



Acceptability of a Mobile App-Based Intervention Program for Choosing Mode of Delivery among Pregnant Women

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ABSTRACT

Aims Maternal health and pregnancy outcomes are vitally important areas of each country's healthcare system. This study aimed to investigate the acceptability of a mobile app-based intervention program for choosing the mode of delivery among pregnant women.

Materials & Methods Thirty pregnant women participated in this study. The Mobile App-Based Program focused on facilitating choosing mode of delivery based on information, motivation, and behavior model among pregnant women in Tehran, Iran. A retrospective post-intervention study was carried out. We used quantitative and qualitative semi-structured interviews to explore the experiences of women participating in the Mobile app-based program and investigate the intervention's acceptability.

Findings Quantitative result has shown that 76.6% of the users assessed the application as usable. In the qualitative section of the study, three main themes were emerged: 1- specific features of the App (images, text, colors, and etc.); 2- advantages (distance learning method, reliability, and credibility, being user-friendly and comfortability, time-saving, and being interactive); and 3- disadvantages (fear of mobile radiation on fetus, poor internet connection, and limited audience) regarding using of the intervention.

Conclusion This mobile application eased women's knowledge and behavior and satisfied them, specifically during the new-emerged pandemic. It also helped women to clarify their thoughts regarding their choice on mode of delivery. Participants suggested some shortages using the application that should be noticed.

Keywords Patient Acceptance of Health Care; Mobile Application; Cesarean Section

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Introduction

Maternal health plays an incredible and crucial role in the health care system globally [1]. The rates of Unnecessary Cesarean Sections (UCS) have risen dramatically across the world over the past years [2, 3]. UCS is a significant threat to women's health, although the benefits of CS have been approved previously for mothers and their infants [4]. In Asia, Iran has the most UCS [2]. Several interventions have been conducted to decrease the UCS in recent years. In 2014, the Ministry of Health brought in policies and suggested some strategies to diminish this up-going trend, such as free vaginal delivery in public hospitals, mother-friendly hospitals, educational reforms, and financial incentives to overcome this problem. However, it was not effective in the long term [5]. Therefore, further steps are needed to be taken to address this issue besides these strategies.

Nowadays, using technology to educate people is booming and mobile application is considered a new way of educating all folks of people. It is clear that we live in the "mobile health revolution" era [6].

The importance of technology, especially mobile applications in education has become bolder during the COVID-19 Pandemic. Moreover, some features of this way of educating, for example, the ability to reach more target groups and the efficiency of this method, expand its use [7]. In other words, using mobile-based intervention, as a non-clinical intervention, has a substantial part in the COVID-19 pandemic [8]. Using Mobile-Health application (MHA) intervention has a profound impact on health care delivery programs, awareness, and changing unhealthy behavior in all aspects of a person's life in light of the economic and practical barriers to treatment [9]. MHA, nowadays, has been seen as a less expensive method of delivering a system of health messages to a target group [10]. Since it is a relatively new way of education, there are limited studies regarding different aspects of using the mobile application as an educational intervention among people [11]. However, several studies have shown that using mobile applications reduced the cost, and improves healthy behavior among the users [12-14]. For instance, in a systematic review that has been done to investigate the effectiveness of using mobile applications to deliver health services, findings showed positive improvements [15]. Moreover, patients' relationships with healthcare professionals and their interactions can positively improve by using mobile applications [16-17].

The use of mobile health apps is now common. However, there could be a plethora of studies that intervened and implemented interventions via mobile applications. Acceptability of these tools can help predict further use of this kind of education and help identify how to improve it [18]. Satisfaction with

using an application can improve the quality of education [18].

It is crucially essential to investigate the acceptability of this device to reveal that it suits the target groups. In this study, we assessed the women's point of view regarding using a mobile application to find out whether the mobile application (Easy Birth mobile application, which was designed to help pregnant women to decide about their mode of delivery) is good enough to satisfy the users' needs and requirements. Thus, this study aimed to investigate the acceptability of a mobile app-based intervention program for choosing the mode of delivery among pregnant women.

Materials and Methods

In this study, a retrospective post-intervention qualitative interview evaluation was used to examine participants' experiences. The purposive sampling method was used to recruit the participants. Recruitment was via invitation for those who have been expressing an interest in participating in the qualitative study post-intervention. The saturation of relevant themes was achieved by interviewing 30 women who had completed training in the intervention phase. We asked about their experiences of using a mobile application to choose a mode of delivery. One-on-one interviews were recorded and then verbatim by one of the researchers via hand-typed notes. Women who were interested and had participated in the trial were included. We invited both women with Cesarean section or vaginal birth experiences to the study.

The demographic information of participants was gathered using a questionnaire that contained items such as age, income, educational level (pregnant women and their partners), employment status (pregnant women and their partners), number of births, number of pregnancies, current gestational age (at recruitment), number of live children, history of infertility, history of illness, date of birth. To assess the Mobile application usability by pregnant women, we used a 5-scaled questionnaire with 17 items attached at the end of the Easy Birth Application [19]. The step of designing an application is presented in Figure 1. The Easy Birth mobile app development process was divided into three phases. In the first phase, we conducted a systematic review to determine different kinds of interventions [3]. Then based on the phase one findings, a four-arm intervention was carried out. The conclusion showed that the Easy Birth mobile app intervention improved women's intentions and self-efficacy more than other face-to-face interventions.

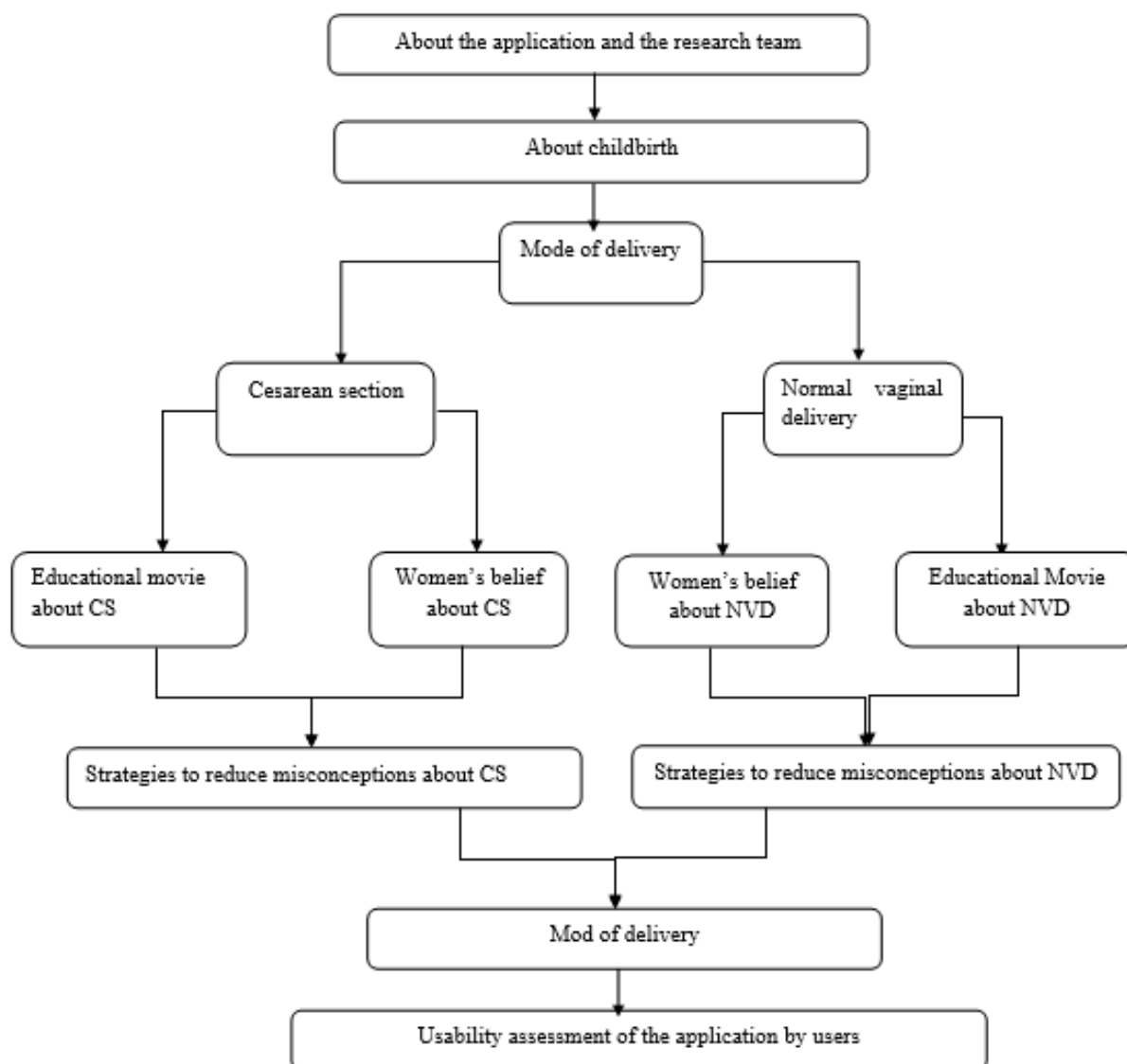


Figure 1) Steps flowchart of designing the Easy Birth mobile app

This study was approved by the Tehran University and Medical of Science. The principles stated in the Helsinki II Declaration were followed. All participants received oral and written information about the study. A four-armed clinical trial intervention study was carried out in a private hospital (Ebne-Sina) in Tehran, Iran in 2019. A total of 120 pregnant women participated in the study. Participants were randomly assigned to four groups (three interventions and one control group). The intervention groups included the following: 1- face-to-face information, motivation, and behavioral skills model (IBM); 2- information, motivation, and behavioral skills model provided using a mobile application (IBM-App); and 3- motivational interviewing (MI). The first group of pregnant women in the IBM group received face-to-face training programs in three sessions of 45 minutes. For the second group, we used The Easy Birth mobile app, which was designed for the aim of the

study based on IBM. The third intervention group was included in the MI intervention program and received training programs for three 45-minute sessions. The fourth group, which was the control group, did not receive any specific intervention program. The protocol of this study was previously published [20].

All participants in the IBM App interventional group were invited to participate in an in-depth interview via telephone (Due to the COVID-19 Pandemic, we could not interview face-to-face) that aimed to describe their experience of participating in the Easy Birth mobile app intervention to choose the mode of delivery. In-depth interviews were used to interpret the women's individual experiences [21]. Our initial topic guide and study procedure were developed following three pilot semi-structured interviews. For reducing acquiescence bias, interviews were conducted by a team member who had no direct role in intervening and communicating with participants.

We called women to ask them about their free time. We interviewed the women in a quiet private place to allow them to talk freely about their intervention experiences. Interview questions were designed to extract the women's understanding of the IBM App intervention. Several experts developed and reviewed these questions in qualitative research and mobile app interventions. The questions included women's intervention experiences and the benefits and challenges of using the Easy Birth mobile app for training and decision-making:

-What is your experience with using the Easy Birth mobile application regarding choosing the mode of delivery?

Neutral initial question:

-What are your views on the quality of educational delivery?

-Can you please tell me your opinion about this type of education?

-Could you please tell me about the usability of the software program that you used?

-Are you satisfied with the mobile software program? If yes, how? If not, why not?

-Have we missed something you think is important about this Mobile application?

-In the end, is there anything you would like to add?

Interviews were carried out for approximately 45 minutes. Recorded interviews were transcribed verbatim. No repeat interviews were carried out. Before the interviews, we informed all participants about the study objectives, procedures, and audio recording; and provided oral consent before initiating the interviews. Also, we assured them that they could discontinue the telephone voice recording at any point or refuse to answer any questions that they did not feel comfortable answering.

The Easy Birth application usability was assessed using a 5-scaled Likert questionnaire divided into three levels. If the score was between 17-40, the app's usability was weak. If the score was 41-60, the usability was moderate, and if the score was 61-85, the usability was good (Appendix 1). A thematic analytical approach with a phenomenological lens, focusing on women's experience from the Easy Birth mobile app intervention, was used to analyze the data. The researchers coded the concepts of data independently to assist in validating the findings. We read twice the transcripts to categorize and understand concepts. Finally, we discussed how to sort them into themes and subthemes.

Findings

Most of the participants were 18-30 years old, nulliparous, and employed (Table 1).

Table 2 shows the assessment of the usability of the Easy Birth mobile application by pregnant women. Based on the women's assessment, most women had assessed this App as a usable device.

Table 1) Demographic characteristics of the information, motivational and behavioral skills model through the mobile application

Variables		N	%
Age (Year)	18-30	13	43.3
	>30	17	56.7
Parity	Nulliparous	21	70.0
	Multiparous	9	30.0
Number of previous deliveries	1	22	73.3
	2	5	16.7
	2<	3	10.0
Number of children	0	24	80.0
	1	4	13.3
	1<	2	6.70
Ethnicity	Azari	21	40.0
	Fars	7	46.7
	Kurd	2	10.0
	Others	1	3.3
Income per month (Million Rial)	<50	17	56.7
	50-100	13	43.3
Education level	Under diploma	1	3.3
	High school diploma	8	26.7
	college or university	21	70.0
Spouse's education level	Under diploma	3	10.3
	High school diploma	6	20.7
	College or university	20	69.0
Job status	Employed	20	66.7
	Housewife	10	33.3
Prenatal education	No	21	70.0
	Yes	9	30.0

Table 2) Assessment of the usability of the Easy Birth mobile application by the participants (N=30)

Ranking	N	%	Min	Max
17-40 (Weak)	1	3.3	32	85
41-60 (Moderate)	6	20.0	54	85
61-85 (Good)	23	76.6	82	85

Three final themes were identified: App features, advantages, and disadvantages of the Easy Birth mobile application (Table 3).

Theme 1: App Features

The app developers provided visual guidance to help users how to navigate this App.

Overview of the specific features of the application

Most users commented positively on the "Easy Birth Application" as their favorite feature. Aesthetics, color contrast, annoying features, font and size, layout, and tactile feedback were assessed as practical and functional. In addition, the images and depictions of the App were understandable and clear adequately. Participants expressed that the application structures were easy to use and no need to know about them. Women said that the intuitive usability of the application was pleasant for them. From their point of view, the interface design of this application was pleasurable. Using simple and easily understandable features of the App was addressed chiefly.

One of these participants expressed that: *"I think the simple feature of an application can be the best feature of it... and this application was one of the best."*

Multiple participants also spoke positively about using some short video features about natural and Caesarean Delivery methods. They said that using this mobile application was simple for them, and it was one of the positive aspects of this application. A woman opined that: *"For me, it was very structured, and you would not get lost... it was not confusing."* Also, they addressed that visual clues help them navigate easily through content. Participants described that it could be challenging to take up excessive space or memory by application. So, they are eager to choose App which uses low space and memory on their mobile. A user of this application addressed that: *"An application that takes up much space and takes up memory is annoying, ... it (Easy Birth APP) take a little space."*

Theme 2: The advantages of using the Easy Birth mobile application

Distance learning method during the Pandemic

A common sentiment that arose during interviews was that most women find this way of intervention a new teaching method during this technological era. They believed that face-to-face maternal educational classes are shrinking, especially during the newly emerged respiratory Pandemic (COVID-19). Thus, women declared that mobile applications were an independent platform to access health-related information without interference or oversight and flexible timetable. They believed that online education and remote instruction are unique because they did not miss any training classes at all with distance learning, but they might not receive full training in face-to-face classes. A woman expressed: *"It is apparent that the world has moved towards virtual education and women's education classes are no exception to this rule."*

This kind of teaching class was a new teaching strategy versus a traditional classroom for pregnant women as they are in the danger group for COVID-19 disease.

"Why do we have to go a remote distance to attend a maternal class when we can use an application" (participant 12)

Reliability and credibility of the APP's content.

Receiving health-related information from reputable and legitimate sources was crucially important for women. Beyond dispute, people are faced with massive information nowadays than they used to, especially in the health and medicine field. Therefore, they may be confused about trusting this broad spread of information. In terms of this issue, some believe that they access plenty of data on the Internet. Using a trustworthy source of information could help them decide which mode of delivery can be the best choice to deliver their baby. In other words, they could not rely on the information presented on some websites or social media because

reliable information resources were their concern. They preferred to choose apps developed by experts in health-related field more than from unknown sources.

One woman said that *"we could click just by using buttons, but we cannot trust the information we receive from some sources; for me, it was (using the mobile application) a reliable source."*

Some women explained the difficulty of determining which information could be trusted nowadays. Many participants were uncertain which internet-based or social media content is valid. Still, this App can be good lighting for this data.

"As you know, there could be found plenty of sources which we can gain information about our mode of delivery, but for me, it was a source which I trust it because I've received it from the hospital" (participant 4)

User friendly and comfortability

A user-friendly mobile application should be clear, neat, and understandable for target groups, and it does not matter how it is revolutionary. Many women stated that this application was straightforward to learn how to use it. They believed that it was an easy, comfortable, and quick way of gaining information, and they 'don't need to search any other sources. They thought there was no need to register, and it was not challenging to understand all of this tool's features. A woman said: *"Among the complex applications that we use every day, it was straightforward to use."*

Convenience was one of the crucial factors why women engage with health apps.

"The most crucial feature of this application was that it was easy to work with; nothing was complicated." (Participant 24)

Time-saving and Setting aside the limitations of face-to-face classes

From some women's point of view, using this application saved their time. They believed that joining maternal educational classes held in hospitals to educate women regarding the mode of delivery could waste their time because most of them were employed. They do not have any additional time to devote their time to joining face-to-face classes. So that they claimed using this way of gaining information can be time-saving for them. *"If I had gone to face-to-face classes, it would have been difficult for me, and I would miss these classes, but I did not have this problem with the App, and I was able to access the information at any convenient time"* woman declared.

Also, low cost and easy access regardless of time and geographic location were some women considered. They expressed that they can access the information anywhere; however, they have to commute a long distance to access some data in a face-to-face class. The flexibility of learning via

Mobile applications anywhere, anytime was a positive point. One response of them was: *"I no longer have to go a long way for maternal class.... I can sit in my home and read about which mode of delivery can be suitable for me...."*

The interactive nature of the App and in touch with health care providers during the COVID pandemic

Most women stated that during the Pandemic they could not access their doctors. The Mobile application (m-health) provides them with a platform for obtaining health information and interactions with health professionals and their recommendations. This software gives clear directions to women about choosing their mode of delivery and how to handle this situation. They indicated that using the mobile application, especially during this Pandemic, can help them be in touch with healthcare providers. M-Health apps can improve interactions with the health care system Simply.

"If this App weren't, I wouldn't have gone to educational classes at all... because of Corona." (Participant 8)

Facilitate decision making

The participants stated that this App was a decision supporter because they seemed too confused regarding their mode of delivery. Some of them said they could not make decisions about their mod of delivery. But this application clears their thoughts. However, some of them discuss their interpretation with the healthcare personnel and obtain verifications. It was noteworthy that the software discussed both deliveries and did not recommend or reject either delivery method and left the decision to women. All in all, it presented the challenges and benefits of both modes of delivery. It left the decision to women to determine their mod of delivery and has not dominated experts' views about one type of childbirth.

"It was interesting to me that it talked about each mode of delivery, and in the end, I decided what kind of delivery to do based on my circumstances."

Women expressed that this App presented different options to them about both modes of delivery. Finally, they weighed the advantages and disadvantages of both modes of delivery. They compared and decided which could suit them. To put it another way, they were satisfied with balancing aspects of the choice of this application; finally, they decided on their mode of delivery.

Practical training tailored to the needs of participants

They stated that the content seemed to be tailored. The main feature of this intervention was that health messages had been adjusted based on the characteristics of the message recipient. What women needed was addressed. For example, this enables them to choose the information tailored to

women's needs, enabling them to make the right decisions. *"It was interesting for me to find all of the questions that I need to be answered by someone"."*

Most of these App users agreed that this application is a valuable information source and motivates them to think deeply about the proper mode of delivery. The practical solutions to the stress and fears of natural delivery were noticeable, and how to tackle this issue was practical for women.

Privacy and Security

Multiple users also mentioned that there was no complex registration feature. This complex registration feature led to trust in the App because most apps need to enter their identifications. It may decrease the user's motivation to continue with the program. The following respondents expressed that they did not have any worries regarding data security. Personal safety was women's concern about installing an application on their mobile. *"Most of the apps that I've used need some identity of users I can't understand why they need our information... I can't trust them."* (participants 3)

"You know when an application requests user identity, you doubt...but in this application did not request your identity."

Theme 3: The disadvantages of using the Easy Birth mobile application

Fear of side effects of mobile phone use on the fetus

Using cell-phone during pregnancy was a concern among women. They stated that there could be a positive correlation between using Cell-Phone and the risk of preterm birth. From their perspective, mobile radiation can suffer a fetus. Therefore, they are eager to join face-to-face classes rather than a mobile application. A respondent stated, *"I heard that cell phone radiation could cause a baby to be born defective."*

Poor Internet connection

Most participants maintained that they could not connect to download videos easily due to poor internet connection. Most smartphone applications need a cell phone signal or Internet connection to access the content. Participants suggested offline connecting. There is need to be mentioned that some part of the application was offline.

Limited audience: Choosing a mode of delivery depends not on women's decisions because it can be related to significant others. Spouses or partners of pregnant women or their family and friends have a determining role in women's decisions about their mode of delivery. In that case, most of these App users who were pregnant women declared that this application should have noticed their partners because they have a crucial role in their decision-making.

Why did you only address women in this App? I wish this information was given to our husband as well. A

woman added.

The limited target audience is considered by women as a target group of this mobile application. They

opined that there is a need to inform and train their husband/partner as a critical determiner of this decision-making.

Table 3) Summary of initial concepts, emergent themes, and final themes.

Categories	Subthemes
App Features	
Overview of the specific features of the application	Clear images and depictions of the App Using simple structures, without any complexity Using different colors and fonts and sizes and graphical format of the App Intuitive usability Simple buttons and click area Security and protection of the password Easy to use and pleasurable (interface design) Short video features Space and memory take-up
The advantages of using the Easy Birth mobile application	
Distance learning method during Pandemic	A new method of learning Fading traditional classroom Virtual education Flexible timetable Pregnant women high-risk group for COVID19
Reliability and credibility of the APP's content	Reputable and legitimate sources A trustworthy source of information Validity of the content
User-friendly and comfort ability	Clear, neat, and understandable Simple and straightforward to learn how to use No need to register
Time saver and set aside the limitations of face-to-face classes	Not complicated Low cost Flexible Access anytime and anywhere to the information
The interactive nature of the App and in touch with health care providers during the COVID pandemic	Interactions with health professionals Be in touch with maternal training
Facilitate decision making	Decision-making assistance Information about risks and benefits of vaginal delivery and CS Not dictate one mode of delivery
Practical training tailored to the needs of participants	Adjusted based on the characteristics Met their needs Practical information Encouraging users to continue by giving them motivations
Privacy and Security	Practical skills No fear of identification stolen Worries regarding data security Personal safety Data health security
The disadvantages of using the Easy Birth mobile application	
Harmful mobile radiation in pregnancy	Effect of Mobile radiation on the fetus Effect of Mobile radiation on women's health Worries regarding mobile use during pregnancy
Limited audiences	Providing information for women's partners/families
poor Internet connection	Limited access to internet connection Preference for offline content

Discussion

Over the past few decades, the use of mobile- health in health care and public health due to low cost has dramatically increased, and the effectiveness of these kinds of interventions and methods of changing unhealthy behavior has been approved [15]. It is also applied in maternal and perinatal health as a practical tool, especially in developing counties [22]. This study aimed to identify the acceptability of a Mobile- Application (Easy Birth Application) during pregnancy and before birth among pregnant women post-intervention.

In Iran, a limited number of usability studies evaluated health apps via qualitative and quantitative methods. Additionally, there is a lack of

studies that actively involve pregnant women in the usability testing of Apps, which this study seeks to address.

The findings of this study highlight several valuable features and challenges that a healthcare provider and App developer may consider in the development and implementation of health Apps. Developers may use them to design their apps to raise users' satisfaction and technology adoption.

We found three critical factors regarding women's experiences of using a mobile application via interviews.

In recent decades, smartphone applications have played a pivotal role in delivering health care services and implementing health interventions.

According to the study's findings, 76.6% of the participants assessed the usability of the Easy Birth mobile application at a reasonable level. This evaluation includes Comprehensibility, Presentation (Image and Text), Usability, and General characteristics of the App. During the intervention, most of these App users remarkably considered the Easy Birth Application's visual features and easy navigating. The importance of clean and simple interfaces and direct interactions with a mobile application is inevitable for everyone.

Our result revealed some merits regarding pregnant women using the Easy Birth Application. Distance learning, especially during the COVID-19 Pandemic, was one of the advantages of this application for the users. The importance of distance learning is crystal clear nowadays for everyone and how it brings about significant change in the education system is irrefutable [23, 24]. Reliable and credible health information resources are a concern among people nowadays more than before; thus, access to trustworthy information was a great advantage of this mobile application. A study conducted by Dennison showed that it was vitally essential for users where and who developed the program that was in line with our findings [25]. The unknown and less reliable sources are not convincing [25]. If users stop using the Apps due to a lack of trust, the potential of m-Health will not be realized [26].

Being user-friendly and comfortable was the advantage of the App stated by the women. The interactive nature of the App; being in touch with healthcare providers during the COVID pandemic and facilitated decision-making were other pros of this application. Due to the booming mobile industry, modern communication tools are utilized widely by doctors and nurses as a method of communication with patients [27], and this technology can improve users' knowledge and help them change unhealthy behaviors [28]. Yuill et al. showed that women in the decision-making process of choosing the type of delivery usually consider the different options and weigh the advantages and disadvantages of the modes of delivery [29]. In this study, women also believed that their decision-making process was facilitated and they could make decisions by comparing Cesarean section and vaginal delivery benefits and side effects.

The practical training tailored to the needs of participants and privacy and security were other pros of this application. Many women believed that this App was a valuable source of information and provided practical solutions to their fears and anxieties. Dennison et al. and Wei Peng et al. have confirmed that smartphones are useful information sources and raise users' awareness [25, 30]. One of the most important benefits of the Easy Birth mobile application from the participants' points of view was the security and privacy of the data. While in other

studies, security and privacy have been mentioned as concerns of users when they want to install the application on their mobile phone [26, 32]. This shows that people in Iran trust healthcare providers and the information they provide to them. Healthcare includes privacy issues for patients and health care providers mostly is prevent unauthorized persons from accessing medical records and private information [31]. Many mobile apps could not keep their health data private and secure [26]. Even though M-Health enables users to manage their health, this shift from the doctor's office to mobile apps raises many privacy and security concerns [32].

Besides these merits of the Easy Birth mobile application, we found limitations and demerits which women addressed during interviews, such as their fear of the negative effect of mobile radiation on their fetus, poor internet connection, and limited audience. However, studies showed no association between cell phone use during pregnancy and infant health at six to 18 months of age [33]. In Dutch [34] and Spanish [35] birth cohort studies, no association was found between prenatal exposure to cell phones and behavioral problems at the age of five and a child's early mental development. However, further studies are needed to address this concern; Therefore, women are advised to manage their cell phone usage time during pregnancy. Nevertheless, m- health is also applied in the field of maternal and perinatal health as an effective tool especially in developing counties [22].

We found that the Easy Birthday app has a limited audience. Women wanted their husbands to be the audience of this App. A meta-analysis study in Iran showed that women were influenced by information received from friends and family, husbands, and doctors to choose the type of delivery. [36]. So, widening the audience of such Apps to spouses should be considered in other interventions.

We investigated the perspectives of the women towards our App and found the strength and weaknesses post-intervention. Assessing the acceptance of an intervention is a crucial phase of implementation studies. However, there could be limitations due to the nature of the qualitative studies; these findings may not necessarily be transferable to other applications and settings. Further studies are needed to be carried out to determine the effectiveness of this mobile application.

Conclusion

From women's point of view, using the Easy Birth mobile application could help them to clarify their thoughts about their choice of mode of delivery. It could satisfy women's informational needs during pregnancy. Mobile app usage eased women's knowledge and behavior, specifically during a new-

emerged pandemic. Participants, however, mentioned some shortages using this application.

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(25%); Hajimiri Kh (Second Author), Methodologist/Assistant Researcher/Statistical Analyst/Discussion Writer (25%); Abedini M (Third Author), Assistant Researcher (25%); Shakibazadeh E (Forth author), Methodologist/Assistant Researcher/Statistical Analyst/Discussion Writer (25%)

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Appendix

Appendix 1) Evaluation of usability of Easy Birth application by users

Main criteria	Sub-criteria	Description of characteristics
		5-point Likert scale (1= does not apply at all; 5= does fully apply)
Comprehensibility	Use of understandable semantics	Avoidance of foreign language and technical terms Use of generally intelligible symbols and terms If necessary, provision of additional explanations Self-explanatory images and depictions, understandable without further support and explanations
	Simple comprehensibility and interpretability of displayed images and depictions	
	Simple, self-explanatory menu structures	Easily understandable and internally consistent menu structures Avoidance of strong hierarchical menu structures and too many functionalities
Presentation (Image and Text)	Sufficient color contrast	Clear, distinguishable colors for images and depictions or choice of color-neutral depictions Avoidance of too glaring colors
	The large size of operating elements	Sufficient size of the screen, as well as input and output, fields
	Ability to adapt the size of operating elements and displayed images	Ability to adapt the size of operating elements and displayed images according to individual needs, capabilities, and preferences
Usability	Instant and easily understandable feedback	Instant response to entered data, including easily understandable error messages in case of erroneous data input
	Intuitive usability	Ability to use the application without prior knowledge Ease of learning Fast achievement of the first feeling of success
	Simple recognition of click-sensitive areas	A simple distinction between click-sensitive and non-click-sensitive areas, also without prior knowledge of the features of the touch screen technology
General characteristics	High fault tolerance/efficient fault management	Reducing the probability of erroneous data input by limiting choice to meaningful values Efficient proofreading mode and/or helpful user feedback, for example, in case of erroneous data input
	Password-protected services	Avoidance of registration at online platforms (but partly contrary to data protection regulations)

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