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RESEARCH ARTICLE

UPTAKE OF INFLUENZA, PERTUSSIS AND COVID-19 VACCINES DURING PREGNANCY IN THE POST PANDEMIC ERA IN WESTERN GREECE

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Abstract

Background: Although vaccination against influenza, pertussis and COVID-19 is recommended during pregnancy, rates of uptake are suboptimal. This study aims to assess the knowledge and attitudes of women towards antenatal vaccination, the predictors of vaccine uptake and the impact of the COVID-19 pandemic.

Method and Material: We conducted a questionnaire-based cross-sectional study on pregnant and postpartum women in ten public healthcare facilities in Western Greece.

Results: Out of 145 women recruited, 18% were vaccinated against influenza during current or recent pregnancy, 11.8% against pertussis, and only 4.9% against COVID-19. Obstetrician`s recommendation was an important predictive factor of vaccination (p=0.021, OR=7.223 for influenza vaccination, p=0.045, OR=9.421 for COVID-19 vaccination). The COVID-19 pandemic did not seem to have affected pregnant women's attitudes.

Conclusions: Vaccination rates of pregnant women in Western Greece remain low. Public health interventions to increase awareness in the field should target both pregnant women and healthcare professionals involved in perinatal care.

Keywords: Vaccination, pregnancy, influenza, pertussis, COVID-19.

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INTRODUCTION

Influenza, pertussis, and COVID-19 are infectious diseases that cause significant morbidity and mortality in high-risk populations, including pregnant women, neonates and infants.[1–3] Therefore, international healthcare organizations recommend vaccination of women during pregnancy, a recommendation that has also been endorsed by the Hellenic National Immunization Schedule since 2015.[4,5] The rationale of vaccination is to protect both pregnant woman and the fetus, to reduce obstetric complications, and to protect newborns from these infections during the first months of their life; the mechanism is the passive transfer of antibodies from mother to fetus during pregnancy through the placenta, as well as to the newborn through breastfeeding.[6–8] Overwhelming data has demonstrated the safety and effectiveness of these vaccines during pregnancy.[9–11] Despite official guidelines, low vaccination rates have been reported in practice, both in Greece and internationally.[12–15]

The present study aimed to assess the knowledge and attitudes of pregnant and postpartum women about vaccination during pregnancy, the predictors of vaccine uptake and the impact of the COVID-19 pandemic.

METHODOLOGY

Study design, participants, and questionnaire

This was a cross-sectional study. We distributed an anonymous questionnaire to a convenience sample of pregnant and postpartum women admitted to or attending any of ten public healthcare facilities in Western Greece—both tertiary hospitals

(University General Hospital of Patras, General Hospital of Patras "Agios Andreas", Agrinio General Hospital and Pyrgos General Hospital) as well as primary healthcare units (Health Centers of: Kato Achaia, Nafpaktos, Gastouni, Northern Sector of Patras, Upper Town of Patras, and Medical and Social Center of Patras). The study was conducted between July and December 2023. The questionnaire was primarily based on a previous one used by our research team for a similar study before the COVID-19 pandemic with few extra questions referring to the pandemic.[13] Pilot testing was conducted prior to study initiation and appropriate adjustments were performed. The questionnaire was administered face-to-face by the researchers in Greek language and included 28 questions divided into two parts. The first part (8 questions) collected sociodemographic information, while the second part (20 questions) assessed women's knowledge and attitudes about influenza, pertussis and COVID-19 vaccination during pregnancy. An overview of the study objectives was provided to the potential participants, and informed consent was obtained. The study was approved by the Research Ethics Committee of the University of Patras, Greece (ID: 15647/17-05-2023) and the Scientific Councils of the respective healthcare units.

Statistical analysis

Descriptive statistical analysis was initially conducted to summarize the data on sociodemographic characteristics and knowledge, perceptions and attitudes towards antenatal vaccination. To assess the determinants predicting uptake of influenza, pertussis and COVID-19 vaccines during pregnancy, we first conducted univariate analysis using the X^2 independence test and then multivariate analysis using binary logistic regression. A statistical significance level of $\alpha = 0.05$ or 5% was used in all analyses. Statistical analysis was performed using the IBM SPSS software package (Statistical Package for the Social Sciences), version 29.

RESULTS

Out of 151 women approached, 145 agreed to participate in the study and responded to the questionnaire (response rate: 96.0%). Most of them were between 30 and 39 years old, married and currently employed, with various educational backgrounds. Twenty-three (15.9%) of those who completed the questionnaire had recently given birth. Thirty women (35.5%) had been vaccinated against influenza/pertussis before pregnancy, while 93 (64.6%) had been vaccinated against COVID-19. Table 1 presents the descriptive characteristics of study participants.

Vaccination rates recorded for current/recent pregnancy were low. In particular, 18.1% of the participants had been vaccinated against influenza, 11.8% against pertussis and only 4.9% against COVID-19. The intention of women, who had not already been vaccinated, to do so later in pregnancy was correspondingly low: 9.4% of the participants stated that they intended to get vaccinated against influenza, 6.2% against pertussis and 2.4% against COVID-19 (Table 2). Women's awareness of the importance and need to get vaccinated during pregnancy was also found to be suboptimal: 52.1% had been informed about the need for vaccination, while 40.6% had received a recommendation by their obstetrician; of them, 46.1% had been recommended vaccination against influenza, 19.7% against pertussis, 13.2% against COVID-19, while only 21.1% (8.6% of the total cohort) had been instructed to receive all three vaccinations recommended by the National Immunization Schedule (Table 3).

Women who participated in the study were also asked if they considered the pandemic to have affected their attitudes regarding vaccination during pregnancy; almost half (47.9%) answered that the COVID-19 pandemic did not have any impact on them, 17.6% answered that it did affect them positively and 19.0% stated that it affected them negatively.

We investigated whether there were any statistical associations between demographic characteristics, knowledge and attitudes towards antenatal vaccination and vaccine uptake during pregnancy, using the X^2 independence test. We found that women aged 30 years or older ($p=0.012$), with high educational level ($p=0.08$), who had been vaccinated against influenza/pertussis before pregnancy ($p<0.001$), who were aware of the need for vaccination during pregnancy ($p<0.001$), and who had received an obstetrician's recommendation ($p<0.001$), were more likely to get vaccinated during their pregnancy against influenza. Moreover, age above 30 years ($p=0.035$), medium ($p=0.007$) and high ($p<0.001$) educational level, pre-pregnancy vaccine uptake

(p<0.001), knowledge about pertussis (p=0.020), awareness of the need for vaccination (p=0.001), and obstetrician's recommendation (p<0.001), were statistically associated with antenatal vaccination against pertussis. Finally, we found that gravidity (third or more) (p=0.002), vaccination against COVID-19 before pregnancy (p=0.043), awareness of the need for vaccination during pregnancy (p=0.010), and obstetrician's recommendation (p=0.017), were associated with COVID-19 vaccination during pregnancy.

The aforementioned parameters were then further studied using binary logistic regression analysis, where the statistically significant predictors of vaccination during pregnancy were found to be: a) for influenza vaccination: influenza/pertussis vaccination before pregnancy (p=0.008, OR=5.062, 95% CI: 1.538-16.657) and obstetrician's recommendation for vaccination (p=0.021, OR=7.223, 95% CI: 1.351-38.602) b) for pertussis vaccination: high educational level (p=0.034, OR=5.904, 95% CI: 1.144-30.467) c) for COVID-19 vaccination: gravidity (third or more) (p=0.010, OR=9.957, 95% CI :1.751-56.632) and obstetrician's recommendation for vaccination (p=0.045, OR=9.421, 95% CI :1.055-84.145) (Table 4).

DISCUSSION

Our study investigated the knowledge and attitudes of pregnant and postpartum women regarding vaccination during pregnancy against three respiratory pathogens; influenza, pertussis and COVID 19. We also aimed to assess the impact of the pandemic and find out whether it contributed to the increased awareness of this population about infectious diseases and recommended vaccinations. The results of the study were not particularly encouraging. Both women's knowledge regarding vaccination and actual vaccination rates were low, while the percentages were even lower as for the reported intention to get vaccinated later in pregnancy. The results for influenza vaccination rate are generally consistent with the recent Greek literature, with a small increase observed in pertussis vaccination rate;[13–16] however, previous studies were conducted before the COVID-19 pandemic. One might have expected a substantial increase in these rates, since vaccination against respiratory pathogens was particularly emphasized by official healthcare authorities during the years of the pandemic. Regarding actual vaccination against COVID-19 disease, although most women in our cohort were vaccinated in the past, only 1 in 20 did get vaccinated during current/recent pregnancy. This percentage is particularly low, and it could be attributed to both lack of information and hesitancy about vaccinations recommended during pregnancy, as well as to the general decline of COVID-19 vaccinations after the declaration of the "end" of the pandemic.

As our findings suggest, recommendation for antenatal vaccination by the obstetrician was the strongest predictor of vaccination during pregnancy. This is not surprising given the trusted relationship between pregnant women and their obstetricians, who are responsible for their medical care and monitoring throughout pregnancy in Greece. However, only 4 in 10 women had received a recommendation for vaccination; hence a key finding of our research, and a point in need of strategic planning and intervention, is the inadequacy of guidance for pregnant women to receive recommended vaccinations.

Regarding the impact of the pandemic on women's attitudes towards possible vaccination during pregnancy, no notable trend was apparent: approximately half of the participants stated that their attitude was not affected, while positive and negative effects were reported at comparable rates. International literature on this topic is limited. A retrospective cohort study conducted in the USA compared antenatal influenza and Tdap vaccine uptake between the period before (2019-20) and during (2020-21) the COVID-19 pandemic; the researchers found higher influenza vaccination rates in the COVID-19 period, but no statistically significant increase in Tdap vaccination, while differences in vaccination rates were noted depending on women's insurance status and medical comorbidities.[17] Also, an Italian study followed a population of pregnant women who were in their 1st trimester of pregnancy during the 2019-20 influenza vaccination season (before the onset of the COVID-19 pandemic), up to their 3rd trimester – the period of vaccination with Tdap – after the emergence of COVID-19: the comparison of influenza and Tdap vaccine uptake rates may indicate that the COVID-19 experience may positively change attitudes toward immunization in pregnancy.[18]

Based both on the results of our own study and on the recent Greek literature, we consider that low vaccination rates during pregnancy in our country are mainly due to the limited knowledge of pregnant women, as we have already highlighted. The study of Maltezou et al., conducted on 814 pregnant women in two maternity hospitals in Athens in 2017, showed that the vast majority of women intended to vaccinate their children according to the National Immunization Schedule, while the average knowledge score for vaccines and vaccination-preventable childhood diseases was high; the main source of knowledge was the pediatrician.[19] These findings suggest that the lack of knowledge and low vaccination rates are not a general phenomenon but mainly concern vaccination during pregnancy, which can be attributed to the absence of targeted information for pregnant women. Undoubtedly, a significant share of responsibility for the unawareness of pregnant women lies with healthcare professionals, who are primarily responsible for providing valid information and proceeding with vaccine recommendation. A recently published study by Taskou et al., which aimed to investigate the knowledge and perceptions of healthcare professionals on perinatal influenza vaccination, also supports the above mentioned conclusion; the results of the study highlight once more the lack of information and misconceptions of healthcare workers involved in maternal and newborn care (midwives, obstetricians, pediatricians) about various aspects of perinatal vaccination, that could partially explain the low acceptance rates of vaccination during pregnancy.[20] Overall, and based on the recent Greek data, we should primarily attribute low vaccination rates observed during pregnancy to the scarcity of systematic and valid education of pregnant women, and less to established anti-vaccination perceptions. This conclusion is also a new call, both to healthcare professionals and official health institutions, to raise awareness and educate women about this important public health issue.

Although the findings of this study are informative, several limitations should be acknowledged, particularly its geographic restriction to the region of Western Greece and the relatively small sample size. Thus, our results may not be generalized. Second, our participants were recruited from a convenient sample of pregnant and postpartum women. Third, participation in our study was voluntary; therefore, vaccine-hesitant women may have decided not to participate, resulting in selection bias. Finally, another limitation is that our study was conducted exclusively in public healthcare facilities. We acknowledge that a significant proportion of pregnant women receive health care in the private health sector (private doctors, private maternity hospitals), and thus the results of this study cannot be generalized to the entire population. It can also be hypothesized that women who use the private health sector may differ statistically in terms of socioeconomic and educational level compared to women who choose public hospitals, and this could possibly affect their knowledge and attitude towards vaccination; a hypothesis that we consider would be interesting to investigate in a subsequent study.

CONCLUSIONS

In conclusion, the present research revealed that pregnancy vaccination rates against influenza, pertussis and COVID-19 in Western Greece are suboptimal. An important inhibiting factor is the lack of specific information, which is often accompanied by the absence of a recommendation for vaccination by the caring physicians. Public health interventions to increase awareness in the field should target both pregnant women and healthcare professionals involved in perinatal care.

Declaration of conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

All authors attest they meet the ICMJE criteria for authorship.

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ANNEX

TABLE 1: Descriptive characteristics of the women who participated in the study

Descriptive characteristics		N	N %
Age groups	< 19	16	11,1
	20-29	44	30,6
	30-39	73	50,7
	40-49	11	7,6
	> 50	0	0,0
Marital status	Single	28	19,6
	Married	95	66,4
	Divorced/separated	0	0,0
	In cohabitation agreement	12	8,4
	Other	8	5,6
Educational level	Illiterate	3	2,1
	Elementary school graduate	14	9,7
	Junior high-school graduate	15	10,4
	High school graduate	28	19,4
	Associates degree (2 years)	19	13,2
	University degree	46	31,9
	Master's degree or PhD	19	13,2
Employment status	Currently employed	83	57,6
	Currently unemployed	40	27,8
	Never employed	21	14,6
Occupation	Public sector employee	26	24,5
	Private employee	54	50,9
	Contractual employee	7	6,6
	Freelancer	19	17,9
Gravidity	First	68	46,9
	Second	43	29,7
	Third	24	16,5
	Fourth	5	3,4
	Other	5	3,4
Pregnancy or postpartum	Pregnancy	114	78,6
	Postpartum	23	15,9
	Did not clarify	8	5,5
Gestational age	< 10 weeks	7	6,1
	11 – 20 weeks	10	8,8
	21 – 30 weeks	24	21,1
	> 31 weeks	73	64,0
Vaccination against influenza/pertussis before pregnancy	Yes	50	35,5
	No	91	64,5
Vaccination against COVID-19 before pregnancy	Yes	93	64,6
	No	51	35,4

TABLE 2: Vaccination rates and intention to get vaccinated during pregnancy (n=145).

	Vaccinated in this pregnancy		**Intention to get vaccinated later in the current pregnancy**		
Diseases	**N (%)**		**N (%)**		
	Yes	**No**	**Yes**	**No**	**I do not know**
Against influenza	26 (18.1)	118 (81.9)	10 (9.4)	66 (62.3)	30 (28.3)
Against pertussis	17 (11.8)	127 (88.2)	7 (6.2)	70 (61.9)	36 (31.8)
Against COVID-19	7 (4.9)	137 (95.1)	2 (2.4)	74 (87.1)	9 (10.6)

TABLE 3. Women's awareness of the need for vaccination during pregnancy (n=145).

Have you been informed about the need for vaccination during pregnancy?	**N (%)**
Yes	75 (52.1)
No	69 (47.9)
I do not know	0 (0.0)
If so, against which disease?	
Influenza	36 (35.6)
Pertussis	11 (10.9)
COVID-19	24 (23.8)
All the above	30 (29.7)
Has your obstetrician recommended you to be vaccinated in this pregnancy?	**N (%)**
Yes	58 (40.6)
No	83 (58.0)
I do not know	2 (1.4)
If so, against which disease?	
Influenza	35 (46.1)
Pertussis	15 (19.7)
COVID-19	10 (13.2)
All the above	16 (21.1)

TABLE 4. Binary logistic regression analysis of predictors of vaccination during pregnancy.

	Influenza				**Pertussis**				**Covid-19**			
Independent variables	p	OR	95% CI		p	OR	95% CI		p	OR	95% CI	
			Lower	Upper			Lower	Upper			Lower	Upper
Age (30 or more)	0.436	1.688	0.452	6.299	0.639	1.440	0.313	6.628				
High educational level	0.844	1.131	0.332	3.846	**0.034**	5.904	1.144	30.467				
Gravidity (3rd or more)									**0.010**	9.957	1.751	56.632
Vaccination against influenza/pertussis before pregnancy	**0.008**	5.062	1.538	16.657	0.141	2.766	0.714	10.710				
Knowledge about pertussis					0.495	1.604	0.413	6.228				
Awareness of the need for vaccination during pregnancy	0.078	7.680	0.798	73.879	0.872	1.179	0.158	8.801				
Obstetrician's recommendation for vaccination	**0.021**	7.223	1.351	38.602	0.054	6.591	0.965	45.021	**0.045**	9.421	1.055	84.145