



Mobile App Design Process to Promote Physical Activity in Cancer Care: Findings about Physical Activity and Quality of Life

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Abstract

Background: Physical activity is recognized as a supportive care in cancer management. Mobile apps have become a common and effective method of promoting physical activity in cancer. The results presented in this paper come from the mobile app design process at the National Institute of Oncology in Morocco. **Objectives:** This study aimed to describe the short-term changes in physical activity and quality of life in post-cancer treatment, after participating in this mobile app design process. **Methods:** Twenty-four post-treatment cancer patients participated in a user-centered design process to create a mobile physical activity application. The data collected was based on self-monitoring and self-assessment. The assessment was requested at the beginning and the end of the participation using the International Physical Activity Questionnaire and the SF-12 questionnaire. **Results:** The physical activity volume rose from 323 MET-min/week (160–410) in the first evaluation to 540 MET-min/week (460–730) after the mobile app participation. Eight of 11 participants have been moved from a low physical activity level to a moderate level. The physical health score rose from 57 (63-37) to 65 (72-54). The mental health score rose from 57 (63-37) to 65 (72-54). **Conclusions:** A short-term improvement in physical activity and quality of life was observed in post-treatment cancer patients. However, stronger studies are needed to confirm these results.

Keywords: Cancer; m-health; quality of life; physical activity.

Introduction

Cancer is a public health problem and a major burden for the individual and the community. The cancer functional impact needs a global care approach. Physical activity (PA) is recognized as supportive care and seems safe with scientifically proven benefits on physical capacities and patients' quality of life (QoL) ^[1].

The PA advice should be aligned with international guidelines in the field. However, there is so much diversity in patients' functional and clinical conditions that it is impossible to give stereotyped PA advice. It requires constant adaptation to patient conditions by healthcare professionals ^[2]. Maintaining adequate PA levels is a priority for cancer patients in all care pathways ^[2-4]. However, a lack of healthcare professionals' knowledge would be one of the barriers to PA advice for patients ^[2].

Mobile apps have become a common and effective method of promoting PA in cancer patients. "NachateBadani" is a mobile app

integrating PA into cancer care designed at the National Institute of Oncology in Morocco. The design methodology for this app was based on the user-centered process. Cancer patients and healthcare professionals participated as users in this process. A multidisciplinary group directed the design procedure. The objective was to provide patients with precise PA advice or initiate self-directed physical exercise programs (PEP). We adhered to behavior modification strategies and international guidelines about PA advice in cancer care. The mobile app assessment of users and two experts has shown positive results. The assessment criteria were usability, quality, and potential for behavior change ^[5].

This study aimed to describe the short-term changes in PA and QoL in post-cancer treatment, after participating in this mobile app design process.

Materials and Method

Study design

After participating in the mobile app design process, this observational study focused on short-term changes in patients' PA and QoL in post-cancer treatment.

Setting

Participation in the app begins with completing a form. The questionnaire included sociodemographic, functional, and clinical information. The PA assessment was requested at the beginning and

the end of mobile app participation. Self-monitoring was done after each PA session for three months. After each participant check-in, the mobile app automatically counts the individual cumulative PEP compliance averages and the individual cumulative self-satisfaction averages about PA advice compliance. Graphs are available in the personal space and represent the data provided daily by the participant. In Figure 1, some mobile app screenshots show the application home page, the participation form, self-monitoring graphs, and the self-assessment grid.

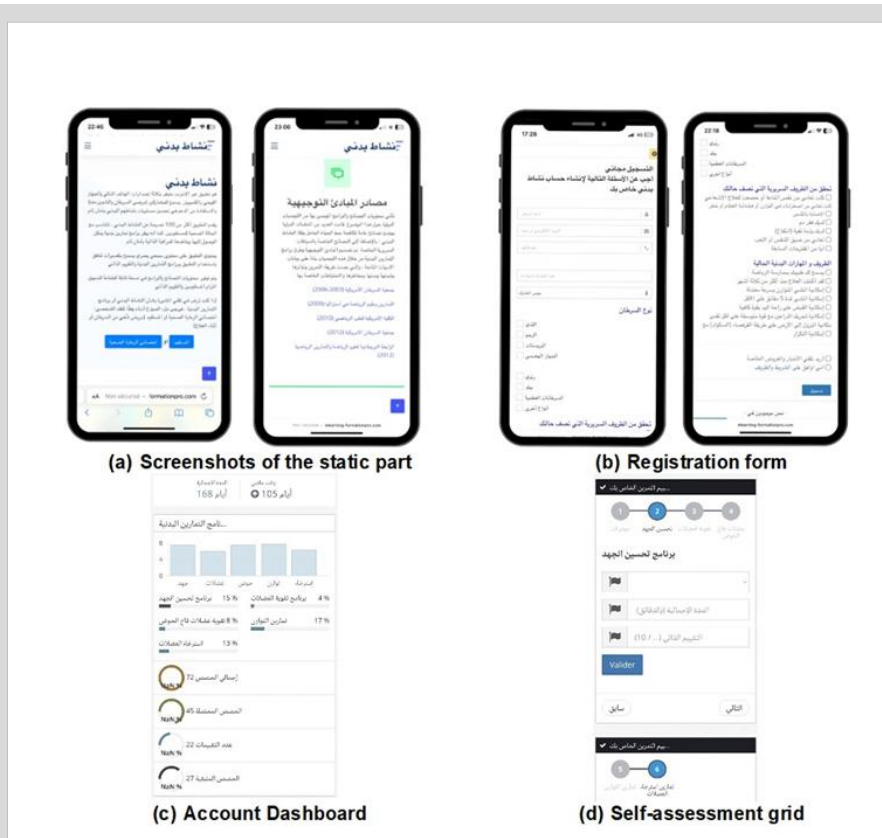


Figure 1: Some mobile app screenshots show the application home page, the participation form, self-monitoring graphs, and the self-assessment grid.

Participants

A total of 24 post-treatment cancer patients participated in this study. The Sample size was estimated based on previous mobile app design studies in the same area [6-8]. The data collection was carried out between May 2022, and March 2023. Participants met the following criteria: Be a cancer patient or cancer survivor; Be at least 18 years old; Own and use a smartphone; Be able to read at least Arabic; Be willing to participate in maintaining or enhancing the PA level. Participants were recruited during the mobile app design process for PA advice in cancer care at the National Institute of Oncology in Morocco.

Study instrument

The instrument consists of a semi-structured interview, and the data supplied by the form of the "NacheteBadani" mobile app. The wireframes were created using "Bootstrap 5.3 in Front-end, and Bootstrap smart admin in Back-end". The mobile app form includes the International Physical Activity Questionnaire (IPAQ) and the Short form-12 Health Survey Questionnaire (SF-12). The IPAQ was administered before and after mobile app participation. An Arabic IPAQ version was used, which correlates well with the French version, with Spearman's correlation coefficient ranging from 0.91 to 1.00 (p < 0.05) [9]. The IPAQ is a validated generic instrument for subjects aged 15 to 69. It calculates two scores the categorical score

and the continuous score. The first classifies individuals into three categories according to their PA level: low, moderate, and high. The second reflects the PA volume expressed in MET-min/week. The MET is the abbreviation of the word "Metabolic Equivalent of Task", it designates the body's energy expenditure under optimal conditions at rest [10]. The SF-12 questionnaire was used to assess participants' QoL. It gives two scores: Mental Component Summary (MCS) and Physical Component Summary (PCS). We have used a valid Arabic version of the SF-12 [11].

Statistical analysis

Descriptive statistics were used to describe all of the data. Results were reported as median (Md), interquartile range (IQR), mean (M), first (Q1), and third quartile (Q3). Graphs representing cumulative averages are also available.

Ethical considerations

The study has been approved by the Joint Ethics Committee of the Faculty of Medicine and the Faculty of Pharmacy of the Mohammed V University of Rabat, Morocco (November 2019; CRTN: 104/19). Participants signed a pre-participation consent form that informed them of the intention to publish data from the study.

Results

Twenty-four participants were the first to participate in the mobile app design process. The number of people who completed the participation was reduced from 24 to 18 due to lack of response and loss of sight. The participant's median age was 49 (57-39). PA content given by the mobile app for beneficiaries varied according to their clinical and functional conditions. Among the 24 participants, half received specific PA advice; seven received specific and general PA advice; and five received specific PA advice with PEP (Table 1).

The cumulative averages of participants' self-satisfaction (n=18) with their adherence to PA advice were variable and generally good (MD=72%, IQR=55%-87%). The cumulative averages of self-reported compliance with programs recommended

for PEP participants (n=5). The average compliance with the PEP programs was good to excellent, except for the balance and stretching programs. Patient "5" seems to adhere less than other patients to PEP programs.

We found a notable improvement in participants' PA volume and level before and after the mobile app participation. Indeed, the PA volume rose from 323 MET-min/week (160-410) in the first evaluation to 540 MET-min/week (460-730) after the mobile app participation. Thus, Eight of 11 participants have been moved from a low PA level to a moderate PA level. We also found a notable improvement in participants' mental and physical health. The physical health score rose from 57 (63-37) to 65 (72-54). The mental health score rose from 57 (63-37) to 65 (72-54) (Table 2).

Table 1: Beneficiaries' sociodemographic and clinical information and type of PA advice (N=24)

Characteristics	Statistics	
	n	Md (IQR)
Age (years)		49 (57-39)
Gender		
Women	15	
Men	9	
Marital status		
Single	6	
Married	15	
Divorced	2	
Widowed	1	
Educational Level		
Less than high school	10	
High school degree	6	
University degree	8	
Types of cancer		
Breast	6	
Gynecological	2	
Prostate	3	
Gastrointestinal	2	
Pulmonary	4	
Others	9	
BMI		
Score (kg/cm2)		27.12 (29.55-26.17)
Underweight	2	
Healthy weight	9	
Overweight	7	
Obesity	4	
PA advice given by the mobile app		
PEP + General PA advice	5	
Specific PA advice	12	
Specific and general PA advice	9	

BMI: Body Mass Index; IQR: Interquartile range; Md: Median; n: number; PA: Physical activity; PEP: Physical exercise program; SD: Standard deviation

Table 2: IPAQ scores before and after participating in the mobile app (n=18)

Measurements	Before	After
IPAQ SCORES		
Continuous score (MET-min/week); Md (IQR)	323 (410-160)	540 (730-460)
Categorical score (n)	Low	3
	Moderate	15
	High	0
SF-12 SCORES		
PCS (0-100); Md (IQR)	57 (63-37)	65 (72-54)
MCS (0-100); Md (IQR)	51 (56-40)	62 (75-49)

IQR: Interquartile Range; IPAQ: International Physical Activity Questionnaire; MCS: Mental Component Summary; MET: Metabolic Equivalent of Task; PCS: Physical Component Summary; SF-12: Short form-12 Health Survey Questionnaire

Discussion

To our Knowledge, “NachateBadani” is the first mobile app designed in this area and adapted to the Moroccan sociocultural and linguistic context. The users' testing has shown positive results about quality, usability, and potential for behavioral change. Compared to previous apps, ours appears to be more global and comprehensive, as it is designed to assist patients and healthcare professionals in the PA advice process and is intended for all cancers and stages of care [5]. However, user testing and clinical efficacy have been weakly correlated. [12].

Although the participants were in the post-treatment phase, they were heterogeneous regarding socio-demographic and clinical variables. To meet this requirement, we designed this mobile app, with all the parameters related to PA advice in cancer care. Several international guidelines in the field were mobilized [13-19]. Only a few PA apps in this area comply with these international guidelines [20].

The short-term improvement in PA and QoL of this mobile app looks promising. These results corroborate the conclusions of Yerrakalva's meta-analysis, which found short-term improvements in sedentary behavior and PA levels after using mobile apps [21]. In Brickwood's meta-analysis, although mobile apps can increase the number of steps, they seem less effective in reducing sedentary behavior [22]. In addition, a randomized controlled trial showed a positive and promising effect of mobile apps at least in the short term on PA, QoL, intrinsic motivation, and sedentary behavior [23].

However, an educational action aims for long-term behavior change. Consequently, the short-term assessment adopted in this study does not appear to be the best approach.

Limitations

The fact that the patient's PA and QoL have improved in this observational study does not mean that it will not improve if no intervention was done. It is impossible to draw any clinical conclusions. Also, due to the limited sample size, these results should be interpreted cautiously, and cannot be generalized. The aim was not to prove the clinical efficacy of this mobile app. That will be done in a robust trial.

Self-monitoring and self-assessment were the main tools to ensure participants adhered to mobile app PA advice. The IPAQ is not the best instrument to assess PA because participants only remember the last week. In addition, the concordance between the IPAQ and the pedometer is insufficient in overweight or obese patients [24]. Therefore, incorporating a PA tracker such as a pedometer could be useful for objective PA monitoring [22].

Conclusion

The results showed that patients' PA and QoL improved in the short term after participating in the process of designing a mobile app. Although the results were promising, no conclusions regarding clinical effectiveness can be drawn from this study, as it is only an observational study with a small sample size. Clinical trials with more reliable instruments are needed to assess the real effectiveness of this mobile app.

Data Availability

The anonymized data used and analyzed during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no competing interest.

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Authors' contributions

YA, SB, and HE participated in the design of the study. The original manuscript was drafted by YA and reviewed by all authors. All authors read and approved the final manuscript.

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