that the pre-redesign website was lacking this specific information.

Likewise, the Teladoc contact phone number, a critical piece of content to have prominently displayed on the Teladoc website, and likely to affect usability, also received negative feedback from respondents in the post-redesign group. Many respondents indicated that it was difficult to locate the phone number on the Teladoc website with statements such as, “I’m not sure the phone number to call a doctor was right so that could be added to find them easier.”

Consumers searching for specific health information often retreat from a website after only 10-20 seconds if they do not easily locate what they are looking for [33]. Moreover, consumers make rapid judgments based on the design of a website and the ease-of-navigation that determine their decision to transact with the service [34]. Thereby, transparency in the display of the cost of Teladoc for a patient may boost consumers’ confidence and trust in the service and increase consumer adoption of telemedicine. More respondents interacting with the pre-redesigned Teladoc website suggested to clearly display the cost than those interacting with the redesigned Teladoc website.

Display

The redesigned Teladoc website was indicated to have improved the display of information and clarity of user interface elements, such as having a larger font, which participants seemed to prefer. The contrast, which is the effective use of background color to call attention to user interface elements, like buttons and links, was also improved post-redesign.

Navigation

Both the pre- and post-redesign groups suggested the website had poor navigation, specifically the orientation of the website. Often users appeared to be confused by the menu options and functionality. This was exemplified by statements such as, “It would be helpful if I could hover over the labels on the menu at the top of the page and have links for more specific pages come down.” The orientation of a website may be perceived differently by a diversity of users and is a design feature that could be improved by performing usability testing and applying subjective user feedback into the iterative design of health information interfaces. Additionally, several participants in the pre-redesign group suggested that the navigation of the website be improved, such as, “add a search bar,” or revise menu dropdown lists to be more “intuitive.” Following the redesign, the Teladoc website appeared to have fewer respondents comment that the navigation of the website was a problem, which suggests the usability problem was resolved.

Interactivity

The redesigned Teladoc website offered more interactive features, which was inferred by the number of usability suggestions to add more interactivity, such as a chat box or video demonstrating how to use the service, by the pre-redesign group.

Performance

Two respondents in the pre-redesign usability test mentioned that page loading speed was slow. No respondents indicated the page loading speed to be a problem in the post-redesign group.

No Usability Improvements Required

Lastly, a nearly equal percentage of respondents in the pre-redesign and post-redesign groups indicated that the Teladoc website was well-designed and could not suggest any changes that would improve the usability. Both groups commented that the Teladoc website was easy to use and intuitive.

Overall User Interface Usability

Overall, the redesigned Teladoc website seemed to improve the usability of user interface elements, including the font size, making clickable buttons better represent the function they allow the user to perform, and implementing a more intuitive navigation menu. However, the redesigned Teladoc website did not appear to deliver the type or level of detailed information potential patients desired or needed to know prior to using the service. Respondents interacting with the post-redesign Teladoc website explicitly asked to know more about the Teladoc physicians' credentials and the health conditions they could treat. These findings suggest that the redesigned Teladoc website had better usability in regards to the user interface design elements, but poorer usability in regards to the human factors aspects. It is not certain whether Teladoc performs usability testing of their website or solicits the opinion of patients to understand their experience using the website in their redesign efforts. However, we strongly recommend, as other scholars have stressed, that user-centered design or that iterative design is included throughout the system development life cycle [35,36]. Overall, it appeared that Teladoc was able to ameliorate some usability issues with the user interface design; however, usability problems that are engendered by user performance or are context-dependent are difficult to predict and prevent by making simple design changes and require more user-inspired design implementations.

Limitations

This study was not without limitations. It was not specified whether users were to perform their interactions with the Teladoc website using a desktop computer or their mobile device. Therefore, the usability suggestions provided by respondents are unable to be tied to a specific user interface or context of use. That said, healthcare providers cannot anticipate where their patients are located or how they are accessing remote healthcare; therefore, the HIT designed to be used in these ambiguous healthcare situations should be designed for a diversity of contexts and unique patients, not just for desktop computer screens or highly eHealth literate patients. Most people own a smartphone [37], and it is often the only internet access an individual has. Moreover, poor eHealth literacy is a problem for the general public [38] and compromises the public's safe and effective use of HIT.

Also, a sole rater performed data analysis. To increase reliability of the results, a second rater could have been included to calculate interrater reliability.

Conclusions

In order to increase awareness of and safe use of DTC telemedicine, telemedicine providers, like Teladoc Inc., must have a usable consumer-facing website. Potential patients must be able to interact with the website in a variety of contexts, including stationary and mobile environments. Usability testing in a setting that best mimics patients' real-life context in which they would need and access telemedicine is better able to provide valuable insight regarding how to improve the usability of telemedicine websites. Telemedicine appears to have promise, and findings from this study can be used to improve the usability of providers' websites, which may increase widespread diffusion of telemedicine. Additionally, other HIT may benefit from the URUT method used in this study in order to obtain subjective user feedback that can be valuable for making usability improvements to the HIT. The codebook developed in this study identifies specific user interface or user interaction elements that may lead to poor usability if not appropriately designed. HIT designers can use it as a guide to design usable context-responsive HIT. Yet, given that every health situation is unique and the vast diversity of HIT, the codebook used in this study is specific for telemedicine provider websites and could be further expanded and refined. Interdisciplinary teamwork is encouraged and required to investigate and design for complex health situations that involve human-interaction with technology.

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