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Using Mobile Applications in Cancer Scanning and Evaluating the Effectiveness

Kanser Taramasında Mobil Uygulamaların Kullanılması ve Etkinliğinin Değerlendirilmesi

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ABSTRACT

Aim: The study aims to ensure that people receive professional and permanent preventive healthcare services in the light of current technology in the case of cancer, increase the awareness about cancer screenings, and activate effectively informed decision-making mechanisms. **Methods:** We developed a mobile application contains basic information about cancers, screening methods and periods. Individuals downloaded the application, received reminders to have their examinations according to the national cancer-screening program for breast, cervical, and colon cancers. The data used belongs to the individuals who downloaded the app between August and December 2019 and filled out the questionnaire we prepared in the app. **Results:** The mobile application was downloaded 1050 times where, there were 539 registrations in the application, and the number of completes questionnaires is 344. There were 142 (26.3%) men and 397 (73.7%) women. The mean age was 33.3 ± 11.5. Health care workers and teachers found the application significantly more beneficial to promote cancer screening ($p = 0.002$). Ages and professions of the participants significantly associated with their opinions regarding the application completed their knowledge gaps and considering continue to use the application ($p < 0.0001$, $p = 0.02$), ($p = 0.04$, $p = 0.01$). Prospects for recommending the application differed significantly with age, body mass index, and profession ($p = 0.01$, $p = 0.02$, $p = 0.01$) **Conclusion:** Awareness should be increased about cancer screening practices within the scope of primary prevention. Information and warnings should be carried out regularly to ensure that examinations and investigations are done on time. Applications should be developed under the leadership of the Ministry of Health and must be ensured to be reached to more people.

Keywords: Prevention, primary, early diagnosis of cancer, mobile applications

ÖZET

Amaç: Çalışmanın amacı, insanların kanser alanında güncel teknoloji ışığında profesyonel ve kalıcı koruyucu sağlık hizmeti almalarını sağlamak, kanser taramaları konusunda farkındalıklarını artırmak ve aynı zamanda etkin, bilinçli karar verme mekanizmalarını harekete geçirmektir. **Yöntem:** Kanserler hakkında temel bilgiyi, tarama yöntemlerini ve zamanlarını içeren mobil uygulama geliştirildi. Ulusal tarama programlarına göre meme, rahim ağzı ve kolon kanserleri için kişilere muayene olmalarını hatırlatıcı bildirimler gönderildi. Veriler Ağustos - Aralık 2019 tarihleri arasında uygulamayı indiren ve uygulamada tarafımızca hazırlanan anketi dolduran kişilerden elde edildi. **Bulgular:** Mobil uygulama indirme sayısı 1050; Başvuruda kayıtlı kişi sayısı 539, anketi dolduran kişi sayısı 344'tür. Erkek sayısı 142 (% 26,3), kadın sayısı 397'dir (% 73,7). Ortalama yaş 33,3 ± 11,5'tir. Kanser taraması konusunda uygulamayı teşvik edici bulma ile meslekler arasında anlamlı fark vardı. Sağlık çalışanları ve öğretmenlerde daha fazlaydı ($p = 0,002$). Uygulamanın taramalar hakkında eksik bilgilerini tamamladığını düşünme ve uygulamayı kullanmaya devam etme durumları ile yaş ve meslek arasında anlamlı farklılık gözlendi ($p<0,0001, p=0,027$),($p=0,04, p=0,01$). Uygulamayı tavsiye etme durumları ile yaş, vücut kitle indeksi ortalamaları ve meslekler arası anlamlı farklılık tespit edildi ($p=0,01, p=0,02, p=0,01$). **Sonuç:** Daha bilinçli ve sağlıklı toplum için, kişilerin birincil koruma kapsamında yer alan, kanser taramaları ile mücadele hakkında farkındalıkları arttırılmalı, bilgilendirme ve uyarılarla tetkiklerin, muayenelerin zamanında yaptırılması sağlanmalıdır. Sağlık Bakanlığı önderliğinde yeni uygulamalar oluşturulmalı ve daha çok kişiye ulaşılmalıdır.

Anahtar Kelimeler: Primer koruma, kanserin erken teşhisi, mobil uygulamalar

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INTRODUCTION

Cancer is one of the most important health problems among the diseases that cause death. For many cancers, incidence rates are expected to increase substantially up to 15 million new cases in 2020, especially in developing countries. [1] World Health Organization (WHO) initiated actions against causes of cancer all over the World in order to prevent cancer. In Turkey, the establishment of the Public Health Agency reinforced and speeded-up these actions. These action movements include combating risk factors such as tobacco and obesity as well as extending cancer screening programs.

Prevention of progression and even emergence is possible in some cancers including colon, cervix, and breast cancers with early diagnosis, which increases the importance of cancer screening. Diagnosing and treating the disease at an early stage is much easier and cheaper than the late diagnosis.

The health of the society is not only depend on increasing the quality of health services, but also depend on raising awareness of individuals about their own health, demanding services, and developing a positive behavior change. Recently, mobile applications play a very active role in many dimensions of our lives as well as in the field of health. They are very important in raising awareness of people. Considering the effectiveness of the mobile applications, the Turkish Ministry of Health has created "e-pulse" and "vaccination report" mobile applications. However, there is no mobile application developed by experts in the field of cancer yet.

The aim of this study is to ensure that people receive professional and permanent preventive healthcare services in the light of current technology in the case of cancer, increase the awareness about cancer screenings and also activate effective, informed decision-making mechanisms.

MATERIAL AND METHOD

Model of the Research

It is an interventional survey study. The mobile application has been developed and downloaded and installed by people in order to increase the participation in cancer screenings, especially in the city of Isparta and in the rest of the country.

Ethical Approval

Approval numbered 72867572. 050. 01-74826 dated 25.04.2017 was obtained from the Süleyman Demirel University Faculty of Medicine Non-Interventional Research Ethics Committee.

The Universe and the Sample of the Research

In Turkey, the cancers of the breast, cervix, colon are within the scope of the National Cancer Screenings Standards Program, and specific age groups are targeted in these screenings. A mobile application is used in our study and the application can be downloaded free of charge from mobile markets, it is also installed by people who are not the targets of screening program. However, women and men aged between 20 and 70 were included in the study. The universe of the research was the whole country with the priority of Isparta. Our sample consists of people who completed the questionnaire in the application.

Database Design

Personal information (phone number, gender, year of birth, family history, place of residence, smoking status, education status, occupation, weight, height) was required for users to benefit from the application efficiently. After installing the mobile application they began to receive warning notices about cancer. Database for the inquiry was created. The received data were both kept on the phone of the participant and monitored from the remote server. An easy-to-use and dynamic SQLite database were used to hold the data in the mobile application, and a MySQL database to keep it on the remote server. The application was organized for iOS and Android operating systems. The C # language was used to develop Visual Studio editor of the desktop software for monitoring the data from patients and analyzing the efficiency of applications.

Application Content

Within the applications there were several interfaces for saving personal data, providing information about diagnosis and screening about cancers (detailed information about cancer screenings, information about the tests they can perform and instructional videos) and guiding notifications about health conditions (an interface which contains survey questions).

Application

Individuals who apply to Cancer Early Diagnosis Screening and Training Center and Family Health Centers in Isparta, Turkey province were told about the application, downloading, and registration. In addition to motivational notifications that are structured according to risk factors such as gender, age, obesity status at specified times, warning messages reminding people about cancer screening times were sent.

Data Collection Tools

In the research, the data is collected from the mobile application via a survey consists of 7-questions which is prepared by us and the personal information declared by the users in the registration interface.

Evaluation of the Data

After the data collection was completed, SPSS 22 (Statistical Program for Social Sciences) package program was used for analysis. Descriptive information of the participants was given in numbers and percentages. Arithmetic means were given with standard deviation and min-max values. In the analysis of the data obtained, chi square test, Fisher exact test and the independent groups t test were used. The significance level was accepted as $p < 0.05$.

RESULTS

Our mobile application was downloaded 1050 times where as the number of registrations was 539, and the number of people filling out the questionnaire was 344. A total of 539 individuals were included in the study. Of these participants, 26.3% (n = 142) were men and 73.7% (n = 397) were women. The average age was 33.3 ± 11.5 years. The socio-demographic characteristics of the participants were given in Table 1.

Table 1. Distribution of Users According to Sociodemographic Characteristics

Variable	**Mean ± standard deviation**	**Min/Max**
Age (years)	33.3 ± 11.5	20/71
Weight (kg)	66.1 ± 15.1	34/132
Size (cm)	165.1 ± 15.0	150/194
BMI (kg/m^2)	23.9 ± 4.4	15.11/40.26
Variable	**n**	**%**
Gender		
Male	142	26.3
Female	397	73.7
Educational status		
Primary school	44	8.2
High school	68	12.6
University	427	79.2
Smoking status		
Not smoking	507	94.1
Smoking	32	5.9
Job		
Housewife	106	19.7
Teacher	47	8.7
Healthcare worker	192	35.6
Employee	49	9.1
Officer	23	4.3
Self-employment	122	22.7
BMI		
Underweight	101	18.7
Normal	259	48.1
Obese	126	23.4
Morbid obese	53	9.8

The answers given to the survey questions in the application were given in Table 2.

Table 2. Survey Questions Answered

Questions	**n**	**%**
Question 1. The application encouraged me to have cancer screenings.		
Unanswered	195	36.2
Yes	332	61.6
No	12	2.2
Question 2. Application provided my missing information about screenings		
Unanswered	175	32.5
Yes	346	64.2
No	18	3.3
Question 3. I will continue to use this application.		
Unanswered	175	32.5
Yes	348	64.5
No	16	3.0
Question 4. I will recommend this application to people around me.		
Unanswered	175	32.5
Yes	348	64.5
No	16	3.0
Question 5. Owing to this application I diagnosed with early breast cancer.		
Unanswered	194	36.0
Yes	0	0
No	345	64.0
Question 6. Owing to this application I diagnosed with early colon cancer.		
Unanswered	175	32.5
Yes	0	0
No	364	67.5
Question 7. Owing to this application I diagnosed with early cervical cancer.		
Unanswered	175	32.5
Yes	0	0
No	364	67.5

The relationship of some factors and questions /answers was given in Table 3.

Table 3. The relationship of some factors and Questions /Answers						
	Q 1. The application encouraged me to have cancer screenings.			Q 2. Application provided my missing information about screenings		
Variable	Mean±SD	Min/max	p			p
Age (Years)	33.3± 11.5	20/71	0.26	33.3± 11.5		**<0.0001***
BMI (kg/m^2)	23.9 ± 4.4	15.1/40.2	0.73	23.9 ± 4.4		0,33
	Answer			Answer		
	Yes (N/ %)	No (N/%)	P	Yes (N/ %)	No (N/ %)	p
Variable						
Gender			0.99			
Male	84/98.8	1/1.2		81/95.3	4/4.7	1.0
Female	248/95.7	11/4.3		265/95	14/5	
Education status			0.98			0.59
Primary school	33/100	0/0		32/97	1/3	
High school	41/97.7	1/2.3		41/91.2	4/8.8	
University	258/96	11/4		273/95.5	13/4.5	
Smoking status			0.19			0.38
Not smoking	303/96.2	12/3.8		314/94.6	18/5.4	
Smoking	29/100	0/0		32/100	0/0	
Job			**0,002***			**0,02***
Housewife	65/95.6	3/4.4		70/97.3	2/2.7	
Teacher	29/96.7	1/3.3		32/94.2	2/5.8	
Healthcare worker	154/98.1	3/1.9		153/96.9	5/3.1	
Employee	24/96	1/4		26/92.9	2/7.1	
Officer	13/92.9	1/7.1		14/100	0.0	
Self-employment	47/94	3/6		51/88	7/12	
BMI			0.33			0.14
Underweight	55/93.3	4/6.7		61/89.8	7/10.2	
Normal	177/98.4	3/1.6		184/96.9	6/3.1	
Obese	73/96.1	3/3.9		73/94.9	4/5.1	
Morbid obese	27/93.2	2/6.8		28/96.6	1/3.4	

	Q 3. I will continue to use this application			Q 4. I will recommend this application to people around me.		
Variable	Mean	Min/max	p			p
Age (Years)	33.3± 11.5	20/71	**0.04***			**0.01***
BMI (kg/m^2)	23.9 ± 4.4	15.1/40.2	0.13			0.52
	Answer			Answer		
	Yes (N/ %)	No (N/%)	p	Yes (N/ %)	No (N/ %)	p
Variable						
Gender			1.04			0.77
Male	82/96.5	3/3.5		81/95.3	4/4.7	

Female	266/95.4	13/4.6		267/95.7	12/4.3	
Education status			0.84			0.65
Primary school	31/94	2/6		31/94	2/6	
High school	44/97.8	1/2.2		42/93.4	3/6.6	
University	273/95.7	13/4.5		275/96.2	11/3.8	
Smoking status			0.37			0.37
Not smoking	316/95.2	16/4.8		316/95.2	16/4.8	
Smoking	32/10	0.0		32/100	0/0	
Job			**0,01***			**0.01***
Housewife	68/94.5	4/5.5		68/94.5	4/5.5	
Teacher	33/97.1	1/2.9		32/94.2	2/5.8	
Healthcare worker	155/98.2	3/1.8		156/98.8	2/1.2	
Employee	27/96.5	1/3.5		26/92.9	2/7.1	
Officer	14/100	0/0		14/100	0/0	
Self-employment	51/88	7/12		52/89.7	6/10.3	
BMI			0.18			**0.02***
Underweight	62/91.2	6/8.8	62	62/91.2	6/8.8	
Normal	184/96.7	6/3.1	186	186/97.9	4/2.1	
Obese	73/94.6	4/5.1	71	71/92.3	6/7.7	
Morbid obese	29/100	0.0	29	29/100	0/0	

Chi-square fisher exact test * Statistically significant

When the survey questions are evaluated; significantly more healthcare workers and more teachers found the mobile application encouraging cancer screening with respect to other professions ($p = 0.002$). For this item, there was no significant difference between BMI (body mass index), averages, age averages, gender, educational level and smoking ($p > 0.05$).

Ages and occupations of participants were significantly effect the opinion of the application completed the missing information about scans, ($p < 0.0001$, $p = 0.027$ respectively), and the opinion of continuing to use the application ($p = 0.04$, $p = 0.01$ respectively). There was no significant difference with respect to BMI, gender, educational level and smoking status ($p > 0.05$).

Decision to recommend the application significantly differs with ages, BMI's and occupations of the participants ($p = 0.01$, $p = 0.02$, $p = 0.01$). No significant difference was found with respect to gender, education and smoking ($p > 0.05$).

DISCUSSION

According to our findings, healthcare workers and teachers found the application encourages cancer screening at significantly higher rate. Age and occupation significantly affected the ideas about the application completed the missing information about the scans and continuing to use the application. Similarly, ages, BMI's and professions of participants significantly changes the attitudes of recommending the application.

Cancer is an important and growing public health problem. Prevention of the disease is very important as well as the early diagnosis, when there is no symptom, both in terms of health outcomes and cost. For this purpose, priority should be given to evidence-based, feasible, and cost-effective screening programs which could catch cancer cases on time. According to the literature, the knowledge and awareness levels of both patients and healthcare professionals about cancer screening are quite insufficient. In the study carried out by Tekpınar et al. in 2008 in Antalya, the knowledge, attitudes and behaviors of the people who applied to the family medicine outpatient clinic were examined and the level of knowledge of the patients about cancer scans was found to be low.[2] Bayçelebi et al, observed that the majority of the people in Trabzon lack of

information about the early diagnosis of cancer.[3] Erdem and colleagues found that in Düzce province, knowledge about cancer and cancer screening was quite low. [4] A study in İzmir conducted by Açıkgöz and colleagues, showed that women did not have enough information about the symptoms, early diagnosis, and screening of cancer.[5] As a result of a survey conducted by Ersin et al. with female healthcare workers, they concluded that the level of knowledge of cervical cancer is lacking.[6] Özçam et al. examined the behaviors and attitudes of female healthcare professionals regarding breast cancer, cervical cancer, and other screening tests, and health personnel's attitudes towards self-care were found to be inadequate, especially in terms of screening for cervical cancer.[7] In the study conducted by Ramatuba and colleagues in Africa, the participants in the study found that they had incomplete information about cervical cancer and its screening. [8] In a study conducted by Şahin Ş in the central district of Aydın, it was concluded that the people who applied to the family medicine outpatient clinic had insufficient knowledge about colon cancer screening and therefore they did not have cancer screening.[9] Pehlivanoğlu et al., found that among women who applied to the family medicine outpatient clinic those who have had a gynecological examination have a statistically significantly higher rate of cervical cancer screening than those who did not have a gynecological examination.[10] In the study conducted by Kaya et al., it was found that healthcare professionals lack information about national cancer screenings, as well as their participation in the screening program was low.[11] As can be seen in the studies, the knowledge, attitudes, and behaviors of the people about cancer screening are quite insufficient. According to the responses given to the questionnaire applied in our study, 64.2% of the users stated that the information deficiencies about cancer screenings were completed by means of the application.

The introduction of technology in the field of health affects people positively in many ways. Patnode and colleagues' healthy nutrition and physical activity interventions were conducted in the USA, and website and private telephone counseling were provided to the participants, and it was found that the application had positive effects on healthy nutrition and physical activity.[12] In the study of O'brien et al. on healthy pregnant women, although interventions made via mobile applications do not have any effect on maternal and fetal complications, they have positive effects on weight gain and healthy lifestyle in pregnancy.[13] In the study carried out by Free and colleagues in London, the effects of mobile technology on healthcare delivery were examined. SMS reminders have been shown to be beneficial in increasing attendance at the clinic for communication between healthcare professionals and consumers.[14] In supporting smoking cessation, Buller et al. found that 60% of people between the ages of 18-30 preferred notifications of mobile application instead of short messaging.[15] In our study, despite the fact that no early diagnosis was made to anyone by means of the mobile application, 61.6% of the people stated that the application encouraged them to have cancer scans.

In a study conducted, with a digital exercise program that can be controlled from primary care, it was found that the daily physical activities of elderly patients were increased in the short term, but there was no increase in long-term.[16] In our study, users could only be followed up in short term. To reveal its effectiveness in diagnosis of cancer, the application should be monitored in long term.

In the study conducted by Yılmaz et al. in Bursa, it was determined that women preferred visual and written media sources rather than health institutions as a source of information about breast cancer.[17] Technological instruments, as a mean to provide information about cancer screenings, seem to be preferred by individuals Our study also showed that a mobile application created as a technological resource could complete the lack of information.

There are many studies evaluating knowledge, attitudes and behaviors about cancer screening, and almost all of them emphasized the necessity of completing the lack of information. Our application provided necessary information to complete knowledge lack or to change false information. In addition, it also reminds personal screening times to maintain continuity of the cancer screenings.

There are some limitations in our research: The process of preparing the application and upload it to the mobile markets took a long time. Number of participants were restricted due to time constraints related with data collection. In one to one conversations, users stated that they experienced difficultiesrelated with insufficient phone memeories during downloading the application. Since the application is freely downloadable via the mobile market, no help was provided during download and download process only could only be evaluated in one-to-one interviews. The compatibility of the downloaders with the cancer screening program has not been observed. The activity evaluation of the study was done with a questionnaire prepared by us. Due to the low response to the notifications sent, it was not possible to assess whether people had their cancer screenings. Efficiency evaluation can only be made with the answers given to the survey questions.

As a result, educaiton on cancer screening should be increased in our country and these education programs should be organized more frequently for the public and also for healthcare professionals. Given the current conditions, the educaitons should be technological, practical and continuous. Health practices should be promoted by educate healthcare professionals, thus contributing to reducing the loss of work force by providing correct information to more people.

Conflict of Interest

The authors declare that they have no conflict of interest.

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