



# Telemedicine and Pregnancy Care from the Perspective of Iranian Pregnant Women: A Study Based on the Technology Acceptance Model

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## Abstract

**Background:** It is apparent that telemedicine will only be a useful health service when individuals start using it. Therefore, the general attitude of end-users toward the acceptance of telemedicine services will play a significant role.

**Objectives:** The present study is the first step in designing telemedicine services for pregnant mothers, with the aim of investigating the views of pregnant women regarding receiving tele-pregnancy care using the technology acceptance model (TAM).

**Methods:** This cross-sectional study was conducted during the year 2021 on 200 pregnant women with gestational age of more than 12 weeks selected through simple random sampling in Karaj, Iran. The telemedicine acceptance questionnaire based on an extended TAM containing 25 questions in nine constructs was used to collect data. Descriptive statistics, including frequency, percentage, mean, and standard deviation (SD), were reported.

**Results:** In this study, the mean age of the participants was 25.29 (SD = 5.62) years. A significant majority, specifically 95.5% of the participants, displayed a high level of acceptance toward incorporating telemedicine into their healthcare routine. In addition, the lowest mean scores of domains were related to technology anxiety, 26.18 (SD = 16.17), and perceived risk, 26.83 (SD = 16.26), respectively.

**Conclusions:** Based on the TAM, the results of this study highlight the readiness and acceptance of pregnant women toward receiving tele-prenatal care.

**Keywords:** Prenatal Care, Telemedicine, Technology Acceptance Model, Pregnant Women

## 1. Background

Healthcare will not always occur in the context of peace, prosperity, and social order, a point often ignored in medical practice. The coronavirus disease (COVID) pandemic, which began at the end of 2019, and its global spread within a short period has resulted in enormous health, economic, and social challenges and dramatic changes in healthcare (1). The COVID-19 pandemic has led to mandatory quarantines in all countries of the world. Curfews have also been imposed due to the outbreak, resulting in many hospitals and health centers providing only emergency services. As a result, the use of health facilities by recipients of healthcare services, particularly pregnant women, has been restricted (2-5). However, factors contributing to the prevention of women from

receiving care during pregnancy and childbirth, in addition to pandemics, include poverty, delays, lack of information and awareness, lack of adequate health services and skilled health professionals, home births, and cultural practices (6). Technologies, such as computers, smartphones, communication systems, and e-health applications, can play a significant role in minimizing these factors and can significantly decrease maternal deaths around the world (6-9).

According to the recommendations of the American College of Obstetricians and Gynecologists (ACOG) and the Centers for Disease Control and Prevention (CDC), some virtual visits replace routine prenatal care to limit prenatal exposure to COVID-19. Prenatal care models have been implemented using remote appointments (6, 10, 11). Routine and high-risk prenatal care can be delivered safely

through telehealth (12). Prenatal care visits that do not require laboratory tests, ultrasounds, vaccinations, or physical exams can generally be conducted via telemedicine (9, 13, 14).

Telemedicine is an essential tool that enables continuous care during natural disasters and public health emergencies. During an epidemic, telemedicine can also reduce the spread of disease by facilitating social distancing and enabling the evaluation and/or follow-up of infected patients in home quarantine (14, 15). Not only has telemedicine provided subspecialty care for remote areas, but it is also more cost-effective for both patients and providers through savings in travel time and costs, as well as savings in clinic staff time and infrastructure (16).

The acceptance of new technology by an individual, done voluntarily, is referred to as technology acceptance. The willingness of users plays a vital role in the successful implementation and utilization of technology (16-19). Several obstacles, including insufficient social support, inadequate technological resources, and patients' preferences hindering acceptance, have been identified (19-21). Therefore, it is crucial to assess patient acceptance during the initial development and evaluation of digital health interventions (20). The technology acceptance model (TAM) predicts the acceptance of new technology among users and highlights the problems of information system design before its use becomes common among individuals (18). The swift advancement of technology, accompanied by decreased barriers to its utilization, might contribute to an increased level of acceptance toward telemedicine. Assuring patients that the traditional approach of in-person care will not be completely replaced could potentially enhance their acceptance of telemedicine (18, 22, 23).

## 2. Objectives

In Iran, during the outbreak of the COVID-19 pandemic, the number of face-to-face pregnancy care services was reduced, and some care services were replaced by telephone follow-up. Since today, a new perspective has been opened in providing telemedicine services all over the world, the level of acceptance among Iranian pregnant women at present remains uncertain. The present study is the first step in designing tele-prenatal care in Iran, with the aim of examining the acceptance of Iranian pregnant women regarding receiving tele-pregnancy care.

## 3. Methods

### 3.1. Design

This was a cross-sectional study conducted on 200 pregnant women who were referred to comprehensive health centers in Karaj (the capital of Alborz Province, Iran) during the COVID-19 pandemic in 2021.

### 3.2. Ethics

This study was approved by the Ethics Committee of Alborz University of Medical Sciences (IR. ABZUMS. REC. 1399.233). All the participants read and signed a written letter of consent. The confidentiality of information was maintained, and the participants were allowed to leave the study at any stage.

### 3.3. Participants

This study involved the participation of pregnant women who received a portion of their prenatal care remotely as a result of the COVID-19 pandemic. The inclusion criteria were 12 weeks of pregnancy and above, having Iranian nationality, being literate in reading and writing, mastering the Persian language, and having a smartphone. The exclusion criteria encompassed incomplete questionnaire submissions.

### 3.4. Sample Size Estimation

By using the formula to estimate the proportion of a qualitative trait in a community, taking into account the frequency of 0.5 and the accuracy of 0.075, alpha 0.05, and d 0.2, the sample size was at least 171 subjects, which was obtained by considering 15% drop out of 200 participants.

$$n = \frac{Z_{1-\frac{\alpha}{2}}^2 pq}{d^2}$$

### 3.5. Sampling Method

During the COVID-19 pandemic, there were 30 comprehensive health centers offering pregnancy care at the time of sampling. Among these centers, a lottery system was used to randomly select 10 comprehensive health centers. In each center, a convenient method was employed to select 20 eligible mothers.

### 3.6. Measures

In this study, the data were collected using a demographics form and telemedicine questionnaire.

### 3.6.1. Demographics Form

The researcher-designed form included the individual's age, spouse's age, individual's education level, spouse's education level, mother's occupation, spouse's occupation, ethnicity, income level, insurance, number of births, type of housing, start of current pregnancy care in the first trimester, type childbirth, distance from the place of silence to the health center, number of abortions, number of live children, pregnancy complications, history of previous pregnancy loss, history of infant loss.

### 3.6.2. Telemedicine Acceptance Questionnaire

The telemedicine acceptance questionnaire was adapted from an extended TAM specifically validated to investigate telemedicine acceptance in healthcare recipients (18, 19). The technology acceptance model is a validated model that forecasts and explains the acceptance of new technologies by users. The concept of perceived usefulness refers to the extent to which individuals believe that a particular technology can improve their job performance. On the other hand, the perceived ease of use refers to the level at which individuals perceive the use of technology to be effortless. The usage intention, which can be considered user acceptance, exhibited positive correlations with these two variables (19). By integrating trust, social influence, facilitating conditions, technology anxiety, resistance to use, and perceived risk, the extended TAM model expanded upon the original TAM (18).

The telemedicine acceptance questionnaire included 25 items with nine constructs. The TAM items included perceived usefulness (3 items), perceived ease of use (3 items), resistance to use (3 items), trust (3 items), technology anxiety (2 items), facilitating conditions (3 items), social influence (2 items), perceived risk (3 items), and intention to use (3 items). Each item's range can be evaluated using a 5-point Likert scale ("strongly disagree" to "strongly agree"), with scores ranging from 1 to 5. The frequency distribution of five Likert options in each item and the mean score of each construct will predict the tendency to use technology. Those participants who score above 3 in the intention to use category are deemed to have a high level of acceptance (19).

The questionnaire's validity and reliability have been thoroughly assessed and confirmed by Kamal et al. Cronbach's alpha coefficient for its reliability test for its 9 constructs was reported within the range of 0.81 to 0.94 (18). The present study utilized the Persian version of the scale. A panel of 10 experts re-evaluated the content and face validity. Subsequently, necessary revisions were made to ensure translation validity, translation quality, and cultural adaptations.

To conduct the pilot study, 10 mothers were provided with the Persian version of the questionnaire and were requested to express their views regarding the clarity of the questions. The findings from the content validity ratio (CVR) analysis revealed that 25 items surpassed the threshold set by Lawshe's table (0.49). This finding suggests that the questionnaire included crucial questions. The experts were then provided with the questionnaire to determine the content validity index (CVI). The results indicated that 25 items achieved a CVI score greater than 0.79, indicating their appropriateness. To assess reliability, the internal consistency of the scale was measured using Cronbach's alpha. Cronbach's alpha obtained for this study was 0.797.

After determining the eligible samples and obtaining their mobile numbers, the participants were sent an electronic link ([docs.google.com](https://docs.google.com)) to the questionnaire designed on the Google platform through virtual messenger (WhatsApp), and the study participants completed it.

### 3.7. Statistical Analysis

The obtained data were analyzed using SPSS software version 23. To show the results, central descriptive statistics (mean), dispersion (standard deviation), and absolute and relative frequency were used.

## 4. Results

In the present study, the mean age of the participants was  $25.29 \pm 5.62$  years, and the youngest and oldest participants were 17 and 44 years, respectively. Among the participants, 67.5% were multigravida. Other demographic and obstetric characteristics of the participants are listed in Table 1.

More than 85% of participants assumed if they were given the chance to access telemedicine, they intend to use remote services in their pregnancy care. Additionally, more than 75% of pregnant women believe telemedicine will suit well with their prenatal care routine. About 85% feel satisfied and confident that they will be able to rely on the benefits of telemedicine. Table 2 shows the attitudes of pregnant women about telemedicine acceptance separately for each area and its items.

The results of this study showed that the average score of the total acceptance of technology in providing remote care of the participants in the study was  $92.27 \pm 7.92$ , and the lowest and highest scores were 71 and 110, respectively. The data collected from the participants' responses to the three items assessing their intention to use telemedicine in their pregnancy care revealed that a

**Table 1.** Demographic and Obstetric Characteristics of Pregnant Women

Variables	No. (%)	Variables	No. (%)
<b>Mother's education</b>		<b>Housing type</b>	
Below high school diploma	50 (25)	Rental	99 (49.5)
High school/diploma	84 (42)	Personal	85 (42.5)
Associate degree/BA	61 (30.5)	Organizational	2 (1)
Above BA	5 (2.5)	With parents	14 (7)
<b>Husband's education</b>		<b>Nationality</b>	
Below high school diploma	53 (26.5)	Lor	23 (11.5)
High school/diploma	92 (46)	Kurdish	17 (8.5)
Associate degree/BA	48 (24)	Turkish	115 (57.5)
Above BA	7 (3.5)	Fars	38 (19)
<b>Mother's job</b>		Other	7 (3.5)
Employed	18 (9)	<b>Type of delivery</b>	
Housewife	182 (91)	NVD	65 (55.6)
<b>Husband's job</b>		C/S	52 (44.4)
Self-employed	106 (53)	<b>Income level</b>	
Employed	34 (17)	Weak	43 (21.5)
Worker	59 (29.5)	Medium	141 (70.5)
Unemployed	1 (0.5)	Good	16 (8)
<b>Type of pregnancy</b>		<b>Distance of residence to health centers, min</b>	
Wanted	148 (74)	5	88 (44)
Unwanted	27 (13.5)	6 - 10	67 (33.5)
Not planned	25 (12.5)	11 - 30	45 (22.5)
<b>Insurance</b>		<b>First-trimester prenatal care</b>	
Yes	30 (15)	No	41 (20.5)
No	170 (85)	Yes	159 (79.5)
<b>History of pregnancy complications</b>		<b>History of pregnancy loss</b>	
Yes	197 (98.5)	No	163 (81.5)
No	3 (1.5)	Yes	37 (18.5)

Abbreviations: BA, Bachelor's degree; NVD, normal vaginal delivery; C/S, cesarean section.

significant majority, specifically 95.5% of the participants, displayed a high level of acceptance toward incorporating telemedicine into their healthcare routine. Table 3 shows the mean scores of perceived usefulness, perceived ease of use, resistance to use, trust, technology anxiety, facilitating conditions, social influence, perceived risk, and intention to use.

## 5. Discussion

Considering the importance, benefits, and difficulties of using telemedicine technology and achieving success in providing health services, the aim of this study was

to investigate the acceptance of providing tele-pregnancy care from the point of view of expectant mothers during the COVID-19 pandemic.

The study's results revealed that the vast majority of mothers-to-be exhibited a high level of acceptance toward utilizing telemedicine for their pregnancy healthcare needs. The results of this study showed that most pregnant mothers believed that the use of telemedicine could improve the quality and accessibility of pregnancy care and be beneficial in their daily life routine. Similarly, a cross-sectional study in the United States showed that the implementation of telemedicine during the initial wave of the COVID-19 pandemic received positive feedback from

**Table 3.** Mean Score of Perceived Usefulness, Perceived Ease of Use, Resistance to Use, Trust, Technology Anxiety, Facilitating Conditions, Social Influence, Perceived Risk, and Intention to Use

Domain	Minimum	Maximum	Mean $\pm$ SD
Perceived usefulness	33.33	100.00	85.12 $\pm$ 15.21
Perceived ease of use	33.33	100.00	82.50 $\pm$ 15.15
Resistance to use	0.00	100.00	70.12 $\pm$ 22.10
Trust	33.33	100.00	72.66 $\pm$ 14.10
Technology anxiety	0.00	87.50	26.18 $\pm$ 16.17
Facilitating conditions	41.67	100.00	75.25 $\pm$ 14.37
Social influence	25.00	100.00	73.06 $\pm$ 18.54
Perceived risk	0.00	75.00	26.83 $\pm$ 16.26
Intention to use	16.67	100.00	81.95 $\pm$ 15.75

both mothers and providers. They expressed a high level of satisfaction with this approach and expressed a strong desire for telemedicine to be offered as an option for future visits. It is worth noting that even patients who lived within 10 miles of an outpatient office, including those within 5 miles, had comparable perceptions regarding the time saved and their preference for virtual visits in subsequent appointments (16).

A study in Africa showed that despite being a new service to all participants, mobile health interventions were highly appreciated by women for their benefits on three levels: firstly, enabling the early detection of pregnancy-related complications; secondly, promoting collaboration between the participants and midwives; and thirdly, serving as a source of reassurance during a time when their health was a concern (22). Clients' digital experiences, perception of no need for physical contact, and perception of time saved in travel significantly influence their desire for telemedicine visits in the future (16). In line with previous studies (16, 20, 23), the participants described learning and interacting with doctors/midwives and interacting with remote care systems as easy, clear, and understandable. In today's midwifery clinical care model, telemedicine can continue to provide access to obstetric care by increasing flexibility for both patients and providers. The desire of patients with a history of high-risk deliveries to telemedicine shows that easier access to the provider through a telemedicine visit not only saves time but also makes it easier for patients to access providers without spending time waiting in line for the visit.

The results of this study regarding the resistance to use showed that most pregnant mothers did not want telemedicine to change their traditional way of using prenatal care services. According to a survey

carried out in the United States, the majority of high-risk obstetrical patients expressed their preference for future appointments to incorporate a blend of telehealth and in-person visits (23). In line with previous studies, most participants considered the use of telemedicine to be reliable but preferred to be cautious about this technology (22, 23).

Regarding the area of technology anxiety, the results showed that most of the participants believed that the use of telemedicine did not make them confused and upset. This finding aligns with other research findings that revealed pregnant mothers who used the virtual care application had significantly higher scores in satisfaction, and their pregnancy-related stress was less than those who were under usual care (22). Most of the expectant mothers reported that they have all the necessary resources to use tele-pregnancy care services and acquire enough knowledge to use them. In line with the aforementioned results, a study in Zimbabwe also showed that most of the participants were able to follow the pattern of using and accessing internet technology in the population. They are women who probably have electronic communication devices, have access to the Internet, and are aware of new technologies (20).

Telemedicine can be effectively used to screen patients before they go to a doctor or treatment center. This issue not only reduces the crowding of clients in health centers but also saves resources in public centers and patients' time and money, and during epidemics, it reduces the possibility of infection of patients and health workers (17). Most pregnant women believe that assuming they are given the opportunity to access telemedicine, they will gladly use it and inform their relatives and friends (23, 24). Given the specific situational constraints imposed by the COVID-19 pandemic, precautions were taken during the sampling process to protect the mothers from potential infection. The participants were briefed about the study objectives via phone communication and provided their consent virtually by signing the informed consent form. In situations where doubts arose while completing the questionnaire, the researcher offered clarifications over the phone. It is important to note that this approach was one of the limitations of the current study.

### 5.1. Conclusions

Considering the population policies in Iran and the forecast of the increase in the fertility rate, followed by the increase in the number of pregnant women receiving care, the provision of telemedicine becomes especially important. The results of this study, as the first study investigating the acceptance of telemedicine among Iranian pregnant women, indicated the acceptance

of receiving medical care, especially remote pregnancy care.

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## Footnotes

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**Conflict of Interests:** The authors declare that there is no conflict of interest.

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**Table 2.** Pregnant Women's Attitudes Toward Telemedicine Acceptance

Attitude	No. (%)	Attitude	No. (%)
<b>Perceived Usefulness</b>		<b>Perceived Ease of Use</b>	
<b>Using telemedicine would improve the quality of my prenatal care</b>		<b>I would find learning to use telemedicine would not be very difficult for me</b>	
Completely agree	108 (54)	Completely agree	86 (43)
Agree	78 (39)	Agree	93 (46.5)
Do not know	9 (4.5)	Do not know	17 (8.5)
Disagree	5 (2.5)	Disagree	2 (1)
Completely disagree	0	Completely disagree	2 (1)
<b>Using telemedicine would improve my access to prenatal care services</b>		<b>I would find it easy for myself to interact with doctors using telemedicine</b>	
Completely agree	96 (48)	Completely agree	88 (44)
Agree	83 (41.5)	Agree	97 (48.5)
Do not know	18 (9)	Do not know	11 (5.5)
Disagree	3 (1.5)	Disagree	4 (2)
Completely disagree	0	Completely disagree	0
<b>Using telemedicine would be useful in my daily routine</b>		<b>Interacting with telemedicine systems would be clear and understandable for me</b>	
Completely agree	100 (50)	Completely agree	76 (38)
Agree	84 (42)	Agree	102 (51)
Do not know	14 (7)	Do not know	20 (10)
Disagree	3 (1)	Disagree	2 (1)
Completely disagree	0	Completely disagree	0
<b>Resistance to Use</b>		<b>Trust</b>	
<b>I would not want telemedicine to alter my traditional way of using prenatal care services</b>		<b>Telemedicine services would be trustworthy for improving my prenatal care routine</b>	
Completely agree	42 (21)	Completely agree	60 (30)
Agree	85 (42.5)	Agree	98 (49)
Do not know	50 (25)	Do not know	35 (17.5)
Disagree	18 (9)	Disagree	5 (2.5)
Completely disagree	5 (2.5)	Completely disagree	2 (1)
<b>I would not want telemedicine to interfere with or change the way I interact with doctors/midwives</b>		<b>Telemedicine systems will require me to be cautious with this technology</b>	
Completely agree	4 (2)	Completely agree	28 (14)
Agree	17 (8.5)	Agree	88 (44)
Do not know	34 (17)	Do not know	50 (25)
Disagree	96 (48)	Disagree	33 (16.5)
Completely disagree	49 (24.5)	Completely disagree	1 (0.5)
<b>I do not want telemedicine services to change the way I deal with my pregnancy problems and choices</b>		<b>I feel satisfied and confident that I will be able to rely on the benefits of telemedicine</b>	
Completely agree	4 (2)	Completely agree	67 (33.5)
Agree	16 (8)	Agree	100 (50)
Do not know	33 (16.5)	Do not know	27 (13.5)
Disagree	97 (48.5)	Disagree	4 (2)
Completely disagree	50 (25)	Completely disagree	2 (1)
<b>Technology Anxiety</b>		<b>Social Influence</b>	
<b>Using telemedicine would make me feel nervous</b>		<b>People around me who mean to me a lot would prefer if I would use telemedicine service</b>	
Completely agree	0	Completely agree	49 (24.5)

Continued on next page



**Table 2.** Pregnant Women's Attitudes Toward Telemedicine Acceptance (Continued)

Agree	37 (18.5)	Agree	96 (48)
Do not know	131 (65.5)	Do not know	48 (24)
Disagree	27 (13.5)	Disagree	7 (3.5)
Completely disagree	5 (2.5)	Completely disagree	0
<b>Using telemedicine would make me confused and uncomfortable</b>		<b>People who significantly influence my behavior would prefer if I use telemedicine services</b>	
Completely agree	3 (1.5)	Completely agree	47 (23.5)
Agree	9 (4.5)	Agree	93 (46.5)
Do not know	27 (13.5)	Do not know	55 (27.5)
Disagree	126 (63)	Disagree	5 (2.5)
Completely disagree	35 (17.5)	Completely disagree	0
<b>Facilitating Conditions</b>		<b>Perceived Risk</b>	
<b>I would be able to have all the necessary resources for using the telemedicine services</b>		<b>Learning how to use telemedicine services and adapting them would be a loss of time</b>	
Completely agree	46 (23)	Completely agree	0
Agree	116 (58)	Agree	15 (7.5)
Do not know	30 (15)	Do not know	22 (11)
Disagree	8 (4)	Disagree	127 (63.5)
Completely disagree	0	Completely disagree	36 (18)
<b>I would acquire sufficient knowledge for using telemedicine service</b>		<b>Using telemedicine systems would result in a loss of money and resources</b>	
Completely agree	49 (24.5)	Completely agree	0
Agree	128 (64)	Agree	11 (5.5)
Do not know	22 (11)	Do not know	32 (16)
Disagree	1 (0.5)	Disagree	119 (59.5)
Completely disagree	0	Completely disagree	38 (19)
<b>Telemedicine will suit well with my prenatal care routine</b>		<b>Using telemedicine would not be compatible with my moral values and image</b>	
Completely agree	35 (17.5)	Completely agree	1 (0.5)
Agree	116 (58)	Agree	10 (5)
Do not know	45 (22.5)	Do not know	28 (14)
Disagree	3 (1.5)	Disagree	122 (61)
Completely disagree	1 (0.5)	Completely disagree	39 (19.5)
<b>Usage Intention</b>			
<b>Assuming that I was given the chance to access telemedicine, I intend to use telemedicine services</b>		<b>Whenever I need tele-prenatal care from professionals, I gladly use telemedicine services</b>	
Completely agree	71 (35.5)	Completely agree	83 (41.5)
Agree	105 (52.5)	Agree	107 (53.5)
Do not know	18 (9)	Do not know	8 (4)
Disagree	5 (2.5)	Disagree	1 (0.5)
Completely disagree	1 (0.5)	Completely disagree	1 (0.5)
<b>I intend to inform my relatives and friends about telemedicine</b>			
Completely agree	85 (42.5)		
Agree	88 (44)		
Do not know	26 (13)		
Disagree	1 (0.5)		
Completely disagree	0		