Prospective acceptability of using mHealth interventions for oral health promotion in a sample of Egyptian women: A cross-sectional study

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Abstract

Background: Unless a health intervention is acceptable to target audience and aligns with their needs and preferences, there is increased likelihood that they would not engage with and benefit from it as planned. Despite that, there is paucity of studies exploring acceptability of oral health promotion interventions prior to implementation. This cross-sectional study was designed to investigate Egyptian women's "*prospective acceptability*" to use mobile technologies in promoting access to oral health services.

Methods: A total of 959 participants completed a questionnaire, based on Sekhon's theoretical framework of acceptability, either in-person or virtually. Data was collected on sociodemographics, smartphones' ownership and usage patterns, acceptability to use mHealth interventions, and any potential motivators and barriers. Chi-square test was used for descriptive statistics and regression analysis was performed to identify predictors of acceptability to use digital technology in improving oral and dental health.

Results: 83 % of women residing in urban settings versus 80.7% in rural settings believed that mHealth could improve health outcomes. WhatsApp was identified by 68% of participants as the preferred application for adopting mobile health services. Health awareness (36.8%) and effort & time saving (29%) were the most commonly cited motivators for using mHealth while lack of time (33%) and privacy issues (14.2%) were the main barriers.

Conclusions: mHealth is perceived as a highly acceptable approach for promoting oral health among Egyptian women. However, mHealth interventions should take into consideration privacy concerns and personal security when targeting this group.

Keywords

mHealth, digital health, mobile phone technology, oral health promotion, theoretical framework of acceptability, Prospective acceptability

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Introduction

Though most oral diseases are largely preventable, oral health disparities still represent a public health concern[1] disproportionately affecting vulnerable populations such as women and children, especially in low-middle-income countries (LMICs).[2] This is due to an interplay of individual, community, and health system-related factors,[3] with

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low income, poor education and lack of or limited health insurance being the most citable factors in the North Africa and Middle East (MENA) region.[4] Those factors jeopardize access to and utilization of oral healthcare services particularly among those living in marginalized or rural areas due to the high expenses of curative services, and shortage of oral workforce,[5,6] which reached approximately 1.9 dentists to 10,000 population in Egypt in 2018.[7] Many Egyptian women face additional barriers to accessing health services due to their financial dependence, inability to pay, and the lack of autonomy and power in their society which stems from cultural norms. Physical barriers such as long travel distance and lack of safe transportation also represent demand-side access barriers that further aggravate their situation.[8]

Lately, the integration of mobile phones in promoting health has become an area of focus to alleviate some of the critical healthcare challenges experienced in LMICs.[9] This is facilitated by the highly proliferative rates of mobile phones' ownership, where, according to the International Telecommunication Union, 78% of the global population and 70% of residents of LMICs owned a mobile phone in 2023.[10] In Egypt, mobile phone penetration has reached approximately 97% in 2023, compared to 90.4% in 2022, representing an annual increase of approximately 6.5%.[11] Mobile phones are regarded as a transformative approach for enhancing healthcare services' access and delivery and addressing health-related needs, particularly in developing countries,[9,12] through ameliorating access to health information and quality health services.[13] This shift has been remarkably prominent in the wake of COVID-19 pandemic whereby global social distancing policies have been associated with a significant rise in the number of mHealth applications and their users since then.[14,15]

The use of smartphone applications, in particular, has been associated with better health outcomes[13] through securing easy connectivity between patients and health providers, allowing for remote screening, monitoring and consultations, improvement of self-care behaviors, and enhancement of treatment adherence and appointments' compliance.[9,13] In the context of oro-dental care, smartphone applications have proven to be efficient in delivering oral health information and teaching patients proper oral hygiene maintenance skills.[13] According to recent systematic reviews and meta-analyses,[16–18] mHealth applications and text messages have been shown to result in better plaque control and thus better gingival health and lower dental caries incidence through behavioral modification techniques.[17] In the same manner, through sending regular dental reminders,[19] mHealth was associated with better orthodontic treatment outcomes denoted by the improvement of oral hygiene and periodontal health, reduction in the incidence of white spot lesions, and improved dental attendance. Not only that, but mHealth has also emerged as a vital asset for enhancing oral health outcomes of the pediatric population through improving the oral health awareness of their caregivers[20] and

familiarizing children with dental visits, consequently enhancing child cooperation and mitigating dental anxiety.[2]

Furthermore, from the perspective of dental practitioners, teledentistry is regarded as an efficient approach which allows them to offer remote patient triaging, telediagnosis, telemonitoring, and teleconsultations. This was perceived to be, particularly, beneficial for patients with geographic barriers, offering them a good quality service at a reasonable cost and without the need to travel.[22]

While the phenomenon of employing mobile technologies to foster health promotion has largely expanded worldwide, even less than a handful of mHealth interventions were implemented to promote oral health in Egypt.[23,24] Upon implementing new interventions, assessing the acceptability, willingness, and capability of end-users to utilize and benefit from them is essential for successful uptake and ongoing use. This is particularly true when it comes to mHealth interventions given the wide variety of designs that exist and depend on the capabilities and preferences of end-users, such as, but not limited to, the availability of- and accessibility to internet connection, the type of device used, and the method of delivering the intervention.[20,25]

Accordingly, the current study was designed to: (1) measure the prospective acceptability of a group of Egyptian women to utilize mHealth interventions for oral health promotion, (2) identify their preferences for mHealth interventions' designs, and (3) determine the potential barriers and motivators to adopt this type of interventions.

Methods

Study design and sampling

A cross-sectional study was conducted between January and August 2020. Women were eligible for inclusion if they were Egyptian, currently residing in the country, older than 18 years of age, and provided a consent to participate. Women who did not own or had no access to a smartphone were excluded from the study. Sample size calculation was performed utilizing the single proportion formula devised by Steven K. Thompson[26] based on the research question which focused on determining the acceptability of Egyptian women to employ mobile phones for health promotion. By adopting a confidence interval of 95%, a margin of error of 5%, and a mobile usage percentage of 60.0% among Egyptian females based on Egypt's demographic and economic characteristics in 2017,[27] the predicted sample size (n) was found to be 369 participants. Assuming a 30% non-response/incompletion rate, the overall sample size was estimated to be 479 participants.

Study procedures

Ethical considerations. This study was approved by Faculty of Dentistry, Ain Shams University (FDASU)-Research

Ethics Committee (FDASU-REC)—*(approval number: FDASU-Rec R111901)* and was carried out in accordance with the Declaration of Helsinki. All participants received information about the study objectives and were informed that their participation is voluntary and without any financial compensation. Participants were also assured about anonymity and confidentiality of data. Written informed consents were obtained from participants who responded "in-person" to questionnaires, while participants who responded virtually provided an electronic consent.

Recruitment. Study participants were recruited via two means:

- "In-person" whereby a trained investigator fluent in Arabic filled a structured questionnaire using a case record form. Women were recruited via convenience sampling from the outpatients' clinics and their waiting areas in FDASU; a public teaching hospital in Cairo, the capital city of Egypt and from primary healthcare centers in Minya governorate in Upper Egypt.
- "Online" using Google forms. A respondent-driven sampling technique (RDS)[28] was also adopted, where eligible women were invited to participate in the study by sending them private messages on social network accounts (*WhatsApp or Facebook messenger*). Afterwards, each participant was asked to recruit at least three eligible acquaintances via messages on any social network accounts. Since recruitment was online, we assumed intact cognitive functioning and literacy of respondents,[29] however, we did not have full control over participants characteristics and therefore the responses that arrived from individuals who didn't fulfill the pre-set inclusion criteria were excluded from the final analysis.

Study tool. After reviewing relevant studies on feasibility, preferences, and willingness to use mHealth,[30–32] an English questionnaire was developed for the current study to investigate the "*prospective*" acceptability of using mobile phones for oral health promotion from the target beneficiaries' perspectives prior to exposure to the intervention. The questionnaire was translated into simple Arabic language and a panel of expert academics at FDASU assessed its ambiguity, understandability, and appropriate use of terms, before and after translation, and their feedback was taken into consideration to ensure that face and content validity were established. Afterwards, a pilot study was conducted on 10% of the sample size to test the level of understanding of the questionnaire. Minor rephrasing was done in some questions to ensure clarity, however responses obtained from the pilot study were not included in the final analysis.

The revised theoretical framework of acceptability [TFA (v2)],[33] proposed by Sekhon and colleagues, was adopted in designing the questionnaire whereby *28 questions* were adapted to fit under five, out of the seven, constructs of the framework as shown in Figure 1. Those questions inquired about participants' ability and pattern of usage of mobile phones, acceptability of using mHealth for oral health promotion purposes, preferences around receiving oral health information, oral hygiene and dental appointments' reminders on their smartphones as well as perceived potential barriers and motivators of using mHealth. Twelve additional general questions, that did not fit under any of the TFA constructs, were used to inquire about participants' sociodemographic characteristics, smartphone and internet access, and type of smartphone used.

In the first section of the questionnaire, data on selected sociodemographic variables such as age, education, occupation, residence, etc. was collected. Ownership or access to a smartphone or mobile internet was inquired about in the second section, while the ability to use mobile phones was measured by 11 questions with yes/no response format in the section after. One section focused on mobile usage patterns including usage of both SMS and mobile data packages. Women's beliefs around the effectiveness of mHealth interventions and their acceptability to use their phones to receive oral health-related information, oral hygiene maintenance reminders, dental appointments reminders and teleconsultations were measured by six questions in section five. Women responded using yes/no/unsure to the following two questions in the section: "Do you believe that mobile phones can be used for promoting health?" and "Would you use your mobile phone for health purposes if your doctor or primary healthcare provider recommended that?," whereas responses to the other four questions were based on a 3-point Likert scale (agree, neutral, disagree). Preferences around methods and frequency for receiving dental reminders and oral health information on mobile phones were also explored using seven questions in section six. In the last section of the tool, two questions were used to identify potential motivators and barriers to adopting mHealth.

Statistical analysis

Categorical data were presented as frequency and percentage values and were analyzed using a chi-square test followed by pairwise comparisons utilizing multiple z-tests with Bonferroni correction. Univariate and multivariate binomial logistic regression models were used to identify the predictors of participants' acceptability to use mobile technologies for promoting oral health (no-yes). Tested predictors included (age-numerical variable), (living place "rural/urban" —urban is reference category), (working "no/yes"—no is reference category), (has children ""no/yes"—no is reference category), (educational level "low/medium/high"—low is reference category), (income level —"low/medium/high"—low is reference category), (has
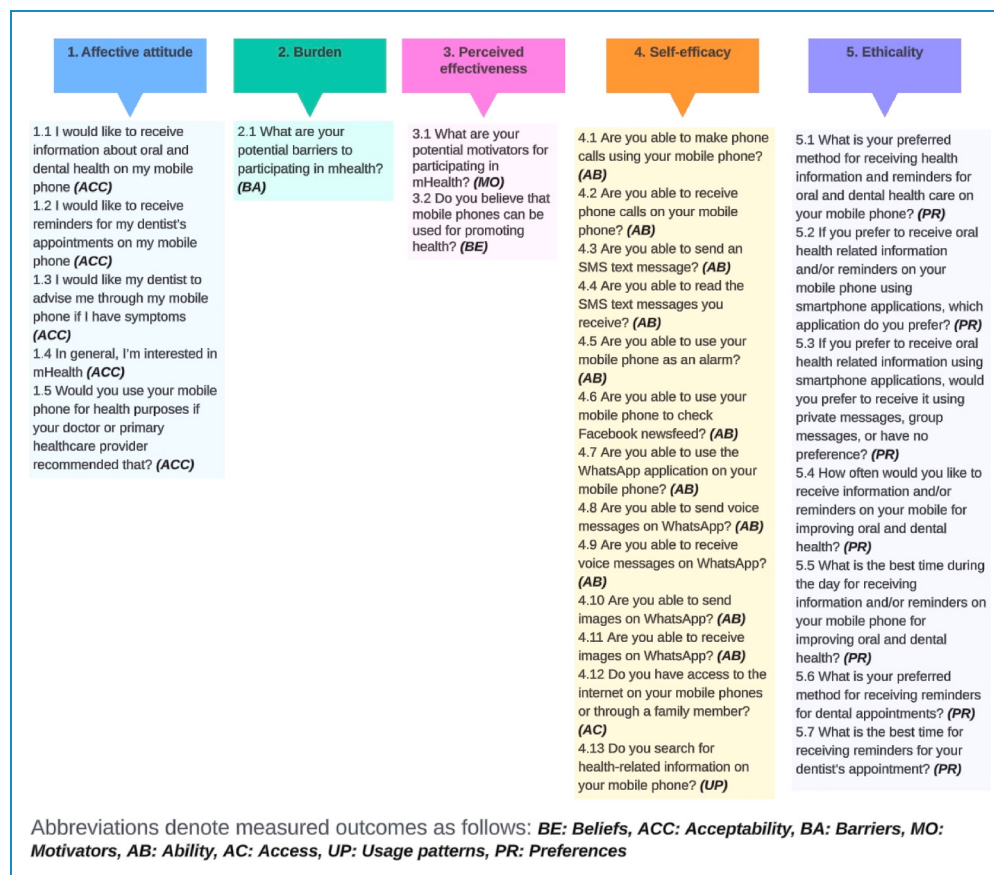
Figure 1. Study tool fit under five constructs of Sekhon's theoretical framework of acceptability.

smart phone "no/yes"—no is reference category). The significance level was set at $p < 0.05$ for all tests. Statistical analysis was performed using R statistical analysis software version 4.1.3 for Windows,[34] and the study conformed to STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist.[35]

Results

Out of 1034 women who responded to the questionnaire, 75 were excluded due to missing data and 959 (92.7%) were included in statistical analysis. Participants' recruitment and exclusion reasons are reported using a flow diagram (Figure 2). The mean age of the participants was (30.49 ± 8.88) years, 82.7% of them resided in urban areas, 82.5% had a university degree or equivalent, and 76% were employed. Around 45.5% of the participants had a household income of more than 5000 EGP (approx. 320 USD at the time of study implementation) and 54% had no children (Table 1).

Ability to use mobile phones and usage patterns. All women asserted they were able to make and receive phone calls and the majority could send (97.8%) and read received messages (99.2%), use alarms (98.9%), use Facebook

(97.6%), and WhatsApp (98.7%). Over 97% of participants indicated that they could send and receive voice messages and images on WhatsApp, around 68% reported checking their short message service (SMS) regularly, 90.3% used mobile internet daily (90.3%) and 76% were using their phones to search for health-related information.

Utility of mobile health (mHealth). The majority of women believed that mHealth could improve health outcomes (83% in urban versus 80.7% in rural settings). Around 94% of women in urban settings versus 88% of those in rural areas indicated they had intentions to utilize mobile technology if recommended by their healthcare providers and a significant difference was detected between both groups ($p < 0.05$). As shown in Table 2, a significantly higher percentage of respondents from urban settings showed interest in using mHealth (79.7%) when compared to those in rural areas (69.9%) ($p < 0.05$).

Preferred channels for receiving mHealth services. WhatsApp was the most preferred application for health purposes (67.8%) and 61.4% of participants preferred
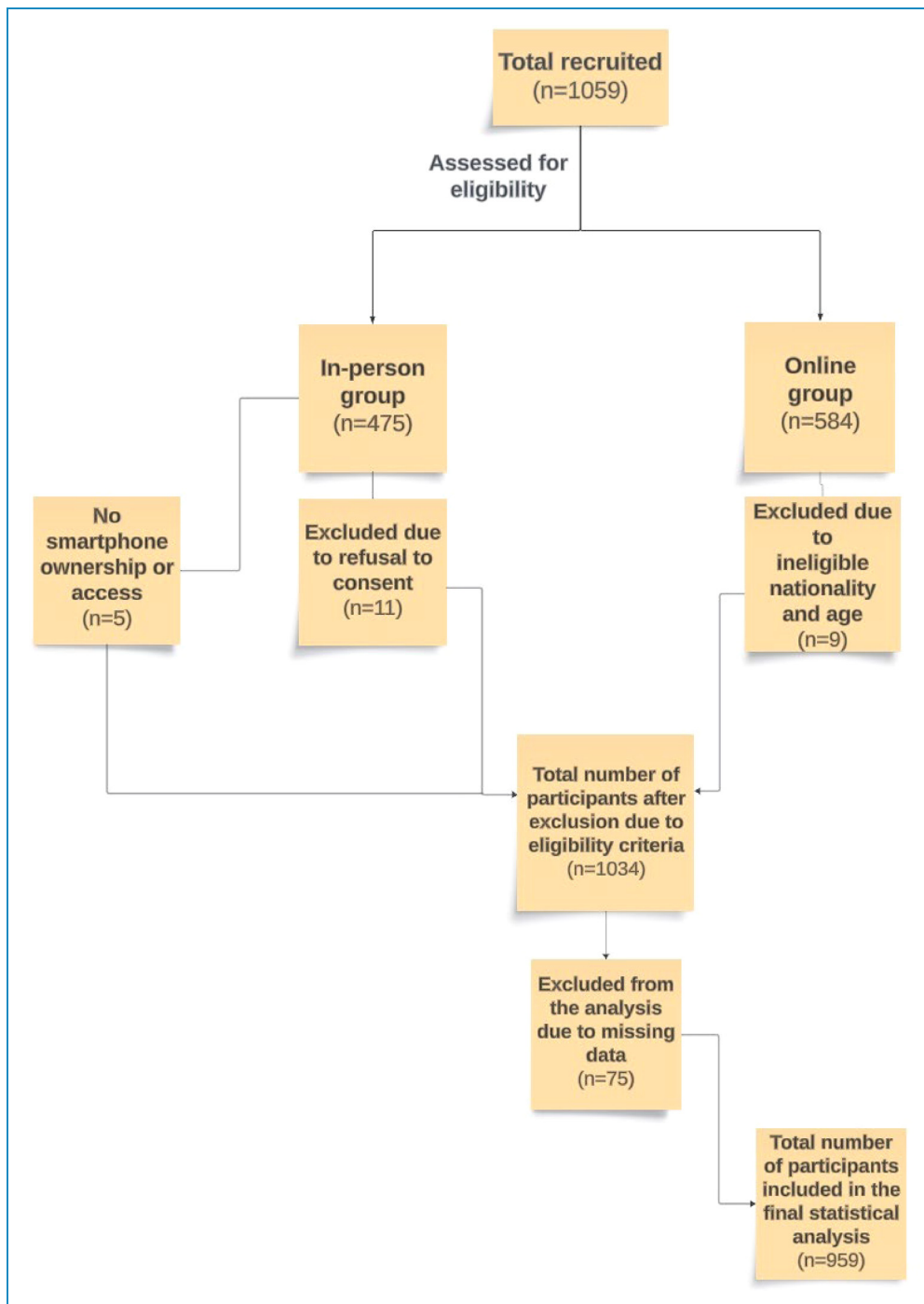
Figure 2. Flow diagram showing participants' recruitment.

communication to be via private (63.6%) rather than group messages (17.5%). Facebook was the second most preferred application, cited by around 18% of the sample, while around 11% reported that they had no preferred application. Telegram and other smartphone applications were collectively cited by as low as 4% of participating women. Around 54% of women would rather receive health information messages on a weekly

basis, and evening hours were perceived as the best time for communication (46.2%). Regarding reminders for dental appointments, the most preferred method was SMS (43.2%), and over 41.8% preferred receiving a message the day before the appointment.

Motivators and barriers to mHealth. Among study participants, promoting health awareness (36.8%) and saving

Table 1. Overview of study population characteristics ($n = 959$).

Parameter	Categories	n	%
Geographic location	Cairo	538	56.1%
	Lower Egypt	78	8.1%
	Upper Egypt	343	35.8%
Area of residence	Urban	793	82.7%
	Rural	166	17.3%
Educational level	No education	7	0.7%
	Literacy programs	15	1.6%
	Primary or preparatory school	7	0.7%
	Secondary school or secondary school diploma	139	14.5%
	Higher institute or university degree	581	60.6%
	Postgraduate studies	210	21.9%
Employment	Yes	729	76.0%
	No	230	24.0%
Do you have children?	Yes	441	46.0%
	No	518	54.0%
If yes, how many? ($n = 441$)	1	134	30.4%
	2	163	37.0%
	3	94	21.3%
	More than 3	50	11.3%
Family monthly income	Less than 1000 EGP $\cong$ (< 65 USD)	53	5.5%
	1000–2000 EGP $\cong$ (65–<130 USD)	170	17.7%
	2000–5000 EGP $\cong$ (130–320 USD)	301	31.4%
	More than 5000 EGP $\cong$ (> 320 USD)	435	45.4%

N.B. included USD rates are based on currency conversion rates at the time of commencement of the study.

time and effort (29%) were the most commonly reported motivators for using mobile phone technology. Interest and ease of communication were reported by only 15.4% and 14.9% respectively. While 33.2% of women identified lack of time as a barrier, privacy concerns and fear of harassment were reported by 14.2% and 9.7%, respectively (Figure 3).

A binomial logistic regression model was performed to study the effect of different independent variables on women's acceptability to receive information about oral and dental health on mobile phones and was summarized in Table 3. The overall multivariate model was statistically significant [$\chi2$ (9) = 20.28, $p = 0.016$], and the odds of acceptability of using mHealth for health purposes were

Table 2. Acceptability of utilizing mHealth interventions disaggregated by place of residence.

Parameter		Urban n	Urban %	Rural n	Rural %	χ^2	*p*-value
Do you believe that mobile phones can be used for promoting health?	Yes	659	83.1%	134	80.7%	3.31	0.191
	No	39	4.9%	14	8.4%		
	Unsure	95	12.0%	18	10.8%		
Would you use your mobile phone for health purposes if your healthcare provider recommended that?	Yes	745[A]	93.9%	146[B]	88.0%	8.69	0.013*
	No	16[A]	2.0%	9[B]	5.4%		
	Unsure	32[A>]	4.0%	11[A]	6.6%		
I would like to receive oral health information on my mobile phone?	Agree	606	76.4%	125	75.3%	1.14	0.565
	Neutral	146	18.4%	29	17.5%		
	Disagree	41	5.2%	12	7.2%		
I would like to receive reminders for my dentist's appointments on my mobile phone	Agree	622	78.4%	120	72.3%	3.64	0.162
	Neutral	125	15.8%	31	18.7%		
	Disagree	46	5.8%	15	9.0%		
I would like my dentist to advise me through my mobile phone if I have symptoms	Agree	659	83.1%	135	81.3%	0.72	0.699
	Neutral	90	11.3%	19	11.4%		
	Disagree	44	5.5%	12	7.2%		
In general, I am interested in mHealth	Agree	632[A]	79.7%	116[B]	69.9%	8.23	0.016*
	Neutral	138[A]	17.4%	41[B]	24.7%		
	Disagree	23[A]	2.9%	9[A]	5.4%		

Values with different superscript letters within the same horizontal row are significantly different.
*Significant ($p < 0.05$).

Discussion

significantly higher among participants with medium and high educational levels when compared to those with lower educational levels ($p < 0.05$).

Recently, several systematic reviews,[18,20,36,37] as well as clinical trials[38–40] which studied the potential benefits of using mHealth interventions in promoting oral health, concluded that oral health education, delivered via electronic media such as mobile phones, is effective in enhancing oral-health related attitudes, practices, and outcomes. Despite that, there is no record of mHealth interventions in Egypt, as documented in the WHO global observatory for eHealth in 2015.[41] Furthermore, as of yet, teledentistry is not governed by any formal regulations in the country, and hence any implemented programs are merely informal "*trials*" at a local level.[42]

The current study was, thus, designed to investigate the "prospective" acceptability of adopting mHealth services from the perspective of potential beneficiaries prior to exposure to interventions and to identify the factors that might influence their uptake of such services. This was done to ensure that the interventions are designed to meet the end users' needs and perspectives[43] and hence maximize participation, reduce dropout rates and increase the intervention's likelihood of being effective.[20,25]
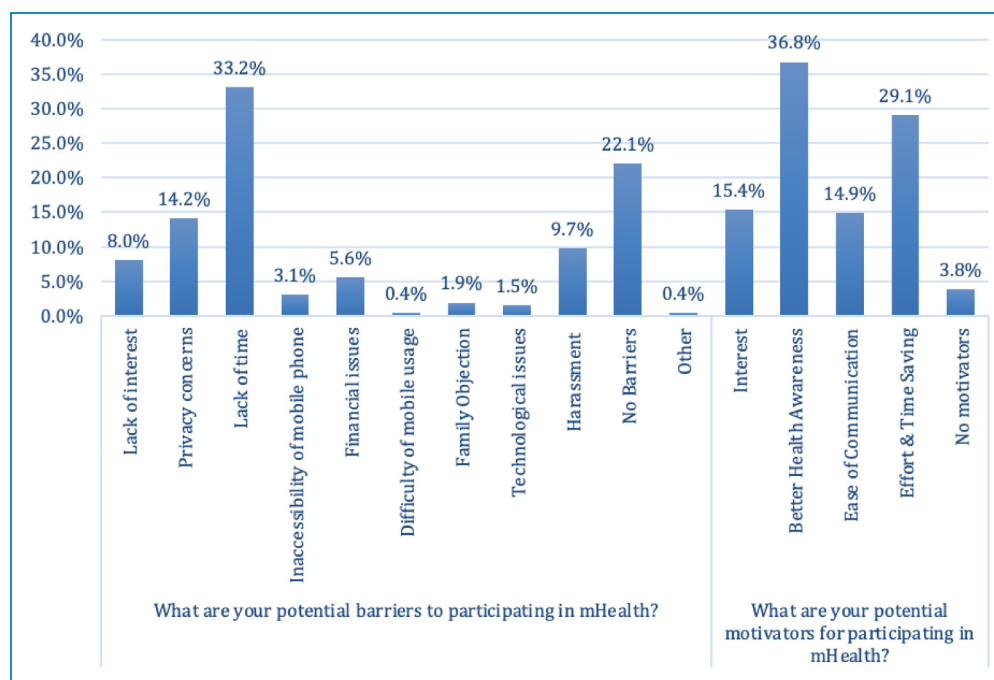
Figure 3. Bar chart showing women's motivators and barriers for using mobile phones for health promotion.

Table 3. Regression model predicting acceptability to receive information about oral health on mobile phones.

Parameter	Multivariate					Univariate				
	Adjusted odds ratio (aOR)	95% CI		Wald statistic	p-value	Unadjusted odds ratio (OR)	95% CI		Wald statistic	p-value
		Lower	Upper				Lower	Upper		
Age	1.00	0.98	1.03	0.13	0.717	1	0.98	1.02	−0.15	0.884
Living place (Rural)	1.50	0.86	2.61	2.02	0.155	1.04	0.69	1.62	0.18	0.854
Working (Yes)	0.73	0.45	1.18	1.67	0.197	0.96	0.65	1.39	−0.22	0.828
Has children (Yes)	0.83	0.55	1.27	0.72	0.395	0.86	0.63	1.19	−0.89	0.376
Educational level (Medium)	5.77	1.10	30.25	4.31	0.038*	4.47	0.95	23.54	1.9	0.057
Educational level (High)	10.36	1.83	58.58	6.99	0.008*	6.04	1.32	30.95	2.34	0.019*
Income level (Medium)	0.82	0.51	1.34	0.62	0.430	0.89	0.58	1.37	−0.52	0.603
Income level (High)	1.05	0.63	1.75	0.03	0.861	1.18	0.78	1.78	0.78	0.433
Has smart phone (Yes)	1.00	0.40	2.48	0.00	0.997	1.48	0.65	3.11	0.99	0.321

In pursuing this, we based our study tool on a theoretical framework of acceptability TFA (v2) which was grounded on an overview of a series of systematic reviews studying the acceptability of healthcare interventions. The framework consists of seven constructs, namely, affective attitude, burden, perceived effectiveness, ethicality, intervention coherence, opportunity costs, and self-efficacy. Two constructs (intervention coherence and opportunity costs), however, were omitted being inapplicable and difficult to exploit given that the intervention is still in its formative stage. In their work, Engdahl et al.[43] who assessed the "anticipated/prospective acceptability" of a digital intervention from the perspectives of service users, also omitted some of the TFA (v2) constructs due to irrelevance.

While our study tool was primarily designed to be used for in-person questionnaires, we had to harness virtual online approaches to reach the calculated sample size as the time of commencement of this study coincided with the era of the COVID-19 pandemic and its related restrictions. This was feasible by virtue of the massive number of mobile connections in Egypt that reached 91% of the entire population in 2020, as well as the high number of internet users in Egypt, which was 54% in January 2020.[44]

In our work, we adopted a gender lens and targeted women to counteract the underrepresentation of women in health research[45,46] and minimize the digital gender divide and other existing gender gaps in health and education. According to the 2023 global gender gap report,[47] Egypt's scores were inferior to those of the previous year, being the 12th country suffering from continuous expansion of gender disparities across different domains. Despite the high penetration rates of mobile phones, women still face access-related (first-level), as well as skill-related (second-level) barriers when adopting this technology,[48] resulting in a persistent gender-related digital divide.[49]

Mobile phones are a two-way media vis-à-vis one-way media (TV and radio), and thus women, particularly those residing in LMICs, consider them a source of liberation and valuable tools to connect to the outer world and self-select and expand their social network. This can alleviate their sense of isolation, boredom, and separation from their social networks and help them contend any confinement they face at home.[48] Furthermore, at societal level, women tend to be an influential group to target in matters of health promotion, not only for advancing their own health, but also for the key role they play in enhancing the emotional and physical health of their children,[50] including oral health. Evidence from multiple studies[51–53] strongly support the hypothesis that mothers' oral health practices and status directly affect their children's oral health-related quality in life not only in childhood but also later in adulthood.

Based on the study findings, over 80% of participants believed that mobile phones could be used in facilitating health promotion. One plausible explanation for that is the effect of COVID-19 on the use of telemedicine that increased 78 times in the first two months of the pandemic compared to pre-pandemic.[54] A number of studies have highlighted the potential benefits of mHealth in crisis management due to improved access to health information and services, particularly among those residing in marginalized and rural areas which are considered "health deserts."[55,56] Moreover, mobile technology has largely contributed to relieving the load on hospitals and facilitating patients' tele-triaging[57,58] hence reducing chances for acquiring infection due to close contact.[58,59]

Despite that, it is noteworthy that women in urban settings were significantly more willing to and interested in using mobile technology for health purposes. This could be attributed to the fact that access to information and communication technology in rural Egypt is restricted, where according to the 2018 United Nations report,[60] 84% of women in rural areas of Egypt did not utilize the internet. Infrastructural challenges such as unreliable or limited network connectivity, lack of outlets for purchasing mobile packages, financial constraints and limited technological literacy have also been cited as potential barriers to mHealth uptake in LMICs.[61] Those factors, in addition to the high illiteracy rates among women in rural Egypt that reached 39%,[60] could collectively hamper women's willingness to use mHealth.[58]

One prominent study finding also supports our postulations, where the odds of women using mobile technology for health promotion were significantly higher among those who had moderate to high levels of education. In a multi-country survey on access and usage of mobile phones in LMICs, the link between level of education and capacity to deal with mobile technical literacy challenges was also verified. In seven countries, including Egypt, women who were less educated were more prone to report difficulties in dealing with complex features of mobile phones and needed guidance even when sending an SMS.[62]

Other barriers to utilizing mHealth interventions were reported in this study. The most accounted for was lack of time which, according to a recent scoping review,[63,64] was also cited in a number of other studies as a major factor for reduced uptake of mHealth Apps. In our study, around 50% of the sample were identified as mothers and over 75% were employed. Without exceptions, on the global level and across different regions, socio-economic classes and cultures, women are usually time-poor due to spending disproportionately larger amounts of time on unpaid care work when compared to men.[65] Not to mention, working mothers, who face "double workload" to balance job and family responsibilities, are left with even less time and energy for self-care[66] and thus, become indolent to learn or integrate any new activities in their daily lives.[58]

Privacy concerns were also perceived as barriers by 14% of study participants which goes in line with previous

studies.[58,63,64] In a conservative community like Egypt, it is not uncommon that women would be worried that participating in mHealth interventions might increase potentials for mobile data breaches or data leakage. Added to that are other severe repercussions such as loss of control over personal information and risk of exposure to online stalking and harassment, the latter being cited in the current study as the third barrier to using mobile technology for health purposes. According to a recent study,[67] which explored cyber abuse in a sample of Egyptian women through an online poll distributed over Facebook and WhatsApp, 85% of participants had been subjected to some form of cyber harassment either through social media platforms (52.7%) or via mobile phones (43.2) and over 64% had this experience at least three times.

On the other hand, interestingly, along with eagerness to raise their health awareness (36.8%), "effort and time saving" was identified as one of two main motivators (29%) for using mHealth interventions among study participants. Similarly, in a recent scoping review[58] that identified the potential benefits of using mHealth in LMICs in the critical era of the COVID-19 crisis, a number of studies reported that mHealth was able to alleviate transportation issues and lessen the time spent by people seeking medical care or advice, resulting in better access to healthcare services, and hence, high users' satisfaction.

Although, in the recent years, multiple social media platforms have been used for promoting oral health, selecting the preferred platform by intended users is critical for the success of an mHealth intervention.[68] In our study, when asking participants about their preferred messaging application for receiving oral health information or reminders about oral hygiene maintenance (e.g., toothbrushing/flossing), WhatsApp was the application of choice. WhatsApp, the second most preferred application in Egypt in 2023, is central in Egyptians' everyday communication,[69] and is regarded as an effective method in delivering health information, particularly in settings with poor internet speeds. It is also regarded as a secure tool with end-to-end encryption, for confidentiality, that allows instant messaging with no complicated social network registration.[70,71] A recent systematic review[68] has described WhatsApp application as a cost-effective strategy in promoting oral health by improving knowledge and enabling people to better adhere to healthier lifestyles.

On the other hand, the majority of women, in our study, preferred receiving reminders about their dental appointments via SMS. According to Schwebel et al.,[72] SMS has been shown to be a very effective tool for appointments' reminders, where it has been associated with higher rates of attendance, fewer missed appointments, and interestingly, higher number of in-advance cancellations which is more advantageous than not showing up as it saves time for healthcare providers and allows alternative patients to receive care. While WhatsApp was preferred by the majority of women for receiving oral health information and oral hygiene reminders, it could be postulated that women might have preferred SMS for appointments' reminders as they might have regarded it as a more reliable tool in case of inaccessibility to internet connectivity to avoid missing the reminder message if sent via a smartphone application. This is especially true in rural settings where Information and communications Technology infrastructure is usually inadequate and access to mobile networks and electric power seems to be a challenge.[73]

Although the study sample was drawn from multiple areas across Egypt, our results cannot be generalized due to the cross-sectional nature of the study. Moreover, due to the inherent nature of both methods of participants' recruitment, namely, the convenience sampling and the respondent driven sampling, there was limited control over the sample characteristics. This has resulted in an unintended homogenous sample with regards to "education" and "income" levels of the participating women. Furthermore, smartphone users were exclusively enrolled as the essence of the study was to investigate women's capabilities and preferences to utilize smartphone applications to deliver mHealth interventions, and thus, non-smartphone users could have had different acceptability levels and preferences. Accordingly, exploring the acceptability of using mobile technology for oral health-related purposes in a more diverse sample is highly warranted in the future to ensure that the study findings are more applicable on a wider audience.

Despite that, it is worth mentioning that this is the first study in Egypt to apply Sekhon's TFA in testing the prospective acceptability of using mHealth interventions for oral health promotion from potential users' views. This was done given that when interventions take into account the needs, culture and circumstances of the target population they are more likely to be well received and used by them. Additionally, targeting women in our study would not only result in the enhancement of their oral health awareness and status, but could, potentially, influence the attitudes and oral health status of their children, positively.

Conclusions

Through this work, positive perceptions of Egyptian women about the efficiency of mobile phones in promoting access to health-related information and quality services have been verified. Familiar, easy-to-use social media platforms such as WhatsApp is an ideal starting point to introduce mHealth interventions to Egyptian women in different settings, however, meaningful steps should be undertaken to address concerns regarding harassment and privacy.

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