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Procedia Computer Science 100 (2016) 369 – 374

Procedia Computer Science

Conference on ENTERprise Information Systems / International Conference on Project MANagement / Conference on Health and Social Care Information Systems and Technologies, CENTERIS / ProjMAN / HCist 2016, October 5-7, 2016

Mobile Applications in the Management of Headache

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Abstract

Mobile applications show great potential for the assessment and registration of information regarding headaches. However, data on the content and usability of mobile applications for headache that are accessible to the public in European Portuguese are scarce. Therefore, this study aims to search for and characterize the mobile applications related to headache in terms of content and usability. A search in the Android app store of applications was conducted. Four mobile applications were found in European Portuguese (Diário da Cefaleia, Diário da Dor, Dor de Cabeça e Registo Simples) that matched a set of predefined criteria. These were characterized in terms of content general characteristics, content and usability. Three of the apps were specific for headache and one could be used for any type of pain, including headache. All apps allow recording pain characteristics and its extraction in a form of a report.

Peer-review under responsibility of the organizing committee of CENTERIS 2016

Keywords: Headache, mobile applications, elderly, usability

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Peer-review under responsibility of the organizing committee of CENTERIS 2016
doi:10.1016/j.procs.2016.09.171

1. Introduction

In Portugal, as in the other countries, the aging population rate has increased in the last few years, and this increase is likely to continue in the years to come[1]. The increase in the elderly population highlights the need to promote healthy aging, with autonomy, health and independence, preserving and improving the functional capacity of the elderly, in line with the concept of active ageing. The World Health Organization (WHO)[2] defines active ageing as a process of optimizing opportunities for health, participation on activities and security, in order to increase the probability of older adults to live an healthier life. This must be accompanied by health opportunities, a sense of security, personal participation in different activities, and with social and family involvement as well.

The aging process is associated with the development of several pathologies. Pain is one of the major symptoms associated with these pathologies. Several studies have shown that the prevalence of pain increases with age[3–6]. Headache is referred in several studies as one of the most common type of pain in the elderly population [7–10]. A study in Spain, at the Neurology Department of the University Hospital of Valladolid, with 262 participants aged 65 years or older, found that the prevalence of headache was 51.9%.

There has been over the years a great development of the Information and Communications Technologies (ICTs), but there is still a stereotyped image that ICTs are only developed for the younger population[11]. However, a study carried out between 2002 and 2007 in the elderly population of five European countries (Germany, France, Italy, Poland and United Kingdom), showed an increase in the internet use among older adults: 27% users in 2001 and 44% in 2007 [12].

Currently, there are several software applications running in mobile devices (such as tablets and smartphones), with capacity to promote better monitoring of pain, which might facilitate better care[13]. WHO defines mobile applications for health as medical and health practice supported by mobile devices, such as mobile phones, monitoring patient devices, personal digital assistants (PDAs) and other wireless devices [14]. Several studies indicate that older people use more and show more interest in new technologies, especially technologies related to health. According to the Food and Drug Administration (FDA), the mobile applications for health should: help people (which means the users of the app), monitoring of health conditions without providing treatment suggestions; provide simple tools to organize and control the health information; provide easy access to information related with health; help to document the health conditions, making this easier to share information with the health providers; automate simple tasks for health care providers; be intended to transfer, store and display medical data[15].

Several authors conclude that the most beneficial applications for the elderly in the future, are related with applications that are able to maintain their social relationships, health and well-being[16]. However, mobile applications for health should go through a process of assessment in order to guarantee the quality and accuracy of its content as well as its usability [17]. The usability of applications is a quality attribute related to the ease of use, more specifically, refers to the degree of easy of use, efficiency, errors and the number of users that like to use the applications[18].

The objectives of this study were to characterize in terms of content, and assess in terms of usability, mobile applications related to headache.

This paper is divided by 5 sections: Introduction, where it is presented the state of art of the mHealth; Methods, the description of the procedures used to collect and process the data; Results, where the data are presented; Discussion, the analyses of the data, and Conclusion.

2. Methods

In order to facilitate the description of all procedures involved in this study, it was divided in two different phases. Phase A, included the selection and analysis of mobile applications and evaluation of its content. Phase B corresponded to the evaluation of their usability.

2.1. Phase A - Selection and analysis of mobile applications

Applications available in the Android platform between the 7th of October 2014 and the 15th of March 2015 were searched. The search was conducted in this platform because it is the most used in terms of applications[19].

To be included in the present study the applications had to meet the following criteria:

- Allow the registration of information about headache;
- Have the individual as primary user;
- Have an European Portuguese version;
- Be free of charge.

The search resulted in four applications that met the inclusion criteria: i) Dor de Cabeça; ii) Diário da Dor; iii) Diário da Cefaleia; and iv) Registo Simples.

The general characterization of each of the four applications consisted of: description of the application; size; number of downloads, version; date last updated, number of evaluations made by users and average score (in stars – from 0 to 5).

A content analysis of each application was also performed. This analysis was performed using a set of criteria previously used by Reynoldson et al. [20] to assess pain related mobile applications. These included: location of the pain (e.g., frontal, temporal); onset of pain (day and time); characteristics of the pain (how the pain is defined); associated symptoms (e.g. nausea, dizziness): duration of pain (duration of the pain episode); aggravating factors or relief factors (e.g. worsens with increasing brightness, improves with rest,); environment (where the pain began, for example, work or home); pain intensity (existence of a pain intensity scale – for example, from 0 to 10); medication or treatment (details of the drugs and pain treatment); additional notes (ability to enter additional information); modification of existing options and results (existence of a results section) for a total of 19 parameters assessed that were scored 1 (if present) or 0 (if not).

The content analysis of each application was performed independently by two researchers.

2.2. Phase B – Usability assessment

Only 3 applications enter the usability assessment phase as Registo Simples, one of the applications, was not available in the Play Store (platform for downloads belonging to Android) at this stage.

A convenience sample of 22 older adults recruited at Universidade Sénior de Cacia (USIDEC), Universidade Sénior de Estarreja (USR) and from the general community were asked to assess the usability of the mobile applications. Those who agreed to participate had to give their written consent. Participants were eligible if they were at least 60 years old and were able to use an electronic device.

To characterize the sample, the data collected were: gender, age, level of education, computer literacy and headache complaint at the time of collection through a questionnaire developed for this study purpose.

For the application's usability evaluation, participants answered a questionnaire of usability, the International Classification of Functioning - Usability Scale I (ICF-US I), which was based on the International Classification of Functioning, Disability and Health[21]. This instrument consists of 10 items covering aspects of ease of use, satisfaction and learning process; expected results and clarity of information. To answer each of the 10 items, the respondent has to consider whether the aspect being considered is a barrier or a facilitator and graduate the magnitude of the barrier or facilitator in a Likert scale of three points (barrier: -3: complete; -2: large and -1: small; facilitator: 1:small; 2:large and 3: complete). The maximum score is 30 points. The scale has a Cronbach's Alpha for internal consistency of 0.46. The ICF-US I was completed after using all three applications according to a written script of tasks aimed to ensure that all participants used each application in a similar way and explored its different functionalities in the same way.

In parallel to the usability evaluation, a performance evaluation was also done, by annotating the success or failure and ease of completion of each task in the written script of tasks. For each task, the researcher assessed the following aspects: i) number of attempts that each participant needed to successfully complete each task; ii) whether participants were able to complete the tasks without any support, with verbal support or needed physical assistance and iii) the time that each participant took to complete all tasks. These procedures were piloted in 2 individuals not belonging to the final sample.

2.3. Data analysis

Data was analyzed using the Statistical Package for the Social Sciences, version 22.0 for Windows. The characterization of the sample, usability and performance of applications was made descriptive statistics (mean, standard deviation, frequencies, minimum and maximum). An ANOVA was used to compare the total score of the

ICF-US I and performance (time to complete the task script) among the three applications. The significance level was set at $p<0.05$.

3. Results

The results will be presented according the phase described previously.

3.1. Phase A - Selection and analysis of mobile applications

All applications enabled the recording of episodes of headache by users, and the possibility to insert various characteristics of the headache. There is also the size application is the Diário da Dor with 9.5 MB, the application presenting a greater number of downloads (between 1000 and 50000) was Dor de Cabeça; the application last updated (2/2/2014) was Registo Simples; the application with the highest number of evaluations made by users was the Dor de Cabeça; and the applications better assessed by users (a mean score of 4.1 out of 5) were the Diário da Dor and Registo Simples.

The content assessment of various applications, as mentioned above, was performed independently by two reviewers. The percentage of agreement ranged between 84.21% (Diário da dor) and 100% (Diário da Cefaleia). However, after discussion, reviewers reached 100% agreement for all applications. It turns out that just the application Diário da Dor refers to the parameter on the duration of the pain as well as to the modification of the existing options. In contrast, all the applications evaluated reference to date; the time and intensity of pain. All applications are faithful to the information given by the programmer in the description; al have a results section and these can be filtered and formatted in a final report. The application with the highest final score (15 points) was Diário da Dor and the application with the lowest final score (8 points) was the Registo Simples.

3.2. Phase B – Usability assessment

The sample consisted of 22 participants, 54.5% (n=12) female and 45.5% (n=10) of males, with a mean (±SD) age of 72.3 (±8.2) years old. Regarding level of education, 31.8% (n=7) had an university degree. As regards the level of computer literacy, all participants (n=22) had at least one mobile device and 59.1% (n=13) used mobile devices every day.

The application with the highest score in terms of usability (ICF-US I) was the Dor de Cabeça (Mean±sd ICF_US I=25.4 ±0.4), followed by the Diário da Dor (Mean±sd ICF_US I=24.7±3.9) and the application Diário da Cefaleia (Mean±sd ICF_US I= 13.6±3.7). There were no statistically significant differences in the final score of the ICF-US I between the three applications (p=0.21), suggesting that they have similar usability levels.

Regarding the scrip (Table 1) , the mean number of participants to finish the tasks at first attempt , as well as the type of support needed was similar for the three applications.

Table 1 - Mean (±SD) of participants according the level of conclusion facility of the tasks of each application

	Nr. of tasks	1ª	2ª	3º	Physical	Verbal
Diário da Cefaleia	12	14,9 (±2,3)	4,3 (±2,1)	1,5 (±0,9)	0,85 (±0,9)	1,0 (0,9)
Dor de Cabeça	11	15,4 (1,6)	3,6 (±1,0)	1,5 (±1,8)	0,8 (±1,1)	0,8 (±1,1)
Diário da Dor	12	14,4 (±2,8)	3,2 (1,7)	2,4 (±0,9)	1,0 (±0,9)	1,1 (±1,0)

The application for which participants took longer to complete the task script was the Diário da Cefaleia (mean ±sd=7.1±3.3min.), followed by Dor de Cabeça (mean ±sd=6.2 ±2.9 min.) and Diário da Dor (mean ±sd=5.1 ±2.7 min). No significant differences were found between applications ($p<0.05$).

4. Discussion

The present study characterized three mobile applications related to ((i) Diário da Cefaleia; ii) Diário da Dor and iii) Diário da Dor de Cabeça) in terms of generalcharacteristics, content and usability .

In terms of content, all applications allowed the insertion of various information regarding the characteristics of headache and all applications included a final report that could be exported or sent by email.

Concerning the usability of the applications assessed in this study, the high mean score of ICF-US (minimum of 24.7 out of 30) suggest that applications were relatively easy to use. Nevertheless, this could have been influenced by the high literacy levels of our sample. This is also shown by the fact that most participants were able to perform the tasks requested in the task script at first attempt. According to several studies[22–24], pain related mobile applications tend to be considered easy to use by end users.

In this study it was found that the vast majority of mobile applications for the management of headache may be of great importance for older people, as they cover the most important clinical aspects of headache and allow communication with health professionals, for example, by sending an email with the data collected using the application. They might be of great use in terms of assessment and monitoring of symptoms before and after an intervention, allowing health professionals to have a more accurate feedback on the impact of interventions [25–28]. Nevertheless, there is a need to ensure that its content is accurate and its mode of use appropriate to end users, and in particular, to older adults.

The present study has some limitations in what concerns the number of applications tested. In fact, there were only three applications available in European Portuguese in the Android platform. Another limitation is related to the sample used. All participants had at least one mobile device, what didn't allow for a comparison between participants with different levels of digital literacy.

Future studies may test more applications, including those available at different platforms like Microsoft or IOS and with participants with different levels of digital literacy. Another future work concerns the validation of the pain related data using mobile applications.

5. Conclusion

This study results suggest that 3 mobile applications related to headache and available in European Portuguese are adequate in terms of content and usability for older adults.

Acknowledgement

Special thanks to all the people who agreed to participate in this study, as well as the Universidade Sénior de Cacia (USIDEC) and Universidade Sénior de Estarreja (USR).

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