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Assessing intention to use mobile phone–based self-management support among adults with type 2 diabetes in Saudi Arabia: A cross-sectional study

Hind M AlOsaimi[1], Mohammed Kanan[2], Mohammed AlOtaibi[3], Saba Alhejaili[4], Bayader Alshammari[5], Aleya Khalaf[5], Amal Hajea[5], Ryoof Saleh[5], Futoon Jamal[5], Amnah AbuShahin[6], Bandar Alanazi[7], Raghad Alshanbari[8], Ashwag Alsubaie[9], Ghadi Alasmari[10] and Rana S Alshahrani[11]

Abstract

Introduction: The use of mobile phone technology for chronic illness self-management is growing, and it may help people with type 2 diabetes mellitus (T2DM). Innovative methods are needed to improve patient involvement and disease management in the Kingdom of Saudi Arabia due to the high incidence of T2DM.

Objective: The purpose of this study was to explore how the T2DM patients in KSA utilizes their mobile phones for self-management.

Methods: A cross-sectional study was conducted between April and June 2025 among T2DM patients who were attending endocrinologists for their diabetes management in the Northern Border region (Rafha and Arar) and the Central region (Riyadh) in KSA using a validated questionnaire.

Results: This study included a total of 267 participants with T2DM. Nearly all participants (99.3%) possess a cellphone, with 94.8% having daily internet access. The majority of the patients reported to have an intention to use mobile phones and the internet for managing diabetes, with 78.3% for dietary planning, 79.4% for physical activity planning, and 78.7% for text messages as reminders. Factors such as female ($p = 0.008$), younger age ($p = 0.001$), and duration of diabetes ($p = <0.001$) were significantly associated with the intention to use mobile apps for managing their diabetes.

Conclusions: This study demonstrates a significantly higher inclination of participants toward mobile phone technology for diabetes self-management vs. face-to-face consultations. These findings highlight the promising role of mobile phone technology for enhancing diabetes self-management among T2DM patients, thus highlighting the need for targeted interventions.

[1]Department of Pharmacy Services Administration, King Fahad Medical City, Riyadh Second Health Cluster, Riyadh, Saudi Arabia
[2]Department of Pharmacy Administration, Rafha General Hospital, Rafha, Saudi Arabia
[3]Pharmacy Department, King Fahad Medical City, Riyadh, Saudi Arabia
[4]Department of Clinical Pharmacy, College of Pharmacy, University of Ha'il, Hail, Saudi Arabia
[5]College of Pharmacy, Northern Border University, Rafha, Saudi Arabia
[6]College of Clinical Pharmacy, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia
[7]Department of Pharmacy, Al Dawaa Medical Services Company, Riyadh, Saudi Arabia
[8]Department of Pharmacy, Erfan and Bagedo General Hospital Jeddah, Jeddah, Saudi Arabia
[9]Department of Pharmacy, Altaawin Medical Clinics, Alkharj, Saudi Arabia
[10]Department of Ambulatory Care Pharmacy, International Medical Center, Jeddah, Saudi Arabia
[11]Department Of Pharmacy, King Khalid University, Abha, Kingdom of Saudi Arabia

Corresponding authors:
Mohammed Kanan, Department of Pharmacy Administration, Rafha General Hospital, Rafha, Saudi Arabia.
Email: ii_kanan101@outlook.com

Hind M AlOsaimi, Department of Pharmacy Services Administration, King Fahad Medical City, Riyadh Second Health Cluster, Riyadh, Saudi Arabia.
Email: halosaimi@kfmc.med.sa

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Keywords

Type 2 diabetes mellitus, smartphone, internet, self-management, Saudi Arabia

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Introduction

Worldwide, type 2 diabetes mellitus (T2DM) has reached epidemic proportions,[1] currently affecting 10.5% of the adult population.[2] At present, 374 million adults are living with prediabetes, which is projected to affect nearly 540 million adults by the year 2045.[3] The rising prevalence of T2DM is attributed to factors such as aging,[4] rapid urbanization,[5] obesogenic environments,[6] sedentary lifestyles,[7] and genetic predisposition.[8] According to the global burden of disease findings, diabetes mellitus (DM) was the eighth leading cause of death worldwide[9]; a total of 6.7 million deaths were attributed to DM in 2021 alone.[10] According to various research findings, T2DM is associated with numerous complications, such as cardiovascular disease, cerebrovascular and peripheral vascular issues, nephropathy, retinopathy, amputations, diabetic foot, and depression.[11–13]

In the Middle East, nearly 46 million individuals are affected by T2DM, with concerning patterns and trends in the overall prevalence, ranging from 2.6% to 21.9% over the past two decades.[14] As of 2021, statistics from the International Diabetes Federation show that diabetes prevalence among adults was 25.5% in Kuwait,[15] 17.7% in KSA,[16] and 12.3% in the United Arab Emirates.[17] A recent meta-analysis reporting the prevalence of T2DM in the general population of KSA reported a 16.4% pooled prevalence of T2DM.[18] Developed nations have witnessed a rising trend in the prevalence of T2DM.[19] The increased prevalence may be attributed to the higher prevalence of obesity among adults and higher risk factors for other noncommunicable diseases[20]; this is particularly evident in KSA, which ranks second in this regard.

Diabetes is a multifaceted condition, the management of which requires various daily self-management decisions by the patient.[21] Similarly, diabetic patients need to possess knowledge and skills to understand their medical care requirements. Hence, T2DM self-management behavior is a crucial step required by diabetic patients in achieving better disease control and preventing disease-associated complications.[22,23] A recently conducted study also reported the importance of diabetes self-care management, which can effectively prevent and mitigate diabetes-related complications.[24] Owing to the high prevalence of DM as well as the importance of self-management behavior, practical, and affordable self-management programs are highly recommended for T2DM patients to improve health outcomes.[25] Since smartphones have become a vital part of many people's daily lives around the world, they are now being used as innovative healthcare tools for patients with DM.[26] Digital solutions, such as applications ("apps") on smartphones, are increasingly in use in healthcare in general and for diabetes care in particular.[27–29] Numerous apps for managing DM have been developed; few of them can provide Bluetooth-enabled wireless data transfer to the smartphone from the measuring equipment.[30] Smartphone apps on diabetes management and self-management are available for the public to download from major app stores, including Google Play and Apple Store.[31,32] The majority of diabetic applications assist users in monitoring their blood sugar, nutrition, exercise, and prescriptions, which facilitates long-term health monitoring.[33–35] Studies reported a reduction in HbA1c level by using mobile apps for self-care and management of their DM.[36,37] Smartphone apps make it easy for patients to monitor and control their blood sugar by providing helpful information, reminders, and personalized tips.[38] Studies have shown that mobile phone interventions and mobile-based applications among diabetic patients can improve adherence to therapy and prevent disease complications.[39,40] Even due to advancements in technology, barriers to using health applications on smartphones include setting up an account, logging in, keeping track of usernames and passwords (which often require frequent changes for security), navigating the interface, and redownloading the application on new devices. There are concerns over the privacy and security risks endemic to the electronic storage and transmission of personal health information or that digital health will replace in-person communication.[41,42] KSA leads the Gulf region in smartphone, internet, and social media use,[43] with smartphone users forecasted to rise to 29.24 million by 2029[44] and mobile internet users growing to 39.18 million in the same period.[44]

The number of smartphone apps for self-managing chronic diseases, particularly DM, is on the rise. However, unlike in advanced nations, such as the United States of America and Europe, there is a scarcity of studies in KSA exploring T2DM patients' attitudes toward utilizing mobile phone applications for self-management of T2DM. Integrating technology, particularly smartphones, has the potential to significantly enhance diabetes care, especially in scenarios with limited access to primary healthcare or when patients face obstacles like time constraints, financial limitations, or geographical isolation.[45] Smartphones and internet connectivity offer avenues for expanding diabetes

education and support services, particularly when patients encounter difficulties attending education sessions or consulting with diabetes educators regularly. Thus, this study aimed to investigate mobile phone usage among T2DM patients in Saudi Arabia and their willingness to employ such devices for self-management of T2DM.

Methods

Study design

A cross-sectional study was conducted between April and June 2024 and involved T2DM patients receiving diabetes management from endocrinology clinics. Given the regional variations in T2DM prevalence across KSA, as indicated in a meta-analysis,[18] the chosen data collection sites encompassed diverse geographic areas, including the Northern Border region (Rafha and Arar) and the Central region (Riyadh). This selection includes both urban and rural areas, thereby ensuring a representative sample of the diverse population of KSA.

Inclusion criteria

The study's inclusion criteria included individuals who were 18 years of age or older, had completed at least a primary school education, had been diagnosed with diabetes by a qualified specialist, were proficient in using smartphones, and were native Arabic speakers. The exclusion criteria were those under the age of 18, people with type 1 diabetes, people who did not understand Arabic, and anyone who did not want to take part in the study.

Data collection sites. We collected data from various endocrinology clinics located in both urban and rural areas of Saudi Arabia's Northern Border region (Rafha and Arar) and Central region (Riyadh). The choice of these sites was made to show how people in different parts of KSA use and feel about mobile apps for managing T2DM, as was shown in a previous study that looked at differences in the number of people with T2DM in different areas.[18]

Data collection procedures and tools. Written informed consent was obtained from patients who were willing to participate after clearly explaining the objective of the study. Recruitment was carried out in endocrinology clinics in urban and rural areas in the selected locations. The participants were approached personally and were provided with a detailed explanation of the study's objectives and procedure. Written informed consent was obtained from individuals who agreed to participate and were requested to complete the paper-based questionnaire. The study did not provide any incentives or reimbursement to the patients for their participation.

For this study, a validated questionnaire[22] consisting of 30 items divided into five sections was utilized. The questionnaire comprised 5 items related to demographic details, 5 items related to disease information, 6 items related to mobile phone and internet usage, 11 items for intention to use mobile phone apps for diabetes control, and 3 items for general explanations. Regarding mobile phone and internet usage, participants indicated whether they own a mobile phone, internet access, and their daily usage duration. The participants also gave details on their mobile phone activities. The section on attitude and intention for using mobile phones and Internet for diabetes management explored the services that the participants deemed necessary. The utilization of smartphones and apps for diabetes management was evaluated by using a five-point Likert scale, which ranged from "very bad" to "very good" across seven dimensions: idea feasibility, enjoyment, ease, excitement, interest, helpfulness, and cost-effectiveness. The smartphone apps and future intentions were also assessed using a five-point Likert scale, ranging from "no intention" to "very high intention".

Ethics approval. Ethics approval was obtained from the institutional review board (IRB) having IRB Log Number: 2rt-193 as an essential step in ensuring that the current research adheres to ethical guidelines and safeguards the rights of participants.

Sample size calculation. The sample size for this study was calculated using a widely utilized formula.[46] Based on the anticipated prevalence of T2DM in KSA, that is, 21.4%,[47] a sample size of 255 was calculated, while assuming 5% precision (d), 95% confidence interval, 1.96 Z-statistics, and 0.21 as anticipated prevalence (p). However, we included a total of 267 patients for more accurate results.

Statistical analysis

Data analysis was performed using the SPSS 22 version. For categorical variables, the data were presented in frequency and percentages for categorical variables, and in mean and standard deviation for continuous variables. The association between the attitude and intention score was performed by using an independent *t*-test and one-way analysis of variance where appropriate. The statistical significance was kept at p-value <0.05.

Results

The study approached a total of $n = 350$ participants, but only $n = 267$ patients (response rate of 76.28%) participated, with the majority being female (55.4%) and primarily belonging to the 31–50 year age group (54.7%). Most of the patients (75.7%) resided in urban areas, and over half

(55.4%) had completed their undergraduate education. The participants' employment status varied, with 38.6% full-time employed and 18% retired. Regarding diabetes duration, 31.8% of patients had been diagnosed for more than five years, and 67% reported no comorbid conditions as depicted in Table 1.

Table 2 shows the general findings about participants' use of cell phones and the Internet and their intention to use them for controlling their diabetes. Nearly all participants possess a cell phone (99.3%) and a smartphone (98.5%), with 94.8% having daily internet access. The majority of the patients expressed their intention to use their cell phones and the internet for managing T2DM, with 78.3% planning their diets, 79.4% planning their physical activities, and 78.7% using text message reminders. Additionally, 76.8% of participants reported an intention to use their cell phones for glucose reading and tracking, 74.9% for interacting with diabetes clinicians, and 77.5% for connecting with other healthcare providers, such as nutritionists, as shown in Table 2 (the Appendix Table is attached for further thorough responses from the participants).

Table 3 illustrates the daily duration of internet and smartphone usage. Most of the patients (40.1%) were spending over 3 h each day on both the internet and smartphones.

Figure 1 presents the patients' attitudes toward using apps for diabetes control and their intention to use such apps in the future. The mean attitude score of the patients was 4.188 ± 1.134, while the mean intention score for future app use for diabetes control was 4.303 ± 1.030.

The comparison of patients' attitudes and intention scores for using mobile apps to their diabetes control with demographic characteristics is shown in Table 4. The findings revealed that females showed a higher intention score (mean $\pm$ SD: 4.452 ± 0.928), with a statistically significant score compared to males ($p = 0.008$). The attitude score was higher in patients aged 18–30 years (mean $\pm$ SD: 1.878 ± 1.302), while the intention score was higher in patients aged 31–40 years (mean $\pm$ SD: 4.473 ± 0.814). A statistically significant difference was observed in the attitude and intention scores among the patients of different ages ($p = 0.036$) and ($p = 0.001$), respectively, as shown in Table 4. The attitude and intention scores showed no statistically significant difference when compared to education status. However, the comparison of diabetes duration with attitude and intention scores revealed a statistically significant difference, with p-values of <0.001 for each. Patients with a diabetes duration of 3–5 years had a higher attitude score (mean $\pm$ SD: 3.129 ± 1.310), while those with a diabetes duration of <6 months had a higher intention score (mean $\pm$ SD: 4.589 ± 0.848), as shown in Table 4.

Table 1. Demographic characteristics of patients ($n = 268$).

Variables		N	%
Gender	Female	148	55.4
	Male	119	44.6
Age in years	18–30 years	69	25.8
	31–40 years	74	27.7
	41–50 years	72	27.0
	51–60 years	40	15.0
	61 years and above	12	4.5
Place of residence	Urban	202	75.7
	Rural	65	24.3
Education status	Primary level	25	9.4
	Secondary level	68	25.5
	Undergraduate level	148	55.4
	Postgraduate and higher	26	9.7
Employment status	Unemployed	35	13.1
	Retired	48	18.0
	Working full time	103	38.6
	Working part time	40	15.0
	Housewife	41	15.4
Duration of diabetes	Less than 6 months	56	21.0
	6 months to 1 year	54	20.2
	1 year to 3 years	41	15.4
	3 years to 5 years	31	11.6
	More than 5 years	85	31.8
Comorbid condition	No	179	67.0
	Yes	88	33.0

Discussion

This study revealed that the majority of the patients had access to smartphones and daily internet, with many expressing an intention to use these tools for T2DM self-care, including diet planning and exercise, tracking glucose, and connecting with healthcare providers. The study found that the mean intention score was significantly higher among female patients compared to males. Patients

Table 2. Patients responses for use of current technology and intention regarding use of mobile phones and internet.

Question		Yes	No	Don't know
Current technology use	"Having a mobile phone"	265 (99.3)	2 (0.7)	-
	"Having a smartphone"	263 (98.5)	4 (1.5)	-
	"Having daily access to the internet"	253 (94.8)	14 (5.2)	-
Intention to use mobile phones and the internet for diabetes control	"Dietary planning"	209 (78.3)	26 (9.7)	32 (12.0)
	"Physical activity planning"	212 (79.4)	29 (10.9)	26 (9.7)
	"Using text messages as a reminder for diabetes self-management"	210 (78.7)	30 (11.2)	27 (10.1)
	"Glucose reading and tracking options"	205 (76.8)	29 (10.9)	33 (12.4)
	"Communication with other people with type 2 diabetes"	174 (65.2)	45 (16.9)	48 (18.0)
	"Communication with diabetes clinicians"	200 (74.9)	28 (10.5)	39 (14.6)
	"Connect with other healthcare providers, such as nutrition, patients, etc."	207 (77.5)	29 (10.9)	31 (11.6)

Table 3. Time spent by patients on smartphones/cell phones and the internet daily.

Question	*N*%	
On average, how many hours a day do you spend on the internet?		
Less than 1 h	27	10.1
Between 1 and 2 h	38	14.2
Between 2 and 3 h	71	26.6
Over 3 h	107	40.1
Don't know	24	9.0
How many hours a day do you spend on your smartphone or cell phone?		
Less than 1 h	27	10.1
Between 1 and 2 h	38	14.2
Between 2 and 3 h	70	26.2
Over 3 h	107	40.1
Don't know	25	9.4

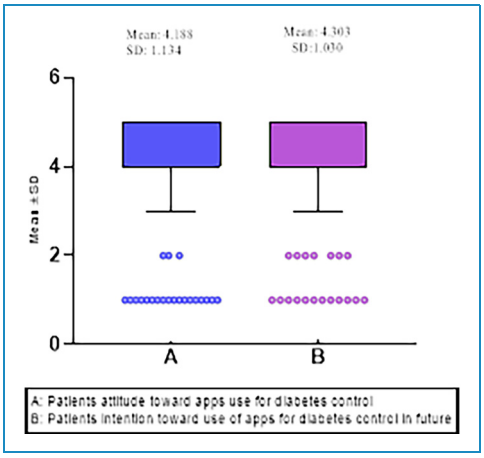

Figure 1. Attitude score and intention score of patients for app use to their diabetes control.

aged 18–30 years had a higher attitude score, and those aged 31–40 years had a higher intention score. Similarly, patients with a diabetes duration of 3–5 years presented a higher attitude score, whereas those with a diabetes duration of less than 6 months had a higher intention score for using mobile apps for T2DM management.

Self-management of chronic diseases is essential for lowering healthcare costs and improving health outcomes.[48,49] In T2DM management, the active engagement

Table 4. Comparison of attitude and intention score of patients for us of apps toward their diabetes control.

Variables		Attitude score	*p*-value	Intention score	*p*-value
Gender	Female	2.108 ± 1.320	0.083 [a]	4.452 ± 0.928	0.008*[a]
	Male	2.403 ± 1.439		4.117 ± 1.121	
Age in years	18–30 years	2.550 ± 1.398	0.036 [b]	4.318 ± 0.865	0.001*[b]
	31–40 years	1.878 ± 1.302		4.473 ± 0.814	
	41–50 years	2.152 ± 1.380		4.430 ± 1.045	
	51–60 years	2.475 ± 1.413		3.925 ± 1.327	
	61 years and above	2.416 ± 1.311		3.666 ± 1.435	
Education status	Primary level	2.122 ± 1.332	0.962 [b]	4.000 ± 1.290	0.084 [b]
	Secondary level	2.294 ± 1.393		4.117 ± 1.240	
	Undergraduate level	2.236 ± 1.396		4.425 ± 0.865	
	Postgraduate and higher	2.230 ± 1.394		4.384 ± 0.941	
Duration of diabetes	Less than 6 months	1.714 ± 1.171	<0.001*[b]	4.589 ± 0.848	<0.001*[b]
	6 months to 1 year	1.740 ± 1.184		4.574 ± 0.923	
	1 year to 3 years	2.268 ± 1.466		4.536 ± 0.636	
	3 years to 5 years	3.129 ± 1.310		3.967 ± 1.110	
	More than 5 years	2.564 ± 1.375		3.952 ± 1.194	

[a]Independent *t*-test; [b]One-way ANOVA was used; *Statistically significant having a *p*-value of <0.05.

of patients in their care through consistent self-management practices is a fundamental aspect of clinical treatment. This active participation of patients not only helps control the disease but also plays a critical role in preventing its complications.[50] Furthermore, studies have shown that self-management strategies significantly improve glycemic outcomes in diabetes patients.[51,52] Apps for mobile devices are frequently used to support diabetic self-management.[33,53] By encouraging healthy lifestyle modifications, these apps have demonstrated efficacy in boosting diabetic self-care.[54,55]

According to our study findings, 94.8% of participants regularly access the internet, and 98.5% of these participants own a smartphone. Our study findings are consistent with another study performed in KSA that found 94% of diabetics have access to the internet via computers, tablets, and mobile phones.[56] Our findings align with those of another Iranian study, which found that most participants had access to a mobile phone and the internet.[22] Out of 33.25 million people, 30.25 million (91%) use the internet, and 25 million (75%) are engaged on social media in KSA.[57] Our study revealed that most patients intended to use smartphone apps and the internet to manage their diabetes. The participants in our study expressed intentions to use these tools for dietary planning, scheduling physical activities, monitoring blood sugar levels, communicating with diabetes specialists, and engaging with other healthcare professionals, such as dietitians. The results of our study align with those of studies performed in Iran,[22] KSA,[56] Canada,[58] the United Kingdom,[59] and the Netherlands.[60] Given the higher trend of internet and smartphone apps for diabetes self-care, younger patients are more inclined towards using these technologies for diabetes self-management.[22] A study conducted in Canada reported a greater inclination of younger T2DM patients toward the internet and mobile applications for diabetes self-management.[61] Similarly, another study in England found that younger patients were more interested in using the internet and mobile applications for managing diabetes.[58]

Similarly, the growing use of the internet and smartphones for self-care and T2DM management has led to a

surge in the use of smartphone apps that offer features such as dietary management, blood glucose monitoring, and physical activity tracking.[62] Several studies have investigated the impact of these technologies on diabetes-related outcomes.[63–68] In our study, the mean attitude score for using mobile apps to control diabetes was 4.188 ± 1.134, and the mean attitude score for intending to use apps in the future to control diabetes was 4.303 ± 1.030. Our study findings are in line with the findings of another study, where the mean attitude score was 4.18 ± 0.68 and the mean intention score for future use was 4.34 ± 0.75.[22]

Our study findings revealed a statistically significant difference in intention scores between genders. However, as reported by another study no significance was found between gender and attitudes regarding intention in utilizing smartphone apps.[22] Our study findings indicated that the attitude score was higher among patients aged 18–30 years, while the intention score was higher among those aged 31–40 years. There was a statistically significant difference in both attitude and intention scores across different age groups. In contrast, other studies have reported that older participants are generally less inclined to use web-based technologies, including the internet and smartphones.[56,58] In our study younger populations' greater preference for and engagement in online activities may contribute to their higher use of the internet and smartphones compared to older age groups. Furthermore, in line with the results of another study,[58] our study showed a statistically significant difference in attitude and intention to use mobile apps for diabetes control, in line with the results of another study.

In our study, we found no statistically significant relationship between education level and the attitude or intention to use mobile apps for diabetes control; in contrast, another study found that utilizing technology to treat diabetes is more likely to be related to higher levels of education.[56] Higher education may also be associated with greater confidence and more informed decision-making when using mHealth technology, according to other research.[69,70] The lack of published research on this topic prevented us from directly comparing our results with those of other studies.

In this study, we examined patients' attitudes and intentions regarding the use of mobile apps for managing T2DM. These findings suggest a direction for future research to explore how health professionals can leverage this information to identify individuals who would benefit most from mobile apps and support. This study has several limitations. Firstly, the questionnaire used was originally validated in an Iranian population; however, it was not validated for the Saudi context and no further linguistic or cultural validation was performed in the Arabic context for the questionnaire in this study. Furthermore, pilot testing was not conducted to assess the questionnaire's appropriateness for the Saudi population, which could have strengthened its reliability. However, future research should focus on developing and validating a questionnaire specifically tailored for Saudi Arabia, ensuring cultural and contextual relevance. Additionally, the inclusion criterion requiring smartphone proficiency may introduce bias, limiting the findings' generalizability. Insights from this study provide valuable guidance for designing and implementing mobile app-based interventions and mHealth solutions to foster T2DM self-management in Saudi Arabia. Future research could explore ways to include a broader range of participants and investigate how support networks can enhance digital tool effectiveness in chronic disease management. Lastly, potential sampling biases could be a potential limitation, as the study was conducted in specific endocrinology clinics, potentially introducing biases due to the exclusion of patients from other healthcare settings.

Conclusion

Our study findings indicate that nearly all participants with T2DM own a smartphone and have daily internet access. The majority of the participating patients use mobile apps for dietary and physical activity planning, and they intend to use them for glucose reading and tracking, as well as for connecting with other healthcare providers, such as nutritionists. Factors such as gender, age, and length of diabetes were significantly associated with their intention to use mobile apps for managing their diabetes in the future.

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Gurantor: Mohammed Kanan

ORCID iDs: Mohammed Kanan https://orcid.org/0000-0001-6687-0461
Saba Alhejaili https://orcid.org/0009-0003-5419-8534

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Appendix

Use of smartphone/cell phone and internet (responses of participants, *n* = 267).

	Yes	No
Do you own a cell phone?	265 (99.3)	2 (0.7)
Do you own a smartphone (such as Android)?	263 (98.5)	4 (1.5)
Do you have daily access to the internet at home?	253 (94.8)	14 (5.2)

	N	%
On average, how many hours a day do you spend on the internet?		
Less than 1 h	27	10.1
Between 1 and 2 h	38	14.2
Between 2 and 3 h	71	26.6
Over 3 h	107	40.1
Don't know	24	9.0
On average, how many hours a day do you spend on your smartphone or cell phone?		
Less than 1 h	27	10.1
Between 1 and 2 h	38	14.2
Between 2 and 3 h	70	26.2
Over 3 h	107	40.1
Don't know	25	9.4

Your attitude to diabetes self-management with using the internet and smartphone application (*n* = 267).

	N	%
For me, using a specially developed smartphone application to assist with self-management would be		
Very bad idea	5	1.9
Bad idea	10	3.7
Neither a bad nor a good idea	26	9.7
Good idea	86	32.2
Very good idea	140	52.4
For me, using a specially developed smartphone application to assist with self-management would be		
Extremely unenjoyable	143	53.6
Unenjoyable	4	1.5
Neither unenjoyable nor enjoyable	33	12.4
Enjoyable	87	32.6
Vert enjoyable	0	0.0
For me, using a specially developed smartphone application to assist with self-management would be		
Very frightening	7	2.6
Frightening	8	3.0

(continued)

Continued.

	N	%
Neither frightening nor comforting	25	9.4
Comforting	81	30.3
Very comforting	146	54.7
For me, using a specially developed smartphone application to assist with self-management would be		
Very boring	9	3.4
Boring	6	2.2
Neither boring nor exciting	42	15.7
Exciting	70	26.2
Very exciting	140	52.4
For me, using a specially developed smartphone application to assist with self-management would be		
Very dull	18	6.7
Dull	3	1.1
Neither dull nor interesting	33	12.4
Interesting	69	25.8
Very interesting	144	53.9
For me, using a specially developed smartphone application to assist with self-management would be		
Very unhelpful	18	6.7
Unhelpful	3	1.1
Neither unhelpful nor helpful	33	12.4
Helpful	69	25.8
Very helpful	144	53.9

(continued)

Continued.

	N	%
For me, using a specially developed smartphone application to assist with self-management would be		
Very time-consuming	12	4.5
Time-consuming	9	3.4
Neither time-consuming nor time-saving	29	10.9
Time-saving	85	31.8
Very time-saving	132	49.4
I feel ....% confident that I could use a smartphone application to help me with my diabetes.		
0%—20%	23	8.6
21%–40%	27	10.1
41%–60%	44	16.5
61%–80%	62	23.2
81%–100%	111	41.6
If you were unable to use a smartphone, would you want a spouse/friend/family member to help you manage your diabetes with a smartphone?		
No	41	15.4
Yes	226	84.6
I intend to use a smartphone application to help me with my diabetes management in the future.		
Not at all	12	4.5
Very little	7	2.6
Somewhat	20	7.5
A little	77	28.8
Very much	151	56.6