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Challenges on the usability of digital platforms for informal caregivers and health professionals: the case study of Help2Care

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Abstract

The usability of digital platforms assumes an important role in the support of health business processes. This is particularly relevant when these platforms automate previously manually-executed activities in a certain process, with the purpose of bringing time, cost and quality benefits both to end-users and health professionals. This is the main objective of the Help2Care e-Health digital platform, where informal caregivers can use a mobile app to access digital training materials on how to properly take care of their patients. Health professionals can, in turn, suggest these materials to their caregivers through a web application, communicate directly with them through a messaging system, and even perform remote health assessment and monitoring. However, the informal caregiver population presents specific attributes which, in general, require special attention for usability. Health professionals can also be challenged by such platforms and their inherent complexity. In this paper, we report the results and challenges of the usability studies performed on both mobile and web applications of the Help2Care platform.

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1. Introduction

The Help2Care[†] digital platform [1] aims at the improvement of the quality of life of informal caregivers and better care of their patients, as well as a reduction in the readmission rate in health organizations for patients who reveal poor care support in home environments. Briefly, it is composed of two main software applications: 1) a mobile app where caregivers can access information on their patients' needs, and perform care procedures based on provided training materials (including videos, infographics and tutorials); and 2) a web application where health professionals manage caregivers and their patients, by registering their needs and adequate training materials.

With the possibility of communication between health professionals and caregivers, the Help2Care platform can help to mitigate the stress and workload factors experienced by informal caregivers, as they will feel more supported in cases of need and health. Additionally, the platform allows for health professionals to send questionnaires to caregivers, in order to obtain their feedback not only regarding the training materials, but also their and their patients' health condition in general. Health professionals can also work more efficiently by providing the appropriate training materials for informal caregivers under their supervision, aiming for a general reduction in health procedures on health organizations associated with preventable readmissions [2, 3].

Technology is making more and more impact in our society and smartphones are, nowadays, considered one of the best ways to transmit information. In spite of the largest target audience of technology being young people, we've been assisting to a generalized increased use of smartphones among all the population segments, including the elderly. They find that it benefits them in many ways, one of them being the amount of information that can be obtained [4].

In fact, informal caregivers are, in most cases, also elder people who take care of other elder persons. The advantage of them being able to use smartphones is to receive all the information they need to give proper care to their patients, and to improve their lives regarding stress, quality of care provided, as well as costs involved in unnecessary travels to the doctor/hospital. Nevertheless, the elder's receptivity towards a device is a long identified common problem [5, 6], which also emerges when developing a dedicated mobile software applications. Actually, studies have identified mobile health app usability barriers for older patients [7]. Also, previous evidence has documented very poor usability of health systems' web portals [8], and first impressions of health professionals on new information systems are often connoted with high resistance, since they have the perception of "one more" system to deal with in their daily practice and miss the advantages they can bring to their work.

In this paper, we report the results of a usability study performed on the two software applications of the Help2Care digital platform. We begin by describing the characteristics of the participants and then identify the results of the tests executed under direct observation (mobile app) (referred as *user testing* in [9]), and the Post-Study System Usability Study Questionnaire (PSSUQ) [10] (web application).

The remainder of this paper is organized as follows: section 2 announces the methods adopted for the study, including the types and details for the usability tests performed, along with a characterization of the participants. Section 3 reports main (condensed) results of these tests, and section 4 discusses these results. Finally, section 5 concludes the paper and presents future work.

[†] <http://help2care.pt>

2. Methods

In this section we introduce the methods used to perform the usability tests carried out on both software applications of the digital platform (mobile and web applications). We begin by characterizing the participants on this study, followed by presenting the materials and procedures used to perform these tests.

2.1. Participants

Criteria to participate in the mobile application's usability tests only included the facts of being an informal caregiver and using a smartphone on the daily life. Therefore, for these first usability tests on the mobile application, we turned to a social/day-care institution and the Short-Term Internment of a National Health Care hospital in the Center region of Portugal to find potential participants. We could find 20 individuals fulfilling the criteria, and Figure 1 (left) illustrates their age ranges. We can observe that most of them belong to the [35, 54] and [55, 74] age ranges.

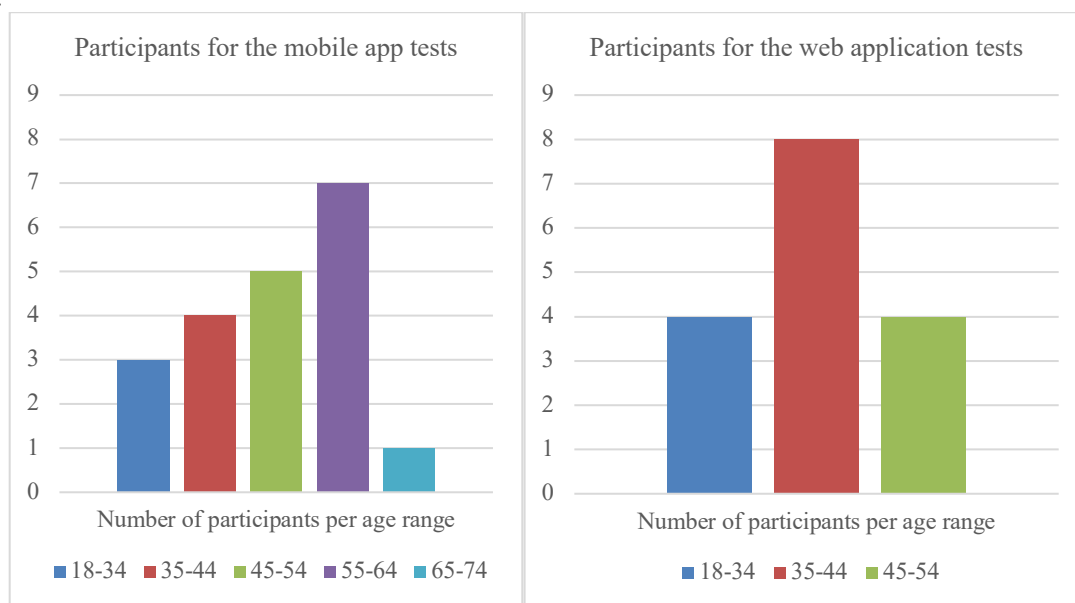


Fig. 1. Age distribution of participants in the usability tests for the mobile app (left) and web application (right) of Help2Care.

For the web application usability tests, and since this is an application to be mainly used by health professionals, we directly invited Registered Nurses with experience in supervising informal caregivers and their dependent relatives and could collect the agreement of 16 health professionals. Figure 1 (right) shows their age distributions, revealing that most of the participants (8) belong to the [35, 44] age range.

2.2. Mobile app test design

The method adopted to perform the usability tests for the mobile application was by direct observation of user testing [9]. In this case, the tests were initiated by placing the smartphone in front of each participant individually, explaining very briefly the purpose of the software application. Then, two team members follow each participant during the testing process: one plays the role of the interviewer, and another plays the observer role.

The interviewer takes on the role of asking the participant to perform certain tasks, while helping the participant to continue the test in case s/he gets lost in the application or is not able to do some feature. At the same time, the observer checks and reports the participant's actions in order to obtain information such as:

- Duration to complete a certain task (in seconds);
- Number of wrong clicks;
- If the participant followed the expected path;
- Comments and participant's expressions;
- What the user expected the application to do when s/he was lost.

As such, team members proposed a set of tasks considered as the most important ones in the interaction with the mobile application, and which the participants would have to try to perform. These were:

- Task 1 - Observe training materials;
- Task 2 - Evaluate training materials;
- Task 3 - Reply to questionnaires;
- Task 4 - Send help requests to health professionals;

After completing all the intended tasks, the participant would have to respond to a short questionnaire so that team members could see if the application was clear, intuitive, and easy to use, as well as to get some suggestions for improvement. This questionnaire consisted of the following questions:

- How much time did you spend in the application until finding it easy going?;
- Did you find the navigation flow simple and easy to use? If not, why?;
- Did you find the questionnaires? If yes, where?;
- Did you find the messages area? If yes, where?;
- Additional observations and comments.

2.3. *Web application test design*

For testing the web application, we used the PSSUQ as instructed in [10]. The testing procedure included a brief explanation of the web applications features to the participants, namely:

- Managing caregivers (users of the mobile application) and patients;
- Associating/disassociating patients to/from caregivers;
- Associating/disassociating patient needs to/from patients;
- Associating/disassociating materials to/from patient needs and caregivers;
- Providing questionnaires for caregivers to answer in the mobile application. These questionnaires can include questions about her/himself, her/his patients or any of the training materials available;
- Consulting overall statistics on the use of the mobile application and each caregiver associated with it;
- Answering to requests for help from the caregiver regarding a given training material.

After this training session, participants tried to accomplish all the tasks presented previously and explored the application. Moreover, during the exploration process of the web application, team members were nearby to clarify any doubts that might exist. We could then evaluate the participants' interaction experience through a questionnaire made available at the end of this session, including the following 19 questions of the PSSUQ:

1. Overall, I am satisfied with how easy it is to use this system.
2. It was simple to use this system.
3. I could effectively complete the tasks and scenarios using this system.
4. I was able to complete the tasks and scenarios quickly using this system.
5. I was able to efficiently complete the tasks and scenarios using this system.
6. I felt comfortable using this system.
7. It was easy to learn to use this system.
8. I believe I could become productive quickly using this system.
9. The system gave error messages that clearly told me how to fix problems.
10. Whenever I made a mistake using the system, I could recover easily and quickly.

11. The information (such as on-line help, on-screen messages and other documentation) provided with this system was clear.
12. It was easy to find the information I needed.
13. The information provided for the system was easy to understand.
14. The information was effective in helping me complete the tasks and scenarios.
15. The organization of information on the system screens was clear.
16. The interface of this system was pleasant.
17. I liked using the interface of this system.
18. This system has all the functions and capabilities I expect it to have.
19. Overall, I am satisfied with this system.

3. Results

In this section we present the results of the usability tests performed on both software applications of the Help2Care digital platform

3.1. Mobile application

Regarding the duration for performing the assigned task of the usability test (Figure 2), it is possible to state that most users aged 55-74 were the ones who took the most time to complete the tasks, due to the lack of experience with the technology in general, which they had demonstrated.

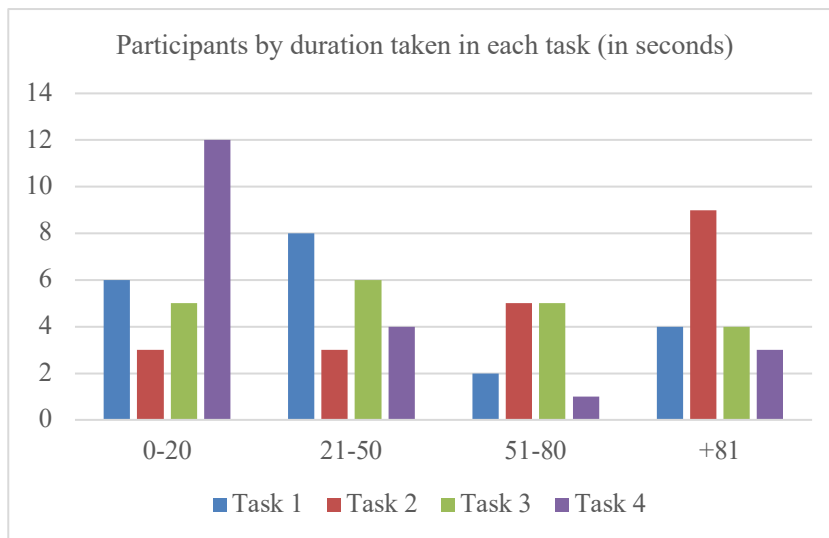


Fig. 2. Duration taken by task in the usability tests for the mobile application of Help2Care.

Task 1 results revealed the common difficulty of a first contact with a mobile application, as there were 14 out of 20 users who took more than 20 seconds to finish it. Of all users, 12 clicked on the wrong identifier for the training material, instead of clicking on the training material itself, as they mistook its label as a button.

Task 2, in general, was the one that obtained longer execution durations. This task forced users to change tabs, which 14 of the users could not find in the menu bar at the bottom of the screen. It was noted that the 6 users who completed this task quickly either had previous experience with iPhones (since the location of the menu bar in these is common to the one adopted by our mobile application), and/or experience in the use of mobile applications. Only 4 of them could realize at a first glance the location of this bar. After instructing the use of the menu bar, they were quickly able to navigate through the app and finish the remaining tasks.

Task 3 revealed to be challenging for approximately half of the participants (9), and Task 4 was, overall, the most successfully accomplished regarding duration time.

Through Figure 3's chart it is possible to conclude that, essentially, after the first two tasks, users increased their performance on the use of the mobile application.

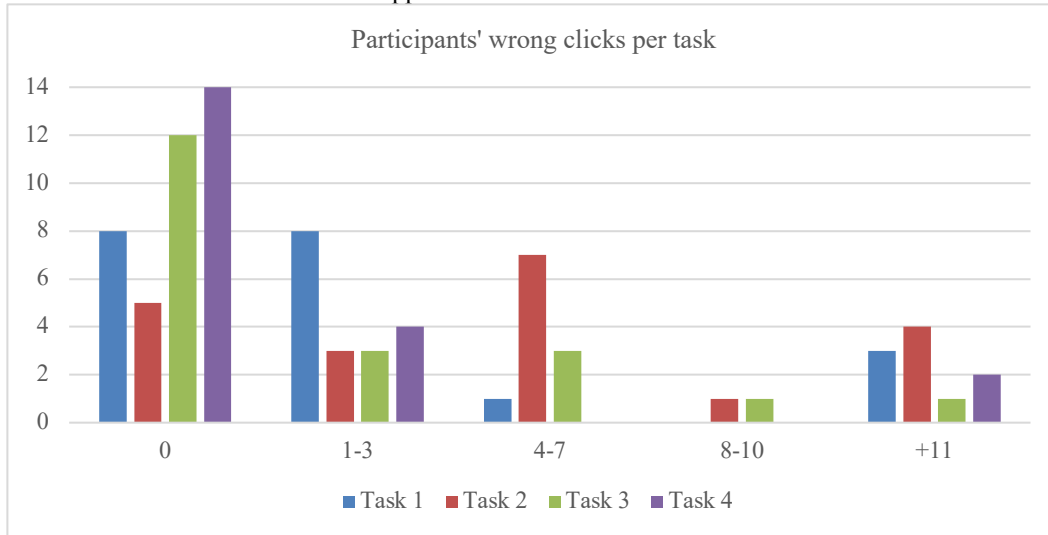


Fig. 3. Number of wrong clicks performed by participants while executing each of the 4 tasks assigned for the mobile application.

3.2. Web application

We present in Figure 4 the condensed (average) results from the PSSUQ answers (ranging from 1-best through 7-worst) regarding the web application, already grouped into categories: *System Quality* (questions 1-8), *Information Quality* (questions 9-15) and *Interface Quality* (questions 16-19).

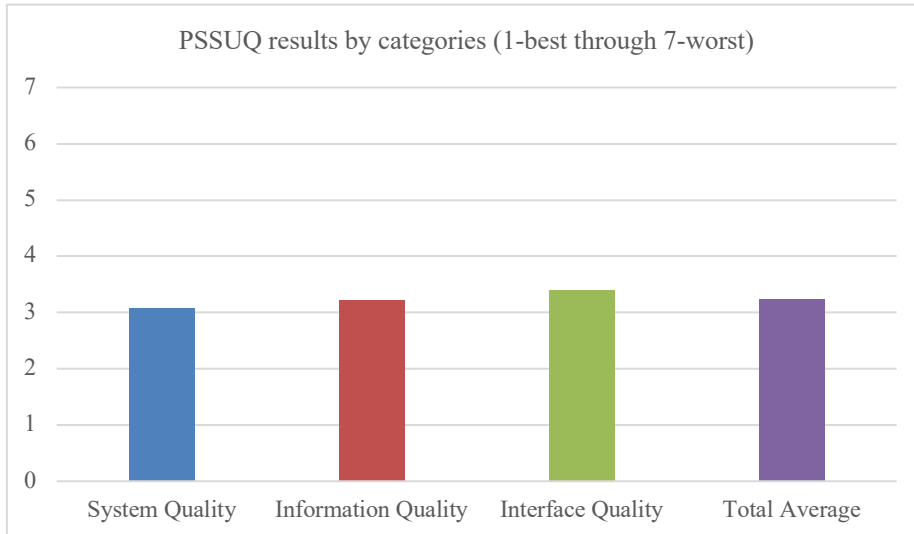


Fig. 4. PSSUQ average results by categories for the web application.

For all three categories, results were very similar, ranging from 3.075 (System Quality) to 3.39 (Interface Quality), with a Total Average of around 3.23, taking into account that PSSUQ answers range from 1-best to 7-worst.

4. Discussion

In spite of the results regarding duration time and number of wrong clicks for each of the 4 tasks assigned for the mobile application, answers to the open questions after the tests revealed an overall positive feedback. Nevertheless, important improvement suggestions were also collected. For instance, 12 participants were confused (at least at a first glance) about what was and what was not a button in the application. Also, 4 of them were confused on the location of the questionnaires on the mobile application, as well as the messaging area. Finally, all users stated in the end that the mobile application was user-friendly and comprehensible.

The *mobile application* usability tests also revealed some challenges regarding the common characteristics of informal caregivers, namely:

- Age of participants was inversely related with the use of mobile applications on a daily basis. While younger participants were more used to mobile applications, older ones confessed to use smartphones mainly for telephone calls;
- First-time use of the mobile app can be challenging, mainly for caregivers less experienced with smartphones, and therefore, additional initial training is advisable;
- The training materials available were considered very useful, even for experienced informal caregivers;
- Access to mobile data (to be online) was not generalized among the participants. This means that the offline mode of the mobile application was very much appreciated, since it allows a similar user experience within the app.

Concerning the *web application*, the main challenges identified by participants included:

- Although the web application includes features to create and manage training materials, participants were immediately concerned with this time-consuming task, and preferred not having it on their daily practice;
- Participants also favored the “automatic association of materials to caregivers” feature, given the needs of their patients, as customizing these materials could reveal to be also time-consuming;
- The majority of participants (10) reported some difficulty in the navigation flow of the application, causing the loss of context in the accomplishment of tasks (mainly in registering data from caregivers and patients, associating needs to patients and associating training materials to caregivers);
- All participants revealed a common concern of having to use “yet another e-Health platform”, but were convinced on the future benefits it could bring, and of the need of restructuring informal caregivers management.

5. Conclusions and future work

In this paper, we described the results of usability tests performed to the Help2Care, specifically to its mobile and web applications. The mobile app was tested by 20 informal caregivers while 16 Registered Nurses tested the web application. For the mobile app, we adopted user testing by direct observation, assuring participants with no previous contact with the app. The interviewer followed a script to ask the participant to execute some tasks in the app, and an observer registered duration, wrong clicks, expected vs executed path and comments.

The web application was tested using the PSSUQ questionnaire, where participants were briefly introduced to the platform, its main features and organization.

The results obtained for the usability tests of the mobile app revealed some initial delays for the first tasks, and an increase of performance (less time and less wrong clicks) towards the last 2 tasks. Also, participants had difficulties regarding some interaction elements in the user interface, and age/experience with smartphones and mobile apps was of great influence in the results.

For the web application, results presented totaled an average of 3.23 out of 7 for the PSSUQ, with similar results among the System, Information and Interface Quality categories.

Further work was immediately carried out essentially to tackle quick-fix issues, such as the “button” confusion reported for the mobile app. Also, we could already develop wizard-like interactions for the web application, to address the complexity of some features available, especially the ones for the most common usage scenarios (register patients and caregivers, and associating training materials to them). Future work includes deploying the Help2Care platform into production in several health organizations, and continuously monitor the adoption and usage rates from caregivers and health professionals. For that, the platform also includes a dashboard with usage metrics including the quality

evaluations on the training materials reported by caregivers, number of times caregivers used the mobile app and number of visualizations for each training material.

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References

- [1] Gomes, Nuno, João Caroço, Ricardo Martinho, Rui Rijo, Ana Querido, and Maria dos Anjos Dixe. (2018) “Help2Care-Towards a digital platform to help to care for dependent persons and caregivers.” *Procedia Computer Science* **138**: 221–227.
- [2] Chen, Sonia Chien-I. (2018) “Technological health intervention in population aging to assist people to work smarter not harder: Qualitative study.” *Journal of Medical Internet Research* **20** (1): e3.
- [3] Huynh, Elizabeth, David Basic, Rinaldo Gonzales, and Chris Shanley. (2018) “Structured interdisciplinary bedside rounds do not reduce length of hospital stay and 28-day re-admission rate among older people hospitalised with acute illness: an Australian study.” *Australian Health Review* **41** (6): 599-605.
- [4] Vaportzis, Eleftheria, Maria Giatsi Clausen, and Alan J. Gow. (2017) “Older adults perceptions of technology and barriers to interacting with tablet computers: a focus group study.” *Frontiers in Psychology* **8** (1687).
- [5] Bertera, Elizabeth M., Binh Q. Tran, Ellen M. Wurtz, and Aisha Bonner. (2007) “A study of the receptivity to telecare technology in a community-based elderly minority population.” *Journal of Telemedicine and Telecare* **13** (7): 327-332.
- [6] Ferreira, Fábio, Flávio Dias, João Braz, Ricardo Santos, Roberto Nascimento, Carlos Ferreira, and Ricardo Martinho. (2013) “Protege: a mobile health application for the elder-caregiver monitoring paradigm.” *Procedia Technology* **9**: 1361-1371.
- [7] Wildenbos, G. A., L. W. Peute, and M. W. Jaspers. (2015) “A framework for evaluating mHealth tools for Older Patients on Usability.” *Studies in Health Technology and Informatics* **210**: 783-787.
- [8] Taha, Jessica, Joseph Sharit, and Sara J. Czaja. (2014) “The impact of numeracy ability and technology skills on older adults’ performance of health management tasks using a patient portal.” *Journal of Applied Gerontology* **33** (4): 416–436.
- [9] Nielsen, Jakob (1994). “Usability engineering”. Elsevier.
- [10] Lewis, J. R. (2002) “Psychometric evaluation of the PSSUQ using data from five years of usability studies.” *International Journal of Human-Computer Interaction*, **14** (3-4): 463-488.