



The prevalence and usage of mobile health applications among mental health patients in Saudi Arabia

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ABSTRACT

Background: Mobile health (mHealth) applications provide new methods of engagement with patients and can help patients manage their mental health condition.

Objective: The main objective of this study is to explore the prevalence of the use of mobile health applications for mental health patients in Saudi Arabia.

Methods: A total of 376 participants with depression and/or anxiety completed an online survey distributed by social networks which asked questions relating to mobile phone ownership, uses of health applications, and utilization patterns to track mental health related issues.

Results: Approximately, 46% of the participants reported running one or two healthcare related applications on their mobile phones. In all age groups, 64% of the participants used their mobile phones to access information related to their own health. Also, 64% of the participants expressed interest in using their own mobile phones to track and follow the progression of their depression and/or anxiety.

Conclusions: Developing mobile health applications for Saudi mental health patients is needed since it can offer opportunities for patients, researchers, caregivers, and legislators to work together to improve the state of mental health care in Saudi Arabia.

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1. Introduction

Mobile phone applications have gained interest from a number of industries ranging from finance, education, to healthcare. Within healthcare specifically, mobile phone applications currently cater to mental health patients and offer them a variety of applications related to monitoring, assessment, education, and treatment [1].

As the prevalence of mental illnesses, such as depression and anxiety, continue to develop, clinicians have turned to portable and mobile applications as tools to aid in the treatment of patients. Mobile phone applications have indicated that they can be useful as an approach in involving patients who may be unwilling or unable to attend face-to-face therapy. Experts have found that these mobile health applications work best when used in combination with medication and with in-person therapy [2]. In Saudi Arabia, little research has been conducted on understanding the prevalence and use of mobile health devices by mental health pa-

tients. Conducting this research is important since the prevalence of mental health illness can reach as high as 48% in certain populations [13]. Mobile health applications can provide an opportunity for Saudi mental health patients to obtain access to mobile health services that can help in the treatment or monitoring of mental health illnesses.

The objective of this study is to determine the prevalence of mobile health application use among Saudi mental health patients. We anticipate that the results of this study will help guide and support Saudi mental health facilities in dealing with the issues impacting the prevalence and use of mobile health applications by Saudi patients. The results of this work may assist in the development of mobile phone applications for Saudi mental health patients, which could be of help in improving patient access and care through mental health services.

2. Literature background

Mental health is a major factor in influencing the personal life satisfaction of an individual. Recently, the psychological well-being of individuals in Saudi Arabia has received increasing consider-

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ation from experts and scientists [5]. Two studies conducted in Riyadh, Saudi Arabia, reported a prevalence of mental health issues in the population ranging from 39% to 46% in 2014 [4,5]. Only 33% of those patients were identified by Primary Healthcare Centers (PHC). Another study conducted in Al-Khobar, Saudi Arabia, exhibited that the occurrence of mental health illnesses in adult male PHC patients was 21.3%. Primary health care doctors diagnosed only 7.7% of those patients as living with a mental health condition [6].

Advances in mobile phone technology are increasingly viewed as enhancing solutions to expand the range of health care delivery options. Little is known, however, about patient choices for mobile phone use in Saudi Arabia or the interest of patients for using their own mobile phones to download and run applications which track and monitor their health conditions. This study will assist exploration of the prevalence and usage of mental health related mobile phone applications in Saudi Arabia [1,5].

Currently, the mental health sector in Saudi Arabia has undertaken steps to create interest among Saudi establishments and mental health providers to initiate a strategic plan that promises to improve the overall mental health wellbeing of the Saudi population [3]. As a result, the creation of services for inpatients has begun to improve over the past ten years. The old and outdated hospital facilities are being replaced by new centers. These changes have been accepted by health experts, a development which will streamline the transmission of good quality services to mental health patients [8]. Even so, there are a number of obstacles to mental health facilities and treatment, which will be specific for that region, such as gender separation and isolation, religious curative practices and social and legal aspects [3].

Despite the fact that Saudi Arabia has one of the highest mobile phone penetration rates in the world, there have been few research studies conducted that relate to the use of mobile phones by mental health patients [9]. Consequently, the goal of this study is to identify the prevalence of mobile application use among mental health patients in Saudi Arabia.

3. Method

The study utilized a quantitative cross-sectional descriptive design to provide an overview and assessment of the prevalence and usage of mobile health (mHealth) applications for mental health patients in Saudi Arabia. A survey was distributed online using Twitter accounts related to depression, stress and anxiety in Saudi society, as well as online support groups and Facebook pages relevant to subject of the study.

The survey included adult patients (>18 years old) living with current mental health conditions such as depression, stress and anxiety, who reported recent involvement in psychiatric treatment, as well as including respondents that possessed ownership of an Android or iPhone smartphone with the ability to download and run mobile applications [3,8].

For this research, a convenient sample of 526 participants was used to collect online responses using Google Documents to analyze the results. The questionnaire was designed to capture only participants living with depression, stress or anxiety. Inclusion criteria used as following: Saudi national, aged 18 years or above >18 years old, and answered YES to the question: "Do you have anxiety, stress, or depression?".

The recruited mental health patients were from the major cities of Saudi Arabia (Riyadh, Jeddah, and Dammam). We used a validated questionnaire taken from a study that had a similar objective to the current study [7]. The researchers translated the survey into the Arabic language and conducted pilot testing for both reliability and validity. The Internal consistency of the survey was high using Cronbach's alpha = 0.845. The survey consisted of twenty questions

where the first two questions were demographic, relating to the age and gender of the patient. The rest of the questions measured different types of patterns including: smartphone ownership, the number of mobile apps usage, and interest in the usage of mobile applications. No personal health information was documented to protect patient confidentiality.

According to the pre-test responses from the patients, the first draft of this questionnaire was revised and then was post-tested on the same patients. Some of the questions were revised according to the pre-test responses.

The questionnaire, see Appendix 1 (English Version), was distributed online among mental health patients to measure the prevalence and usage of mobile phone applications among patients who suffer from mental health disorders. This was done by determining the difference between distinct variables such as age, interest in mobile applications use, and ownership. The researchers were responsible for monitoring and tracking the collection of the surveys, and for making sure of fulfillment, completion, and accuracy of the information with no attempt to influence the opinion of others.

Results were entered in a password protected spreadsheet software, and all the analysis and graphs were completed using The Statistical Package for Social Science (IBM SPSS) Software. This was undertaken to establish a statistical overview on data and to obtain in-depth understanding of variables, association and cross-tabulations that were used in this study. Chi-squared test analysis was used to make comparisons between different variables.

4. Results

A total of 526 participants completed the survey. Of that total, 72% (n = 376) reported suffering from anxiety and depression. The majority were females at 68.9% and 31% were males.

Younger study participants were more likely to use various mobile applications. Approximately 43% (n = 160) of respondents were aged between 18–30 years. Approximately, 37% reported their age between 31 and 45 years, 12% were aged between 46–60 years and only 0.8% were aged above 60 years (see Figs. 2 and 3). A significant association was found between mobile application use and age groups $\chi^2(2) = 13.466$ $p < .001$. However, since there were 3 cells with an expected count less than 5, Fisher's Exact was used and showed a statistically significant result with a P value of less than 0.001 (Table 1).

A total of approximately 92% of the participants use mobile applications on their phones and about 16% reported using health care related applications. Almost half of the participants in this survey (46.8% had accessed mental health related information (see Fig. 4). There was a significant association between Total Health Apps Number and Past 6-Month Health Information Access $\chi^2 = 45.081$ $p < 0.001$ (Table 2).

Access of health information from mobile applications among participants ranged from public health information to personal related information. A percentage of 64%, 20% and 16% reported 'yes', 'perhaps' and 'no', respectively, when asked if they were willing to use a mobile application to monitor, or control their health. With respect to their concern about the risk to a breach of personal information, 29% reported seeing no risk, while 23% were concerned about that potential risk related to sharing or saving personal information on the applications they were using (see Fig. 5). A statistically significant association was found between willingness to monitor their health on the mobile application on a daily basis and sharing Personal Information risk $\chi^2 = 17.120$ $p < 0.001$ (Table 3).

With respect to the relationship between the use of health applications and impact to their health, the majority, 53.5% (n = 201), of participants indicated no expectation of improvements to their health. A percentage of approximately 31% of participants doubted

Table 1
Cross-tabulation of mobile apps use vs. age.

Variables			Age				Total
			18 - 30	31 - 45	46 - 60	Above 60	
Mobile Apps Use	No	Count	8	11	8	2	29
		% of Total	2.1%	2.9%	2.1%	0.5%	7.7%
	Yes	Count	160	139	45	3	347
		% of Total	42.6%	37.0%	12.0%	0.8%	92.3%
Total		Count	168	150	53	5	376
		% of Total	44.7%	39.9%	14.1%	1.3%	100.0%

Table 2
Cross-tabulation of total health apps number vs. Past 6 months health info access.

Variables			Past6months Health Info Access			Total
			No	Perhaps	Yes	
Total Health Apps Number	1 - 2	Count	31	28	114	173
		% of Total	8.2%	7.4%	30.3%	46.0%
	3 - 5	Count	3	3	62	68
		% of Total	0.8%	0.8%	16.5%	18.1%
	None	Count	50	23	62	135
		% of Total	13.3%	6.1%	16.5%	35.9%
Total		Count	84	54	238	376
		% of Total	22.3%	14.4%	63.3%	100.0%

Table 3
Cross-tabulation of willingness daily basis health monitoring vs. personal info risk.

Variables			Personal info risk			Total
			No	Perhaps	Yes	
Willingness daily basis health monitoring via app	No	Count	28	13	20	61
		% of Total	7.4%	3.5%	5.3%	16.2%
	Perhaps	Count	22	39	14	75
		% of Total	5.9%	10.4%	3.7%	19.9%
	Yes	Count	109	76	55	240
		% of Total	29.0%	20.2%	14.6%	63.8%
Total		Count	159	128	89	376
		% of Total	42.3%	34.0%	23.7%	100.0%

if there would be any positive outcomes, while 16% believed that there would be a positive outcome. Interestingly, 19% of the 201 participants with no expectation of positive outcome have recommended the use of health applications while 10.9% of them have not recommended its use. Across all groups, 48.7% have recommended the use of health applications (see Fig. 1). A significant association was observed between expectation of health condition improvement and the recommendation to use Health Apps $\chi^2 = 49.517 p < 0.001$.

5. Discussion

The research results show that Saudi mental health patients are in constant use of mobile phone applications. Approximately 92% of the participants reported using specialized applications to do different activities on a daily basis including personal health control and monitoring. The results also show that 29% of the participants reported little concern regarding risk to personal information when using the application to monitor, control or record a personal health event. Overall, participants reported little confidence about the outcomes of using the mobile health applications as a tool to improve their mental health state. Literature indicates that psychiatric patients who attended a clinic reported mobile phone ownership to be 72%, while 68% of patients were found willing to use mobile phones to monitor their mental health status [10]. A study including schizophrenic patients concluded that 28% had a mobile phone [11]. Another study with 189 psychiatric patients from a psychiatric clinic revealed that 85.7% of the patients in the study owned a mobile phone [12].

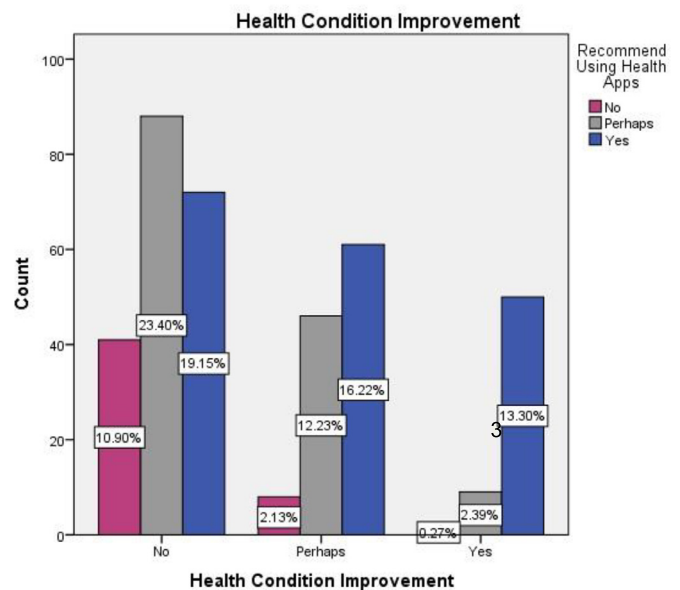


Fig. 1. Health condition improvement.

Nonetheless, 48% of the participants in this study recommended the use of mental health mobile applications, including the respondents that reported no positive outcomes (19%) in using mobile health applications. Together, these results show an opportunity to

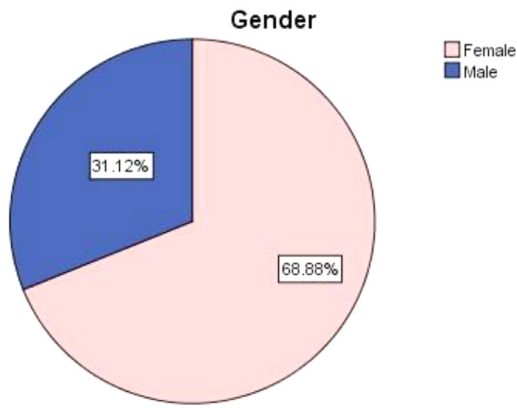


Fig. 2. .

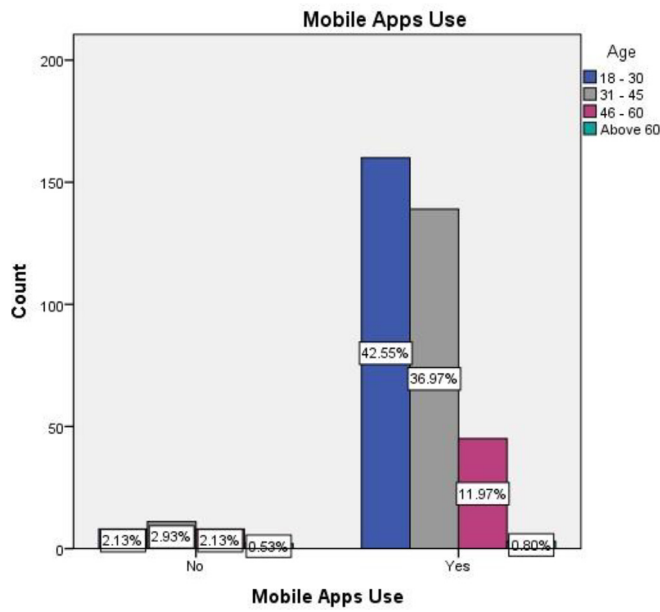


Fig. 3. .

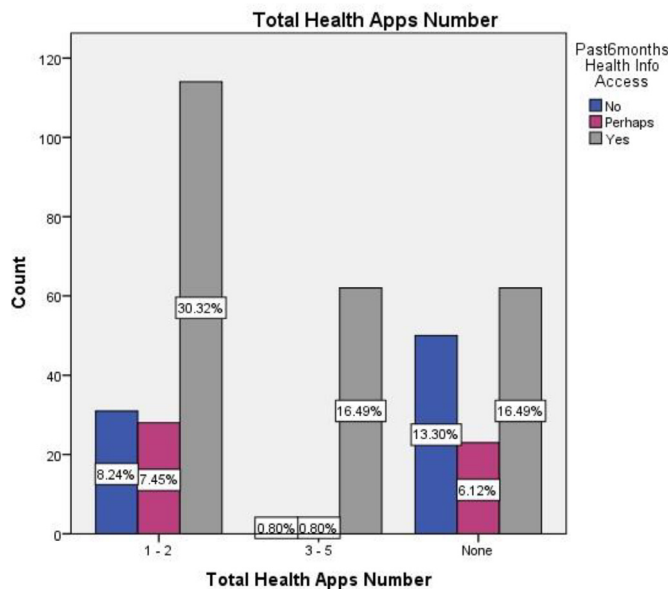


Fig. 4. .

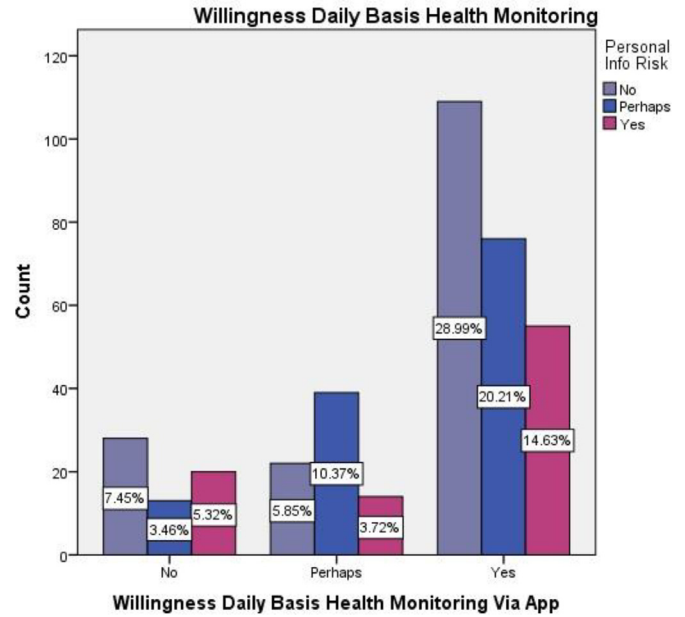


Fig. 5. .

develop an application for depressed and anxious patients especially in the age range of 18 to 30 years. Additionally, in the study, all of the respondents were Arabic Saudi speakers, which may indicate their expectation of having an Arabic interface of the application as part of any mobile health application that may be developed.

The World Health Organization’s Mental Health Atlas, which is the leading Mental and Social Health Atlas in Saudi Arabia, defines the foundation of mental health and social services in the nation. It recognizes several shortcomings in providing mental health services relating to logistics, substructure, and the absence of epidemiological information. This has led to substantial advancement of strategic planning in creating and enhancing mental healthcare services for Saudi Arabia. The planning has led to several recommendations such as creating psychiatric services for recognized special communities, setting up mental healthcare service groups, enhancing research and training in mental health concerns and with personnel, and the leveraging of the use of innovative information technology which would allow for annual reporting of key performance indicators for mental health care services [1]. We project that the results of this work can assist in encouraging the development and use of mental health mobile applications to improve access to mental health services in Saudi Arabia.

6. Implications

Application of the results of this survey will aid in the management and treatment of patients at the level of primary care who are suffering from depression or anxiety in Saudi Arabia. Using interactive mobile applications for patients with depression and anxiety may unlock improved benefits to patients and providers. Recording real life events is an effective tool in overcoming memory issues and retrospective methods on collecting and analyzing events of depression and anxiety. However, the development of any mental health related application should consider age, language, disease specificity, privacy, security and means of collecting data and analyzing them. Therefore, large mental health hospitals in Saudi Arabia should invest in the development of mobile mental health applications to link and empower their patients.

7. Limitations

There is a threat of selection bias in this study because of the use of a convenience sample of social media respondents. Since the data is self-reported, reporting bias and recall bias cannot be avoided. The generalizability of the study may be affected due to the introduction of such biases.

However, we expect that this research will provide interested organizations, researchers and healthcare professionals with baseline information for future studies. This work will also help researchers in finding ways to improve mental health services by making such services broader and wider in order to reach a maximum number of patients with depression and/or anxiety, in Saudi Arabia and elsewhere.

8. Conclusion

The study concludes that a significant number of mental health patients are already using or intend to use smartphones and various apps including mental health applications. We anticipate that the results of this study will provide evidence of the need for mental health mobile applications to be developed in Saudi Arabia. In addition, the results of this study will aid in the promotion of using mobile health technologies to improve healthcare services provided to mental health patients in Saudi Arabia. Empowering patients to access, interact, and record events in Arabic, as it relates to mental health will be a major benefit to the Saudi health care system. The use of mobile health applications to increase healthcare services to patients in general, and specifically to mental health patients, indicates great benefits to the overall healthcare system in Saudi Arabia and abroad [14–18].

Conflict of interest

Authors: **Nora Atallah**, **Ashraf El Metwally** and **Mowafa Househ**, from the Department of Health Informatics, College of Public Health and Health Informatics, King Saud Bin Abdulaziz University for Health Sciences, National Guard Health Affairs, Riyadh, Saudi Arabia and **Mohamed Khalifa** from Centre for Health Informatics, Australian Institute of Health Innovation, Faculty of Medicine and Health Sciences, Macquarie University, Sydney, Australia, all confirm that they have completely no financial or personal relationships with other people or organizations that could inappropriately influence (bias) their work.

Appendix 1

1. Gender? Male Female
2. Age? < 30 Between 30–45 Between 45–60 > 40
3. Do you have daily access to the Internet? Yes or No
4. Do you currently own a mobile phone? Yes or No
5. Can your phone receive and send text messages? Yes or No
6. Can your phone be used to browse the Internet? Yes or No
7. Can your phone download applications or “apps” ? Yes or No
8. Does your phone have built-in GPS? Yes or No
9. Do you own a smartphone? Yes or No
10. What is the brand and type of your mobile phone? iPhone or Android
11. How many applications or “apps” do you have on your phone?
12. How many applications or “apps” do you put on your phone each month?
13. How many health care-related applications or “apps” do you have on your phone?
14. In the past 6 months, have you used your smartphone to access general health care information? Yes or No

15. In the past 6 months, have you used your phone to access your personal health care information such as, for example, test results or to schedule appointments? Yes or No

16. Would you want to be able to access general information related to your health via your smartphone? Yes or No

17. Would you want to receive text messages on your phone related to your health from your doctor's office? Yes or No

18. Would you want to use your phone to help track your medical condition via an application or “app” on your smartphone? Yes or No

19. Would you download an application or “app” to your phone to help monitor your health condition? Yes or No

20. Would you be willing to use an application or “app” on your phone on a daily basis to help monitor your health condition? Yes or No

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