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Selda Yörük & Döndü Güler

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RESEARCH PAPER

Factors associated with pediatric vaccine hesitancy of parents: a cross-sectional study in Turkey

Selda Yörük[a] and Döndü Güler[b]

[a]School of Health, Department of Midwifery, Balıkesir University, Balikesir, Turkey; [b]Training And Research Hospital, Sakarya University, Sakarya, Turkey

ABSTRACT

Aim: This study aims to determine the prevalence and associated factors of vaccine hesitancy in females with children aged 12 months to 6 years who receive service from the antenatal class of a tertiary hospital in Turkey.

Method: The study group includes 370 parents receiving service from a tertiary hospital. The data collection tools of the study were a descriptive data form and the Parent Attitudes about Childhood Vaccines survey.The data were analyzed using chi-square analysis and logistic regression analysis.

Results: In our study, the prevalence of vaccine hesitancy was determined as 13.8% and vaccine refusal prevalence as 4.8%. In univariate analysis, vaccine hesitancy was found to be significantly higher in mothers with a university education, who got pregnant with treatment, who were not trained about pediatric vaccines in the antenatal follow-up, who followed anti-vaccine groups on social media, and who did not use vitamin D and iron supplements regularly or never used for their child. Vaccine hesitancy was significantly higher in parents who stated that their information sources of vaccines were not scientific, who were worried about vaccine ingredients (aluminum, mercury, pig gelatine) and who used alternative medicine practices ($p < .05$). In multivariate analysis, the risk of vaccine hesitancy increases 3.05 times in pregnancies with treatment, 3.74 times in those who did not use vitamin D or iron preparations, 3.01 times in those who followed anti-vaccine groups on social media,2.93 times in parents who were worried about the vaccine ingredients.

Conclusion: Our findings suggest that the prevalence of vaccine hesitancy and risk factors should be monitored closely in the following years.

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Vaccine hesitancy; parents' hesitancy; vaccine refusal

Introduction

Vaccines are cost-effective and useful tools in lowering the burden of diseases and mortality[1]. However, due to the increase in the number of parents who would not like to vaccinate their children, health systems are gradually confronting more problems.[2] Although vaccine hesitancy is a complex concept, the SAGE Working Group defines it as a "delay in acceptance or refusal of vaccines despite the availability of vaccination services."[3] Vaccine hesitancy has increased in many developed and developing countries over the past decade. In a study covering eighteen European countries, it has been determined that 20% of families delayed vaccination, 12% refused vaccination, 24% defined themselves as somewhat hesitant, and 4% as very hesitant.[4] In a study conducted in the USA, it has been reported that 15% of parents refused vaccination and 27% delayed it.[5] In studies conducted in different countries, the prevalence of pediatric vaccine hesitancy in parents varies between 7–27%.[6–8]

In order to distinguish vaccine hesitancy socially, its underlying causes need to be revealed. The investigation of its basic determinants, sociodemographic features, and prevalence is required for addressing vaccine hesitancy.[3] The World Health Organization (WHO) has stated that there are many factors that influence parents' decision to vaccinate their children, and focused on the importance of sociocultural factors in vaccine refusal and hesitancy.[9] In the literature, it has been reported that the socioeconomic and cultural characteristics of families are important in vaccination acceptance.[10] Parents' age, education level, poverty, religious belief, gender of the child, distance to healthcare facilities, trust in healthcare personnel, patriarchal family structure, and cultural factors that restrict mothers' autonomy are associated with non-vaccination or incomplete vaccination.[3,11,12] In addition, the risk of vaccine hesitancy increases in people who prefer alternative methods more. Negative attitudes and beliefs toward vaccination reduce childhood immunization rates and herd immunity.[13] Incomplete or incorrect information about the importance, reliability and protection of vaccines may be the reason for vaccine hesitancy and refusal.[14] It has been expressed that people who do not accept the services provided in the health system have more vaccine refusal and hesitancy.[11] Parents who have antenatal follow-ups and pregnancy screenings, gave birth in hospital, and had newborn screening are significantly more tend to vaccinate their children. A sample event which has triggered vaccine hesitancy has occurred in Turkey. A family who would not like to vaccinate their children has won the case, which was reflected in the newspapers and on social media as a 'legal victory' and great success.[15] Yörük et al. have determined that

CONTACT Selda Yörük syoruk@balikesir.edu.tr School of Health, Department of Midwifery, Balıkesir University, Cagis Campus, Balikesir 10145, Turkey

the main reasons for vaccine hesitancy of family healthcare professionals working in vaccination services are mistrust in vaccination, the belief of being harmful, having serious side effects and causing autism, being affected by misinformation in mass media, and religion.[16]

Pediatric vaccination rates are decreasing[17] and vaccine hesitancy is increasing in Turkey.[18] According to 2019 WHO data, there has been an increase in the incidence of vaccine-preventable infectious diseases such as measles and rubella.[19] In order to strengthen vaccination services, it is necessary to carry out studies on vaccine refusal and hesitancy in the society and to determine the reasons. More studies are needed on the frequency and causes of vaccine hesitancy in society and parents. In the literature, the number of studies examining the causes of vaccine hesitancy and refusal in Turkey is limited.[11,12,16] In addition, there is no population-based study to determine the prevalence of vaccine hesitancy.[11,12] In many countries, it has been reported that it is difficult to determine the exact origin of this trend, since data collection begins after vaccine hesitancy has become an important issue, and its causes and frequency cannot be determined at an early stage.[20] It is important to determine the frequency of vaccine refusal in the society, to monitor it in the following years, and to develop intervention, monitoring and training programs to effectively deal with vaccine hesitancy.

The aim of this study is to examine vaccine hesitancy and associated factors in females with children aged 12 months to 6 years old who receive service from the antenatal class of a tertiary hospital in Turkey

Method

Setting and sample

This cross-sectional study was conducted with parents who received service from the antenatal class of Sakarya University Training and Research Hospital, the largest maternal hospital in the city. The study group consisted of the parents who were enrolled in the antenatal class between January 2015 and December 2019 and followed-up from the antenatal class (n = 2364). The data regarding the last year were excluded because face-to-face services were not provided in the school in 2020 due to the COVID-19 pandemic. OpenEpi, Version 3, open source calculator was used to calculate the sample size. A total of 331 surveys were needed for a representative sample with 95% confidence level and 5% margin of error. Due to limitations in accessing the sample or reasons such as refusing to participate in the study, 15% were taken as backup and, accordingly, the number of individuals needed to be reached was determined as 381. Simple random sampling was preferred. 11 mothers refused to participate in the study while 370 parents accepted to participate. The study included literate parents who received service from the antenatal class, who had children between 12 months and 6 years old, who could communicate, and who were willing to participate in the study.

Measurements/instruments

Data were collected using a descriptive data form and the Parent Attitudes about Childhood Vaccines (PACV) survey.

Descriptive data registration form

A descriptive questionnaire form was developed by the researchers by examining the relevant literature.[6–12,16] The first part of this questionnaire includes sociodemographic information of the parents (the person answering the questionnaire, the age of the mother and father, education, profession, income, age and gender of the child). The second part of the questionnaire consists of questions about the pregnancy, birth and postpartum characteristics of the mother; the number of pregnancies and births, whether the pregnancy is planned or not, getting pregnant with treatment, the institution where she gave birth, the mode of delivery, getting information about childhood vaccinations during pregnancy, the duration of breastfeeding, newborn screening for her baby/child, and the use of vitamin D and iron preparation. In the third part of the questionnaire, attitudes and opinions about vaccinations are asked.

The parents are asked whether the vaccines included in the national vaccination calendar and special vaccines (rotavirus, flu vaccine, meningococcus) are administered to their children and about vaccination delays. They are also interrogated about whether they follow anti-vaccine groups on social media, there is any substance in vaccines that they are worried about (aluminum, mercury, pig gelatin), they get tetanus vaccine during pregnancy and flu vaccine in the last year, and they use alternative medicine practices. Their opinions about vaccines (6 questions) are questioned in 3-point Likert type as “I agree,” “I do not agree” and “I have no idea.”

A total of 26 parents filled out the form for the pilot administration of the study. After examining the responses, necessary corrections about items which were not clearly understood were made and the final form was created. Opinions of two Public Health experts were attained for testing the face validity of the study.

The parent attitudes about childhood vaccines (PACV)

The PACV, which was developed by Opel et al., is an instrument created to detect vaccine hesitant parents who have underimmunized children.[21] The 15-item questionnaire has three domains as behavior, safety and efficacy, and general attitudes.[21,22] In order to score the PACV, two points are given to items interrogating nondemographic information that is responded hesitantly, one point for questions responded as “don’t know or not sure,” and 0 for items that are responded nonhesitantly. Total raw scores are reached by summing item scores. Total scores to be obtained from the scale range between 0 and 10. Values between 0 and 3 were scored “2,” between 3 and 7 were scored “1,” and between 7 and 10 were scored “0.” We calculate the final scores by summing all of the answers given to the questions. Similar to the method created by Opel et al., scores were rescaled to reach values between 0 and 100 using linear transformation.[21,22] Total raw scores of the PACV were converted to a scale that ranges from 0 (least hesitant) to 100 (most hesitant). A score of 50 demonstrates vaccine hesitancy in parents, whereas a score less than 50 indicates non hesitant parents.[22] The PACV was adapted to Turkish and a reliability study was conducted by Bulun and

Acuner,[23] who found that the reliability of PACV was .84. Cronbach's α coefficient of the PACV was .81 in the present study.

Data collection

Data were collected in September-December 2020. The survey was shared electronically with Google Drive's online service system then on WhatsApp. Parents who had access to the survey link answered the questions. The completion time for the questionnaire was approximately 5–10 minutes.

Research ethics

This study was conducted in accordance with the principles of the World Medical Association (WMA) Helsinki Declaration. Ethics approval was obtained from Sakarya University Medical Faculty Clinical Research Ethics Committee (Date:05.29.2020, No:304). The consent form was on the first page of the survey. Information related to the research included the assurance that the parents had the right to refuse to participate in the research and all information to be provided would be kept confidential. The parents declared that they had agreed to participate voluntarily by marking the "I agree" option. Then, they completed the other parts of the questionnaire.

Data analysis

Statistical analysis was performed using SPSS 20.0 statistical software. Descriptive statistics were expressed as mean, standard deviation, number, and percentage. When the parents' vaccine hesitancy score is less than 50, this shows non hesitant parents. If this score is more than 50, vaccine hesitant parents are grouped as a dichotomy. In the univariate analysis, the sociodemographic characteristics of the individuals, the obstetric characteristics of the mothers, the relationship between vaccine hesitancy scores and the variables indicating their opinion on vaccines were evaluated by Pearson Chi-Square or Fisher's Chi-Square analysis. Logistic regression analysis was performed to determine the factors affecting the risk of vaccine hesitancy. Significant independent variables in chi-square analysis that were included in the model were the education of the mother, pregnancy with treatment, following the anti-vaccination groups on social media, trainings about pediatric vaccines in pregnancy, information about vaccines, the use of vitamin D and iron supplements except for illnesses, and being worried about ingredients in vaccines. The enter method was used in the logistic regression analysis and OR values were presented with 95% confidence intervals. If the p value obtained in the analysis is less than 0.05 (two sided), the difference is considered significant.

Results

The mean age of the parents was 31.35 ± 5.25 8 (min: 20; max: 47) and 93% of the participants were mothers. 58.6% of the children were between 0–24 months and 44.6% were girls. 43% of mothers and 34.3% of fathers were university graduates. The prevalence of vaccine hesitancy was 13.8% (n = 51). A significant relationship was found between the mother's education level and vaccine hesitancy) . Vaccine hesitancy was found to be higher in mothers who had university educations (OR:4.77, 95%CI:1.26–30.79) than primary school graduates (p = .022) (Table 1).

When the mode of delivery was examined, 66.8% gave birth by cesarean and 67.3% in a private hospital. 81.6% of mothers had their first or second pregnancy. 7.82% got pregnant with treatment. 20% stated that their pregnancy was not planned.

Table 1. The relationship between descriptive statistics of parents and vaccine hesitancy (n = 370).

Variables	Total	Non-hesitant (n = 319)		Hesitant (n = 51)				
Age of parents	n(%)	n	%	n	%	OR	95% CI	P
<30	159(51.1)	131	82.4	28	17.6	1 [a]		
30≥	181(48.9)	188	89.1	23	10.9	0.57	0.31–1.03	0.064
Parents								
Mother	344(93.0)	294	85.5	50	14.5	1 [a]		
Father	26(7.0)	25	96.2	1	3.8	0.23	0.03–1.77	0.231
Age of the child								
0–24 months	217(58.6)	190	87.6	27	12.4	1 [a]		
25–59 months	153(41.4)	129	84.3	24	15.7	1.30	0.72–2.37	0.373
Gender of the child								
Female	165(44.6)	143	86.7	22	13.3	1 [a]		
Male	205(55.4)	176	85.9	29	14.1	1.06	0.63–1.77	0.82
Mother's education								
Primary School	45 (12.2)	43	95.6	2	4.4	1 [a]		
High School	80 (21.6)	67	83.8	13	16.2	4.13	0.99–28.2	0.051
University	159(43.0)	130	81.8	29	18.2	4.77	1.26–30.79	0.022
Graduate school	86 (23.2)	79	91.9	7	8.1	1.89	0.40–13.83	0.420
Monthly income								
≤349 $	153(41.4)	130	85.0	23	15.0	1 [a]		
350 $ >	217(58.6)	189	87.1	28	12.9	0.83	0.42–1.51	0.55
Father's education								
Primary	41 (11.1)	37	90.2	4	9.8	1 [a]		
High School	116(31.4)	97	83.6	19	16.4	1.80	0.60–6.55	0.304
University	127 (34.3)	110	86.6	17	13.4	1.42	0.47–5.21	0.541
Graduate school	86 (23.2)	75	87.2	11	12.8	1.35	0.41–5.21	0.620

[a]Reference category

Table 2. The relationship between maternal obstetric and vaccine characteristics with vaccine hesitancy (n = 370).

	Total	Non-hesitant (n = 319)		Hesitant (n = 51)				
Variables	n(%)	n	%	n	%	OR	95% CI	p
The number of pregnancy								
1–2	302(81.6)	258	85.4	44	14.6	1 [a]		
3+	68(18.4)	61	89.7	7	10.3	0.67	0.28–1.56	.356
The number of birth								
1–2	332(89.7)	284	85.5	48	14.5	1 [a]		
3+	38(10.3)	35	92.1	3	7.9	0.50	0.15–1.71	.266
Getting pregnant with treatment								
No	341(92.2)	298	87.4	43	12.6	1 [a]		
Yes	29(7.8)	21	72.4	8	27.6	2.18	1.13–4.20	.025**
Planned pregnancy								
Yes	296(80.0)	255	86.1	41	13.9	1[a]		
No	74(20.0)	64	86.5	10	13.5	0.97	0.46–2.04	.94
Training about childhood vaccinations during pregnancy (n = 340)*								
Yes	174(51.1)	157	90.2	17	9.8	1[a]		
No	166(48.9)	136	81.9	30	18.1	2.03	1.07–3.85	.027
Mode of delivery								
Vaginal Birth	123(33.2)	109	88.6	14	11.4	1[a]		
C-section Birth	247(66.8)	210	85.0	37	15.0	1.37	0.71–2.64	.344
The place where the birth took place								
Public hospital	121 (32.7)	98	30.7	23	19.0	1[a]		
Private hospital	249 (67.3)	221	88.8	28	11.2	0.54	0.29–0.98	.042
Exclusive breastfeeding for the first 6 months								
Yes	297(80.3)	257	86.5	40	13.5	1[a]		
No	73(19.7)	62	84.9	11	15.1	1.14	0.55–2.34	.72
Duration of breastfeeding								
0–12 months	146(39.5)	122	83.6	24	16.4	1.43	0.79–2.60	.23
13–24 months	224(60.5)	197	87.9	27	12.1	1[a]		
Following anti-vaccine groups on social media								
Yes	43(11.6)	24	55.8	19	44.2	4.51	2.82–7.22	<.001
No	327(88.4)	295	90.2	32	9.8	1[a]		
Using vitamin D or iron supplements except illnesses for their child								
Yes	266(71.9)	240	90.2	26	9.8	1 [a]		
No	29(7.8)	21	72.4	8	27.6	3.49	1.33–8.60	.004
Partially	75(20.3)	58	77.3	17	22.7	2.69	1.35–5.30	.002
Worrying about ingredients in vaccines								
No	248(67.0)	235	94.8	13	5.2	1[a]		
Yes	122(33.0)	84	68.9	38	31.1	8.17	4.15–16.09	<.001
Source of information on vaccines								
Official or medical information sources	335 (90.5)	296	88.4	39	11.6	1[a]		
Social media, TV.	35 (9.5)	23	65.7	12	34.3	3.96	1.82–8.58	.001**
Using alternative medicine								
Yes	104(28.1)	81	77.9	23	22.1	2.10	1.27–3.47	.004
No	266(71.9)	238	89.5	28	10.5	1[a]		

[a]Reference category, * The ones who gave responses as "I do not remember" were removed., **Fisher's Exract test

Approximately 50% of the parents reported that they received training on pediatric vaccines during pregnancy follow-ups. Vaccine hesitancy was significantly higher in mothers who gave birth in a public hospital, who got pregnant with treatment, who did not receive training on childhood vaccines in antenatal follow-up, who followed anti-vaccine groups on social media, and who did not use vitamin D and iron supplements regularly or never used for their child ($p < .05$). Additionally, vaccine hesitancy was significantly higher in parents who stated they got information about vaccines on social media, TV, etc., who were worried about the ingredients of the vaccine (aluminum, mercury, pig gelatine), and who used alternative medicine practices ($p < .05$) (Table 2).

The rate of parents who refused any vaccine were 4.8% (n = 18). The most refused vaccines were influenza, rotavirus, and meningococcal vaccines, which are not included in the Expanded Program on Immunization (EPI) and are paid by families. Parents stated that they refused these vaccines because they thought they are expensive and unnecessary. Other important reasons for vaccine refusal were the mistrust in the vaccine, concerning that it would be harmful, worrying about side effects, religious reasons, and believing that a single dose of Hepatitis A is protective. The vaccines included in EPI and refused were BCG, DaBT-IPA, and Hepatitis A (Table 3).

Table 3. Distribution of the reasons for vaccine refusal (n = 18).

Reason(s) selected by participants	n (%)
Mistrust in the vaccine ingredients	3 (16.6)
Adverse effect (BCG, Allergy)	1 (5.6)
The belief of being harmful to the child (Hepatitis A, BCG)	2 (11.1)
Refusing special vaccines (influenza, rotavirus, meningococcal vaccine) (expensive, unnecessary)	10 (55.5)
Hepatitis A second dose (the belief that a single dose is protective)	1 (5.6)
Religious reasons (the belief that there are porcine products in rotavirus vaccine)	1 (5.6)

Table 4. Factors affecting vaccine hesitancy according to logistic regression analysis.

Variables	OR	CI 95%	p
Mother's education			
Primary	1 [a]		
High school	0.79	0.13–4.63	.802
University	1.84	0.34–9.74	.47
Graduate school	2.82	0.59–13.43	.19
Pregnancy with treatment			
No	1 [a]		
Yes	3.05	1.02–9.10	.045
Training on vaccines during pregnancy			
Yes	1 [a]		
No	1.38	0.65–2.91	.38
Vitamin D use			
Yes	1 [a]		
No	3.74	1.17–11.96	.026
Partially	1.70	0.75–3.86	.199
Alternative medicine use			
No	1 [a]		
Yes	1.55	0.73–3.28	.250
Following anti-vaccine groups on social media			
No	1 [a]		
Yes	3.01	1.23–7.33	.015
Source of information			
Scientific information	1 [a]		
Social media	1.89	0.62–5.73	.255
The place where the birth took place			
Public Hospital	1.25	0.23–3.54	.278
Private Hospital	1 [a]		
Worrying about ingredients in vaccines			
No	1 [a]		
Yes	2.93	1.20–7.15	.018

[a]Reference category; boldface indicates statistical significance ($p < .05$).

Among the independent variables included in the logistic regression model to determine the factors affecting the vaccine hesitancy of the parents, the risk of vaccine hesitancy increases 3.05 times (CI 95%, OR:1.02–9.10) in pregnancies with treatment, 3.74 times (CI 95%, OR:1.17–11.96) in those who do not use vitamin D or iron preparations, 3.01 times (CI 95%, OR:1.23–7.33) in those who follow anti-vaccine groups on social media, and 2.93 times (CI 95%, OR:1.20–7.15) in those who state that vaccines contain a substance of concern (Table 4).

Discussion

In this study, we aimed to determine the frequency of vaccine hesitancy and causes of vaccine hesitancy in parents with 12 months-6 years old children. In our study, vaccine hesitancy prevalence was determined as 13.8% and vaccine refusal was 4.8%. The most common reasons for vaccine hesitancy were found as not using regular vitamin D and iron supplements, getting pregnant with treatment, following anti-vaccine groups on social media, and worrying about the ingredients of the vaccine.

Although there is no standardized tool to measure vaccine hesitancy, the tool developed by Opel et al. can fill the void.[21] In addition, a series of survey questions measuring hesitancy have been suggested by WHO's SAGE working group recently.[3] In cross-sectional studies evaluating the prevalence of vaccine hesitancy using PACV, the prevalence has been found to be varied.[6–8,24–26] In our study, Vaccine hesitancy prevalence in our study was slightly higher than that of in Malaysia (11.6%)[24] and United Arab Emirates (12%).[25] On the other hand, the prevalence found in our study were lower than that of in Italy (15.6%),[26] in Indonesia (15.9%).[7]

People who follow anti-vaccine groups on social media have more vaccine hesitancy. Today, the use of social media and internet is an important factor influencing vaccination decision. Fake news and misinformation quickly spread on social media, which is the main cause of vaccine hesitancy.[27] In the digital age we live in, the media are still effective in forming an attitude toward vaccines and the interactive social media platforms are effective in the increase of vaccine refusal. It is seen that anti-vaccine groups reach wider audiences and organize them all over the world via social media and the internet.[20] Social media disinformation is the most effective factor in the spread of anti-vaccine movement by accelerating the spread of fear culture.[28] Personal stories of social media and internet users about vaccines may negatively affect the vaccination decision by causing information pollution, fear and anxiety. An important finding of this study was that there were many vaccine hesitant parents who followed anti-vaccine groups on social media, which is similar to the literature. In their study conducted with the university students in Turkey, Yörük found that the vaccine hesitancy because of the social media influence were 27.7% among the relatives of the participants.[29] Yörük et al. also reported that the most important reason of vaccine hesitancy among family health care workers as social media with 35.7%.[16]

Vaccine hesitancy was found to be higher in participants stating that they had a child with fertility treatment. In these families, the reason of high hesitancy may be the fact that they are more sensitive to their children's health.

In our country, families are recommended to use vitamin D from the 15th day to 12 months, and routine iron preparations from the 4th to 12th months. It was observed that the parents who did not use regular vitamin D and did not use iron supplements had more vaccine refusal. In the studies of Topcu et al, similar results were found with our findings.[11] In the literature, families called as "vaccine refusers" reject applications such as vitamin K and ocular prophylaxis.[30] It is predicted that there may be a relationship between the refusal of routine health care services and vaccine hesitancy.

In the literature, the most important causes of vaccine hesitancy in Turkey are mistrust in vaccines, the belief that it is risky and not beneficial. Vaccine refusal is more common in families who are concerned about the ingredients of the vaccine. Families stated that they were concerned about porcine products, mercury and aluminum. The rejection of porcine skin graft in vaccines is thought to have a role in vaccine refusal in Muslim societies such as Turkey.[31] In a study conducted in China, religious reasons had no effect on vaccine hesitancy.[32] Another reason of concern is that the mercury and aluminum may cause autism, multiple sclerosis, etc.

The strength of our study is that the prevalence and causes of vaccine refusal and hesitancy in families were determined. The relationship between sociodemographic and obstetric reasons was examined in detail. This study is important in determining the prevalence of vaccine refusal and hesitancy in Turkey. It contributes to monitoring and evaluation. It also contributes to future studies.

The most important limitation of the study is that this cross sectional study was conducted with families trained in the antenatal class of a tertiary hospital in a western province of Turkey. Therefore, it may have created a limitation in evaluating the temporal aspect of the cause – effect relationship. In addition, the fact that the study was conducted in a university hospital prevented the results from being generalized to the society. The fact that the answers given to the questionnaire were based on the statements of the individuals and that the answers were affected by the memory factor may be among the other limitations of the study. Families may not have remembered which vaccine they were administered and their birth and postpartum features.

In conclusion, the prevalence of vaccine hesitancy was determined as 13.8% and the prevalence of vaccine refusal was 4.8% in our study. Following anti-vaccine groups on social media, not using regular vitamin D and iron supplements, and worrying about the ingredients of the vaccine were among the main reasons for vaccine hesitancy in families.

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Authors' contributions

SY participated in the design of the study, acquisition of data, performed the statistical analysis and drafted the manuscript. DG participated in the design of the study and acquisition of data. All authors read and approved the final manuscript.

Disclosure of potential conflicts of interest

The authors declare that they have no competing interests.

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ORCID

Selda Yörük http://orcid.org/0000-0003-3840-1996
Döndü Güler http://orcid.org/0000-0003-2618-4920

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