ORIGINAL RESEARCH

Investigation of the Functional Requirements and Influencing Factors of Self-management App Use in Patients with Diabetes Mellitus

Wenjuan Han, MM; Jingjuan Xu, MM; Yun Ye, MM; Xianyan Hao, BM; Zhifen Tang, BM

ABSTRACT

Objective • Diabetes self-management apps can provide convenient and personalized health information and reduce glycosylated haemoglobin, weight, the occurrence of severe hypoglycaemia and disease burden. This study aims to describe the attitudes towards and needs of self-management apps among diabetic patients in China.

Methods • A self-administered cross-sectional survey was offered to patients in Changzhou from March to December 2021. Participants were included if they were≥ 18 years old, had the ability to read and write, and completed the questionnaire independently. Responses were summarized using descriptive statistics. Multiple logistic regression analysis was used to identify factors associated with attitudes towards the use of self-management apps.

Results • We surveyed 615 diabetes patients and found that 60% of the patients were willing to use self-management applications. The scores indicating importance of functional needs were sequentially ordered as follows: contact and interaction with medical practitioners (4.16), reminder to assess blood glucose levels (4.07), alert indicating abnormal blood glucose levels (4.06), medication reminder (3.93), documentation of intake per meal (3.91), calculation of carbohydrate intake (3.85), graphic presentation of blood glucose levels (3.84), setting of personal goals (3.82), reminder to exercise (3.80), and providing diabetes knowledge (3.77). Factors influencing the usage of mobile applications included age (OR:0.956, 95%CI:0.935-0.977, $P < .01$), employed (OR:2.822, 95%CI:1.373-5.802, $P < .05$), medical insurance (OR:2.084, 95%CI:1.073-4.047, $P < .05$) and the eHealth Literacy Scale score (OR:1.128, 95%CI:1.088-1.169, $P < .01$). The main reason for unwillingness to use self-management applications was a lack of experience using it.

Conclusions • The functional needs of patients using diabetes self-management apps include contacting and interacting with medical staff, recording and alarming blood glucose, reminding medicine, recording and calculating intake, providing graphic representation of blood glucose, setting health goals, recording exercise and sending diabetes knowledge. Age, employed, medical insurance and the eHealth Literacy Scale score were the factors influencing willingness to use self-management applications. The main reason for reluctance to use self-management applications was lack of experience. (*Altern Ther Health Med.* 2024;30(6):144-148).

Wenjuan Han, MM, co-chief nurse; Department of Respiratory and Critical Care Medicine, Changzhou First People's Hospital, Changzhou, China. **Jingjuan Xu,** MM, chief nurse; Outpatient service center, Changzhou First People's Hospital, Changzhou, China. **Yun Ye,** MM, co-chief nurse; Department of Nursing, Changzhou First People's Hospital, Changzhou, China. **Xianyan Hao,** BM, supervisor nurse; **Zhifen Tang,** BM, supervisor nurse; Department of Endocrinology and Metabolism, Changzhou First People's Hospital, Changzhou, China.

Corresponding author: Wenjuan Han, MM
E-mail: hwj442465650@163.com

INTRODUCTION

Diabetes mellitus is a group of clinical syndromes that are mainly characterized by chronic hyperglycaemia caused by genetic and environmental factors.[1]In total, 114 million people in China have been diagnosed with diabetes, and an average of 550 000 new cases are diagnosed annually.[2] Diabetic patients need to improve their blood glucose and other clinical indicators by changing their lifestyle, complying with complex medical plans, monitoring blood glucose and other self-management behaviors. A study found that regimen adherence is less than optimal in both type 1 and 2 diabetes patients.[3] Patients also faced many difficulties in self-management, especially daily management needs.[4] The high prevalence of diabetes and the significant economic burden have led to the identification of more effective

methods to treat and care for these patients. Studies have shown that self-management apps can be used to provide convenient and personalized health information[5,] reduce glycosylated haemoglobin and the occurrence of severe hypoglycaemia. In addition, apps can also improve self-efficacy.[6-9] These apps not only save time and cost for registration, even transportation, but also help patients develop healthy habits more efficiently.[10]

Breland[11] found that only 5.7% of 227 diabetes self-management apps were developed by nonprofit or government agencies after reviewing Apple's mobile app store, and most diabetes apps do not conform to evidence-based recommendations. In China, there are 683 mobile phone apps directly related to diabetes in the Android Market and Apple iTunes Store,[12] but the number of professional medical apps is limited.[13] Most diabetes self-management apps in China were developed by entrepreneurs, and the function of these apps needs to be improved.[14] This study aims to describe the attitudes towards and needs of self-management apps among diabetic patients in China. Indicating the influencing factors of self-management App use in patients with diabetes mellitus.

METHODS

Study design

From Marchto December 2021, we selected diabetic patients treated in the First People's Hospital of Changzhou. Inclusion criteria: (1) age ≥ 18 years old with the ability to read and complete the questionnaire independently; (2) voluntarily participated in the experiment. Exclusion criteria: (1) patients with visual or hearing impairment; (2) patients with dementia or mental disorders. The study objectives and risks were explained to potential participants by a study team member. After obtaining verbal informed consent, a self-administered questionnaire was distributed to the participants. Participants were encouraged to submit the completed questionnaire using a drop-box.

Survey development and pretesting

The survey instrument included multiple choices, modified Likert scales, and yes/no questions. Survey questions were organized into 4 sections: (I) demographic and social data, including age, height, body weight, sex, education, occupation and medical insurance, information of disease consisting smoking, alcohol consumption, type of diabetes, course of disease, whether insulin was used, whether the patient had been hospitalized due to diabetes, and monthly cost for treating diabetes; (II) the eHealth Literacy Scale (eHEALS) consists of 8 sections and was used as a tool for assessing consumer comfort and skill in used of information technology for health; We have conducted a survey study on the Chinese edition of eHEALS scale which has good reliability and validity,(III) attitudes towards apps in general and factors influencing receptivity towards apps. () we designed a questionnaire to test the willingness to use applications and functional needs of self-management apps, which included 10 single-choice questions with 1-5 points each.

The proposed survey instrument was pretested with ten participants (including elderly participants). Modifications were made based on feedback to improve ease of understanding.

Table 1. Baseline demographic and medical characteristics of participants (n = 615)

Characteristics	$\bar{x} \pm s$ or n (%)	Characteristics	$\bar{x} \pm s$ or n (%)
Age	(50.7±13.8) years	Medical insurance	
BMI	24.2±3.6	Yes	551 (89.6)
Disease course	(6.8±5.9) years	No	64 (10.4)
Gender		Insulin use	
Female	255 (41.5)	Yes	397 (64.6)
Male	360 (58.5)	No	218 (35.4)
Education		Hospitalizations	
Primary or blew	75 (12.2)	1 or more	407 (66.2)
Secondary or preuniversity	406 (66.1)	None	208 (33.8)
Degree/diploma	134 (21.8)	Employment	
		Employed	344 (56.0)
		Unemployed/retired	250 (40.6)
		Farmer	21 (3.4)

Statistical analyses

Statistic Package for Social Science (SPSS) 21.0 (IBM, Armonk, NY, USA)was used for statistical analysis. The measurement data are described as the means ± standard deviation. Descriptive statistics for categorical data were described as frequencies and percentages. Subgroup analyses were conducted using the *t* test for comparisons, and Pearson's chi-squared test was used to compare proportions. Multivariate logistic regression analysis was performed using the willingness to use the diabetes self-management app as the dependent variable and the sociodemographic data, disease data and eHEALS score as the independent variables. All tests were two-sided with a $P < .05$.

RESULTS

Participant characteristics

In this survey, 771 patients were included, 644 questionnaires were distributed, and 615 valid questionnaires were returned. Eighteen of 29 invalid questionnaires were incomplete, and 11 of them had logic errors. The effective recovery was 95.5%. The mean age of the patients was 50.7 years old with a disease course of 6.8 years. The majority of them completed tertiary education. (Table 1)

Willing to use self-management apps

Among the 615 diabetic patients, 496 people had smartphones, accounting for 80.7% of patients. In addition, 110 people (17.8%) had non-smartphones, 9 participants (1.5%) did not have any mobile phones. In this survey, 369 respondents were willing to use self-management apps, accounting for 60% of participants, and the other 246 participants were not willing to use self-management apps. All individuals without any mobile phones would not like to use self-management apps, and 11.8% of persons without smartphones were willing to use self-management apps. The mean eHEALS score of participants was 25.0±7.3.

Functional needs of self-management apps

The 369 respondents who were willing to use apps were

asked to rate the importance of each function.Respondents were more concerned about the function of contact and interacting with medical practitioners (4.16±0.67). (Table 2)

Table 2. The score of functional needs (n = 369)

Functional needs	Score
Contact with medical practitioner	4.16±0.67
Records blood glucose levels	4.07±0.62
Abnormal blood glucose alert	4.06±0.63
Medication reminder	3.93±0.76
Records intake per meal	3.91±0.69
Calculation of carbohydrate intake	3.85±0.70
Graphic presentation of blood glucose	3.84±0.71
Setting of personal goals	3.82±0.77
Exercise tracker	3.80±0.72
Provide diabetes knowledge	3.77±0.76

Factors influencing patients' willingness to use self-management apps

The mean eHEALS Literacy Scale score was 27.9±6.2 for participants willing to use self-management apps and 20.5±6.7 for those not willing to use self-management apps(P < .01).The higher eHEALS score, the more likely to use diabetes apps. The younger(45.8±12.3) were more likely to use apps(P < .01).(Table 3).

The variables with P < .25 were selected, and the willingness to use a self-management app served as the dependent variable. Factors influencing the usage of mobile applications included age (OR:0.956, 95%CI:0.935-0.977, P < .01), employed (OR:2.822, 95%CI:1.373-5.802, P < .05), medical insurance (OR:2.084, 95%CI:1.073-4.047, P < .05) and the eHealth Literacy Scale score (OR:1.128, 95%CI:1.088-1.169, P < .01). (Table 4).

Table 3. Single factor analysis of those willing to use apps (n = 615)

Factors	Willing to use apps	Not willing to use apps	t/χ^2	P value
Age, years	45.8±12.3	57.9±12.7	11.7	<.01
BMI	24.2±3.8	24.3±3.3	0.28	.77
Disease course, years	5.6±4.9	8.4±6.9	5.86	<.01
Gender			1.44	.22
Male	240 (39.0)	120 (19.5)		
Female	158 (25.7)	97 (15.8)		
Education			75.19	<.01
Primary or below	20 (3.3)	55 (8.9)		
Secondary or preuniversity	239 (38.9)	167 (27.2)		
Degree/diploma	110 (17.9)	24 (3.8)		
Employment			89.54	<.01
Employed	254 (15.3)	90 (14.6)		
Unemployed/retired	114 (18.6)	136 (22.1)		
Farmer	6 (0.9)	15 (.4)		
Medical insurance (YES)	342 (55.7)	209 (34.0)	9.44	<.01
Insulin use (YES)	243 (39.5)	154 (25.0)	0.68	.41
Hospitalization (NO)	255 (41.5)	152 (24.7)	3.53	.60
eHEALS score	27.9±6.2	20.5±6.7	14.23	<.01

Reasons for patients not being willing to use the self-management app

There were 246 people unwilling to use self-management apps, accounting for 40% of respondents in this study. Most people were reluctant to use it because they had no experience and worried about increasing the burden of self-management. In addition, two patients complained that they "do not use smartphones", and one patient complained that he did not "have a smartphone" (Table 5).

Table 4. Multivariate logistic regression analysis of willingness to use apps

Factors	β	Std. Error	OR (95% CI)	Wald χ^2	P value
Age	-0.045	0.011	0.956 (0.935, 0.977)	16.216	<.01
Employment				11.602	.021
Employed	1.037	0.368	2.822 (1.373, 5.802)		
Unemployed/retired	0.446	0.390	1.563 (0.727, 3.358)		
Farmer	0.211	0.618	1.235 (0.368, 4.151)		
Medical insurance (YES)	0.734	0.339	2.084 (1.073, 4.047)	4.705	.030
eHEALS score	0.120	0.018	1.128 (1.088 1.169)	43.416	<.01

Table 5. Reasons why patients were not willing to use the self-management app (n = 246)

Reasons	n (%)
No experience with self-management apps	205 (83.3)
Increased the self-manage burden	42 (17.1)
Security of personal information	28 (11.4)
Inconvenient to communicate with medical staff	13 (5.3)
Economic burden	12 (4.9)

DISCUSSION

A total of 615 diabetic patients participated in this survey, including 541 patients with type 2 diabetes (87.9%) and 360 men (58.5%). Sixty percent of survey respondents were willing to use self-management apps. Boyle[15] found that 60.5% of diabetic patients were interested in using self-management apps in New Zealand. The most needed functions of diabetic patients were contact with medical staff, documentation of blood glucose levels, medication reminder, recording and calculating intake, graphically presenting blood glucose levels, setting health goals, documenting exercise and providing diabetes knowledge.

Patients with diabetes face multiple problems in self-management. These patients must interact with medical staff for guidance, and professionals must provide help on time. In addition, it is also important to alleviate the problem of difficult and expensive medical treatment, and self-management apps can serve as an effective interactive platform for information sharing. Documentation of blood glucose levels was the most common function provided by the self-management apps,[16] which can improve the patient's condition and provide the basis for treatment. Patients also need to take a variety of oral drugs and/or insulin, which increases the difficulty of self-management. Thus, patients also urgently need apps to provide medication reminders. Documentation of food consumption and exercise can help patients maintain a good lifestyle. This function provides a reliable record of blood glucose values. This information was also important for medical staff as it facilitates personalized health guidance. Graphical presentation of blood glucose values makes this information easier to understand, allows patients and medical staff to perceive the blood glucose fluctuation and provide an effective response. The diabetes treatment strategy was comprehensive and is based on various parameters, such as hypoglycaemia, blood pressure, blood lipid regulation, antiplatelet therapy, weight control and other measures.[17] The health goals were also comprehensive, and the function of setting health goals can encourage patients to achieve better clinical outcomes. Studies have confirmed that diabetes self-management support can improve clinical outcomes and reduce disease costs.[18]

In this study, we found that younger patients, employed patients, and those with medical insurance and higher eHEALS scores were more inclined to use self-management apps.Age was an important influencing factor in the choice to use new internet technologies.[19,20] Ball[21] described the distinction between people who grew up in the digital world (digital natives) and those who have not used digital technology (digital immigrants) in 2001. The study argued that digital natives who grew up in environments with the internet were more confident in using mobile internet technology. Age was considered the greatest obstacle to using self-management mobile apps.[22] On the one hand, the elderly have limited understanding and usage of new technologies, which leads to technical concerns when using electronic products. On the other hand, the decreased physical function of elderly individuals causes difficulties in the use of electronic devices, which increases feelings of fatigue. An app design should include perceived ease of use to improve patient compliance. Older patients could reduce technical hurdles by selecting apps with a more concise interface and larger font size.[23]

Studies have argued that females prefer applications related to nutrition, self-health care.[24] Those with a high level of education are more capable of using new technology,[25] but our study did not obtain similar findings. This difference may be related to the high prevalence of internet and smartphone use in China, which do not affect the use of these platforms among these populations even the low education. We found that the employed individuals prefer to use mobile apps. These individuals take on social roles, cannot attend regular outpatient follow-up due to less free time. However, they have a strong learning ability to use self-management mobile apps. We also found that those with medical insurance preferred to use mobile apps, which was similar to that reported in Bhuyan's study.[26] In addition, 89.6%of respondents in this study had medical insurance, which is lower than the national level. It is generally believed that non-insured individuals have a lower income level and may not have the necessary hardware to use the mobile app. Thus, these individuals have a reduced willingness to use apps. The eHEALS was designed to assess consumers' perceived skills in using information technology for health and to aid in determining the fit between eHealth programs and consumers.[27] Those with high eHEALS scores were more confident in seeking and using internet health knowledge, and they were more inclined to use self-management apps.

The biggest reason for the reluctance to use self-management apps in this study was a lack of usage experience. Study found that concerns about security and privacy were the biggest barriers for patients to choose mobile health.[28,29] Research suggest that medical staff could help patients use mobile medical devices.[30] We need to understand these tools and be involved in the choice and use of such apps. We also need to establish a good relationship with patients because it is the key to improving patient compliance. We should provide the necessary knowledge and skills support for patients in need, especially elderly patients, and medical staff can help these patients choose a self-management app with an easy-to-use interface. Moreover, medical staff can evaluate the barriers and provide help promptly to improve patient participation.

CONCLUSIONS

The number of digital natives who tend to choose mobile apps will increase over time. The implementation of the delayed retirement policy makes older individuals remain employed. Both of these are positive factors associated with the use of self-management apps. It is most important to design a practical app that fits the actual needs of patients and complies with the evidence-based guidelines. The conclusions of this investigation provide a scientific basis for the design of such apps. We must consider the educational level of patients, choose a self-management app that is easy to operate and improve acceptance. Second, we also need to participate in the use of the self-management app and understand its function and use experience. Finally, we should provide guidance according to the learning ability of patients, solve the practical problems and ensure that patients can operate the app safely and independently.

CONFLICT OF INTEREST

The authors have no potential conflicts of interest to report relevant to this article.

AUTHOR CONTRIBUTIONS

WH and JX designed the study and performed the experiments, JX and YY collected the data, XH and ZT analyzed the data, WH prepared the manuscript. All authors read and approved the final manuscript.

FUNDING

This study did not receive any funding in any form.

ETHICAL COMPLIANCE

This study was approved by the ethics committee of Changzhou First People's Hospital.

REFERENCE

1. Lemelman MB, Letourneau L, Greeley SAW. Neonatal Diabetes Mellitus: An Update on Diagnosis and Management. *Clin Perinatol*. 2018;45(1):41-59. doi:10.1016/j.clp.2017.10.006
2. Alaofè H, Asaolu I, Ehiri J, et al. Community Health Workers in Diabetes Prevention and Management in Developing Countries. *Ann Glob Health*. 2017;83(3-4):661-675. doi:10.1016/j.aogh.2017.10.009
3. Adu MD, Malabu UH, Malau-Aduli AEO, Malau-Aduli BS. Enablers and barriers to effective diabetes self-management: A multi-national investigation. *PLoS One*. 2019;14(6):e0217771. doi:10.1371/journal.pone.0217771
4. Freeman-Hildreth Y, Aron D, Cola PA, Wang Y. Coping with diabetes: provider attributes that influence type 2 diabetes adherence. *PLoS One*. 2019;14(4):e0214713. doi:10.1371/journal.pone.0214713
5. Bonoto BC, de Araújo VE, Godói IP, et al. Efficacy of Mobile Apps to Support the Care of Patients With Diabetes Mellitus: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *JMIR Mhealth Uhealth*. 2017;5(3):e4. doi:10.2196/mhealth.6309
6. Hooshmandja M, Mohammadi A, Esteghamti A, Aliabadi K, Nili M. Effect of mobile learning (application) on self-care behaviors and blood glucose of type 2 diabetic patients. *J Diabetes Metab Disord*. 2019;18(2):307-313. doi:10.1007/s40200-019-00414-1
7. Wang Y, Min J, Khuri J, et al. Effectiveness of Mobile Health Interventions on Diabetes and Obesity Treatment and Management: Systematic Review of Systematic Reviews. *JMIR Mhealth Uhealth*. 2020;8(4):e15400. doi:10.2196/15400
8. Zhai Y, Yu W. A Mobile App for Diabetes Management: Impact on Self-Efficacy Among Patients with Type 2 Diabetes at a Community Hospital. *Med Sci Monit*. 2020;26:e926719. doi:10.12659/MSM.926719
9. Feuerstein-Simon C, Bzdick S, Padmanabhuni A, Bains P, Roe C, Weinstock RS. Use of a Smartphone Application to Reduce Hypoglycemia in Type 1 Diabetes: A Pilot Study. *J Diabetes Sci Technol*. 2018;12(6):1192-1199. doi:10.1177/1932296817749859
10. Lavikainen P, Mattila E, Absetz P, et al. Digitally Supported Lifestyle Intervention to Prevent Type 2 Diabetes Through Healthy Habits: Secondary Analysis of Long-Term User Engagement Trajectories in a Randomized Controlled Trial. *J Med Internet Res*. 2022;24(2):e31530. doi:10.2196/31530
11. Breland JY, Yeh VM, Yu J. Adherence to evidence-based guidelines among diabetes self-management apps. *Transl Behav Med*. 2013;3(3):277-286. doi:10.1007/s13142-013-0205-4
12. Wu Y, Zhou Y, Wang X, et al. A Comparison of Functional Features in Chinese and US Mobile Apps for Diabetes Self-Management: A Systematic Search in App Stores and Content Analysis. *JMIR Mhealth Uhealth*. 2019;7(8):e13971. doi:10.2196/13971
13. Gao C, Zhou L, Liu Z, Wang H, Bowers B; Mobile application for diabetes self-management in China: Do they fit for older adults? *Int J Med Inform*. 2017;101(68-74. doi:10.1016/j.ijmedinf.2017.02.005

14. Gong E, Zhang Z, Jin X, et al. Quality, Functionality, and Features of Chinese Mobile Apps for Diabetes Self-Management: Systematic Search and Evaluation of Mobile Apps. *JMIR Mhealth Uhealth*. 2020;8(4):e14836. doi:10.2196/14836
15. Boyle L, Grainger R, Hall RM, Krebs JD. Use of and Beliefs About Mobile Phone Apps for Diabetes Self-Management: Surveys of People in a Hospital Diabetes Clinic and Diabetes Health Professionals in New Zealand. *JMIR Mhealth Uhealth*. 2017;5(6):e85. doi:10.2196/mhealth.7263
16. Gong E, Zhang Z, Jin X, et al. Quality, Functionality, and Features of Chinese Mobile Apps for Diabetes Self-Management: Systematic Search and Evaluation of Mobile Apps. *JMIR Mhealth Uhealth*. 2020;8(4):e14836. doi:10.2196/14836
17. Garber AJ, Handelsman Y, Grunberger G, et al. Consensus Statement By The American Association Of Clinical Endocrinologists And American College Of Endocrinology On The Comprehensive Type 2 Diabetes Management Algorithm - *2020 Executive Summary. Endocr Pract*. 2020;26(1):107-139. doi:10.4158/CS-2019-0472
18. Cunningham AT, Crittendon DR, White N, Mills GD, Diaz V, LaNoue MD. The effect of diabetes self-management education on HbA1c and quality of life in African-Americans: a systematic review and meta-analysis. *BMC Health Serv Res*. 2018;18(1):367. doi:10.1186/s12913-018-3186-7
19. Reddy R, Majmudar M, Dhopeshwarkar N, Vacaro V, Isselbacher E, Bhatt AB. Mobile health apps preferences and practice among ambulatory cardiovascular patients. *Future Cardiol*. 2018;14(5):381-388. doi:10.2217/fca-2018-0005
20. Crilly P, Jair S, Mahmood Z, et al. Public views of different sources of health advice: pharmacists, social media and mobile health applications. *Int J Pharm Pract*. 2019;27(1):88-95. doi:10.1111/ijpp.12448
21. Ball C, Francis J, Huang KT, Kadylak T, Cotten SR, Rikard RV. The Physical-Digital Divide: Exploring the Social Gap Between Digital Natives and Physical Natives. *J Appl Gerontol*. 2019;38(8):1167-1184. doi:10.1177/0733464817732518
22. Wang C, Qi H. Influencing Factors of Acceptance and Use Behavior of Mobile Health Application Users: systematic Review. *Healthcare (Basel)*. 2021;9(3):357. doi:10.3390/healthcare9030357
23. Sun C, Sun L, Xi S, et al. Mobile Phone-Based Telemedicine Practice in Older Chinese Patients with Type 2 Diabetes Mellitus: Randomized Controlled Trial. *JMIR Mhealth Uhealth*. 2019;7(1):e10664. doi:10.2196/10664
24. Elavsky S, Smahel D, Machackova H. Who are mobile app users from healthy lifestyle websites? Analysis of patterns of app use and user characteristics. *Transl Behav Med*. 2017;7(4):891-901. doi:10.1007/s13142-017-0525-x
25. Carroll JK, Moorhead A, Bond R, LeBlanc WG, Petrella RJ, Fiscella K. Who Uses Mobile Phone Health Apps and Does Use Matter? A Secondary Data Analytics Approach. *J Med Internet Res*. 2017;19(4):e125. doi:10.2196/jmir.5604
26. Bhuyan SS, Lu N, Chandak A, et al. Use of Mobile Health Applications for Health-Seeking Behavior Among US Adults. *J Med Syst*. 2016;40(6):153. doi:10.1007/s10916-016-0492-7
27. Norman CD, Skinner HA. eHEALS: The eHealth Literacy Scale. *J Med Internet Res*. 2006;8(4):e27. doi:10.2196/jmir.8.4.e27
28. Alaiad A, Alsharo M, Alnsour Y. The Determinants of M-Health Adoption in Developing Countries: An Empirical Investigation. *Appl Clin Inform*. 2019;10(5):820-840. doi:10.1055/s-0039-1697906
29. Zhou L, Bao J, Watzlaf V, Parmanto B. Barriers to and Facilitators of the Use of Mobile Health Apps From a Security Perspective: Mixed-Methods Study. *JMIR Mhealth Uhealth*. 2019;7(4):e11223. doi:10.2196/11223
30. Graffigna G, Barello S, Bonanomi A, Menichetti J. The Motivating Function of Healthcare Professional in eHealth and mHealth Interventions for Type 2 Diabetes Patients and the Mediating Role of Patient Engagement. *J Diabetes Res*. 2016;2016:2974521. doi:10.1155/2016/2974521