Quality of Life through Quality of Information
J. Mantas et al. (Eds.)
IOS Press, 2012

doi:10.3233/978-1-61499-101-4-189

Patient Support ICT Tool for Hypertension Monitoring

Morten Algy BONDERUP[a1], Stine Veje HANGAARD[a], Pernille Heyckendorff LILHOLT[a], Mette Dencker JOHANSEN[a], Ole K. HEJLESEN[a]
[a]*Department of Health Science and Technology, Aalborg University, Aalborg, Denmark*

Abstract: Detection of hypertension is traditionally a matter for the general practitioner, but an alternative detection scheme is home blood pressure measurement by patients, on patients' or doctors' decision. We designed and implemented a prototype software tool to provide information about hypertension, video instructions on correct home blood pressure measurement technique and a measurements diary. The system was developed using standard, software development methods and techniques. The program was developed for Danish-speaking patients. Usability (navigability, level and outcome of instructions, logical arrangement, level and focus of information, and program accessibility) was evaluated in a think-aloud test with test users performing specific, realistic tasks. The prototype provides written information about hypertension, written and video instructions on correct blood pressure measurement technique, and measurements diary functionality. All test users performed all tasks and rated navigability, level and outcome of instructions, logical arrangement, level and focus of information, and program accessibility high, and had positive attitudes towards the system. The components in the patient support tool can be used separately or in combination. The effects of video for home blood pressure measurement technique instruction remain unexplored.

Keywords: blood pressure, blood pressure measurement, patient education as topic, video instruction.

Introduction

Cardiovascular disease constitutes a major cause of death in all industrial countries. Systemic hypertension is the most common treatable risk factor for cardiovascular disease [1]. The prevalence of systemic hypertension in the European adult population is above 40% [2]. Pharmacological interventions using antihypertensiva remain the treatment of choice. Screening programs exist to detect hypertensive patients, but many are detected by chance when blood pressure is measured for other reasons. Office/clinic blood pressure measurements can be affected by different conditions, most prominently white-coat hypertension [3]. An alternative with higher temporal resolution is home blood pressure measurements (HBPM), most frequently using automated digital blood pressure monitoring devices. The long-term effects of antihypertensive treatment are higher in patients monitoring their own blood pressure by HBPM [4], perhaps due to the expectedly higher responsibility and thus compliance assumed by these patients.

[1] Corresponding author: Morten Algy Bonderup, email: mbonde10@student.aau.dk

HBPM levels reported by patients cannot, however, readily constitute the basis of diagnosis and treatment, as the procedures assumed by patients without previous instruction are erroneous [5], and patients may not record their values with necessary detail. This is also the case for people who out of health interest buy their own blood pressure monitoring devices in supermarkets or drugstores. Different teaching schemes have been applied: Hypertensive patients who receive structured teaching in the use of automated digital blood pressure monitoring devices by a nurse, individually or in groups, have a higher knowledge gain and lower error frequency than patients left to self-instruction via a booklet [6], and instructive videos have been applied as a detailed yet work efficient approach for training patients in other medical procedures [7, 8]. Also, a combination of a hypertension patient guide for information purposes (but not measurement technique teaching purposes) and a blood pressure measurement diary with a graphical tool has been suggested [9]. A comprehensive software tool comprising patient hypertension information, HBPM technique video instruction, and blood pressure diary is to our knowledge non-existing, despite the patient empowerment potential of such tool. We present a prototype tool for hypertension information, HBPM technique instruction and records of blood pressure measurements.

1. Methods

1.1. Software development

The program was designed and implemented using standard web page graphical user interface software development methods.

The program was designed to display information about hypertension and instructions on correct blood pressure measurement technique, and to support diary records of blood pressure measurements. To further support patient/user involvement and compliance, especially in those cases when HBPM is not prescribed by a doctor, a risk screening tool (Framingham algorithm for hypertension risk score) and a hypertension quiz was included.

All graphical user interface features were developed with a native Danish (potentially) hypertensive patient or user as the intended user.

1.2. Usability test

The usability test of the system evaluated whether the system was usable and relevant in blood pressure information and HBPM technique teaching and recording situations. The usability of the system was evaluated regarding navigability, level and outcome of instructions, logical arrangement, level and focus of information, and program accessibility in the think-aloud test, where test users rated the system characteristics in a questionnaire after they had performed specific tasks.

Tasks were to 1) find and read information about hypertension, 2) find and read instructions for HBPM, 3) find and play a video with instructions for HBPM, 4) take a quiz about their knowledge of hypertension and how to measure blood pressure, 4) screen themselves for hypertension risk, and 5) record a blood pressure measurement and view blood pressure history. These six tasks all resembled real life situations and intended use cases of the system. No information regarding system organization and intended use patterns was given to the users before the test.

During and after performing the six tasks, the test users' experiences and thoughts about using the system were recorded, and researchers observed the test users during the task performing sessions. As background information, the test users were asked about their behaviour regarding anatomy note taking and their attitudes and experiences towards using technology to support their learning.

The questionnaire was developed by the researchers developing the system and it had one or two question for each of the five topics (navigability, level and outcome of instructions, logical arrangement, level and focus of information, and program accessibility), and the users were asked to indicate their assessment on a 1-5 scale (interval between steps: 1), 1 being the least positive and 10 being the most positive.

The study was advertised orally, and the inclusion and exclusion criteria were mentioned. Inclusion criteria were: (a) age ≥ 20 years, (b) ability to speak and understand Danish, (c) no previous formal HBPM instructions. Exclusion criteria were: (a) cardiovascular disease, (b) pregnancy, (c) hypertension diagnosis, (d) inability to use upper limbs. Five persons, drawn in a convenience sample from the social circles at Aalborg University, mean age 39 years (range 24-59 years), two males, participated. All test users are daily users of information technology.

2. Results

2.1. System development

2.1.1. Technical features of the system

The program is in HTML with an OpenOffice database and a graphical user interface.

2.1.2. System contents

The system consists of graphical user interface that links to a local database, where all hypertension information, instructional information, quiz questions and screening basis is found and to which diary information is stored, added to and retrieved from.

The system does not require the user to be logged in before the system can be used as shared use of the program on one machine is not anticipated and would not cause privacy problems, should it occur, however, login is required for entering and accessing blood pressure measurement diary data.

The system prompts the user to select an action. Selectable actions are:

- View information about hypertension
- View instructions for blood pressure measurement technique (video and text)
- Perform hypertension risk screening
- Take hypertension and blood pressure measurement technique quiz
- Login to diary

Sub-contents exist for risk screening and diary features, see figure 1.

For naïve users, who have not used the system before, the primary contents of interest would likely be the information and perhaps screening and quiz features. For returning, competent patients performing HBPM, the primary feature to use is diary login for entering and viewing blood pressure measurement values (in a graph or a list).

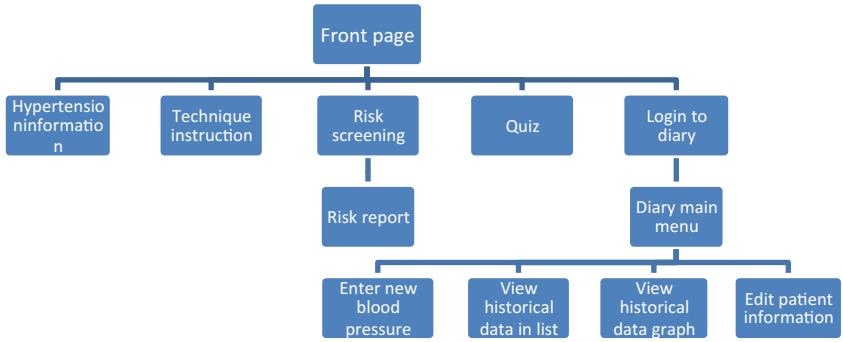

Figure 1. Sitemap of sub-contents

2.2. Usability test

All test users performed all tasks, however, some of the participants needed help to understand one question in the screening tool about family history of hypertension. Further, some needed hints to view blood pressure history, and some confusion was expressed about whether data is stored when users report blood pressure values.

Median ratings by test users were level of navigability: 4 (range 4-5); level and outcome of instructions: 5 (range 4-5) (level) and 5 (range 4-5) (focus); logical arrangement: 5 (range 4-5); level and focus of information: 4 (range 4-5) (level) and 5 (range 3-5) (focus); program accessibility 4 (range 2-5).

All test users considered the system relevant and a good tool for lay people due to the combination of information, video instruction, risk calculator and diary. However, during the think-aloud test, layout and structure issues were uncovered especially for the blood pressure history graphs in the diary.

3. Discussion

This study presents prototype tool for (potentially) hypertensive patient information, HBPM measurement technique instruction and records of blood pressure measurements. The system was developed using standard methods for software design and implementation. Fully similar systems are scarce as the use of video instructions is not currently implemented in any widely used electronic hypertension information systems. This may arise from the easily transportable and paper-based tradition for patient instruction, as handing out a leaflet makes it evident that the information is given, though in reality it is only the opportunity for the patient to acquire the information presented. Further, it is not trivial to ensure presentation of all relevant instructions in a video, so meticulous oral and written support information must be provided.

The usability test showed that the users found the program easy to use and navigate, and that it was arranged in a logical manner. The test users also considered the information and instructions to be at an appropriate level and that their outcomes of reading information and getting HBPM instructions were good. The test further indicated that the system was useable for the intended tasks.

Despite the test users' approval of system usability, the current prototype would benefit from modifications to further support usability and usefulness before releasing it for use in real life settings. Further support of patient-doctor communication using the blood pressure diary data could improve care [9]. Incorporating the system in a distributable medium is necessary; e.g. a webpage, and patients could be referred to the webpage and the system by practitioners allocating patients to HBPM, and the page could also be advertised as a place for persons concerned with their blood pressure and with access to blood pressure monitoring devices but not diagnosed with hypertension.

The shift from doctor and clinic based care to patient-centered care in numerous chronic disease populations underlines the importance of patient education and care instructions as well as of patient compliance support. Information technology tools and especially video instructions may be a feasible way to improve HBPM technique, but this requires meticulous evaluation, for instance using the tool presented here. The results of other alternatives to written HBPM instructions (nurse instructions, e.g.) are promising [6], and nurse students have benefitted of video instructions on blood pressure measurement technique compared with traditional class room teaching [10].

We conclude that is was possible to develop a prototype tool for patient information about hypertension, HBPM measurement technique instruction and records of blood pressure measurements, and that it is welcomed and usable by potential users. It can potentially support patient education and adherence to correct HBPM technique. A few improvements and adaptions to end users' requirements must be done before evaluating its impact on knowledge and adherence to correct HBPM technique.

References

[1] Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJ, Comparative Risk Assessment Collaborating Group. Selected major risk factors and global and regional burden of disease. Lancet. 2002;360(9343):1347-1360

[2] Wolf-Maier K, Cooper RS, Banegas JR, Giampaoli S, Hense HW, Joffres M, Kastarinen M, Poulter N, Primatesta P, Rodriguez-Artalejo F, Stegmayr B, Thamm M, Tuomilehto J, Vanuzzo D, Vescio F. Hypertension prevalence and blood pressure levels in 6 european countries, canada, and the united states. JAMA. 2003;289(18):2363-2369

[3] Verberk WJ, Kroon AA, Lenders JW, Kessels AG, van Montfrans GA, Smit AJ, van der Kuy PH, Nelemans PJ, Rennenberg RJ, Grobbee DE, Beltman FW, Joore MA, Brunenberg DE, Dirksen C, Thien T, de Leeuw PW, Home Versus Office Measurement, Reduction of Unnecessary Treatment Study Investigators. Self-measurement of blood pressure at home reduces the need for antihypertensive drugs: A randomized, controlled trial. Hypertension. 2007;50(6):1019-1025

[4] Ishikawa J, Carroll DJ, Kuruvilla S, Schwartz JE, Pickering TG. Changes in home versus clinic blood pressure with antihypertensive treatments: A meta-analysis. Hypertension. 2008;52(5):856-864

[5] Stryker T, Wilson M, Wilson TW. Accuracy of home blood pressure readings: Monitors and operators. Blood Press Monit. 2004;9(3):143-147

[6] Leblanc ME, Cloutier L, Veiga EV. Knowledge and practice outcomes after home blood pressure measurement education programs. Blood Press Monit. 2011;16(6):265-269

[7] Armstrong AW, Idriss NZ, Kim RH. Effects of video-based, online education on behavioral and knowledge outcomes in sunscreen use: A randomized controlled trial. Patient Educ Couns. 2011;83(2):273-277

[8] Gagliano ME. A literature review on the efficacy of video in patient education. J Med Educ. 1988;63(10):785-792

[9] Dawes MG, Kaczorowski J, Swanson G, Hickey J, Karwalajtys T. The effect of a patient education booklet and BP 'tracker' on knowledge about hypertension. A randomized controlled trial. Fam Pract. 2010;27(5):472-478

[10] Bauer M, Geront M, Huynh M. Teaching blood pressure measurement: CD-ROM versus conventional classroom instruction. J Nurs Educ. 2001;40(3):138-141