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The effects of the COVID 19 pandemic on vaccine decisions in pregnant women

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ABSTRACT

Background: Pregnancy is an important time for developing attitudes and beliefs about childhood vaccinations. Vaccinations are among the most effective way of preventing some infectious diseases. Discussions on vaccinations have increased due to the Covid-19 pandemic and there is an opportunity to give society correct information on vaccinations.
Aim: The aim of the study was to determine the opinions of pregnant women on vaccinations in pregnancy and childhood and the effect of the Covid-19 pandemic on these views.
Methods: The study was conducted as a cross-sectional study. The sample included 152 pregnant women. Data were collected through a 25-item online questionnaire created by the researchers.
Results: It was found in our study that 29.6% of pregnant women using forum websites exhibited hesitant attitudes towards vaccinations. The vaccine hesitancy rate was found to be high in pregnant women who said that their economic level was low and who worried about the risks of vaccination. The Covid-19 pandemic was reported to be the cause of a decrease in vaccine hesitancy in 28.9% of the participants.
Conclusion: The events surrounding the pandemic provided an opportunity to explain how pregnant women feel about vaccinations. Providing pregnant women with access to correct information from health workers may reduce the problem of trust, which is among the most important reasons for vaccine hesitancy.

Statement of significance

Problem or issue

Vaccine hesitancy is one of the greatest obstacles to vaccination. Very few studies have researched the effect of the Covid-19 pandemic on the vaccination decisions of pregnant women.

What is already known

The main reasons for vaccine hesitancy in pregnant women are a lack of trust in vaccinations and possible side-effects. Vaccines are being discussed often due to the Covid-19 pandemic. This may affect positively the attitudes towards vaccinations.

What this paper adds

The most important reasons for vaccine hesitancy are problems of trust and hearing or reading about negative events. The pandemic has had a positive effect on decisions to be vaccinated in the future.

1. Introduction

It is possible to reduce and even eradicate vaccine preventable diseases when vaccinations are broadly implemented. However, a high rate of vaccination must be achieved for bringing these diseases under control. According to the working group of the Strategic Advisory Group of Experts on Immunization (SAGE) of the World Health Organization, vaccine hesitancy is defined as delaying or refusing vaccination services despite their availability. This has a negative effect on combating vaccine preventable diseases [1].

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One of the important events in vaccine hesitancy was Andrew Wakefield's claim on a link between the MMR (mumps, measles, and rubella) vaccine and autism and that symptoms of autism were diagnosed in 12 children one month after MMR vaccination. This claim was published in the Lancet in 1998. This study highlighted the suspected consequences of vaccination and immunization [2]. The scientific limitations of this study were shown as of its first publication. It was found that the families of all the children in the study had opened a court case against the government alleging that the MMR vaccine had harmed their children and that their lawyers had paid money to Wakefield to prove that the vaccine was linked to autism. In 2010, the Lancet withdrew the article [3].

In some European countries including Italy [4] and Romania, an increase in measles cases has been seen as an indicator of a decrease in vaccination rates [4,5].

In Turkey, the rate of vaccine hesitancy increased in 2015 when a family that did not want their children vaccinated won a court case and rumours became widespread in the media [6]. As a result, in 2017 the incidence of measles was 0.09 per 100 000, but in 2018 it had risen to 0.87 per 100 000 [7].

Covid-19, a disease which causes serious respiratory tract problems, such as pneumonia and pulmonary failure, was first reported in Wuhan, China. Many studies have investigated Covid-19 [8]. The effect of Covid-19 is felt by the entire world, and this provides an opportunity for increasing trust in the role of vaccines in preventing disease [9].

Opinions on vaccinations in childhood start to form during pregnancy. Therefore, pregnant women are considered to be an ideal population for information interventions [10]. There are very few studies on what pregnant women think about vaccinations and the effect of the Covid-19 pandemic on these. The aim of this study was to research these ideas.

2. Material and methods

2.1. Design

This cross-sectional study utilized an online questionnaire.

2.2. Participants

The convenience sampling method was used to recruit participants. The sample included pregnant women who had at least primary school education, who were above 18 years of age and who participated voluntarily in the study. Studies were searched that measured vaccination hesitancy with the objective of calculating the sample size. In a study conducted on pregnant women in the United States, it was found that the vaccine hesitancy rate was 8.2% [11] and in a study in Malaysia, which included pregnant women, it was found to be 11.6% [12]. The size of the study sample was calculated using the sampling method where the population is unknown [13] and a vaccine hesitancy of 11% was accepted.

$$n = \frac{t^2 \times (p \times q)}{d^2}$$

n: sample size.

p: frequency of incidence of the event under consideration (expected prevalence).

q: frequency of absence of the event under consideration (expected non-prevalence).

t: the standard normal deviate (usually set at 1.96, which corresponds to the 95% confidence interval).

d: relative desired precision [13].

$$\frac{(1.96)^2 \times (0.11 \times 0.89)}{(0.05)^2} = 150$$

It was found that a minimum of 150 pregnant women needed to be included in the study. Recruitment to the study was via an online parenting forum. Women wishing to take part in the study, clicked on the online questionnaire. They were given information on the aims, who was included in the study and that participation was voluntary. They were told that personal information would be kept confidential, and that the questionnaire would take about five minutes to complete. Women could complete the form after reading information about the study and clicking on "I agree to participate in the study" on the screen. The sample was composed of 152 women who completed the questionnaire fully between 1 July and 31 October 2020.

2.3. Data collection

A 25-item questionnaire was created by the researchers according to the literature. The questionnaire was composed of questions that could be answered yes, no or with more than one choice. Expert opinions were obtained from two faculty members for the questionnaire contents and the required corrections were made. It contained questions on sociodemographic information, which were predicted might affect vaccine hesitancy, such as age, educational level, and economic status, together with opinions on vaccination and possible changes in thoughts experienced during the Covid-19 pandemic.

2.4. Data analysis

Data analysis was performed with the use of the SPSS 22.0 package program. Numerical values, percentages and means were calculated in the evaluation of the women's descriptive characteristics and their views on vaccinations. Binary logistic regression was used in the statistical analysis of variables affecting their attitudes towards vaccinations. The level of significance was $p < 0.05$ in the logistic regression analysis. Conformity to normal distribution was tested with the Kolmogorov Smirnov test, and single variable analysis was performed to determine the variables to be taken into the regression model. The dependent variable for logistic regression analysis was attitude to vaccinations (vaccine hesitancy versus positive attitude towards vaccinations). Variables which were found to have a statistically significant correlation with the dependent variable in the single variable analysis before regression analysis were included in the logistic regression model. Generally, $p = 0.25$ is accepted as a limit for this, and it is recommended that variables with a p value of below 0.25 should be included in the model [14].

2.5. Ethical considerations

Permission was obtained from the Pamukkale University Medical Ethics Committee (approval date and number of Ethical Council: 10 June 2020-60116787-020/34117) and from the Turkish Ministry of Health. Women could complete the form after they had read information on the study and had clicked on "I agree to participate in the study" on the screen. The online questionnaire was designed in a manner so that each question had to be answered before passing on to the next, and there was no sampling loss due to unanswered questions.

Table 1
The women's sociodemographic characteristics.

Variables	Pregnant women (n = 152)
Age[a]	28.66 ± 4.98
Week of pregnancy[a]	26.93 ± 8.23
Education level[b]	
Primary or high school	89 (58.6)
University	63 (41.4)
Work status[b]	
Working	67 (44.1)
Not working	85 (55.9)
Occupation[b]	
Housewife	70 (46.1)
Office worker	33 (21.7)
Manual worker	21 (13.8)
Health worker	28 (18.4)
Income level[b]	
Low	64 (42.1)
Medium or high	88 (57.9)

Values in parentheses are percentages.
[a] Mean ± standard deviation.
[b] Frequencies.

3. Results

It was found that the mean age of the women was 28.66 ± 4.98 years, their mean weeks of pregnancy was 26.93 ± 8.23, n = 89 (58.6%) had primary or high school education, n = 85 (55.9%) were not working when the study was conducted, n = 70 (46.1%) were housewives and the income of n = 88 (57.9%) was medium or high (Table 1).

It was found that n = 96 (72.1%) of the women had had their children vaccinated. Pregnant women n = 132 (86.9%) evaluated their knowledge about the vaccine as sufficient or partially sufficient. Regarding their sources of information on vaccination and their trust in the source of information, health workers came first (n = 85 (55.9%) and n = 138 (90.8%) respectively). It was found that n = 117 (77.0%) of the women believed that vaccinations protected their children against serious illnesses and that n = 107 (70.4%) had a positive attitude towards vaccinations. The most important reasons for vaccination hesitancy were hearing or reading negative news in the media at n = 33 (21.7%) and thinking that the vaccinations were not safe or concern about the subject of side-effects at n = 33 (21.7%). Also, n = 117 (77.0%) of the women had had a vaccination or intended to have one during pregnancy and n = 63 (41.4%) thought that in the future, they would only give their children compulsory vaccinations, while n = 94 (61.8%) of the women were not worried about the risks of vaccination. Finally, n = 115 (75.7%) of the pregnant women participating in the study thought that vaccinations strengthened the immune system, n = 108 (71.1%) that vaccinations were beneficial and n = 118 (77.6%) thought that vaccinations were safe (Table 2).

It was found that n = 42 (27.6%) of the women were worried at a "medium level" because of the Covid-19 pandemic, but the opinions on vaccinations of n = 97 (63.9%) had not changed. The Covid-19 pandemic had not affected the views of n = 77 (50.6%) of the women about being vaccinated in the future; the intention of n = 76 (50.0%) to have their children vaccinated in the future had been positively affected and that n = 71 (46.7%) who thought that vaccinations should be compulsory had increased. Also, n = 80 (52.6%) of the women wanted to have the Covid-19 vaccine when it was available (Table 3).

The logistic regression model was used to evaluate more than one factor affecting attitude towards vaccinations. Goodness-of-fit tests were used in evaluating the suitability of the logistic regression model. Score and omnibus test values were statistically significant ($p < 0.01$), and the Hosmer-Lemeshow test values were insignificant ($p > 0.05$). It means that the model conforms to the goodness- of-fit criteria [15]. In this study, the goodness-of-fit test results for the logistic regression model showed that the model fulfilled the goodness-of-fit criteria ($p = 0.000$, $p = 0.000$ and $p = 0.387$, respectively) (Table 4).

The Cox and Snell R^2 and Nagelkerke R^2 values show how much of the variance in the dependent variable is explained by the

Table 2
Variables relating to the women's views on vaccination.

Variables	N (%)
Vaccination of previous children (n = 133)	
Yes	96 (72.1)
No	37 (27.9)
Level of knowledge of vaccinations	
Adequate or partially adequate	132 (86.9)
Inadequate	20 (13.1)
Sources of information on vaccinations[a]	
Health workers	85 (55.9)
Friends or relatives	22 (14.5)
Newspapers, magazines or television	69 (45.4)
Internet	92 (60.5)
Institutional web sites	43 (28.3)
Level of trust in sources of knowledge of vaccination[a]	
Health workers	138 (90.8)
Newspapers, magazines or television	20 (13.2)
İnternet	10 (6.7)
Institutional web sites	24 (15.8)
Belief that vaccinations protect children from serious illnesses	
Yes	117 (77.0)
No	35 (23.0)
Attitude to vaccinations[a]	
Positive	107 (70.4)
Hesitant	35 (29.6)
Reasons for hesitancy to vaccination[a]	
Thinking it unnecessary	7 (4.6)
Hearing or reading negative things from the media or internet	33 (21.7)
A bad experience or a reaction to a previous vaccination	12 (7.9)
A bad experience with a person or institution giving a vaccination previously	10 (6.6)
Another person saying their children had had a bad experience or reaction because of a vaccination	30 (19.7)
Thinking that vaccination was ineffective	11 (7.2)
Thinking that vaccination was unsafe/worry about side effects	33 (21.7)
Fear of needles	2 (1.3)
Other beliefs/traditional medicine	2 (1.3)
Having a vaccination or thinking of having a vaccination during pregnancy	
Yes	117 (77.0)
No	35 (23.0)
Intention to have children vaccinated in future	
Only compulsory vaccinations	63 (41.4)
All vaccinations	57 (37.5)
I don't intend to have them vaccinated	32 (21.1)
Worry about the risks of vaccination	
Yes	58 (38.2)
No	94 (61.8)
Belief that the vaccination strengthens the immune system	
Yes	115 (75.7)
No	37 (24.3)
Belief that the benefits of vaccination are greater than the risks	
Yes	108 (71.1)
No	44 (28.9)
Belief that vaccines are safe	
Yes	118 (77.6)
No	34 (22.4)

[a] More than one response could be given to this question.

Table 3
Variables concerning the women's views on the Covid-19 pandemic and vaccinations.

Variables	N (%)
Worry about Covid-19	
I'm not worried	35 (23.0)
Very little	6 (3.9)
A little	18 (11.8)
Medium	42 (27.6)
A lot	41 (27.0)
Extremely worried	10 (6.7)
Change of opinion on vaccinations due to covid 19 pandemic	
My hesitation about vaccinations has lessened	44 (28.9)
My hesitation about vaccinations has increased	11 (7.2)
No change	97 (63.9)
Effect of the Covid-19 pandemic on intention to have vaccinations in the future	
Positive effect	67 (44.1)
Negative effect	8 (5.3)
No effect	77 (50.6)
Effect of the Covid-19 pandemic on having children vaccinated in the future	
Positive effect	76 (50.0)
Negative effect	13 (8.6)
No effect	63 (41.4)
Change due to the Covid-19 pandemic in thoughts about compulsory vaccination	
It has increased my opinion that vaccination should be compulsory	71 (46.7)
It has increased my opinion that vaccination should not be compulsory	12 (7.9)
No change	69 (45.4)
Wish to have Covid-19 vaccination when it is available	
Yes	80 (52.6)
No	72 (47.4)

independent variables in the model. Since the Nagelkerke R^2 takes a value of between 0 and 1, it is recommended that this value be interpreted [16]. Cox & Snell $R^2 = 0.509$ and Nagelkerke $R^2 = 0.724$ were found for the model. The Nagelkerke R^2 value showed that 72.4% of the total variance of the model was explained.

The regression coefficient β, standard error and Wald statistics were evaluated in the logistic regression analysis. Accordingly, a positive attitude towards vaccinations was found to be significantly high in those with a medium or high income (OR = 10.32, $p < 0.05$) and in those who did not worry about the risks of vaccinations (OR = 4.22, $p < 0.05$). A hesitant attitude towards vaccinations was found to be significantly high in those who thought that vaccinations did not strengthen immunity (OR = 0.09, $p < 0.05$) or that the risks outweighed the benefits (OR = 0.12, $p < 0.05$) (Table 4).

4. Discussion

Our study showed that 29.6% of pregnant women in Turkey who use pregnancy forum websites have a hesitant attitude towards vaccinations. Other studies have found the vaccine hesitancy rate to be 8.2% [11] and 11.6% [12]. Henrikson et al. conducted a study in Washington state in the United States and the vaccine hesitancy rate was found to be 9.7% after giving birth and 5.9% 24 months later [17]. In the study by Costantino et al. on the general population in Palermo, Italy, 12.7% of participants were found to be hesitant towards vaccines, and 4.7% were against them [18]. According to results from the Turkey Demographic and Health Survey (TDHS), the rate of partially vaccinated or unvaccinated children was found to be 33% [19]. A rate close to that of the TDHS data was found in the present study. A study conducted in several countries showed that the vaccination hesitancy rate was variable [20]. According to the results of various studies [11,12,17,18] and of our own, the vaccine hesitancy rate varies according to populations and societies.

Results from our study showed the most important reasons for vaccine hesitancy were thinking vaccines were not safe or worrying about side-effects and hearing or reading negative news from the media or the Internet. In studies conducted in Malaysia, Turkey, and Canada, it was shown that the most important reasons for vaccine hesitancy were a lack of trust and feeling anxiety about side-effects [10,21–23]. Those experiencing indecision were of the belief that vaccinations are riskier than infections [21].

As parents' levels of worry about the safety of vaccinations increase, so do their information-seeking behaviours. Information is generally sought from friends or from the Internet [24]. Our results demonstrated a similar outcome where pregnant women seek information from the Internet. A systematic review conducted in Turkey revealed similar information supporting this result [25]. It is thought that because information spreads widely on the Internet, vaccine hesitancy has the potential to increase. The study by Yiannakoulias et al. showed that anti-vaccination content on YouTube was more often visited than pro-vaccination material [26].

Our results showed that the vaccine hesitancy rate was high in pregnant women who stated that their economic level was low. There are studies in the literature which show that as income levels increase, vaccine hesitancy also increases and vaccination rates fall [24,27], or that there is a correlation between low income and vaccine hesitancy [21,28]. Azizi et al. conducted a study with parents and no correlation was found between low education, income levels and vaccine hesitancy, but a high vaccine hesitancy rate was found among unemployed parents with these characteristics [12]. Furthermore, lower income levels and a higher probability of worry are correlated [22]. It is thought that the worry caused by difficulty of access to vaccinations for economic reasons may also be a reason for vaccine hesitancy.

Perception of risk is an important determinant in parents' decisions concerning vaccinations [21]. In our study, vaccine hesitancy was found to be high in pregnant women who worried about the risks of vaccinations, and low in those who thought that the benefits were greater than the risks. In a study examining the decision to have vaccinations from the aspect of risk theories, it was found that people who were in favour of immunization saw illnesses as unknown and frightening, and assessed vaccinations as better known, and therefore did not consider the risks to be important. People who were not in favour of immunization, as well as thinking that vaccinations were ineffective, also worried about unknown side-effects which could appear later [29].

The results of our study showed that those who thought that vaccinations strengthen immunity experienced less vaccine hesitancy. In a study conducted in Turkey by Abbasoğlu and Güngör, it was observed that parents who experienced vaccine hesitancy thought that the immunity provided by vaccinations was less than natural immunity. In the same study, participants assessed vaccines as an injection which destroyed the wholeness of the body and modern medicine as artificial [23]. Such people think that they can cope with illness without being vaccinated. Also, they do not want to have their children vaccinated so that they will acquire immunity by natural processes [30].

In our study, the number of women whose vaccine hesitancy decreased during the Covid-19 pandemic was greater than the number of those in whom it increased. At the same time, the pandemic had a positive effect on pregnant women's decisions to have themselves and their children vaccinated in the future. However much the pandemic creates doubt against new vaccines, which will be produced, it also provides an opportunity to explain the importance of vaccinations and to raise awareness [31].

Table 4
Logistic regression model of variables affecting attitude to vaccination (vaccine hesitancy versus positive attitude to vaccination).

Variables	β	S.E.	OR (95% confidence interval)	p
Fixed	−0.57	0.60	0.56	0.349
Education	0.12	0.69		
-Primary or high school			reference	0.858
-University			1.13 (0.29–4.38)	
Economic status	2.33	0.78		
-Low			reference	**0.003**
-Medium or high			10.32 (2.20–48.22)	
Level of knowledge of vaccinations	−0.78	0.80		
-Adequate or partially adequate			reference	0.330
-Inadequate			0.45 (0.09–2.20)	
Worry about Covid-19	−1.02	0.87		
-Yes			reference	0.243
-No			0.35 (0.06–2.00)	
Worry about the risks of vaccination	1.44	0.73		
-Yes			reference	**0.049**
-No			4.22 (1.00–17.71)	
Thinking that vaccinations strengthen immunity	−2.36	0.96		
-Yes			reference	**0.014**
-No			0.09 (0.01–0.62)	
Thinking that the benefits of vaccination are greater than the risks	−2.07	0.91		
-Yes			reference	**0.023**
-No			0.12 (0.02–0.75)	

β: Beta, S.H: Standard error, OR: Odds ratio.
Cox & Snell $R^2 = 0.509$, Nagelkerke $R^2 = 0.724$, -2 Log likelihood = 76.434.
Score test: $X^2 = 95.970$, p = 0.000.
Omnibus test: $X^2 = 108.241$, p = 0.000.
Hosmer & Lemeshow test: $X^2 = 8.496$, p = 0.387.
The bold values signify the effective in attitudes towards vaccinations.

According to the results of our study, approximately half of the pregnant women did not want a Covid-19 vaccination when one was developed. This proportion is higher than the 29.8% rate of vaccine hesitancy. In a study conducted in France with the general population, a rate of 24% was found in those not wanting to have a Covid-19 vaccination when one was developed [32]. In a study in Indonesia, it was found that a Covid-19 vaccine provided free would be accepted at a rate of 93.3% if it were 95% effective, and at a rate of 67.0% if it were 50% effective [33]. In a study in Israel, it was determined that 75% of the general population would accept having a Covid-19 vaccination for themselves and 70% would accept it for their children. One of the basic concerns was that the Covid-19 vaccine had been developed very quickly. It was found in the same study that a higher proportion of men accepted vaccinations than did women, and among those with children, the proportion was lower [34]. In a multi-national study in Europe, it was found that the average of those accepting to have a Covid-19 vaccination was 73.9% [35]. It usually takes about ten years to develop a vaccine, but the pandemic has shortened this process. This can cause hesitancy even in those who are in favour of vaccinations. Also, individuals may experience hesitancy against a new vaccine because it has not been tested on a large proportion of the population. When people are making a decision on vaccinations, they are affected by the decisions of other members of society and those who are trusted by society, such as doctors, nurses, or health workers [36]. Most pregnant women are concerned about Covid-19 [37]. Studies have shown that the risk of morbidity and mortality from Covid-19 is greater in pregnant women than in those who are not pregnant [38]. At the same time, there is limited knowledge concerning its effect on pregnant women, foetuses, and infants.

It is thought that pregnant women should be included in properly designed vaccine studies [39]. In our study, the proportion of pregnant women who did not want to be vaccinated when a Covid-19 vaccine was developed was higher than in other populations. It is thought that this may be because the vaccine is newly developed [40], and there is insufficient information on its use in the pregnancy and breastfeeding period [39].

5. Conclusion

The results of our study showed that the most important reasons for vaccine hesitancy were thinking the vaccine was not safe or worrying about side-effects and hearing or reading negative news from the media or the Internet. The vaccine hesitancy rate was found to be high among pregnant women who stated that their economic status was low and who worried about the risks of vaccination. It was found to be low among pregnant women who thought that the benefits of vaccination were greater than the risks and that it strengthened immunity. It was found that although nearly half of the pregnant women did not want to have a Covid-19 vaccination when one was developed, the pandemic had had a positive effect on the decision to have vaccinations in the future, and had reduced vaccine hesitancy.

The struggle against preventable diseases with vaccines is more difficult due to vaccine hesitancy. Vaccine hesitancy can be prevented by educational interventions for pregnant women who are an appropriate segment of the population. Providing correct information can prevent problems of trust and negative ideas. It is thought that messages given on the topic of vaccination by people who can provide leadership in society can have a positive effect in reducing vaccine hesitancy. It is important to be aware of the sources of information on vaccinations which pregnant women follow. Today the Internet is the most important tool for obtaining information. It is recommended that health professionals and informatics experts work together to create websites and mobile apps which include correct and clear information on vaccinations, and that their numbers should be increased. Also, it must not be forgotten that the pandemic has increased awareness on the importance of vaccinations, and this can be turned into an opportunity to explain vaccines correctly.

Limitations

The data used in this study have been collected through forum websites prepared for pregnant women in Turkey. Consequently, the conclusions of the study cannot be generalized for all pregnant women. Another limitation of the study is that the questionnaire used in the research was not tested for validity and reliability.

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Conflict of interest

None declared.

Ethical Considerations

Permission was obtained from Pamukkale University Medical Ethics Committee (approval date and number of ethical council: 10/06/2020-60116787-020/34117) and from the Turkish Ministry of Health. After the women had read information on the study and had clicked on "I agree to participate in the research" on the screen, they were able to complete the forms.

CRediT authorship contribution statement

Hatice Gencer: Conceptualization, Methodology, Software, Data curation. **Sevgi Özkan:** Methodology, Software, Writing - review & editing, Data curation. **Okan Vardar:** Conceptualization, Methodology, Software, Investigation, Data curation. **Pınar Serçekuş:** Methodology, Software, Investigation, Data curation.

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