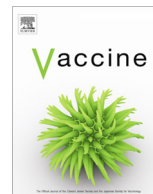Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

COVID 19 vaccine hesitancy among pregnant women and their reported reasons for vaccine refusal – A prospective study in Tehran, Iran

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ABSTRACT

Objective: Evaluation of covid 19 vaccine hesitancy among pregnant women and their reported reasons for vaccine refusal.

Methods: This prospective study was performed in Arash women's Hospital, Tehran, Iran, between December 1, 2021 and January 1, 2022. All pregnant women who were attended to prenatal care unit were considered eligible for inclusion. A validated questionnaire was used for data gathering. Written informed consent was obtained from all participants.

Results: Finally, 477 pregnant women were recruited and were divided into two groups according the status of vaccine acceptance (237 accepted and 240 women refused vaccination). The mean age of accepted participants was higher (31.65 ± 5.69 vs 30.39 ± 5.5; $P = 0.01$). There was a significant statistical difference between the groups regarding education level. Access to internet and social media were also significantly different between the two groups (94.8% in accepted vs 86.6% in refused group; $P = 0.002$). There was more rate of severe COVID-19 infection in friends or relatives of accepted group (50% vs 38%). we did not find any statistically significant differences in obstetric characteristics and the rate of obstetric complications between the two groups. The most common reasons reported by participants for vaccine refusal, was fear of vaccination side effects on the fetus (86.5%), and the less common reported reasons were husband's disagreement (9.7%), use of traditional medicine (5.6%), religious beliefs (3.7%), and information obtained from social media (2.8%). After advices from medical staff, most of these mothers (86.5%) still refused vaccination.

Conclusion: Based on the results of the present study, rate of COVID-19 vaccine hesitancy was about 50% and its most common reported reason was fear of probable side effects of vaccine on the fetus.

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1. Introduction

The COVID-19 pandemic was a significant health challenge for the world and still affecting different aspects of people's lives. Pregnant women are at higher risk of severe COVID-19 and mortality than non-pregnant women, as they are more likely to need admission to ICU[1], supplemental oxygen therapy, and invasive ventilation [1]. These consequences are the same as other viral pneumonia, like influenza, which is associated with higher morbidity and mortality rates during pregnancy [2,3]. Infection of COVID-19 in pregnant women also increases the likelihood of adverse pregnancy outcomes, like thromboembolic events, myocardial infarction, and pre-eclampsia [4]. Also, COVID-19 in pregnancy seems to be associated with an increased risk of preterm delivery, as 22% of neonates are born prematurely [5].

Although, thousands of basic and clinical studies have been performed in the worldwide response to the pandemic to assess the safety and efficacy of medical interventions [6], no specific and quite effective therapeutics are established for the treatment of COVID-19 [7]. Accordingly, the health and research centers focused on vaccination against this disease.

Simultaneously, several COVID-19 vaccines evolved and were accepted while holding rigorous regulatory processes [8–10]. However, the success of vaccination programs depends not only on their effectiveness, but also on their receipt, and they cannot stop the epidemic without universal acceptance. Unfortunately, vaccine hesitancy has become one of the main problems in controlling COVID-19 pandemics, as reported by WHO [2][11,12]. Identification of social, personal, and even cultural factors influencing people's

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[1] ICU: Intensive care Unit.

[2] WHO: World Health Organization.

beliefs and thoughts about vaccination, are one of the critical steps toward efficacious and sustainable COVID-19 vaccination programs. Also, addressing the impact of information and misinformation on people's decision making about vaccination, can lead health policy makers toward planning suitable, regional, national, and global programs to increase public awareness, acceptance, and trust [13].

Vaccine hesitancy during pregnancy can be even more intense, and the decision-making process in pregnant women can be very complicated. In general, pregnancy cause mothers to be faced with tough decision-making regarding medication use during pregnancy [14], so they need specific information, specifically about the teratogenic risks, to make decisions [15]. The same rule applies to the Covid vaccine, as it was shown in a study in the UK that acceptance of the COVID-19 vaccine was significantly lower during pregnancy in women who were accepting a COVID-19 vaccine during the non-pregnant period [16].

A review of the literature shows us that the trend of the acceptance rate for COVID-19 vaccination among pregnant women is changed over time, as it raised from 29 percent in a study conducted between June and July in Switzerland [17] to above 70 percent in two studies performed in Qatar [18] and China [19] in November or January, and subsequently reached to 74.5% in an Italian study [20].

Vaccine hesitancy can be even more complex in a country like Iran, where the attitude of mothers toward vaccination is influenced by many cultural, economic, and personal factors. It may seem that Iranian women beliefs about vaccination could be affected by factors like their husband's disapproval, religious beliefs, or desire for traditional medicine. So, in the present study, we aimed to evaluate CIVID 19 vaccine hesitancy among pregnant women and their reported reasons for vaccine refusal.

2. Material and Methods

This prospective study was performed in Arash women's Hospital, Tehran, Iran, between December 2021 and January 2022. All pregnant women who attended to prenatal care unit were asked to participate in the study, and except willingness to participate in the study, no other inclusion criteria were considered. Data were accumulated using a validated questionnaire. Written informed consent was obtained from all participants. The study protocol was designed according to the declaration of Helsinki and was approved by the Research Ethics Committees of Imam Khomeini Hospital Complex, affiliated to Tehran University of Medical Sciences, Tehran, Iran (Ethics approval ID: IR.TUMS.IKHC. REC.1401.014).

Participants were asked whether they had ever been vaccinated in our hospital or elsewhere, and if not, their possible reason for not being vaccinated were asked. Then, participants were divided into two groups according to COVID-19 vaccination status, including pregnant women who accepted to be vaccinated and who refused vaccination. Participants who were not vaccinated at the time of inclusion into study, received advices from their prenatal caregiver, about COVID-19 vaccination importance during pregnancy and were recommended to be vaccinated. These women were followed-up four weeks later, through phone calls, and their vaccination status were rechecked. In case of vaccine refusal, their reasons were asked and reported through phone call.

Medical information about the participant's current pregnancy were obtained through medical records available at hospital's Health Information System (HIS), and information about previous pregnancies (fetal anomalies, abortion history etc.) were obtained through asking questions. The gestational age was calculated according to the last menstrual period or first-trimester crown-rump length.

The questionnaire was answered by the participants on the paper, and the researcher asked questions only if the participant was not able to read/write. The questionnaire consisted of 34 questions in two separate parts, including baseline characteristics (sociodemographic characteristics, vaccination history, obstetric history, internet access, cultural and religious beliefs) and vaccine refusal reasons. Only the refused group were asked to answer the second part of questionnaire. Also, since COVID-19-related severe infection or death in people around pregnant women may affect participants attitude towards vaccination, questions were asked about the history of previous COVID-19 infection. To evaluate the content validity of the vaccine hesitancy questionnaire, content experts (including ten obstetricians, perinatologists, and psychologists) were asked to determine the degree of coordination of the content of the questionnaire with the purpose of the research.

3. Results

Finally, among the 500 women who were asked to participate in the study between December 2021 to January 2022, 477 women completed the questionnaire (response rate = 95.4%). All of the 477 questionnaires were assessed in the final analyses. Participants were divided into two groups according to COVID-19 vaccination status, including 237 pregnant women who accepted to be vaccinated and 240 pregnant women who refused vaccination. So, the acceptance rate for COVID-19 vaccination among mothers who participated in our study was about 50%. Also, the acceptance rate for the tetanus vaccine was about 89%. Mean age of participants were 31.01 ± 5.61 years (ranging from 15 to 48 years). As it has been shown in Table 1, about half of the mothers (45.1%) have an academic degree of education, while a lower proportion of fathers have an academic degree (39%). Almost all of our participants had access to the internet and social media (about 91%). Most of the participants were housewives, and only 18.6% were employed. Also, most fathers were self-employed (68.1%).

The basal and social characteristics of the two groups are shown in Table 2. The mean age of accepted participants was significantly higher than the refused group (31.65 ± 5.69 vs. 30.39 ± 5.5; P = 0.01). There was a significant difference between the two groups regarding the education level of mothers and fathers. Most mothers who accepted vaccination had an academic degree (50.2%), while most women in the refused group had an elementary or high school education (68.3%) (P = 0.02). The same pattern was seen in fathers since most of the husbands of women who accepted the COVID-19 vaccination had an academic degree (46% vs. 31.7%; P = 0.001). Also, there was a significant difference between the two groups regarding access to the internet and social

Table 1
Basic Characteristics of Participants.

Age [a]	31.01 ± 5.61
Age at the time of inclusion to the study [a]	26.69 ± 10.09
Educational Status (Mother) [b]	
Elementary and High School	263 (54.9%)
Academic degree	216 (45.1%)
Educational Status (Father) [b]	
Elementary and High School	292 (61%)
Academic degree	187 (39%)
Access to Internet and social media [b]	424 (90.8%)
Occupational Status (Mother) [b]	
Housewife	390 (81.7%)
Employed	89 (18.6%)
Occupational Status (Father) [b]	
Self Employed	309 (68.1%)
Employee	145 (31.9%)

Total Number of Participants: 477; a: Data Presented as mean standard deviation; b: Data presented as number (%).

Table 2
Comparison of Basic and Social Characteristics between Pregnant Women Accepted to be Vaccinated against COVID-19 versus Pregnant Women Refused COVID-19 Vaccination.

	Accepted vaccination (237)	Refused vaccination (240)	P-value
Age [a]	31.65 ± 5.69	30.39 ± 5.5	**0.01**
Educational Status (Mother) [b]			
Elementary and High School	118 (49.8)	145 (60.4)	**0.02**
Academic degree	119 (50.2)	95 (36.9)	
Educational Status (Father) [b]			
Elementary and High School	128 (54)	164 (68.3)	**0.001**
Academic degree	109 (46)	76 (31.7)	
Access to Internet and social media [b]	221 (94.8)	201 (86.6)	**0.002**
Occupational Status (Mother) [b]			
Housewife	179 (75.5)	209 (87)	**0.001**
Employed	58 (24.5)	31 (13)	
Occupational Status (Father) [b]			
Self Employed	143 (62.4)	164 (73.5)	**0.01**
Employee	86 (37.6)	59 (26.5)	
Severe COVID-19 Infection in Friends or Relatives	117 (50)	91 (38)	**0.01**
Death of Friends or Relatives because of COVID-19 Infection	24 (10)	19 (8)	0.39

a: Data Presented as mean standard deviation and analyzed by T-test; b: Data presented as number (%) and analyzed by chi-square or Fisher's exact tests.

media (94.8% in women who accepted vaccination vs. 86.6% in women who refused vaccination; P = 0.002). More participants in the accepted group were employed compared to the rejected group (24.5% vs. 13%, respectively; P = 0.001). Also, more proportion of husbands of women who refused the vaccination was self-employed compared to the accepted group (73.5% vs. 62.4%; P = 0.01).

The results showed that there was more rate of severe COVID-19 infection in Friends or relatives of women who accepted vaccination compared to refused women (50% vs. 38%). There was no difference regarding the death of friends or relatives because of COVID-19 infection between the groups.

As it has been presented in Table 3, no statistical differences were found regarding obstetric characteristics and complications between the groups. The rate of pregnancies induced by medically assisted reproduction was slightly higher in the refused group, and the rate of congenital malformations in previous pregnancies was twice as higher as in the rejected group than in the accepted group (4.2% vs. 2.1%), but none of these findings were statistically significant.

At Fig. 1, the mother's reasons for vaccination refusal are illustrated. As shown in this figure, most mothers (86.5%) feared vaccination side effects on the baby, and a small percentage of them (27.8%) were concerned about the consequences of vaccination

Table 3
Comparison of Obstetric Characteristics between Pregnant Women Accepted to be Vaccinated against COVID-19 versus Pregnant Women Refused COVID-19 Vaccination.

		Accepted vaccination (237)	Refused vaccination (240)	P-value [b]
Obstetric Characteristics [a]				
Gravity				
	Nulligravid	2 (0.8%)	0	0.48
	1	87 (36.7)	97 (40.4)	
	2	74 (31.2)	76 (31.7)	
	≥3	74 (31.2)	67 (27.9)	
Parity				
	Nulliparous	99 (41.8)	117 (48.8)	0.45
	1	97 (40.9)	90 (37.5)	
	2	35 (14.8)	28 (11.7)	
	≥ 3	6 (2.5)	5 (2.1)	
Live Childs				
	0	101 (42.6)	120 (50)	0.21
	1	93 (39.2)	90 (37.5)	
	2	37 (15.6)	24 (10)	
	≥3	6 (2.5)	6 (2.5)	
Pregnancy induced by MAR		31 (13.1%)	41 (17.2)	0.21
Pregnancy induced by ART		19 (8)	26 (10.8)	0.29
History of Obstetric complications in previous pregnancies [a]				
Abortion History		174 (73.4%)	183 (76.3)	0.47
CM in Previous Childs		5 (2.1)	10 (4.2)	0.19
GDM		31 (13.1)	36 (15)	0.54
GHTN		18 (7.6)	21 (8.8)	0.64
IUFD		7 (3)	7 (2.9)	0.98
PTB		12 (5.1)	11 (4.6)	0.81
Chronic Diseases		23 (9.7%)	21 (8.8)	0.71

a: Data presented as number (%); Data were analyzed by chi-square or Fisher's exact tests.
ART: Assisted Reproductive Techniques; CM: Congenital Malformations; GDM: Gestational Diabetes Mellitus; GHTN: Gestational Hypertension; Intrauterine Fetal Death; MAR: Medically assisted Reproduction; PTB: Preterm Birth.
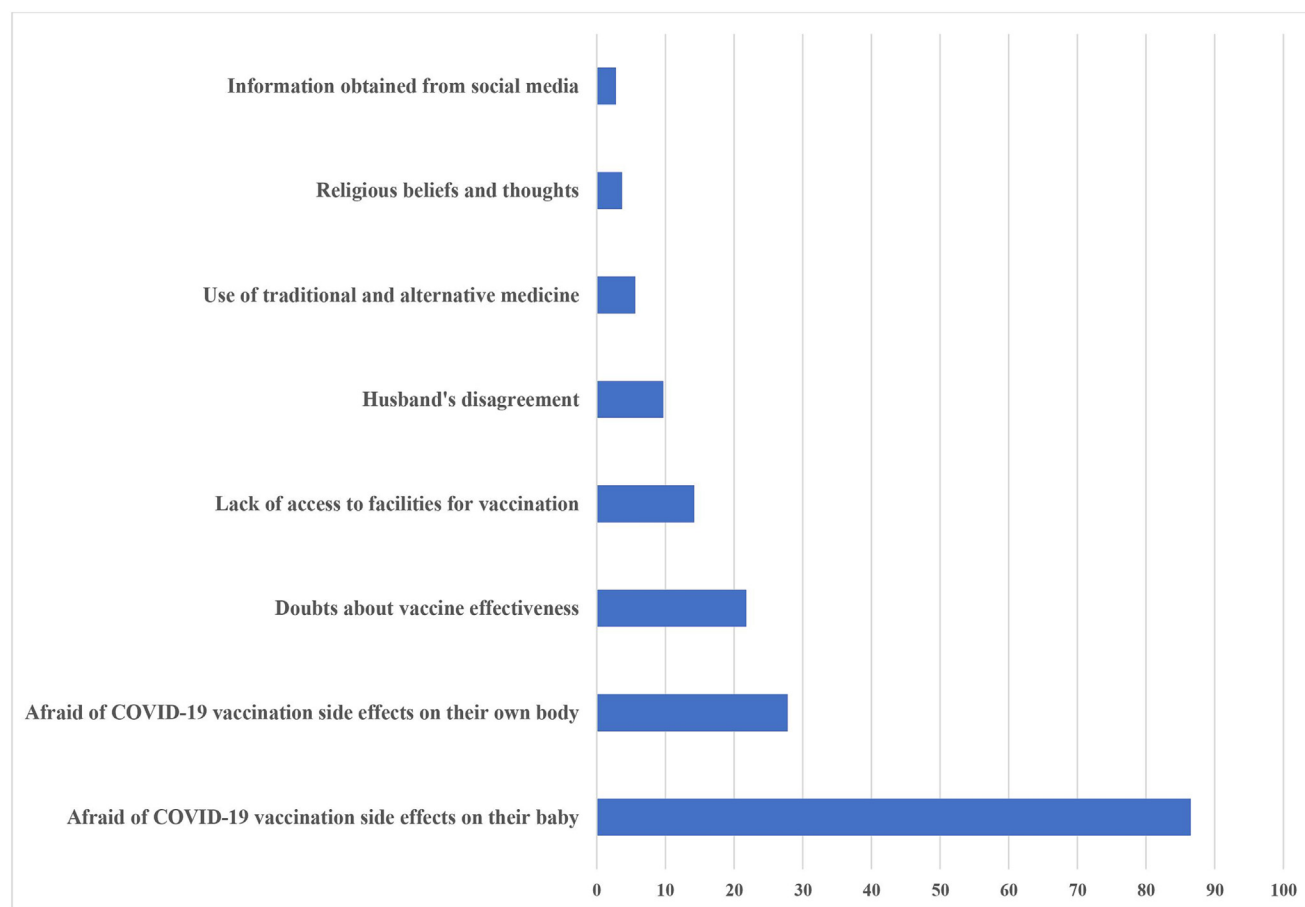
Fig. 1. Reasons for refusing the COVID-19 vaccination.

on their health. Doubts about the effectiveness of vaccines (21.8%) and lack of access to vaccination facilities (14.2%) were respectively other common reasons reported by mothers. The disagreement of husbands (9.7%), use of traditional or alternative medicine (5.6%), religious beliefs or thoughts (3.7%), and information obtained from social media (2.8%) were among the less common reported reasons.

After advice from medical staff, the vaccination acceptance rate was rechecked among 240 mothers who had refused vaccination at the time of their inclusion in the study. 216 women were assessed through phone call, and 24 women have not answered. There were only 29 mothers who changed their decision about vaccination refusal, and most of these mothers (86.5%) still did not want to be vaccinated. Doubts about vaccine effectiveness (37.9% vs.

19.3%, p: 0.02), lack of access to facilities for vaccination (17.2% vs. 2.7%; P: 0.001), and information obtained from social media (10.3% vs. 1.6%; P:0.03) were significantly more prevalent in these women, compared to the group who did not accept the advice of medical staff about vaccination (see Table 4).

4. Discussion

The acceptance rate for COVID-19 vaccination among mothers who participated in our study was close to the global rate reported in a *meta*-analysis (about 50%) [21]. Ayhan et al. also reported an acceptance rate of 30% for COVID-19 vaccination among Turkish pregnant women [11] which was similar to the findings of Blake-

Table 4
Comparison of the reasons for refusing COVID-19 vaccination between the women who accepted vaccination after medical staff's advice and who refused vaccination despite advices from medical staff.

	Accepted vaccination after advices (29)	Refused vaccination despite advices (187)	P-value
History of Obstetric complications in previous pregnancies [a]			
Afraid of COVID-19 vaccination side effects on their baby	26 (89.7)	160 (86)	0.59
Afraid of COVID-19 vaccination side effects on their own body	7 (24.1)	53 (28.3)	0.63
Doubts about vaccine effectiveness	11 (37.9)	36 (19.3)	**0.02**
Lack of access to facilities for vaccination	5 (17.2)	5 (2.7)	**0.001**
Husband's disagreement	1 (3.4)	20 (10.7)	0.22
Use of traditional and alternative medicine	0	12 (6.4)	0.16
Religious beliefs and thoughts	2 (6.9)	6 (3.2)	0.32
Information obtained from social media	3 (10.3)	3 (1.6)	**0.03**

a: Data presented as number (%) and were analyzed by chi-square or Fisher's exact tests.

way et al. study in the United Kingdom that reported the same rate [22]. In a survey in 16 countries, Skjefte et al. showed that the intention rate for receiving the COVID-19 vaccine was 52.0% among pregnant women. They also reported that the highest acceptance rates belonged to India, the Philippines, and Latin American countries [23].

In our study, the level of education and access to social media was higher in the vaccinated group, which suggests a possible role for education and training in the decision-making process for vaccination against COVID-19 during pregnancy. Ezati Rad et al. found similar results and showed that the use of social media predicts the intention to receive COVID-19 vaccine [24].

Higher intention for tetanus compared to the COVID-19 vaccine (89% versus 50%) may be related to the unawareness of mothers about the importance of the COVID-19 vaccination. Also, as an old vaccine, the tetanus vaccine has fewer unknowns than the covid vaccine. In the study of Ayhan et al., tetanus vaccine acceptance was significantly higher than COVID-19 and even flu vaccines [11]. Our results showed that mothers who were vaccinated against COVID-19 had a higher education level and access to the internet and social media. On the other hand, in this study the most common reported reason for vaccine refusal was fear of COVID vaccine-related effects on the fetus. In line with our findings, a study by Nguyen et al. in Vietnam showed that the most common reason for vaccination refusal was concerns about the safety of the vaccine and doubts about their efficacy [25]. Also, Ayhan et al. reported that the most common cause of COVID vaccine refusal is the lack of data on COVID-19 vaccine safety during pregnancy and its probable teratogenic effects on the fetus [11]. Evidence shows that the health behaviors of pregnant women regarding non-adherence to taking any medication are significantly affected by health literacy [15]. So, it can be concluded that the level of maternal knowledge about the importance and safety of the COVID-19 vaccination during pregnancy will strongly affect their attitude.

In our study, the mean gestational age of the vaccinated group was about 22.5 weeks. In Ayhan's study [11], vaccination acceptance was higher among first-trimester pregnant women, while in the other study [22], most women received the vaccine in the third trimester, and only 14.3% were vaccinated during the second trimester since they were concerned about receiving the vaccine at low gestational ages. The reason for the difference in mean gestational age in the vaccinated group in our study compared to these studies is that according to the instructions of the Iranian ministry of health, medical staff should adequately inform pregnant women attending prenatal care centers about the importance of covid vaccination after 14 weeks of gestation.

This study found no correlation between vaccine acceptance rate and obstetrics characteristics. These findings were similar to the study of Ayhan et al. [11]. Also, the history of severe COVID-19 infection in friends or relatives of the vaccinated group was significantly higher than in the mothers who rejected covid vaccination. Therefore, the experience of encountering this disease and the fear of its severe complications convinced mothers to be vaccinated. A cross-sectional survey that was carried out among healthcare workers in Iran also showed history of COVID-19 infection, and hospitalization due to COVID-19 infection, are significantly associated with vaccine acceptance (.

In the present study, the mean age of participants in the vaccinated group was higher than the other group. Skirrow e al. found the same results, as women from lower-income households and ages younger than 25 years old are more likely to reject COVID vaccination. Results of the present study were contrary to the findings of Ayhan. They found no correlation between COVID-19 vaccine acceptance and sociodemographic factors like age, number of householders, and monthly income [11]. Also, a *meta*-analysis

showed no significant association between sociodemographic factors like maternal age, educational status, income levels, and knowledge scores [21].

Findings showed that, contrary to public opinion regarding Iranian women, the decision of most participants in this study for vaccination was not affected by factors like husband's disapproval, religious beliefs, or desire for traditional medicine, and a very few parts of our participants cited such factors as their reason for vaccination disapproval. Of course, it should be noted that this study was conducted in the city of Tehran, which is the capital of Iran, and its residents have higher educational, economic, and cultural facilities, and attitudes and decision-making processes may be different in mothers who live in rural areas and small cities.

According to the findings of the present study study, only 12.1% of women in the non-vaccinated group changed their opinion about vaccination after the advice of medical staff, and 77.9% refused vaccination again, despite the advice they received from medical staff. One of the interesting findings of this study was that in those few pregnant women, who had changed their opinion and were vaccinated, there was a higher percentage of doubt about the effectiveness of vaccines and access to vaccination facilities compared to the group who were firm on their decision of not being vaccinated. Also, most of these women (89.7%) were still concerned about the side effects of vaccines on their babies, despite the advice of medical staff. So, what has led to a change in their attitude? Our assessments showed that a significantly higher percentage of these women considered the information obtained from social media to be effective in their decision-making. Therefore, it seems that these networks have critical role in people's decision-making process. Also, public health and social care are strongly influenced by the information people obtain through social media.

5. Limitations

The most limitation of the present study is related to its small sample size. Also, the study population were selected from just one hospital in Tehran, capital of Iran, so the study sample may not be representative of the whole Iranian society, specifically small cities and rural areas with different cultural, social, and religious beliefs.

6. Conclusion

Based on the results of the present study, the rate of COVID-19 vaccine hesitancy among Iranian pregnant women was about 50%, and its most common reason was fear of probable side effects of vaccines on the fetus. Also, findings of this study indicated the crucial role of maternal age, education level, employment status, and access to the internet and social media in the acceptance of COVID-19 vaccination.

CRediT authorship contribution statement

Ashraf Moini: . **Maryam Rabiei:** Supervision. **Reihaneh Pirjani:** Supervision. **Amene Abiri:** . **Arezoo Maleki-Hajiagha:** .

Data availability

Data will be made available on request.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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