

RESEARCH ARTICLE

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Determining the Content of a Melanoma Prevention and Care Mobile Application for Melanoma Patients: A Survey Study

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Abstract

Objects: Skin cancer is one of the most common cancers and melanoma is the deadliest type of skin cancer. Since the Mobile based health interventions have significant effects in the management of diseases. This study aimed to determining the content of melanoma prevention and care application. **Methods:** This is a descriptive study that was conducted in three stages. at first, in order to identify the features of the application, search was conducted based on PubMed, Google Scholar + Scopus databases. In the second step, in order to determine the content of information, articles and guidelines related to melanoma were searched. In the third stage, in order to ensure the validity of researcher-made questionnaire, a survey was conducted by 51 experts based on targeted sampling. The collected data were analyzed. **Results:** demographic and clinical information and melanoma prevention training was common in 14 reviewed applications; The possibility of sending reminders for patients was less considered. Most of the articles have paid attention to the data elements: age, gender, history of sunburn, skin color and history of cancer, exposure to ultraviolet rays, how to care for the skin. The content of the melanoma prevention and care application consists of three general sections: 1- Demographic, clinical information and melanoma risk factors; 2- Educational needs; 3- Features and capabilities of the application for prevention and care were formed. The results of the expert survey showed that 81% of the section1, 80% of the section2, and 91% of the section3 were approved. **Conclusions:** Mobile applications has an effective role in disease management and accelerating the provision of health services and reducing the costs of providing services. Melanoma prevention and care application can be an aid in patient education and ultimately better disease management in the field of prevention and care during the current crisis.

Keywords: Melanoma- application- prevention- mobile health- self care

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Introduction

Skin cancer is a common cancer in most countries of the world, including developing countries [1]. There is evidence that incidence, prevalence, and DALYs (disability-adjusted life years) can be reduced through prevention. However, they are disproportionately increased among different population groups [2]. Squamous Cell Carcinoma (SCC) and malignant melanoma types are less common but are fatal skin cancers that may not be related to exposure to ultraviolet. Trauma, immunosuppressive therapy, human papilloma viruses and chronic ulcers may have a role in skin cancers. Unfortunately the incidence of malignant melanoma and SCC has been increased in recent years [3]. It is very important to detect melanoma in the early stages, because at this stage it is "curable". After metastasis, it is difficult to treat, and the five-year

survival rate is only 25%. However, in recent years, a better understanding of the melanoma's cause of and its progression and the development of targeted therapies such as Vemurafenib and immunotherapies have made it possible to treat advanced melanomas as well [4, 5]. Obviously, the traditional approach of hospitals and clinics care are used less than optimal level for the improvement of chronic diseases [6]. In order to solve this problem, researchers have recommended the use of technological solutions, especially electronic health, in the health system. The meaning of mobile health in health care is the widespread use of mobile telecommunications and multimedia technologies for providing services [7]. Recently, many efforts have been made to develop and apply new information technology models for chronic diseases. In particular, mobile health interventions have significant effects in the chronic diseases management.

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These are one of the most promising tools that have a wide range of users; easy to use and they are smartphones [8]. Due to the high capacity of wireless networks as well as universal access, smart phones have provided a suitable environment for users in different aspects of life [9]. The Android operating system is an open source operating system that, in addition to being easy to use, is customizable and can be extended for new technologies that appeared. Powering more than a billion devices worldwide, this operating system removes the barriers to create new and innovative applications and provides a wide range of tools for application development. This operating system, which powers more than a billion devices worldwide, removes barriers to product new and innovative applications and provides a wide range of tools for development application [10, 11]. Interventions through mobile health have advantages compared to face-to-face interventions. Mobile phones provide interactions in any location and time when needed [12]. Connected health technology and its application in chronic disease management is beneficial not only for patients but also for health care providers [13]. According to the mentioned above and the importance of melanoma disease as well as the effective and increase role of technology and mobile applications in the health and their use for easier access and removal of location and time barriers, This study aimed to determining the content of melanoma prevention and care application.

Materials and Methods

This study was a descriptive that was carried out in three stages. In the first step, in order to access studies related to the features of the application, a search was made in PubMed, Google Scholar, and Scopus databases. In the second step, based on the mentioned keywords and in order to determine the content of information, articles and guidelines related to melanoma were searched in common search engines including Google, Yahoo and Bing. In the last step, a questionnaire that contains three parts including: 1- Demographic, clinical information and risk factors of melanoma (26 items) 2- Educational needs (10 items) 3- Features and capabilities of the application for the purpose of prevention and care of melanoma (7 items) were prepared.

In the first step, the search has been performed on the following databases: Google scholar, PUBMED, Scopus. The search strategy involved a combination of Mesh terms and free text words related to Prevention, control, prophylaxis, follow-up, melanoma, applications, software, and mobile-app, portable. Based on the inclusion criteria, all Farsi and English articles that have full text and are related to the care and prevention of melanoma were reviewed. After removing duplicates, their content was reviewed and their data was extracted. Finally, the extracted data were inserted into Excel to classify and combine them and report results.

Then, the search has been performed on the following search engines: Google, Yahoo and Bing. In search engines, first the application's names that were identified from previous stage were searched by using the phrase

"application similar to. . .". With this method, applications similar to the subject of the research were identified. Then this process was repeated with the obtained application names. After removing duplicates and non-relative applications to melanoma, their content was reviewed and their data was extracted. Finally, the extracted data of 14 application were inserted into Excel to classify and combine them and report results (Figure 1).

In the second step, in order to determine the information content of the application, the inclusion and exclusion criteria were determined. Then the research literature was searched based on the mentioned keywords and the obtained articles were evaluated according to the inclusion and exclusion criteria. The articles that were determined by the inclusion and exclusion criteria were classified and analyzed and evaluated, and the information content presented in them was extracted.

Inclusion criteria

- 1- The article is related to information system design.
- 2- Information system in the field of melanoma.

Exclusion criteria

- 1- Failure to introduce information elements related to melanoma in the article.

Then, each of the articles were reviewed based on the duplicate cases and exclusion criteria; finally, 6 articles were identified as the final samples for review (Figure 1).

In the continuation of the second step, in order to complete the informational content of the application program, a number of valid and branched guidelines in the field of melanoma in America, England and Europe were examined and their content was used in the design of the questionnaire in addition to the content specified in the review of articles.

In the last step, all of the data which extracted in these stages, were used in the design of the questionnaire. Then, a researcher-made questionnaire consisted of 3 parts and 42 questions. The first part included 25 questions related to demographic, clinical and melanoma risk factors. The second part included 10 questions related to user's educational needs. Third part included 7 questions related to features and capabilities of applications and also added a suggestions part for the respondents.

It based on a five-point Likert scale according to the importance and degree of agreement from 1 to 5 in the form of 5 = completely agree, 4 = agree, 3 = moderate, 2 = disagree and 1 = completely disagree. The criterion for including the requirements was to achieve a level of 75% regarding the agreement rate option. Also, in the questionnaire, a part was included to suggestions for the respondents. Content validity was confirmed by the research team and its reliability with Cronbach's alpha coefficient of 91.8%.

The research environment was Telegram social network in October 2022, based on available and targeted sampling, 51 specialist doctors of the country, including dermatologists, medical oncologists, clinical oncologists, surgeons and palliative medicine specialists, were selected as the research participants. The online form was made available to them. Then, the reports obtained from the

experts' answers to the questionnaire were analyzed and some items were selected as data elements which, according to the opinions of the experts, obtained the required frequency percentage.

Results

Step1

Applications review

The primary method for searching and obtaining applications in the field of melanoma was to use common databases of scientific documents in the medical field and then to use search engines. In the following, each of these 2 cases is explained.

Databases: In order to identify applications in the field of melanoma, first the mentioned keywords was searched. The obtained results were used to obtain further results using the second method described below.

Search engines: Common search engines including Google, Yahoo and Bing were used in this study. The search method was that first, the applications that were identified from the first method (databases) using the phrase “*application similar to. . .* » were searched in the mentioned search engines and the results obtained from the records of the first pages of the search were examined.

In this step, the inclusion and exclusion criteria were specified. Then the research literature was searched and the obtained sites were evaluated according to the inclusion and exclusion criteria. The applications that were determined by the inclusion and exclusion criteria

were classified and analyzed and evaluated, and the features presented in them were extracted.

After the implementation of the proposed search method and based on the inclusion criteria, 45 applications were identified. Then, each of the applications were reviewed based on the duplicate cases and exclusion criteria; finally, 14 applications were identified as the final samples for review. Then an effort was made to identify the features in these applications by carefully examining each of these applications that they can be evaluated by experts (Figure 1).

In reviewing the applications, the important and common features between all 14 applications that were included in the study; It was Demographic and clinical information and Melanoma prevention training. In addition, items Melanoma training and Create a gallery of skin images were features that most applications had. among the features extracted from the reviewed programs: set reminder and melanoma care training, were among the items that were less noticed and were common among a small number of programs (less than half). Displaying content related to the user's status is one of the features that seems important and attractive, but only one of the applications paid attention to it. The result of the applications extracted from the search engines are shown in Table 1.

Step2

Articles review

In the review of 6 articles that were included in the

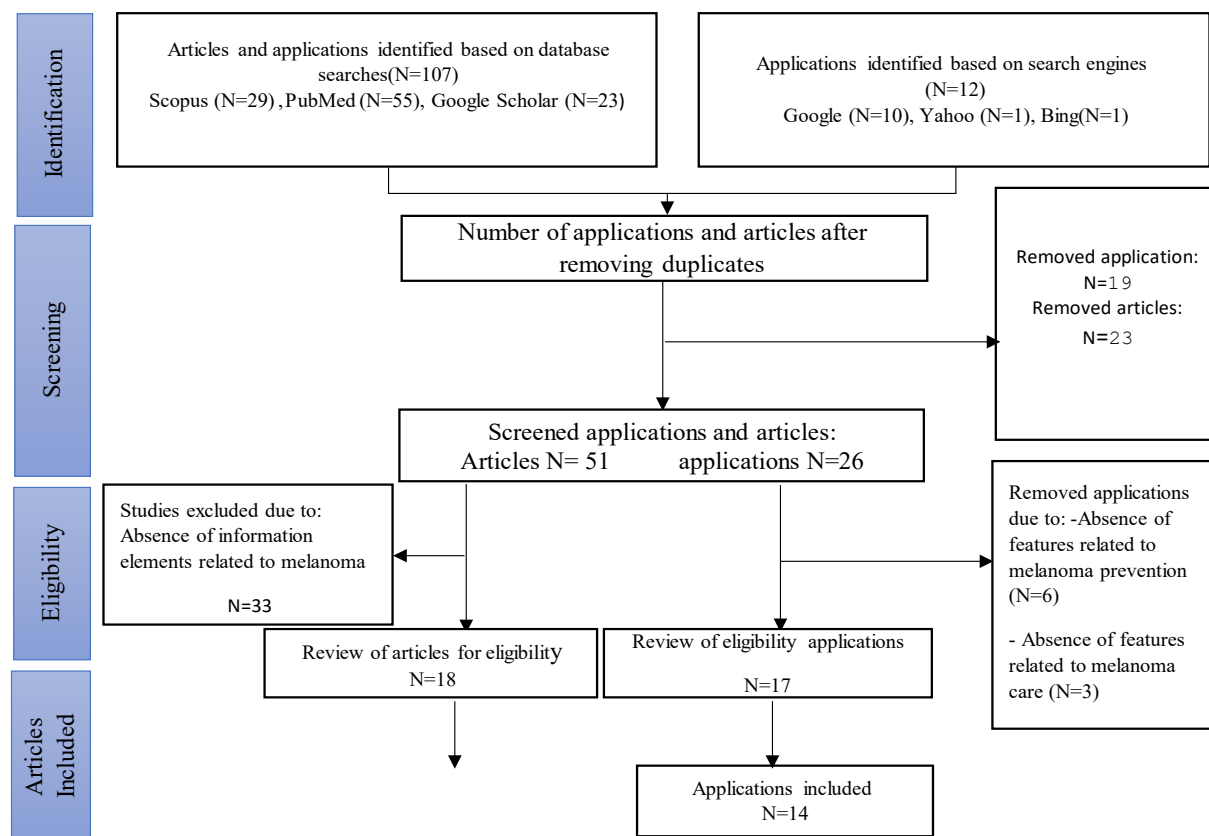


Figure 1. PRISMA Chart Depicting the Articles & Applications Selection for Study. The flow diagram describes the number of studies & Applications identified, screened, included, and reviewed

Table 1. The Features Extracted from Applications for Melanoma Care

	Applications	Demographic and clinical information	Melanoma training	Melanoma prevention training	Melanoma care training	Set Reminder for evaluating mol	Set a reminder to visit the doctor	Create a gallery of skin images	Display content related to the user's status
1	Miiskin	*		*	*		*	*	*
2	Skinvision	*	*	*				*	
3	Molescope	*	*	*			*	*	
4	Umskincheck	*	*	*				*	
5	Molecare	*		*			*	*	
6	Dermatology A to Z	*		*	*				
7	Sun smart	*		*					
8	My mole checker	*	*		*	*		*	
9	Fotoskin	*	*	*			*	*	
10	Idoc24	*	*	*					
11	MoleTrac	*	*	*				*	
12	Mollie's fund	*	*	*	*				
13	Nevus	*	*	*			*		
14	Track-A-mole	*	*	*		*		*	

study and the results of which are shown in Table 2, it was found that almost all of them introduced age, gender, history of sunburn, skin type or color and history of skin cancer as important data elements. Half of the reviewed studies have introduced education and exposure to ultraviolet rays and skin care such as the use of sunscreen as effective data elements in melanoma that should be considered.

Guideline review

In the continuation of the second step, in order to complete the informational content of the application program, a number of valid and branched guidelines in the field of melanoma in America, England and Europe were examined and their content was used in the design of the questionnaire in addition to the content specified in the review of articles.

The important data elements that were extracted from the reviewed guidelines can be seen in Table 3. Age, sex, Race, place of residence, Skin color, Sunburn history, exposure to the sun's UV rays, number of unusual moles melanoma family history, history of other cancers, duration of exposure to UV rays for prevention, wear protective clothing for prevention, evaluate the skin regularly, Melanoma introductory material were common between all 4 guidelines and have been introduced as risk factors and important data elements.

The cause of melanoma, different stages of melanoma, diagnosis of melanoma, methods of treating melanoma were among the important educational content that all 4 guidelines paid attention to. Skin pictures related to melanoma, which make people more familiar with melanoma, were part of the content of information that was only in one of the guidelines. The results of the review of well-known and reliable guidelines in the melanoma in America, England and Europe are shown in Table 3.

Step3

Survey study

A questionnaire that contains three parts including: 1- Demographic, clinical information and risk factors of melanoma (26 items) 2- Educational needs (10 items) 3- Features and capabilities of the application for the purpose of prevention and care of melanoma (7 items) were prepared. Then, in order to evaluate the content of application, the questionnaire were completed by 51 specialist, whose demographic characteristics were specified in the table based on gender, specialty and age group (Table 4).

After examining the results of the questionnaire, it was found that in the Demographic, clinical information and melanoma risk factors section, Unusual number of moles has the highest percentage of agreement (95%) and eye color has the lowest percentage of agreement (78%). In the Educational needs section, Melanoma risk factors and Signs and symptoms of melanoma have the highest percentage of agreement (96%) and Different stages of melanoma has the lowest percentage of agreement (75%). In the Application features and capabilities for prevention and care section, The user's choice between one of the options "*I have melanoma*" along with entering the stage of the disease and "*I do not have melanoma*" has the highest percentage of agreement (93%) and Recommendations related to the prevention of melanoma, to a user who does not have melanoma has the lowest percentage of agreement (79%) among the participants. The results of the needs assessment of the participants are shown in the following table (Table 5).

Discussion

The results showed that more than 88% of the participants considered the data elements of the questionnaire to be necessary for the design and creation

Table 2. Studies on a Melanoma Prevention and Care Application

Articles	Year	Goal	Method	Tool	Sample	Design Apps	Result of evaluation	Data set identified	Suggestions
[14]	2020	To study the effect of a commercially available skin self-monitoring (SSM) smartphone application among individuals with increased risk of melanoma on their decision to seek help for changing skin lesions.	-Receiving standard written counseling by the intervention and control groups. -Receiving instructions for use and monthly Supported-self management (SSM) self-care reminders by the intervention group.	Application and questionnaire	12 families in the East of England	present an application to provide care recommendations to the research community	Data of consultation was gathered before the experiment and 12 months after the consultation through the "melanoma risk assessment" questionnaire in the year.Finally, no significant difference was observed in the use of the application.	Age/Sex /Marital status/zip code/ highest level of education/occupation/ history of skin cancer/skin and hair type/number of protrusion moles on both arms	Using the app in people who have medium or low risk of getting melanoma
[15]	2020	to assess the feasibility of a three-component sun protection intervention- presentation, action planning, and SMS messages - and trial parameters.	Quantitative and qualitative data were collected in 2 experimental and control groups and in 2 time periods, before and after training, from a group of teenage students.	questionnaire	724 students aged 13 to 15 years	The participants completed the questionnaire once at the beginning of the study, and once after the training [after completing the summer vacation].	Data elements were assessed once at the beginning of the study and once after the training and after completing the summer vacation period. No intervention was observed to have a significant effect on skin care behavior Adolescents did not perceive the effectiveness of skin care against sun in their age group in the UK.	Report on the number of sunburns / dry skin / geographic location / tanning / behaviors related to sun care [including using sunscreen, wearing sleeved clothing, being in the shade] / skin color / skin evaluation in terms of infection to cancer/age/gender/ethnicity	The main teacher of the students participated in the research and took over part of the teaching.
[16]	2014	To identify most significant factors for melanoma prediction in our population and to create prognostic models for identification and differentiation of individuals at risk.	Interview and skin examination of the participants. Interview about data such as gender, age, education level and... ..	questionnaire	697 participants [341 patients and 356 control groups over 18 years old in the Department of Plastic and Reconstructive Surgery, Vovodina Clinical Center, Novi Sad, during a 12-year period, 2001-2012)	Completion of the questionnaire by the participants and diagnosis of melanoma risk factors	Analysis of logistic regression(LR) predictive models and alternating decision trees (ADT) Determination of effective factors in predicting melanoma	Sex/age/level of education/previous skin cancers/melanoma in the family (first-degree relatives)/exposure to ultraviolet rays/use of sunscreen creams/blistering sunburns at different stages of life/hormonal contraceptive treatment (HCT) / immunosuppressive therapy	Improving the proposed model by developing the melanoma database Using larger sample sizes
[17]	2011	evaluated whether long-term application of sunscreen decreases risk of cutaneous melanoma.	Use of sunscreen in combination with 30 mg of placebo by a group as optional for the face and arms daily for 10 years	Questionnaire and pathology laboratory and cancer registry	1621 people aged 25-75 years who were randomly selected from the city of Nambour, Queensland, Australia.	Using 2 participant and control groups. Using sunscreen is mandatory for the participating group and optional for the second group.	Evaluation of participants in order to diagnose primary melanoma for 10 years continuously through questionnaires or pathology laboratories and cancer registration. After 10 years, the results indicated that participants who used sunscreen on a daily basis had less melanoma.	Sex / age / history of skin cancer / reaction to sunlight / skin color / occupation / leisure activity / history of sunburn / birthmarks	Investigate long-term sunscreen intervention in children and adolescents in cancer prevention.
[18]	2017	Development of a mobile application to aid in the diagnosis of melanoma	Creating 3D images of people using a technique called "mirroring" for melanoma prevention training	Questionnaire	205 students of both sexes aged 13 to 19 years [average 15 years] in 2 German secondary schools	Designing an application with the ability to receive selfies from users and create 3D animations from the images.	Evaluating the effect of 3D images to encourage users in melanoma care and prevention. Most people in the research community stated that the 3D selfie encourages them to increase sun protection and not use tanning beds.	Age / gender / skin type / history of sunburn / use of tanning beds	More research is needed to evaluate the possible effects of prevention intervention for adolescents with different cultural backgrounds.
[19]	2016	to develop a mobile phone app, integrated with its camera coupled to an amplifying lens, to help distinguish melanoma	Creating an application to analyze skin images by Airvixy, Breathing, Circulation, Disability, Exposure (ABCDE) scoring method	"Pedro Hispano" Hospital Melanoma Images Database	-	Application design based on the ABCDE evaluation model in melanoma cases	Ability to diagnose with 100% accuracy for malignant cases and 80% for benign cases	Using the grading method based on ABCDE	Designing an application on a larger scale to analyze any type of image sent by the user

Table 3. The Information/Data Element Extracted from Guidelines

Data elements	NCCN	NICE	ESMO	ASCO
age risk factor	*	*	*	*
Sex risk factor	*	*	*	*
Race risk factor	*	*	*	*
Risk factor of place of residence	*	*	*	*
Skin color risk factor	*	*	*	*
Eye color risk factor		*	*	*
Hair risk factor		*	*	*
Freckle risk factor		*	*	*
The risk factor of using tanning beds	*	*	*	*
Sunburn history risk factor	*	*	*	*
The risk factor is the duration of exposure to the sun's UV rays	*	*	*	*
The risk factor is the number of unusual moles	*	*	*	*
The Risk factor of immunosuppressive diseases	*		*	*
The risk factors for melanoma family history is a risk factor	*	*	*	*
The risk factor of family history of other cancers	*	*	*	*
The risk factor of previous history of skin cancers	*	*	*	*
The risk factor of History of endometriosis			*	*
The risk factor Parkinson's disease history			*	*
The risk factor of a history of genetic diseases [xeroderma pigmentosum, retinoblastoma, Li-Fraumeni syndrome, Werner syndrome and hereditary breast and ovarian cancer syndromes]	*		*	*
The risk factor of alcohol consumption			*	*
The risk factor of citrus consumption			*	*
Risk factor of taking oral contraceptives and hormone therapy after menopause			*	*
Risk factor of using Sildenafil, TNF-alpha inhibitor and BRAF inhibitor drugs			*	*
Recommendation to use sunscreen for prevention	*	*	*	*
Recommendation to reduce the duration of exposure to UV rays for prevention	*	*	*	*
Recommendation to wear protective clothing for prevention	*	*	*	*
Recommendation to evaluate the skin regularly for prevention	*	*	*	*
Recommendation to visit a doctor annually for prevention	*		*	
Melanoma introductory material [including definitions and statistics related to melanoma incidence and mortality]	*	*	*	*
cause of melanoma	*	*	*	*
Signs and symptoms of melanoma	*		*	*
Different stages of melanoma	*	*	*	*
Melanoma diagnosis methods	*	*	*	*
Melanoma treatment methods	*	*	*	*
Metastatic melanoma	*	*	*	
Choose of treatment type by the patient	*		*	
Care recommendations for patients with different stages of melanoma	*	*		
Skin pictures related to melanoma	*			

of the application. Also, 81% of the participants weighed the importance of demographic, clinical and melanoma risk factors with a score of 4 and 5. The aforementioned elements were included in the demographic, clinical and melanoma risk factors section. Previous studies have also considered demographic, clinical and melanoma risk factors in designing the application. Walter et al identified

age, gender, education level, history of skin cancer, skin and hair type, number of moles, and occupation as data elements to be obtained from a melanoma patients [14].

Hubbard and colleagues in their study to determine the effect of skin care against the sun on the incidence of melanoma, the number of sunburns, skin dryness, the geographical location of tanning, the amount of sunscreen

Table 4. Demographic Information of the Participants

demographic characteristics	Frequency	
Sex	N	%
Female	23	45
Male	28	55
Specialist		
Surgeon	16	31
Medical oncologist	3	6
Clinical oncologist	9	17
Dermatologist	19	36
Palliative medicine specialist	5	10
Age		
Under 35 years	1	2
35-39 years	12	25
40-44 years	15	28
45-49 years	6	12
50-54 years	11	24
55-59 years	2	4
60 and over 60 years old	2	4

use, wearing sleeved clothing, being in the shade, skin color, skin assessment in terms of cancer, age, sex and ethnicity were investigated as data elements about melanoma [15].

Also, another study conducted by Nikolic and et al, to identify the most important factors affecting on melanoma in the population showed that factors such as Sex, age, education level, medical history, melanoma in the family (first degree relatives), exposure to ultraviolet rays, use of sunscreens, sunburn, hormonal contraceptive treatment (HCT) and immunosuppressive treatment have been identified as important data elements in this regard [16]. In the study of Green et al., with the aim of investigating the effect of sunscreen cream in dealing with melanoma, elements such as gender, age, observation of skin cancer, reaction to sunlight, color, occupation, number of sunburn and birthmark observation were considered as data elements [17].

Brinker et al. have introduced age, sex, skin type, history of sunburn and use of tanning beds as data elements in their study with the aim of using mobile phone technology in preventing melanoma [18].

Also, in the NCCN [19], NICE [20], ESMO [21] and ASCO [22] guidelines, data elements such as age, sex, race, place of residence, skin color, use of tanning beds, history of sunburn, exposure to UV rays, number of unusual moles, immunosuppressive diseases, family history of melanoma, family history of other cancers, and previous history of skin cancers have been introduced as necessary data elements and risk factors related to melanoma.

In the current study, the data elements are age, sex, race, hair color, eye color, complexion, place of residence, skin color, history of sunburn, duration of exposure to UltraViolet rays of the sun per day, history of exposure to

radiation UV rays, tanning beds, unusual number of moles, reducing the strength of the immune system, family history of melanoma, family history of other cancers, previous history of skin cancers, history of genetic diseases (Xeroderma pigmentosum, retinoblastoma, Li-Fraumeni syndrome, Werner syndrome, Li-Fraumeni, hereditary syndromes of breast and ovarian cancer), use of Sildenafil drugs, TNF-alpha inhibitor and BRAF inhibitor, the type of treatment used and laboratory information such as Complete Blood Count (CBC) and Lactate dehydrogenase (LDH). The results of this study were consistent with the aforementioned studies, and the highest level of agreement (95%) was assigned to the number of unusual moles.

According to the educational needs part of this study, 80% of the participant's specified data elements related to educational needs with a score of 4 and 5. The results indicated that the data elements of the educational needs part were of high importance.

In the guidelines of NCCN, NICE, ESMO and ASCO, there are recommendations related to melanoma prevention, melanoma preliminary materials (including definitions and statistics related to melanoma incidence and mortality), cause of melanoma, signs and symptoms of melanoma, different stages of melanoma, methods of diagnosing melanoma, Melanoma treatment methods, metastatic melanoma have been introduced as educational needs.

In the Miiskin application [23], melanoma prevention and melanoma care have been considered as educational needs. The getting to know melanoma and melanoma prevention are educational needs that have been implemented for users by Skinvision [24], Molescopem and Umskincheck applications. In the application Molecare, Dermatology A to Z and Sun smart, the focus has been on the implementation of melanoma prevention training as an educational needs. My mole checker application has considered getting to know melanoma and melanoma care as educational needs. In the fotoskin, Idoc24, Mollie's fund, moleTrac and Track-A-mole applications, getting to know melanoma and melanoma prevention were educational needs which were available to users. In this study, all the mentioned components were approved with the high agreement of the participants to design the application. The highest level of agreement (96%) was assigned to the training of melanoma signs and symptoms and its risk factors.

Regarding the application features and capabilities in the questionnaire, 91% of the participants considered the importance of the mentioned features with a score of 4 and 5. Therefore, the mentioned features were implemented in the development of melanoma prevention and care application.

My mole checker and Track-A-mole applications have implemented a reminder setting for mole assessment as a feature. The feature of setting a reminder for visiting a doctor is implemented as a feature by Miiskin, Molescope, Molecare, Fotoskin, Nevus applications. Most of the aforementioned applications have implemented the feature of creating a gallery of skin images for users. One of the features implemented by the Miiskin application for users is the display of relevant educational materials according

Table 5. Assessing the Needs of the Participants based on the Required Components in the Application

Components	Totally agreement		agreement		Moderate		disagreement		Totally disagreement		Range of agreement %
	No	%	No	%	No	%	No	%	No	%	
Demographic, clinical information and melanoma risk factors											
Age	32	67.20%	18	35.30%	0	0%	1	2%	0	0%	91%
Sex	30	58.80%	16	31.40%	4	7.80%	1	2%	0	0%	89%
Race	27	52.90%	16	31.40%	4	7.80%	4	7.80%	0	0%	85%
Location	30	64%	18	23%	2	14%	1	2%	0	0%	90%
Hair color	21	41.20%	18	35.30%	8	15.70%	3	5.90%	1	2%	81%
Eye color	17	33.30%	16	31.40%	14	27.50%	4	7.80%	0	0%	78%
Skin color	32	62.70%	17	33.30%	2	3.90%	0	0%	0	0%	91%
History of sunburn	34	66.70%	14	27.50%	3	5.90%	0	0%	0	0%	92%
Presence or absence of freckles	25	49%	21	41.20%	4	7.80%	1	2%	0	0%	87%
The time of day when the user is exposed to the sun's UV rays	37	72.50%	10	19.60%	4	7.80%	0	0%	0	0%	93%
History of exposure to UV rays from tanning beds	38	74.50%	10	19.60%	2	3.90%	1	0%	0	0%	93%
Unusual number of moles	39	76.50%	11	21.60%	1	2%	0	0%	0	0%	95%
A condition that weakens the immune system	36	70.60%	14	27.50%	1	2%	0	0%	0	0%	93%
Family history of melanoma	37	72.50%	13	25.50%	1	2%	0	0%	0	0%	94%
Family history of other cancers	30	58.80%	15	29.40%	6	11.80%	0	0%	0	0%	89%
Previous history of skin cancer of the user	35	68.60%	14	27.50%	2	3.90%	0	0%	0	0%	93%
History of genetic diseases (xeroderma pigmentosum, retinoblastoma, Li-Fraumeni syndrome, Werner syndrome, hereditary breast and ovarian cancer syndromes)	35	68.60%	15	29.40%	1	2%	0	0%	0	0%	93%
Taking Sildenafil drugs, BRAF inhibitor and TNF-alpha inhibitor	12	23.50%	23	45.10%	14	27.50%	1	2%	1	2%	77%
Type of treatment	35	68.60%	12	23.50%	3	5.90%	1	2%	0	0%	91%
Laboratory information such as CBC and LDH	26	51%	15	29.40%	6	11.80%	4	7.80%	0	0%	84%
Melanoma introductory material (including definitions and statistics related to melanoma incidence and mortality)	25	49%	15	29.40%	10	19.60%	1	2%	0	0%	85%
Educational needs											
Melanoma risk factors	41	80.40%	10	19.60%	0	0%	0	0%	0	0%	96%
The cause of melanoma	34	66.70%	13	25.50%	3	5.90%	1	2%	0	0%	91%
Signs and symptoms of melanoma	42	82.40%	8	15.70%	1	2%	0	0%	0	0%	96%
Types of melanoma diagnosis methods	31	60.80%	14	27.50%	4	7.80%	2	3.90%	0	0%	89%
Different stages of melanoma	21	41.10%	7	13.70%	15	29.40%	6	11.80%	2	3.90%	75%
Types of melanoma treatment methods	24	47.10%	14	27.50%	7	13.70%	6	11.80%	0	0%	82%
Metastatic melanoma	22	43.10%	11	21.60%	13	25.50%	5	9.80%	0	0%	79%
Deciding on the type of treatment chosen by the patient	21	41.20%	16	31.40%	8	15.70%	4	7.80%	2	3.90%	79%
Album of images related to melanoma	29	56.90%	14	27.50%	6	11.80%	1	2%	1	2%	87%

to the user's status. The features and capabilities proposed for the application along with the features suggested by this study were considered in the application data elements. This study showed that the highest level of agreement (93%) was assigned to the recommendations related to the prevention of melanoma (including the use of sunscreen, protective clothing and reducing the duration of exposure to UV rays and regular skin evaluation) in the program.

In this study, all items of questioner that had obtained the quorum score which consist of data elements and educational needs extracted from the articles and guidelines and features extracted from applications, were used in the design of the app. As a result, the data set, content and features created in this study considered more complete compared to similar applications. In other words, considering the total data sets and features available in various apps related to melanoma, the content specified for the design of the melanoma app in this study is comprehensive and can meet most of the users' needs.

This study was faced with limitations such as the lack of access to some applications and couldn't register to some of them. Also, some guidelines were not available for free. Therefore, the researcher used guidelines and applications that were available for free.

In conclusion, melanoma prevention and care is a conscious and targeted activity that people need to benefit from the knowledge and skills available in this field to provide, maintain and improve their health status so that they can take care of their health. Application melanoma prevention and care is not a substitute for specialized treatments, but a complement to it. Therefore, the society can be empowered to deal with this disease by using a suitable applications.

Determining the importance of each of the identified elements and adding new elements through brainstorming and focus groups with specialists and patients can increase the assurance of resolving the needs of users by this program. It is also recommended to consider some criteria such as reliability, errors, complexity and weighting of these criteria in order to evaluate and benchmark these applications.

Author Contribution Statement

All the authors contributed to the preparation of the final manuscript.

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Data Availability

Data are available from the corresponding author upon request.

Ethics review and approval

Its ethics code is IR.TUMS.SPH.REC.1399.106

Table 5. Continued

Components	Totally agreement		agreement		Moderate		disagreement		Totally disagreement		Range of agreement %	
	No	%	No	%	No	%	No	%	No	%		
Application features and capabilities for prevention and care	The user's choice between one of the options "I have melanoma" along with entering the stage of the disease and "I do not have melanoma"	17	33.30%	23	45.10%	5	9.80%	5	9.80%	1	2%	79%
	Setting reminders for all users to visit a doctor	34	66.70%	15	29.40%	2	3.90%	0	0%	0	0%	92%
	Set a reminder for all users to re-evaluate the mol	25	49%	23	45.10%	2	3.90%	1	2%	0	0%	88%
	Creation of photo albums by all users at different time intervals for skin evaluation	30	58.80%	16	31.40%	5	9.80%	0	0%	0	0%	89%
	Display of care information related to the disease stage of the user who is suffering from melanoma	26	51%	23	45.10%	2	3.90%	0	0%	0	0%	89%
	Recommendations related to the prevention of melanoma, to a user who does not have melanoma	36	70.60%	12	23.50%	3	5.90%	0	0%	0	0%	93%
	Reporting demographic, clinical and melanoma risk factors in the Excel format	28	54.90%	18	35.30%	5	9.80%	0	0%	0	0%	89%

that approved by Iran National Committee for Ethics in Biomedical Research.

Conflict of Interest

The authors declare that they have no conflict of interest.

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