

PHYSICIAN'S RECOMMENDATION AS A KEY DETERMINANT OF INFLUENZA VACCINATION UPTAKE DURING PREGNANCY: A PROSPECTIVE OBSERVATIONAL STUDY

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SUMMARY

Objectives: Influenza infection is associated with substantial maternal morbidity and mortality during pregnancy; however, influenza vaccination uptake remains low. Physician's recommendations have been identified as one of the key determinants of vaccination rates. This study was conducted to evaluate the effect of physician's recommendation on influenza vaccination rates among pregnant women and to examine factors associated with vaccination behaviour.

Methods: This prospective observational study included 356 pregnant women aged 18–50 years with a gestational age of ≥ 12 weeks who were receiving prenatal care at a tertiary-care hospital in Istanbul, Türkiye. Participants completed a structured questionnaire assessing their knowledge and attitudes toward the influenza vaccine. Standard information about the influenza vaccine was provided as part of routine prenatal care. Vaccination status was confirmed via telephone follow-up at the end of the influenza season.

Results: The overall influenza vaccination rate during pregnancy was 7.6%. A prior physician's recommendation was strongly associated with higher vaccination uptake (15.2% vs. 1.5%, RR = 10.0, 95% CI: 3.07–32.69, $p < 0.001$). In multivariable analysis, physician's recommendation remained an independent predictor of vaccination (aOR = 10.39, 95% CI: 3.00–35.97, $p < 0.001$). The most common reasons for vaccine refusal were a lack of trust (42.2%) and perceived lack of necessity (36.2%).

Conclusion: Influenza vaccination uptake during pregnancy remains low in this Turkish cohort. Physician's recommendation is a strong independent determinant of vaccination behaviour. Strengthening physician-led counselling and improving patient awareness may play a critical role in increasing vaccination rates and reducing preventable maternal and neonatal complications.

Key words: pregnancy, influenza vaccination, vaccination during pregnancy, vaccine hesitancy, physician's recommendation, maternal immunization

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INTRODUCTION

Influenza is a highly contagious viral respiratory disease caused by a negative-sense, single-stranded RNA virus of the family Orthomyxoviridae. It is responsible for nearly half a million deaths worldwide each year. There are three types of influenza viruses, among which Influenza A is the most prevalent and is characterized by substantial antigenic variability. This high mutation capacity enables the virus to cause large-scale epidemics and pandemics (1, 2). The majority of patients with influenza have uncomplicated, self-limiting illnesses, and full recovery is typically expected (3). Clinically, influenza is characterized by the sudden onset of fever, chills, sweating, myalgia, malaise, and cough. While individuals with mild to moderate disease typically recover within approximately two weeks, some patients may develop severe or prolonged illness.

Complications are more frequently observed in specific high-risk groups, particularly pregnant women (4). Pregnancy is a risk factor for severe influenza infection, with pregnant women having a seven-fold increase in the risk of influenza-associated hospital admissions compared to the non-pregnant population (5). During previous influenza pandemics, pregnant women were shown to have a higher risk of severe morbidity and mortality. For this reason, many countries classify even healthy pregnant women as a high-risk group for seasonal influenza (4–6). Influenza infection during pregnancy poses significant risks for both maternal and foetal health. Vaccination is considered the most effective preventive strategy against influenza. The World Health Organization (WHO) recommends influenza vaccination for all pregnant women, regardless of trimester (7).

Maternal immunization induces the production of antibodies that cross the placenta, thereby increasing foetal antibody

levels and providing passive immunity to the newborn. Despite the well-established benefits and safety of influenza vaccination during pregnancy, vaccination coverage among pregnant women in developing countries remains suboptimal and is influenced by multiple factors (8, 9). A 2022 review examining publications related to vaccine hesitancy during pregnancy found that factors such as young age, high parity, being unmarried/without a partner and/or unemployed, delayed and inadequate prenatal care, and a lack of education were positively associated with hesitancy toward the influenza vaccine during pregnancy (10).

In addition to these factors, one of the most important determinants of vaccine hesitancy is a lack of information. Inadequate awareness regarding the safety and efficacy of the influenza vaccine during pregnancy negatively affects vaccination rates. Therefore, informing pregnant women through accurate, reliable sources, increasing health literacy, and providing effective counselling during prenatal care are critical to reducing vaccine hesitancy.

This study primarily aimed to evaluate the effect of physician's recommendation on influenza vaccination uptake among pregnant women, with a focus on its role as a key determinant of vaccination behaviour. Secondly, the study aimed to assess pregnant women's knowledge and attitudes toward influenza vaccination and to identify additional factors associated with vaccine uptake.

MATERIALS AND METHODS

Study Design and Participants

This prospective observational study was conducted among pregnant women attending antenatal care at Bahçelievler Medipol University Hospital, a tertiary referral centre in Istanbul, Türkiye, between 16 October 2025 and 1 March 2026. A total of 360 pregnant women aged 18–50 years were enrolled in the study. Four participants could not be reached during follow-up and were excluded. The final analysis included 356 participants. The age of the participants included in the final analysis ranged from 19 to 45 years. Participants were recruited through direct contact in the obstetrics outpatient clinic, maternity education classes, and the delivery unit.

Inclusion criteria were:

- age between 18 and 50 years;
- be in any week of pregnancy; and
- sufficient Turkish language proficiency to complete the questionnaire.

Exclusion criteria included:

- a participant was younger than 18 or older than 50 years;
- had a gestational age below 12 weeks;
- had cognitive impairment or any condition limiting their ability to understand or respond to the questionnaire;
- had insufficient proficiency in Turkish to complete the survey;
- declined to participate or did not provide informed consent;
- could not be reached during follow-up;
- had missing or incomplete questionnaire data;
- had a contraindication to influenza vaccination (e.g., history of severe allergic reaction to vaccine components).

Data Collection

Women who met the eligibility criteria were informed about the purpose and procedures of the study. Written and verbal informed consent was obtained from all participants. Questionnaires were self-administered by literate participants and returned to the research assistant. For participants unable to complete the form independently, questions were read aloud in a standardized and neutral manner, and responses were recorded accordingly. Participants were informed that there was no financial incentive associated with participation.

At enrolment, participants completed a structured questionnaire that included an item asking whether they had previously received a physician's recommendation for influenza vaccination during the current pregnancy. This variable was used as the primary exposure in the analyses.

The questionnaire was developed by the investigators based on the study objectives and relevant literature. It included items assessing socio-demographic characteristics, obstetric history, chronic diseases, knowledge regarding influenza vaccination during pregnancy, previous influenza vaccination history, physician's recommendations, vaccination status, and reasons for vaccine refusal. The effect of physician's recommendation on vaccination intention was assessed using predefined response categories indicating whether the recommendation reinforced an existing intention to be vaccinated, changed a previously negative intention into a positive intention, or did not result in vaccination despite the recommendation. The questionnaire was developed specifically for this study and was not formally validated.

After completion of the questionnaire, all participants received standardized information regarding the maternal and foetal benefits of influenza vaccination, and vaccination was recommended as part of routine antenatal care in accordance with current clinical guidelines.

Participants were subsequently followed until the end of the influenza season and were contacted by telephone to assess their vaccination status. Vaccination uptake was recorded during this follow-up assessment. Vaccination status was primarily assessed by participant self-report during telephone follow-up. When available, vaccination information was cross-checked using hospital records; however, verification was not possible for all participants.

Bias Control Measures

To minimize potential sources of bias, participants were consecutively recruited from different antenatal care units within the hospital. Clearly defined inclusion and exclusion criteria were applied.

A structured and standardized questionnaire was administered to all participants. When necessary, trained research personnel assisted participants by reading the questions aloud in a neutral manner without influencing their responses.

To reduce recall bias, participants were contacted by telephone at the end of the influenza season, and vaccination status was reassessed and recorded.

To limit observer and interviewer bias, data collection procedures were standardized, and all participants were provided with the same information regarding influenza vaccination throughout the study period.

To address potential confounding factors, variables such as maternal age and knowledge about vaccination were evaluated using multivariable logistic regression analysis.

Despite these measures, residual confounding and potential bias related to the single-centre design and the provision of vaccination-related information during the study period cannot be entirely excluded.

Outcome Measures

The primary outcome measure was influenza vaccination status during pregnancy, with a particular focus on evaluating the impact of a physician's recommendation on vaccination.

Secondary outcomes included:

- knowledge and awareness of influenza vaccination during pregnancy;
- attitudes toward influenza vaccination and reasons for vaccine refusal;
- effect of physician's counselling on change in vaccination intention;
- association between socio-demographic and clinical factors (e.g., maternal age, smoking status, education level) and vaccination uptake.

Statistical Analysis

Following completion of the prospective data collection and follow-up period, statistical analyses were performed using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequencies and percentages. Associations between categorical variables were assessed using the chi-square test. To identify independent predictors of influenza vaccination uptake and attitudes toward vaccination, both univariate and multivariate logistic regression analyses were performed. Variables were selected for the multivariable model based on their clinical relevance and/or statistical significance in univariate analyses. Given the limited number of vaccinated participants ($n = 27$), the number of covariates included in the model was deliberately restricted to reduce the risk of overfitting and to improve model stability. All statistical tests were two-tailed, and a p -value of less than 0.05 was considered statistically significant.

No formal sample size calculation was performed prior to the study. The study aimed to include all eligible pregnant women presenting to the study centre during the study period. A total of 356 participants were included, which was considered sufficient to detect statistically significant associations between physician's recommendations and influenza vaccination uptake.

RESULTS

Demographic and Clinical Characteristics

A total of 356 pregnant women were included in the study. The mean maternal age was 29.75 ± 4.47 years (range 19–45), and the mean gestational age was 21.81 ± 6.66 weeks (range 12–34). Overall, 194 (54.5%) participants were primigravida. The distribution of socio-demographic and health-related characteristics is presented in Table 1.

Table 1. Baseline characteristics of study populations ($N = 356$)

Variables		n (%)
Educational status	Under high school	41 (11.5)
	High school and above	315 (88.5)
Employment status	Employed	103 (28.9)
	Unemployed	253 (71.1)
Smoking status	Non-smoker	318 (89.3)
	Quit during pregnancy	16 (4.5)
	Smoker	22 (6.2)
Presence of at least one chronic disease	Yes	27 (7.5)
	No	329 (92.5)

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Primary Outcome

Influenza vaccination uptake during pregnancy was strongly associated with physician's recommendation. At the end of the influenza season, 27 (7.6%) participants had received the vaccine.

Vaccination rates were significantly higher among women who had received a physician's recommendation before the study visit compared with those who had not (15.2% vs. 1.5%, $RR = 10.03$, 95% CI: 3.07–32.69, $p < 0.001$). This corresponded to an absolute difference of 13.7 percentage points (95% CI 6.1–21.1).

In multivariable logistic regression analysis, prior physician's recommendation remained an independent predictor of vaccination uptake ($aOR = 10.39$, 95% CI: 3.00–35.97, $p < 0.001$).

Secondary Outcome

Among the 33 women whose attitudes shifted toward vaccination after a physician's recommendation, 19 (57.6%) were vaccinated, whereas 14 (42.4%) remained unvaccinated. The most commonly reported barrier in this subgroup was insufficient information about the vaccine ($n = 13$, 92.9%). Vaccination uptake differed significantly across decision-response groups ($\chi^2(2) = 158.35$, $p < 0.001$), with the highest uptake observed among women whose decision changed after counselling, followed by those whose pre-existing intention was reinforced. In contrast, no vaccinations occurred among women who reported no change in intention.

The distribution of primary reasons for declining the influenza vaccine is illustrated in Figure 1. The most prevalent barriers identified were concerns regarding vaccine safety and efficacy (42.2%) and a perceived lack of necessity for vaccination (36.2%).

Socio-demographic and pregnancy-related characteristics according to influenza vaccination status are presented in Table 2. Smoking status was significantly associated with influenza vaccination uptake ($p = 0.012$), whereas maternal age was not significant in univariate analysis ($p = 0.90$). In multivariable analysis, increasing maternal age was associated with lower odds of vaccination uptake, while higher vaccination rates were observed among women who had never smoked. Maternal age was not significant in univariate analysis but showed a modest association in the adjusted model. In contrast, education level, employment status, presence of chronic disease, gestational week, number of pregnancies, and prior

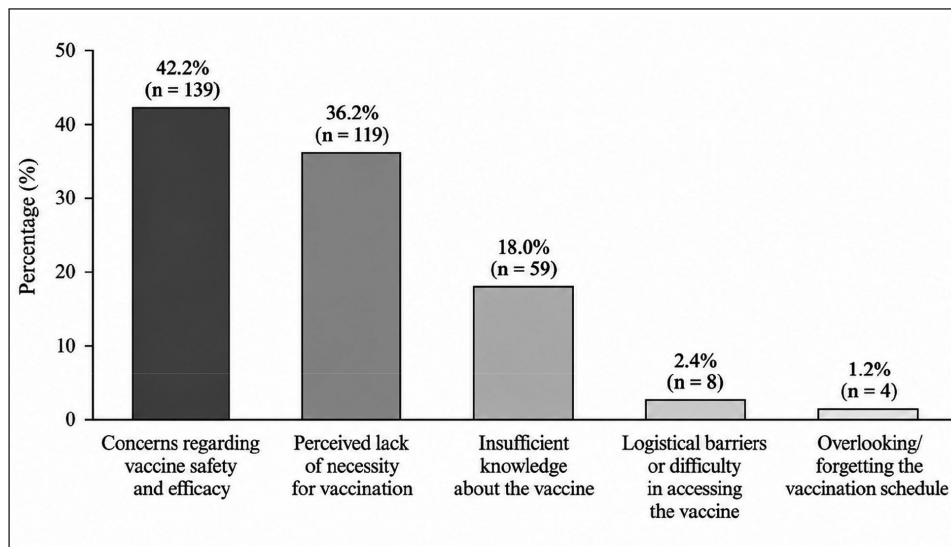


Fig. 1. Distribution of primary reasons for declining the influenza vaccine among unvaccinated pregnant women (N = 329).

Table 2. Comparison of participants' characteristics by influenza vaccination status (N = 356)

Characteristics		Vaccinated n = 27 n (%)	Unvaccinated n = 329 n (%)	p-value
Age (years), mean (SD)		29.84 (4.57)	29.74 (4.34)	0.90
Gestational week, mean (SD)		22.23 (5.95)	22.61 (6.31)	0.433
Education level	Under high school	5 (12.2)	36 (87.8)	0.236
	High school and above	22 (7.0)	293 (93.0)	
Employment status	Employed	9 (8.7)	94 (91.3)	0.600
	Unemployed	18 (7.1)	235 (92.9)	
Smoking status*	Non-smoker ^a	20 (6.3)	298 (93.7)	0.012
	Quitted during pregnancy ^b	4 (25.0)	12 (75.0)	
	Smoker ^c	3 (13.6)	19 (86.3)	
Presence of at least one chronic disease	Yes	2 (7.4)	25 (92.6)	0.971
	No	25 (7.6)	304 (92.4)	
Previous vaccination history to influenza	Yes	2 (8.0)	23 (92.0)	0.936
	No	25 (7.6)	306 (92.4)	
Can the vaccine be administered during pregnancy?	Yes	9 (16.7)	45 (83.3)	0.006
	No/don't know	18 (6.0)	284 (94.0)	
Physician recommendation for influenza vaccination prior to the study visit	Yes	24 (15.2)	134 (84.8)	<0.001
	No	3 (1.5)	195 (98.5)	

Mann-Whitney U test for continuous variables; chi-square test for categorical variables.

Percentages are presented as row percentages.

*Post-hoc pairwise comparisons for smoking status were performed with Bonferroni correction; women who quit smoking during pregnancy had higher influenza vaccination uptake than non-smokers (b > a, adjusted p = 0.017).

influenza vaccination history were not significantly associated with vaccination uptake (all $p > 0.05$). In univariate analysis, knowledge that the influenza vaccine can be administered during pregnancy was significantly associated with higher vaccination rates ($p = 0.006$).

In the adjusted logistic regression analysis (Table 3), prior physician's recommendation before the study visit was independently associated with higher odds of influenza vaccination uptake (aOR = 10.39, 95% CI: 3.00–35.97, $p < 0.001$), whereas

knowledge regarding vaccine administration during pregnancy was not significant after adjustment (aOR = 0.54, 95% CI: 0.22–1.35, $p = 0.189$). Maternal age showed a modest association with influenza vaccination uptake in the adjusted analysis, with increasing age associated with lower odds of vaccination (aOR = 0.90 per year, 95% CI: 0.83–0.98, $p = 0.020$); however, this finding should be interpreted with caution, given the lack of significance in univariate analysis and the limited number of vaccinated participants.

Table 3. Logistic regression analysis of factors associated with influenza vaccination uptake during pregnancy

Variable	aOR	95% CI	p-value
Maternal age	0.90	0.83–0.98	0.020
Prior physician recommendation before the study visit	10.39	3.00–35.97	<0.001
Knowledge that influenza vaccine can be administered during pregnancy	0.54	0.22–1.35	0.189

Multivariable binary logistic regression analysis.

Reference categories were no prior physician recommendation and no/unknown knowledge.

aOR – adjusted odds ratio; CI – confidence interval

DISCUSSION

Influenza infection during pregnancy is associated with numerous maternal and foetal complications, including stillbirth, preterm birth, and foetal growth restriction (4, 11, 12). Evidence supports the safety of influenza vaccination during pregnancy (13). Vaccination remains the most effective method for preventing influenza and its related complications in pregnant women.

Several authoritative organizations, including the WHO, the European Centre for Disease Prevention and Control (ECDC), the American College of Obstetricians and Gynecologists (ACOG), and the Advisory Committee on Immunization Practices (ACIP), recommend influenza vaccination during pregnancy regardless of gestational age (13, 14). Despite strong recommendations from major public health authorities, decades of clinical experience, and extensive evidence supporting the vaccine's safety, negative attitudes and concerns regarding influenza vaccination during pregnancy persist among many pregnant women and even among some healthcare professionals (15, 16).

Previous studies have shown that concerns about vaccine safety during pregnancy, as well as a lack of awareness and limited access to influenza vaccines, are among the main reasons for low vaccination rates (10). A previous study conducted in Germany demonstrated that pregnant women obtained information about influenza vaccination from multiple sources, most commonly from gynaecologists and the media (17). Similarly, several studies have consistently reported that obstetricians are the primary and most influential source of vaccine-related information during pregnancy (18, 19).

In the present study, only 7.6% of the participants reported receiving the influenza vaccine during pregnancy. Public health authorities, including the ECDC and CDC, recommend influenza vaccination for pregnant women because of their increased risk of influenza-related complications (20). Despite these recommendations, influenza vaccination uptake remained low in our study population.

Our findings are also consistent with data from other European countries. In a large prospective study conducted in the Czech Republic involving 4,617 pregnant women, the influenza vaccination rate during pregnancy was only 1.5%, despite national recommendations supporting maternal influenza vaccination (21). Similar to our findings, awareness regarding the possibility of influenza vaccination during pregnancy was limited, and women who had received information about vaccination were significantly more likely to be vaccinated (21). The authors concluded that increasing awareness among both pregnant women and healthcare professionals and incorporating vaccination recommendations into routine antenatal care are essential for improving vaccination coverage. These findings support the central role of

education and physician's engagement in promoting maternal influenza vaccination.

The main finding of this study is that physician's recommendation is a strong and independent determinant of influenza vaccination uptake during pregnancy. Although the overall vaccination rate was low, women who received a physician's recommendation were significantly more likely to be vaccinated. This finding highlights that physician's engagement plays a central role in shaping vaccination behaviour, beyond general awareness or socio-demographic characteristics.

When the association between education level and vaccination uptake was examined, the influenza vaccination rate was 7.0% among pregnant women with a high school education or higher, whereas it was approximately 12.2% among those with lower educational attainment; however, this difference was not statistically significant. Smoking status was significantly associated with vaccination uptake, with higher vaccination rates observed among women who had never smoked. Maternal age was not significantly associated with vaccination uptake in univariate analysis; however, increasing age was associated with lower odds of vaccination in the adjusted model. This discrepancy should be interpreted cautiously, as it may reflect residual confounding, model instability, or the limited number of vaccinated participants. Given the small number of outcome events, this finding should be considered exploratory and requires confirmation in larger studies. Although socio-demographic characteristics may influence vaccination behaviour, some researchers suggest that individual beliefs and perceptions may play a more influential role than socio-demographic factors (22).

Among unvaccinated women, the most frequently reported reasons for refusing vaccination were the belief that the influenza vaccine was unnecessary and a lack of trust in the vaccine. Notably, 139 (42.2%) women identified vaccine distrust as the primary reason for not being vaccinated. These findings are consistent with previous studies showing that vaccine hesitancy during pregnancy is commonly driven by concerns regarding vaccine safety, efficacy, and trust (15, 17, 18, 23–26). Many studies have also reported that women who receive influenza vaccination during pregnancy are more likely to have accepted routine vaccinations previously (25, 26). In addition, anti-vaccination attitudes are not limited to influenza vaccination during pregnancy but extend to other vaccines as well. A study conducted in Türkiye among patients and healthcare workers in family health centres similarly identified lack of trust as a major factor contributing to vaccine hesitancy (26).

Overall, the findings of this study highlight the importance of improving awareness about the safety and benefits of influenza vaccination during pregnancy. Providing accurate, comprehensive information and clear recommendations from healthcare profes-

sionals may help increase vaccination uptake among pregnant women.

Strengths and Limitations

This study has several strengths. First, it provides real-world data on influenza vaccination uptake among pregnant women and highlights the substantial impact of physician's recommendations on vaccination behaviour. Second, the inclusion of follow-up data at the end of the influenza season enabled a more accurate assessment of actual vaccination status, rather than relying solely on self-reported intentions. Third, multivariable logistic regression identified independent predictors of vaccination uptake.

Additionally, the study evaluated not only vaccination rates but also knowledge, attitudes, and reasons for vaccine hesitancy, providing a comprehensive understanding of factors influencing vaccination behaviour during pregnancy.

However, several limitations should be acknowledged. The study was conducted in a single centre, which may limit the generalizability of the findings. In addition, participants were recruited from a hospital-based population, which may not fully represent the broader pregnant population.

Another important limitation is that information about influenza vaccination was provided to all participants during the study period as part of routine antenatal care. While this was consistent with ethical and clinical practice, it may have influenced participants' attitudes and vaccination decisions. Accordingly, the observed vaccination uptake may overestimate background real-world uptake, and the magnitude of the observed association between physician's recommendation and vaccination uptake may be overestimated and should be interpreted cautiously.

In addition, vaccination status was primarily based on participant self-report during telephone follow-up. Although available hospital records were reviewed when possible, vaccination status could not be independently verified for all participants, which may have introduced reporting bias.

Furthermore, although a multivariable analysis was performed, residual confounding from unmeasured factors (such as socioeconomic status or healthcare access) cannot be completely excluded. Finally, the relatively low vaccination rate may have limited the statistical power for detecting associations with some variables. In addition, no formal sample size calculation was performed prior to the study, and the study may therefore have been underpowered for some secondary analyses.

CONCLUSION

In conclusion, influenza vaccination uptake among pregnant women remains low; however, physician's recommendation was strongly associated with vaccination uptake and appears to be an important modifiable factor related to vaccination behaviour.

Our findings indicate that a lack of information and distrust of vaccines are the major barriers to vaccination. Although physician's recommendations play an important role, they are not always sufficient to ensure vaccine acceptance.

Pregnant women should be clearly and consistently informed about the safety and benefits of the influenza vaccine during routine prenatal care. Strong, repeated counselling by healthcare

professionals is crucial for increasing vaccination rates and reducing preventable maternal and foetal complications.

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Conflicts of Interest

None declared

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

Language editing was supported by artificial intelligence-based tools. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Adherence to Ethical Standards

Ethical approval for this study was obtained from the Non-Interventional Clinical Research Ethics Committee of Istanbul Medipol University (approval No. 1197 of 16 October 2025). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki (as revised in 2013). Written informed consent was obtained from all participants prior to inclusion in the study.

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