

# VACCINATION OF POLISH PREGNANT WOMEN IN THE PERINATAL PERIOD AGAINST COVID-19

Katarzyna Filipiak<sup>1A,B,C,D</sup>, Justyna Kot<sup>2C,D</sup>, Patrycja Ostrogórska-Gonszewska<sup>3C,D</sup>, Anna Leja-Szpak<sup>4E,F</sup>, Dorota Matuszyk<sup>3A,E,F</sup>

<sup>1</sup>Clinical Department of Obstetrics and Perinatology, University Hospital in Krakow, Poland

<sup>2</sup>Department of Maternal Health, Institute of Nursing and Midwifery, Faculty of Health Sciences, Jagiellonian University Medical College in Krakow, Poland

<sup>3</sup>Section of Basic Obstetrics Training, Institute of Nursing and Midwifery, Faculty of Health Sciences, Jagiellonian University Medical College in Krakow, Poland, Poland

<sup>4</sup>Department of Medical Physiology, Institute of Physiotherapy, Faculty of Health Sciences, Jagiellonian University Medical College in Krakow, Poland

## Authors' contribution:

A. Study design/planning • B. Data collection/entry • C. Data analysis/statistics • D. Data interpretation • E. Preparation of manuscript • F. Literature analysis/search • G. Funds collection

## Address for correspondence:

Patrycja Ostrogórska-Gonszewska  
Section of Basic Obstetrics Training  
Institute of Nursing and Midwifery  
Faculty of Health Sciences  
Jagiellonian University Medical College  
Krakow, Poland  
e-mail: patrycja.ostrogorska@uj.edu.pl

SUBMITTED: 25.03.2023

ACCEPTED: 12.04.2023

DOI: <https://doi.org/10.5114/ppiel.2023.129134>

## ABSTRACT

**Introduction:** The Polish Society of Gynaecologists and Obstetricians and other scientific organizations emphasize that pregnant women represent a group with a higher risk of severe COVID-19 infection with SARS-CoV-2. Scientific societies recommend that pregnant women get immunized against COVID-19, especially with the use of preparations based on mRNA technology.

The aim of the study was to determine the level of vaccination of pregnant women against COVID-19.

**Material and methods:** A survey was conducted between February and March 2022 at a hospital in Krakow. The survey questionnaire consisted of 38 questions on demographic characteristics, the clinical and obstetric situation, and health behaviours during the COVID-19 pandemic. The respondents were pregnant, in the perinatal period.

**Results:** 53.6% of the respondents had received a COVID-19 vaccination. Most of the vaccinated women (81.4%) had received the Comirnaty vaccine (BioNTech and Pfizer). As many as 46% of the women had not been vaccinated against COVID-19, out of which nearly 53% still did not intend to undergo immunization. The women had knowledge of the PSGO's recommendations. Correct answers to two questions asked were given by 70.9% (first question) and 48.2% (second question) of the respondents. There was a statistically significant correlation between age and education, and the level of COVID-19 vaccination. Medical personnel and knowledge were the factors contributing to the women's decisions to get vaccinated. The main reason for getting vaccinated was to protect oneself and the child to be born, while those pregnant women who did not want to receive the vaccine reported fear of side effects in the foetus as the main cause.

**Conclusions:** Being ill with COVID-19 before pregnancy influenced the decision not to vaccinate during pregnancy. Getting vaccinated for COVID-19 in the full course before pregnancy is a form of protection against getting ill during pregnancy, but it does not completely eliminate the risk of infection.

**Key words:** pregnancy, vaccinations, SARS-CoV-2 virus, COVID-19 pandemic.

## INTRODUCTION

Reports on the first appearance of a new, human, pathogenic virus came from the city of Wuhan (Hubei, China) in December 2019 [1]. The International Committee on Taxonomy of Viruses (ICTV) named it severe acute respiratory syndrome coronavirus 2: SARS-CoV-2. As a highly contagious virus, it quickly spread to many regions, causing the coronavirus disease 2019 (COVID-19). Due to the number of people infected, the COVID-19 disease was recognized by the World Health Organization (WHO) as a pandemic on 11 March 2020 [2]. In Poland, the first case of COVID-19 was reported on 4 March 2020. The Ministry of Health reports that since then the number of infections in Poland has exceeded 6 million [3].

The SARS-CoV-2 virus causes respiratory disease of various nature: asymptomatic, mild, or moderate. Among the typical symptoms of the disease are fever, dry cough, shortness of breath, muscle pain, and fatigue. Some patients complain of loss of sense of smell (anosmia) or taste (ageusia). Symptoms reported by more severely ill patients include coughing up blood, diarrhoea, nausea, and vomiting [2]. People infected with the SARS-CoV-2 virus and suffering from comorbidities often experience shortness of breath, hypoxia, and changes in the lungs, which are an indication for hospitalization in an intensive care unit (ICU) [1]. Complications of COVID-19 include kidney failure and liver damage. In serious cases, acute respiratory distress syndrome (ARDS) can develop, which is life-threatening [2].

The Polish Society of Gynaecologists and Obstetricians (PSGO) emphasizes the fact that being pregnant can influence the risk for infection and severe COVID-19 outcomes [4]. During pregnancy, a woman's body undergoes changes, e.g. hormonal changes and consequences, mechanistic effects of the enlarging uterus, increased metabolic demands of the fetoplacental unit, changing lung volumes, mechanics of ventilation, control of respiration, and decrease in functional residual capacity (FRC). The airway in pregnancy is both anatomically and physiologically challenging with increased oxygen consumption. Additionally, the functioning of the immune system is modified, which is associated with greater susceptibility of pregnant women to viral infections [5, 6]. The increasing size of the uterus limits the mobility of the diaphragm, which reduces the effectiveness of lung ventilation [7].

A greater risk of serious complications of COVID-19 during pregnancy (such as severe COVID-19, admission to an intensive care unit [ICU], invasive ventilation, maternal death) is observed in older mothers, mothers with overweight and obesity, and those suffering from comorbidities such as hypertension, diabetes, or pre-eclampsia [8]. Maternal COVID-19 diagnosis can cause preterm birth or caesarean section delivery [9]. The risk of transmission of the SARS-CoV-2 virus to the newborn was considered in scientific research, but the results are not clear [9, 10]. The systematic review carried out by Sánchez-García *et al.* suggests that vertical transmission from mother to child could be exceptionally possible at the time of delivery or breastfeeding, but not through the placenta [11]. Kyle *et al.* concluded that vertical transmission of SARS-CoV-2 is rare, and exposed neonates generally show favourable health outcomes [12]. Norman *et al.* found that maternal SARS-CoV-2 infection was positively associated with some neonatal morbidities, including respiratory disorders and hyperbilirubinae-

mia, but not with mortality or length of hospitalization in the neonatal ward [13].

The virus that causes COVID-19 is mainly spread from person to person (via the infected person's nose, eyes, and mouth). To prevent transmission of the pathogen, it is important to take behavioural measures, such as washing hands, social distancing, and wearing masks [14]. What is more, the European Medicines Agency (EMA) authorized 5 vaccines to prevent COVID-19. Currently available vaccines are shown in Table 1 [15-19].

Vaccination is the mainstay of preventive medicine for many infectious diseases. When a woman is vaccinated during pregnancy, she protects herself against the disease and protects her unborn child from congenital infection and harmful complications in the case of the mother's sickness. Thanks to transplacental transport of IgG antibodies and breast milk transfer of IgA antibodies, immunity is acquired by children during foetal life, as well as in the neonatal and infant period [20]. Scientific societies recommend vaccination against COVID-19 in pregnant and lactating women with mRNA vaccines [4, 21-24].

The main objective of the study was to determine the level of vaccination of pregnant women against COVID-19. In addition, it was decided to examine women's knowledge about vaccinations, identify the main motivations for vaccination and the reasons for resignation, as well as determine the attitude of pregnant women to comply with the recommended methods of preventing the spread of the SARS-CoV-2 virus.

## MATERIAL AND METHODS

The study was conducted from February to March 2022 at the Clinical Department of Obstetrics and Perinatology of the University Hospital in Krakow. The survey questionnaire consisted of 38 questions

**Table 1.** Characteristics of COVID-19 vaccines approved by EMA [15-19]

Type	Name (manufacturer)				
	Comirnaty (BioNTech and Pfizer)	Spikevax (Moderna)	Vaxzevria (AstraZeneca)	Jcovden (Janssen/Johnson & Johnson)	Nuvaxovid (Novavax)
Use in pregnancy	mRNA	mRNA	Vector	Vector	Classic
Use during lactation	Can be used in pregnancy Despite limited data on the 1 <sup>st</sup> trimester of pregnancy, no increased risk of miscarriage was observed Abundant data on the 2 <sup>nd</sup> and 3 <sup>rd</sup> trimester of pregnancy showed no increase in the risk of complications during pregnancy		A decision of a pregnant woman to receive the vaccine should be made after consultations with medical personnel, considering the risks and benefits Data on the use of this vaccine during pregnancy are very limited, although initial animal studies demonstrated no harmful effect on pregnancy or development of the embryo and/or foetus		
	Can be used during lactation Data on lactating women allowed for a conclusion that there was no risk of adverse reactions in children fed with their mother's milk		No studies were conducted among lactating women		

**Table 2.** The matrix correlation between dimensions of burnout and demand scale, control scale, social support scale, well-being scale, and need for change scale

Socio-demographic characteristics	N	%
Place of residence		
Big town/city (> 50,000 inhabitants)	50	45.5
Small town (5000-50,000 inhabitants)	16	14.5
Village	44	40.0
Marital status		
Single	7	6.4
Cohabitation	3	2.7
Married	98	89.1
Divorced	2	1.8
Widow	0	0.0
Education		
Primary	0	0.0
Lower secondary	0	0.0
Vocational	9	8.2
Secondary/post-secondary	1	0.9
Secondary/college	20	18.2
Higher	80	72.7
Professional activity		
Unemployed	7	6.4
Pupil/student	8	7.3
Professionally active	95	86.4
Satisfaction with salary		
Yes	67	60.9
No	43	39.1

about demographic characteristics, the clinical and obstetric situation, and health behaviours undertaken during the COVID-19 pandemic.

The respondents were women of reproductive age, giving birth for the first or subsequent time by vaginal delivery or caesarean section, usually after the 37<sup>th</sup> week of pregnancy, but term pregnancy was not a condition for participation in the study.

The collected data was analysed using PS IMAGO PRO 7 (IBM SPSS Statistics 27). Pearson's chi-square statistical test ( $\chi^2$ ) was used to analyse the relationship between qualitative variables, and Fischer's exact test was used for smaller groups. The level of statistical significance was  $\alpha = 0.05$ . Statistically significant results are presented in bold in the tables.

All necessary consents were obtained to conduct the study.

## RESULTS

The study involved 116 women in the perinatal period, of whom 110 fulfilled the inclusion criteria (age > 18 years, informed consent to participate in the

study, complete questionnaire) and whose answers were used for further analysis.

The mean age in the study group was 31.64 years, ranging from 20 to 44 years. In total, 60% of the survey participants lived in the city, while 40% reported the countryside as their place of residence. As many as 89.1% of the respondents were married, and some described their marital status as single (6.4%), cohabitation (2.7%), or divorced (1.8%). The respondents were mostly highly educated (72.7%). In the surveyed group, 86.4% reported professional activity. The remaining respondents were studying (7.3%) or unemployed (6.4%). 60.9% of the survey participants were satisfied with their financial situation. Detailed socio-demographic characteristics are presented in Table 2.

In the study group, 47.3% of women gave birth for the first time, while 52.7% were multiparous. 52.7% were qualified for vaginal delivery and 47.3% for caesarean section. Taking into account the clinical situation, 51.8% reported the presence of at least one comorbid condition; the most common were hypothyroidism (36.4%), gestational diabetes (15.5%), and hypertension (10.9%). Of those participating in the study, 51.8% did not develop COVID-19. The remaining 48.2% of the respondents were infected. Taking into account the period of onset, 43.4% of women suffered from the disease before pregnancy, 5.7% in the first trimester of pregnancy, 22.6% of women suffered from the disease in the second trimester, and 28.3% in the third trimester of pregnancy. Each of the respondents who suffered from COVID-19 reported that the disease was mild and they did not require hospitalization (Tables 3 and 4).

The respondents were asked about compliance with the recommendations of the Ministry of Health regarding the prevention of the spread of the SARS-CoV-2 virus and about the impact of the coronavirus pandemic on their behaviour and decisions (the results are presented in Table 5). The vast majority of respondents wore a mask in accordance with the guidelines of the Ministry of Health (91.8%) and regularly washed and disinfected their hands (87.2%). More than three-quarters (80%) of the respondents tried to avoid large groups of people and keep a safe distance, while almost half (45.5%) were afraid to leave the house due to the possibility of becoming infected with the SARS-CoV-2 virus. Slightly more than 8% of the respondents delayed their maternity plans due to the coronavirus pandemic, and 2.7% of the respondents admitted that the decision to become parents depended on the possibility of being vaccinated against COVID-19.

Among the surveyed women, 53.6% were vaccinated against COVID-19. Among the vaccinated women, most (81.4%) were vaccinated with Comirnaty (BioNTech and Pfizer). Respondents vaccinated against COVID-19 as the main motivation for vaccination stated the belief that vaccination against COVID-19 would

allow them to pass the disease mildly and reduce the risk of complications (69.5% of respondents). Other frequently given arguments included willingness to provide the child with antibodies in transplacental transfer (57.6%) and being in favour of vaccination (52.5%). The respondents also gave such motivations as the belief that vaccination will help in the fight against the pandemic (35.6%) or the fear that

the lack of vaccination will be the reason for refusing hospitalization (22%). Due to the recommendation of the medical staff, 30.5% of the surveyed women were vaccinated. A small percentage (1.7%) reported that they were immunized because being vaccinated allowed them to travel abroad.

On the other hand, the main reason for refusing a COVID-19 vaccine was the concern about the possibility of complications in the foetus related to taking the vaccine (which concerned as much as 74.5% of the respondents). Nearly half of the respondents (49%) were afraid of vaccine side effects. A significant proportion of the respondents believed that the research on the safety profile of the vaccine was insufficient and 33.3% of the respondents were not convinced about the effectiveness of the vaccine. Some of the respondents cited previous COVID-19 illness as the reason for not vaccinating. Other arguments, which were reported by the respondents in smaller percentages, were anxiety that vaccination will cause COVID-19 disease, fear of possible complications in the event of illness, or advice against vaccination by a doctor, midwife, or relative.

Among the group of unvaccinated women, 47.1% declared their willingness to be vaccinated, 33.3% only after the end of the lactation. On the other hand, 52.9% of women claimed that they did not plan to be vaccinated any further.

In the surveyed group of pregnant women, the most frequently chosen source of knowledge about

**Table 3.** Obstetric and clinical characteristics of the respondents

Obstetric characteristics	N	%
Number of past deliveries		
1	52	47.3
2	42	38.2
3	11	10.0
4	5	4.5
Number of past miscarriages		
0	83	75.5
1	14	12.7
2	6	5.5
3	7	6.4
Qualification for delivery		
Vaginal delivery	58	52.7
Caesarean section	52	47.3
Completed weeks of gestation		
< 37 weeks	11	10.0
> 37 weeks	99	90.0
Clinical characteristics	N	%
Comorbidities		
Pregestational diabetes mellitus (PGDM)	1	0.9
Gestational diabetes mellitus (GDM)	17	15.5
Hypertension	12	10.9
Hypothyroidism	40	36.4
Other	8	7.2
No comorbidities	53	48.2
Getting over COVID-19		
Yes	53	48.2
No	57	51.8

**Table 4.** Characteristics of the infected respondents

Socio-demographic characteristics	N	%
Time of getting COVID-19		
Before pregnancy	23	20.9
In the 1 <sup>st</sup> trimester of pregnancy	3	2.7
In the 2 <sup>nd</sup> trimester of pregnancy	12	10.9
In the 3 <sup>rd</sup> trimester of pregnancy	15	13.6
Course of COVID-19		
Mild, not requiring hospitalization	53	100.0
Aggravated, requiring hospitalization	0	0.0

**Table 5.** Health behaviours undertaken by the respondents during the pandemic

Health behaviours undertaken during the COVID-19 pandemic	Answers given by the respondents									
	Definitely yes		Mostly yes		I don't know		Mostly no		Definitely no	
	n	%	n	%	n	%	n	%	n	%
Wearing a mask in accordance with the guidelines of the Ministry of Health	66	60.0	35	31.8	4	3.6	5	4.5	0	0.0
Regular washing and disinfecting hands	59	53.6	37	33.6	7	6.4	7	6.4	0	0.0
Avoiding large groups of people and keeping a safe distance	52	47.3	36	32.7	11	10.0	11	10.0	0	0.0
Avoiding going out for the fear of becoming infected with SARS-CoV-2	21	19.1	29	26.4	9	8.2	35	31.8	16	14.5

**Table 6.** Knowledge of the respondents concerning the opinion of the Polish Society of Gynaecologists and Obstetricians on COVID-19 vaccination in pregnant women

Question 1			
Answer	n	%	Comments
Pregnant women should undergo mandatory vaccination against COVID-19	6	5.5	Incorrect answer
Pregnant women are advised to get vaccinated against COVID-19, but the vaccination should be consulted with a doctor	78	70.9	Correct answer
Pregnant women should not be vaccinated against COVID-19	3	2.7	Incorrect answer
I don't know	23	20.9	Incorrect answer
Question 2			
Answer	n	%	Comments
Recommended at every phase of pregnancy	19	17.3	Incorrect answer
If no indications for urgent vaccination are present, it should take place after completion of the 1 <sup>st</sup> trimester of pregnancy (completion of 12 weeks of pregnancy)	53	48.2	Correct answer
The vaccination is not acceptable during pregnancy	0	0.0	Incorrect answer
I don't know	38	34.5	Incorrect answer

vaccinations against COVID-19 was information obtained from medical staff (66.4% of respondents).

The respondents were asked two questions regarding their knowledge of the current statement of the PSGO on vaccination of pregnant women against COVID-19 and the period of pregnancy in which it should be performed. Question 1 was: *Please mark the current statement of the PSGO on vaccination against COVID-19*, and question 2 was: *Please indicate in what period of pregnancy the PSGO recommends vaccination of pregnant women against COVID-19*. The correct answer regarding the statement of the PSGO on vaccination of pregnant women against COVID-19 was given by 70.9% of the respondents. Among the respondents, 48.2% knew that if there were no indications for urgent vaccination, pregnant women could be vaccinated after the end of the first trimester (correct answer). None of the women indicated that vaccination against SARS-CoV-2 was unacceptable during pregnancy. The exact distribution of answers to questions 1 and 2 is presented in Table 6. Among the respondents who knew the PSGO recommendations, 39.7% were vaccinated against COVID-19. This percentage was different in the group of women who did not know the PSGO recommendations, of whom only 18.8% were vac-

inated. The differences are statistically significant. The data are presented in Table 7.

To verify the assumptions of the work, statistical analyses were performed, the results of which are presented in Tables 7-9.

Among the socioeconomic data, age ( $p = 0.035$ ) and education ( $p < 0.001$ ) had an impact on vaccination against SARS-CoV-2. Older (70.0%) and better educated (67.5%) women were more likely to be vaccinated. However, the place of residence had no influence on the decision to vaccinate.

The study showed no differences between wearing a mask, washing and disinfecting hands, avoiding large groups of people and keeping a safe distance, as well as the fear of leaving the house, and the level of vaccination of pregnant women against COVID-19.

The analysis of the results showed that there was a statistically significant relationship between the medical personnel recommending vaccinations to pregnant women and their vaccination ( $p < 0.001$ ). The obtained knowledge from medical staff ( $p = 0.002$ ), as well as knowledge of the recommendations of the PSGO ( $p = 0.034$ ) and the recommended period for vaccination against COVID-19 ( $p = 0.013$ ), also had an impact on getting vaccinated against COVID-19.

However, no relationship was demonstrated between obtaining knowledge about vaccinations from the media, scientific reports, or information obtained from family and relatives and being vaccinated against COVID-19. Statistical analysis did not show a statistically significant relationship between a bad obstetric history (miscarriage in the history) or having comorbidities and being vaccinated against coronavirus among pregnant women. The data are presented in Table 7.

Considering the relationship between getting COVID-19 before pregnancy and being vaccinated against SARS-CoV-2 during pregnancy, it was noted that being ill with coronavirus encouraged women not to be vaccinated against COVID-19 during pregnancy ( $p = 0.002$ ). The data are presented in Table 8.

Verifying the relationship between being vaccinated with a complete course of vaccinations against COVID-19 before pregnancy and falling ill with the SARS-CoV-2 virus during pregnancy, it was found that receiving a full course of vaccinations against COVID-19 before pregnancy minimized the risk of getting COVID-19 during pregnancy but could not completely exclude it ( $p = 0.034$ ). The data are presented in Table 9.

## DISCUSSION

Although pregnant women infected with the SARS-CoV-2 virus usually experience asymptomatic or mild disease, it should be emphasized that pregnancy may have an adverse effect on the course of

**Table 7.** Analysis of variables affecting the vaccination coverage of the respondents

Variable	Vaccination against COVID-19				p
	Yes		No		
	n	%	n	%	
Sociodemographic data	Age				0.035*
	< 35 years	38	47.5	42	52.5
	≥ 35 years	21	70.0	9	30.0
	Education				< 0.001*
	Higher	54	67.5	26	32.5
	Less than higher	5	16.7	25	83.3
Place of residence					0.532*
	City	37	56.1	29	43.9
	Country	22	50.0	22	50.0
Health behaviours	Wearing a mask				0.564*
	< 35 years	55	54.5	46	45.5
	≥ 35 years	4	44.4	5	55.6
	Washing and disinfecting hands				0.153*
	Higher	49	51.0	47	49.0
	Less than higher	10	71.4	4	28.6
	Keeping a safe distance				0.566*
	Yes	46	52.3	42	47.7
	No	13	59.1	9	40.9
	Avoiding going out for the fear of becoming infected with SARS-CoV-2				0.650*
Yes	28	56.0	22	44.0	
No	31	51.7	29	48.3	
Recommending vaccination by the medical personnel				< 0.001*	
Yes	35	54.7	29	45.3	
No	9	19.6	37	80.4	
Acquiring knowledge about vaccination	Media				0.393*
	Yes	23	48.9	24	51.1
	No	36	57.1	27	42.9
	Scientific reports				0.207*
	Yes	23	46.9	26	53.1
	No	36	59.0	25	41.0
	Medical personnel				0.002*
	Yes	47	64.4	26	35.6
	No	12	32.4	25	67.6
Family and friends				0.181*	
Yes	9	40.9	13	59.1	
No	50	56.8	38	43.2	
Respondents' knowledge	Opinion of the Polish Society of Gynaecologists and Obstetricians on vaccination in pregnant women				0.034*
	Yes	31	39.7	47	60.3
	No	6	18.8	26	81.3
	Recommended period for COVID-19 vaccination				0.013*
Yes	24	45.3	29	54.7	
No	13	22.8	44	77.2	
Clinical condition	History of miscarriage				0.969*
	Yes	10	37.0	17	63.0
	No	27	32.5	56	67.5
	Comorbidities during pregnancy				0.984*
Yes	13	22.8	44	77.2	
No	12	22.6	41	77.4	

\* On the basis of chi-square test of independence

**Table 8.** Analysis of correlation between getting over COVID-19 before pregnancy and vaccination against COVID-19 during pregnancy

Vaccination against COVID-19 during pregnancy	Getting over COVID-19 before pregnancy				<i>p</i>
	Yes		No		
	<i>n</i>	%	<i>n</i>	%	
Yes	0	0.0	25	28.7	0.002**
No	23	100.0	62	71.3	

\*\* Based on the Fisher test

**Table 9.** Analysis of correlation between receiving a full cycle of COVID-19 vaccination before pregnancy and getting the SARS-CoV-2 virus during pregnancy

Getting the SARS-CoV-2 virus during pregnancy	Receiving a full cycle of COVID-19 vaccination before pregnancy				<i>p</i>
	Yes		No		
	<i>n</i>	%	<i>n</i>	%	
Yes	2	9.1	28	31.8	0.034**
No	20	90.9	60	68.2	

\*\* Based on the Fisher test

COVID-19 [7]. The most common symptoms in pregnant women are fever and cough. Observations show that pregnant women manifest symptoms of the disease less often but require hospitalization in ICUs more often than their non-pregnant peers. Staying in such a ward is associated with a higher risk of implementing invasive procedures, such as mechanical ventilation or extracorporeal membrane oxygenation (ECMO) [8].

Until the development of vaccines against COVID-19, disease prevention was based mainly on non-pharmacological methods of preventing infection, such as washing hands, social distancing, or wearing masks [25]. When vaccines against COVID-19 were approved in the European Union by the European Medicines Agency (EMA), prophylaxis was enriched with vaccinations, which is recommended for pregnant women by the Polish Society of Gynaecologists and Obstetricians, the American College of Obstetricians and Gynaecologists (ACOG), the Royal College of Obstetricians and Gynaecologists (RCOG), the Society for Maternal-Foetal Medicine (SMFM), and the Centres for Disease Control and Prevention (CDC) [4, 21-24].

Studies on the safety and effectiveness of vaccines are necessary before marketing authorization. Many scientific studies, systematic reviews, and meta-analyses have been carried out, which have proven that vaccines reduce the risk of suffering from COVID-19, among others in pregnant women. The meta-analysis by Ma *et al.* showed that vaccination of pregnant women with vaccines based on

mRNA technology reduced the risk of SARS-CoV-2 infection and reduced the risk of hospitalization for this reason. After administration of the vaccine, no adverse effects were detected in women, fetuses, and newborns [26]. Possible side effects of the vaccine, such as pain at the injection site, tiredness, and headache, were transitory and had no harmful effects on the pregnancy. What is more, thanks to vaccination, the body's immune response is triggered by the production of antibodies for the mother and foetus. Two doses of the vaccine are recommended. After the first dose, the production of antibodies occurs very quickly. However, after the administration of the next dose, the immune response is stronger and is associated with better transport of antibodies across the placenta. The passage of a longer amount of time between the vaccination of the pregnant woman and the birth determines the higher level of IgG antibodies in the foetus [27]. In the short-term perspective, it can be concluded that the vaccination does not adversely affect the period of pregnancy, delivery, and the health of newborns.

In our own research, the group of pregnant women vaccinated against COVID-19 consisted of 53.6% of respondents who were vaccinated before or during pregnancy. Egloff *et al.* conducted a diagnostic survey in France from February to April 2021, in which they asked pregnant women about their statement on vaccination against the SARS-CoV-2 virus. In the cited study, 29.5% of respondents agreed to be vaccinated. As reasons for vaccination, the respondents cited protecting themselves (84.7%) and the child to be born (62.2%). Pregnant women who did not want to be vaccinated explained their beliefs mainly by the fear of side effects in the foetus (76.9%) [28]. A similar conclusion was provided by our own study, in which almost 75% of respondents indicated the issue of side effects on the foetus as the main reason for not being immunized against COVID-19. Egloff *et al.* also showed the effect of age on the frequency of vaccination against the SARS-CoV-2 virus. Slightly older people were vaccinated more often [28]. A similar relationship was proven in our study, as well as the impact of higher education on vaccination. This relationship was not confirmed by studies by Kansal *et al.*, which showed no relationship between the level of education and the consideration of vaccination [29].

In a cross-sectional study conducted from April to October 2021 in the Czech Republic among pregnant and lactating women, Riad *et al.* showed that the acceptance of COVID-19 vaccines was high but differed in both groups (76.6% vs. 48.8%). In our own study, the group of respondents consisted only of pregnant women. Despite this, the potential willingness to be vaccinated during lactation by mothers who were not vaccinated during pregnancy was verified – then the acceptance of COVID-19 immunization was only

13.8%. As in our study (81.4%), in the study by Riad *et al.* the respondents most often used a vaccine based on mRNA technology (58.6%) [30].

Based on our own research, the relationship between recommending vaccinations during pregnancy and being vaccinated for these vaccinations has been proven. If the medical staff issued recommendations, nearly 55% of pregnant women were vaccinated, while in the opposite situation less than 20% of respondents were vaccinated. The impact of consultations with a doctor on decision-making processes regarding vaccination (especially against COVID-19) is shown by the results of a study by Januszek *et al.* conducted in Poland and Ukraine. 53.3% of pregnant women from Poland and 16.7% of pregnant women from Ukraine reported a willingness to be vaccinated against coronavirus. After the medical visit, this percentage increased to 72.6% and 46%, respectively. The authors reported that providing information on the safety, effectiveness, and benefits of immunization against COVID-19, which takes place during a medical consultation, may increase the acceptance of vaccines by 105.6% in Poland and by 176% in Ukraine [31].

## CONCLUSIONS

Due to the high percentage of women who are not vaccinated during pregnancy and the reluctance to undergo immunization after pregnancy and lactation, educational activities in the field of COVID-19 vaccination should be undertaken. Education conducted by doctors and midwives in cooperation with the Ministry of Health has a significant impact on shaping the health behaviours of pregnant women. It could help to avoid dangerous complications of the disease and reduce the number of hospitalizations. It is necessary to ensure that all medical professionals present a uniform attitude and refer to credible sources of knowledge.

Being ill with COVID-19 before pregnancy influenced the decision not to vaccinate during pregnancy. Getting vaccinated for COVID-19 in the full course before pregnancy is a form of protection against getting sick during pregnancy, but it does not completely eliminate the risk of infection.

### Disclosure

The authors declare no conflict of interest.

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