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Human-Centered Design of an mHealth App for the Prevention of Burnout Syndrome

Santiago NARVÁEZ[a], Ángela M. TOBAR[a], Diego M. LÓPEZ[a,1] and Bernd BLOBEL[b]
[a] *Telematics Engineering Research Group, University of Cauca, Colombia*
[b] *eHealth Competence Center Bavaria, Deggendorf Institute of Technology, Germany*

Abstract. Background: Stress-related disorders have become one of the main health problems in many countries and organizations worldwide. They can generate depression and anxiety, and could derive in work absenteeism and reduction in productivity. Objective: Design, develop, and evaluate an mHealth App for the prevention of Burnout Syndrome following the recommendations of standard User-Centered Design methodologies. Results: 1) A descriptive cross-sectional study was performed on a sample of 59 faculty members and workers at the University of Cauca, Colombia using the Maslach Burnout Inventory as an instrument for measuring Burnout, accompanied by a demographic and technological questionnaire. 2) Three prototypes of the mHealth App were iteratively developed following the recommendations provided by the ISO Usability Maturity Model and the ISO User-Centered Design model. 3) Usability tests of the system were performed based on the ISO 9126 standard. Conclusions: The results obtained are considered positive, particularly those regarding user's satisfaction measured using the System Usability Scale.

Keywords. User-Centered Design, mHealth App, Burnout

1. Introduction

According to WHO [1], occupational stress is defined as an individual's reaction to an imbalance between the demands of the workplace and his/her capacities. There are different types of stress in the workplace including the Burnout Syndrome (BS). BS is a chronic state of occupational stress which is developed gradually because of prolonged exposure to occupational stress factors, leading to a large psychological stress [2]. Burnout is a three-dimensional Syndrome with signs and symptoms categorized in three axes: emotional exhaustion, depersonalization and reduced personal accomplishment [3].

Information and Communication Technologies (ICT) can help to improve the efficiency of occupational stress interventions since, compared with conventional interventions, it is possible to carry them out at a larger scale, regardless of time, place, or group of people [4]. The growing use of mobile devices opens a new way for innovative interventions in Burnout supported by mobile Apps.

[1] Corresponding Author: Diego M. López, Full Professor, Telematics Department, University of Cauca. Calle 5 No 4-70, Popayán, Colombia; Email: dmlopez@unicauca.edu.co.

The aim of this study was to design, develop, and evaluate a mHealth App for the prevention of Burnout Syndrome occurring to university faculty members and employees, following a standard human (user)-centered design methodology.

2. Methods

The implementation of the system was carried out following an adaptation of standard Human or User Centered Design (UCD) models, according to the recommendations provided by the European INUSE and TRUMP projects and the resulting standardizations of human-centered lifecycle process description (ISO/TR 18529:2000) as well as ISO 13407:1999 - Human-centered design processes for interactive systems specifications. The UCD development process used, called OpenUP/MMU-ISO, is an iterative design process, which involves the user from the project inception until the last phase of the development. It describes user's behavior and the context, and sets clear usability and user experience goals, which must be able to be empirically measured [5]. Throughout the project, a multidisciplinary group collaborated including developers, designers, occupational health specialists (physicians, psychologists, physical therapists, and a psychiatrist), social communicators, usability experts, and faculty members.

The most relevant activities of the UCD development Process were: 1) Understanding and specifying the context of use. For this purpose, a descriptive study was conducted with a sample of 59 faculty members and workers at the University of Cauca, Colombia. This was performed through a survey that included the Maslach Burnout Inventory (MBI) as an instrument for measuring Burnout, accompanied by a demographic and technological questionnaire. 2) Iterative Development of three prototypes of the mHealth App using the activities, roles and work products proposed in the UCD development process. 3) Evaluation of each prototype following usability-testing guidelines developed by the Department of Health and Human Services of the United States of America. Also, the System Usability Scale (SUS) was used to measure the level of customer satisfaction. During the first two evaluation rounds, 6 participants from the total population were selected for each prototype (3 faculty members and 3 employees); for the final round of the usability evaluation, that number was doubled. All participants were randomly chosen, and each test was conducted at the University facilities. In all the evaluations, the research team used the Think Aloud technique. Monitoring metrics defined in ISO 9126 were used: internal quality (evident functions, function understandability, message clarity, interface element clarity, attractive interaction), external quality (operational consistency in use) and quality of use (satisfaction scale).

3. Results

3.1. Context of Use

The descriptive study carried out showed that 78% of the study group were males, 67.8% of workers were married, 50.8% had been professionals for less than 15 years, 66.1% had been in their current job for less than 15 years, 84.7% were faculty members and 71.2% had a permanent contract. The mean age was 41 years old with a standard

deviation (SD) of 9.3, with a minimum age of 24 years and a maximum age of 66 years, 55.9% were under 41 years. Finally, 81.4% of workers had to do overtime work.

MBI results showed that there was an overall BS prevalence of 27.1% at a 95% confidence interval (CI) [16.36 to 40.27] among faculty members. It was identified that of the 59 participants in the first stage of the study, 62.7% were equipped with a Smartphone, of which 73% were using the Android operating system. Participants considered applications focused on health, welfare and personal care as useful. In addition, 86.5% of workers were willing to use an application to prevent and reduce stress levels. 23.9% of workers wanted to find in the application relaxation exercises and 17% relaxing music.

The research group used the prior results, together with some interviews carried out with occupational health specialists, to determine the modules that should be included in the system. Those modules are listed in Table 1. The technological profile of faculty members led the research group to develop an Android App. With this in mind, 3 prototypes of the solution were designed, developed, and tested.

Table 1. Mobile App functionalities.

APPLICATION MODULE	DESCRIPTION
Work Gymnastics Exercises Module	Stretching exercises that aimed at improving user's muscle-skeletal conditions. The module included images and audio guides.
Relaxing Music Module	Relaxing music tracks that aimed at reducing physical and mental stress. The objective was to decrease stress levels and anxiety.
Burnout Level Module	Module for the self-administration of the MBI test, as well as a graphical and historical representation of the results.
Burnout Information Module	It included the most relevant information about the Burnout Syndrome: definition, symptoms, and prevention.
Active Breaks Module	It included a timer for reminding the user from time to time to have a break and conduct an active pause.

3.2. First prototype

The first prototype of the system was designed on paper, and then a simulation in a real device using the "POP 2.0 - Prototyping on Paper" application was developed, as shown in the first model of Figure 1. The objective of this prototype was to describe the navigation flow and design according the users' requirements. It was observed that most participants successfully completed the tasks assigned in the test. However, it was clear that each functionality of the application (described in Table 1) should be represented by an icon in order to allow users to easily recognize them. In addition, the evaluation showed that the timer configuration in the Active Breaks Module was extremely complex and unclear. Therefore, the module was re-designed.

3.3. Second prototype

The results of the evaluation of the first prototype contributed to the design and construction of the second prototype. The aim of this prototype was to define the graphic design and the navigation flow of the application. Thus, it was decided that this prototype was a wireframe (i.e., a visual guide to the structure of the application). In this case, the JustInMind tool was used to generate the prototype navigation flow.

During the evaluation of this prototype, some usability metrics described in the ISO 9126 standard were used (evident functions, function understandability and satisfaction scale). 85% of the functions were evident and 80% were easy to understand. The research

group expected to obtain at least 70% in both metrics. Most participants successfully completed the assignments, and the success rates improved compared to the ones found in the first prototype. The SUS average score amounted to 81.25.

Based on these evaluation results, some changes in the application were conducted. For example, several participants stated that the application looked "uniform" but also "flat" and "boring"; thus, the project´s designer decided to change the colors of the application. In addition, some participants claimed that in some cases it was difficult to read the applications content; therefore, the text font size was increased. Finally, most of the participants wished to see application's information and instructions; so, the research team decided to add an icon in the main menu with such functionality.

3.4. Final prototype

Figure 1. Design Process of the main menu of the App, evolving from the first through the last prototype.

The final prototype was designed based on the feedback received in the previous prototypes. This prototype, unlike the others, was a fully functional mobile App.

During the evaluation of this prototype, other usability metrics defined in ISO 9126 were used (message clarity, interface element clarity, attractive interaction, satisfaction scale and operational consistency in use). 94% of the deployed messages and 95% of the interface elements were clear, 100% of the participant considered the use of the app consistent. The research group expected to obtain at least 70% in the previous metrics. Most participants successfully completed all the assignments. The SUS average score had a value of 89.38, which exceeded the one obtained in the previous test (81.25).

4. Discussion

The descriptive study carried out showed that the overall BS prevalence among faculty members is consistent with the values reported similar studies, e.g., (10.7% - 46.3%) [6]. So, it is possible to conclude that the faculty members are indeed exposed to psychosocial risk factors. Therefore, actions should be taken to prevent the prevalence increases. In addition, the study allowed identifying the profile of a faculty member with Burnout. The Socio-demographic and technological characterization performed in this study allowed the development team to build the application according to the users' needs.

The evaluation results of the last prototype showed that the users who tested the prototype had a positive perception of the application. Particularly important are the results obtained in the SUS, for which an average score of 89.38 was obtained. Sauro [7] stated that any system getting a score higher than 80.30 is in the 10% of the best-rated systems. Therefore, we can conclude that the results of this evaluation were very positive, and users were satisfied with the application. All quality objectives set by the research team were met. Participants found no inconsistencies in the system, functions or deployed messages. The interaction was considered attractive to the users.

Limitations. The development and evaluation of the application was limited to faculty members of the University of Cauca, limiting the generalization of the results.

Since the main objective of this research was to assess the application perception within a group of faculty members, the clinical impact of the application on Burnout levels was not measured. The latter can be analyzed in future studies.

Comparison with Prior Work. Few reported Burnout interventions made use of ICT solutions. In a previous study, a systematic review of ICT supported interventions for prevention and treatment of work-related stress was performed [7]. The study found that most work-related stress interventions were supported via the web. However, mobile Apps have not yet been fully explored and evaluated.

5. Conclusions

In this study, the development and evaluation process of an mHealth App for prevention of Burnout Syndrome occurring in and university context was presented. As part of this study, potential users of the system were characterized. This characterization led the research team to conclude that the users were indeed exposed to psychosocial risk factors, and that they are willing to use mobile Apps for the prevention of the syndrome. The results obtained throughout the evaluation could be considered as positive, particularly those regarding user's satisfaction, with a 89.38 SUS score. The last may be the result of the deployment of the UCD methodology, which emphasizes the final user's needs. Nonetheless, the clinical impact of the App should be evaluated in future studies.

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