Survey of influenza vaccine knowledge, attitudes, and beliefs among pregnant women in the 2016–17 season

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Abstract

Objectives: Influenza vaccination coverage among pregnant women in the United States is suboptimal. We surveyed women who were pregnant during the 2016–17 influenza season to assess knowledge and attitudes regarding influenza vaccination.

Methods: We identified and sampled pregnant women to include approximately equal numbers of vaccinated and unvaccinated women from strata defined by vaccination status and trimester from four integrated health systems in the Vaccine Safety Datalink (VSD). Potential participants

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were contacted via mail and telephone to complete a standardized survey. Characteristics and responses of women vaccinated and unvaccinated during pregnancy were compared.

Results: The survey was completed by 510 (48%) of 1062 contacted women; 500 were included in the analysis. Vaccine receipt while pregnant was associated with primigravida status (p = 0.02), college degree (p = 0.01), employment in health care (p < 0.01), and history of routine annual influenza vaccination (p < 0.01). Among 330 vaccinated women, the primary reasons for vaccination included protection of self and baby from influenza (n = 233, 71%), and medical professional recommendation (n = 46, 14%). Multiple reasons were given for nonvaccination, but concern about 'negative effects' was cited most often (n = 44, 29%). Vaccinated women were significantly more likely to believe that influenza vaccines are safe and effective, and to recognize the potential for harm from influenza infection. Nearly all women reported receiving at least one influenza vaccination recommendation from a healthcare provider.

Conclusions: Vaccinated pregnant women were more likely to receive routine annual influenza vaccine compared to those not vaccinated. Recommendations by obstetric providers should be supplemented with efforts to encourage women of childbearing age to receive annual vaccination.

1. Introduction

Pregnant women are at increased risk of influenza-associated morbidity and mortality, especially during pandemics [1,2]. Prevention of influenza illness among pregnant women is best achieved through vaccination. The Advisory Committee on Immunization Practices (ACIP) and the American College of Obstetricians and Gynecologists (ACOG) have recommended influenza vaccination during pregnancy regardless of trimester since 2004 [3,4]. Targeted efforts during the 2009 H1N1 pandemic led to sustained improvements in vaccination coverage, with the Centers for Disease Control and Prevention (CDC) reporting annual coverage rates among pregnant women around 50% since the 2009–10 season [5]. These rates, however, fall well below the Healthy People 2020 goal of 80% coverage [6].

Reasons for vaccination, or non-vaccination, during pregnancy are not fully understood. There is extensive evidence that influenza vaccination is safe for both the mother and fetus when administered during pregnancy, particularly during the second or third trimester [7–9]. However, many women, and even some healthcare providers, continue to have reservations regarding vaccination during pregnancy [10–12]. The objective of this study was to conduct a survey of women pregnant during the 2016–17 influenza season in order to (1) identify reasons for vaccination or non-vaccination during pregnancy; (2) assess knowledge, attitudes, and beliefs related to influenza infection and vaccination; (3) determine the prevalence of provider recommendations; and (4) ascertain clinical circumstances surrounding vaccination, including knowledge of pregnancy status at time of vaccination.

2. Methods

2.1. Design, setting & participants

We identified women who were pregnant during the 2016–2017 influenza season at four integrated health care organizations that participate in the Vaccine Safety Datalink (VSD) [Kaiser Permanente – Colorado (Denver, CO), Northern California (Oakland, CA), and Northwest (Portland, OR); Marshfield Clinic Health System (Marshfield, WI)] [13]. VSD is a federally-funded project designed to monitor and evaluate the safety of vaccines. Sites participating in this survey study obtained immunization, medical encounter (e.g., ambulatory, emergency department, hospitalizations), and demographic data from VSD data files. Women 18–44 years of age were eligible for this survey if they were continuously enrolled in the VSD site population from August 1 through December 31, 2016 and had at least one prenatal visit since September 1, 2016.

2.2. Survey procedures

We randomly sampled eligible women from strata defined by VSD site, pregnancy trimester (1–3 or unknown), and influenza vaccination status (vaccinated or unvaccinated) as of December 31, 2016. We used weighted sampling to achieve an initial sample of approximately equal distribution across the 8 strata at each site. Recruitment included an introductory letter followed by up to four telephone calls from trained interviewers. All surveys were completed over the phone between April 2017 and January 2018, and respondents received a monetary gift card for participation. Staff at Marshfield Clinic Research Institute conducted all survey procedures. Participating sites ceded ethics review to the Marshfield Clinic Institutional Review Board, which approved the study including verbal consent.

2.3. Data sources

2.3.1. Survey—We developed a 32-item, structured survey instrument in collaboration with VSD investigators and an obstetric consultant; some questions were adapted from the CDC's 2014–15 National Internet Survey of Health and Medical Care during Pregnancy [14]. The survey addressed demographics, self-reported receipt of influenza vaccine, primary reason for influenza vaccination or non-vaccination, recommendations for influenza vaccination, and circumstances surrounding influenza vaccination. Knowledge, attitudes, and beliefs (KAB) were assessed regarding influenza vaccine effectiveness and safety, and perceived harms of influenza infection during pregnancy. Most survey questions were open-ended, with the exception of the KAB questions, which had Likert-type response options. Interviewers selected the appropriate response from a pre-specified list of choices, or recorded the response verbatim for later categorization.

2.3.2. Electronic data—Prenatal visit dates were obtained from VSD data files. We initially assessed vaccination status as of December 31, 2016 to generate weighted strata for the survey sample, but vaccination status was updated through June 1, 2017 at the conclusion of the survey period. For women with a record of at least one ICD-10 code that specified weeks of gestation (Z3A codes), we were able to calculate an approximate

pregnancy start date, pregnancy status, and weeks of gestation at time of influenza vaccination (if vaccinated).

2.4. Statistical analysis

We compared demographic attributes for respondents and non-respondents. Among respondents to the survey, we compared demographics and Likert-scale responses to knowledge, attitudes and beliefs questions by self-reported vaccination status. We calculated the agreement between self-reported vaccination status and electronic vaccination records using Cohen's kappa. Self-reported vaccination status was used in analyses in order to assess responses in the context of women's perceived vaccination status at the time of the survey.

For questions about safety and effectiveness of vaccination, lower numbered responses reflect more positive attitudes (e.g. 1 = Very effective vs. 4 = Not at all effective). We performed statistical comparisons of the vaccinated and unvaccinated groups using the Jonckheere-Terpstra test, which is equivalent to the Wilcoxon rank sum test when two groups are being compared [15]. In addition to the p-value derived from the two-sided Jonckheere-Terpstra test to indicate if the distributions differed, to better assess how they differed, we further quantified the vaccinated versus unvaccinated comparisons by calculation of the probabilities that a randomly selected vaccinated woman would have a smaller, larger, or equal Likert-scale response compared to a randomly selected unvaccinated woman [16]. "Rather not say/Not sure" responses were excluded from these analyses of Likert-scaled data. All analytic procedures were conducted using SAS Version 9.4 (Cary, NC).

3.   Results

Of the 2118 women sampled, 1062 (50%) were successfully contacted (Fig. 1). Of those reached, about half (48%) agreed to participate in the survey, and about half refused (47%). Only 5% of women reached were ineligible, and reasons included not pregnant during the time period of interest (n = 8) and did not speak English (n = 48). Ten women were excluded in the analysis because they did not finish the survey or had unknown self-reported vaccination status, resulting in a final analytic sample of 500. The participation rate varied by site, and respondents were more likely to be vaccinated than non-respondents (54% vs. 49%, p = 0.05) (Table 1).

3.1.   Participant characteristics

The mean age of all participants was 30.5 (standard deviation (SD): 5.2) years. The majority identified as non-Hispanic white and had been previously pregnant (Table 2). Vaccination status based on self-report showed good agreement with vaccination data in VSD files (Cohen's kappa = 0.76). Among the 289 women with electronic record of influenza vaccination in the 2016–17 season, 286 (99%) self-reported vaccination. An additional 54 women self-reported vaccination for which there was no electronic confirmation.

In bivariate analyses, self-reported vaccination was significantly associated with primigravida status, higher educational achievement, and employment in health care (Table 2). Women who were vaccinated during pregnancy were significantly more likely to report

routine annual vaccination (n = 191, 56%) compared to those not vaccinated during pregnancy (n = 7, 4%). The majority (n = 117, 73%) of unvaccinated women reported that they never receive the influenza vaccine.

3.2. Reasons for vaccination or non-vaccination

3.2.1. Reasons for vaccination—Just over 70% of the women vaccinated during pregnancy stated that the primary reason for vaccination was to protect themselves and their babies from influenza. (Table 3). An additional 46 (14%) stated that a recommendation from a health care provider was the primary reason. Other reasons making up less than 10% of responses included requirement for employment and protection of family and friends.

3.2.2. Reasons for non-vaccination—There were 150 unvaccinated women who reported a primary reason for non-vaccination (Table 3). Sixty (40%) felt that influenza vaccine is not necessary or ineffective. About half (n = 73) expressed concern about safety. Of those with safety concerns, 44 (60%) named concerns about influenza vaccine specifically and the remaining indicated concern about vaccines in general. There were seven women who reported routine annual vaccination before pregnancy and did not receive the vaccine while pregnant. One expressed concern about safety and another expressed concern about effectiveness as the primary reason for not receiving vaccine during her pregnancy. There were 35 women who reported influenza vaccination during some years but not while pregnant. Of these, 21 (60%) indicated concerns about safety but only five mentioned safety concerns specifically for the baby.

3.3. Knowledge, attitudes, and beliefs

The responses to questions about knowledge, attitudes, and beliefs regarding influenza vaccination showed significant differences by vaccination status (Table 4). Vaccinated women overall had more positive attitudes regarding effectiveness and safety compared to unvaccinated women. For example, a typical vaccinated woman in our study believed the vaccine was a more effective method of preventing influenza compared to a typical unvaccinated woman with a probability of 0.655. However, the distinction between vaccinated and unvaccinated women was less clear when asked whether influenza infection causes harm to mother or baby. For example, a typical vaccinated woman was more likely to believe influenza would harm her baby compared an unvaccinated woman but with a probability of 0.414, lower than that observed for vaccine effectiveness questions.

3.4. Provider recommendations

Nearly all women (n = 470, 94%) reported that at least one medical professional had recommended influenza vaccine or talked about the importance of vaccination during their pregnancy. The proportion of women receiving a recommendation varied significantly by site but not by vaccination status, age, or race/ethnicity (Supplemental Table 1). Obstetric providers, such as OB/GYNs and midwives, were frequently mentioned as providing recommendations, among both vaccinated (n = 261, 81%) and unvaccinated women (n = 117, 80%). None reported that a medical professional had recommended against the influenza vaccine during pregnancy.

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.vaccine.2020.01.039.

3.5. Clinical circumstances surrounding vaccination

Among the 340 women that self-reported vaccination in the 2016–17 season, 310 (92%) reported that they were pregnant at the time of vaccination. Of these, 299 (96%) reported being aware they were pregnant when vaccinated. Among 255 women with vaccination and pregnancy start date confirmed by medical records, 244 (96%) were confirmed as vaccinated during pregnancy. According to medical records, gestational age at time of vaccination ranged from 1 to 39 weeks, with a median of 22.9 weeks. Nearly all women reported that they received the influenza vaccine during a routine visit (n = 230, 75%) or at a vaccination only visit (n = 69, 22%); vaccination occurred most commonly at their OB/GYN's office (n = 222, 73%) or during a vaccination clinic at a healthcare facility or place of employment (n = 66, 22%).

4. Discussion

In this multi-site survey of women pregnant during the 2016–17 influenza season, women who were vaccinated during pregnancy had more positive attitudes regarding influenza vaccine effectiveness and safety compared to unvaccinated women. However, there were important demographic differences between these groups. Women vaccinated during pregnancy were more highly educated, more likely to work in health care, and more likely to receive routine annual influenza vaccination compared to women who were not vaccinated while pregnant. Two primary reasons for non-vaccination were cited by unvaccinated women: (1) belief that influenza vaccination was ineffective or unnecessary, and (2) concern about the safety of vaccination for the mother or the baby. It is striking that most unvaccinated women reported that they never receive the annual influenza vaccine despite a national recommendation. This suggests that more general concerns about influenza vaccine or vaccines in general may have contributed to the decision to forego vaccination while pregnant. We did not assess the relative importance of pregnancy-specific concerns vs. broad concerns about influenza vaccine and vaccination in general. However, other studies have found associations between prior season vaccine receipt and receipt, or intent to receive, influenza vaccination during pregnancy [17–19]. Consequently, addressing barriers to vaccination and increasing vaccine uptake among non-pregnant women may facilitate higher rates of vaccination during pregnancy. Influenza vaccination is universally recommended for adults in the United States, and discussions of influenza vaccination should be included along with other preconception health messages for all women of reproductive age.

Nearly all surveyed women, including 92% of those unvaccinated, had received a recommendation for influenza vaccination during pregnancy, suggesting that other factors influenced the decision to remain unvaccinated. We did not assess whether obstetric providers offered influenza vaccine during prenatal visits or merely recommended vaccination. Other studies have found that a provider recommendation positively influences the decision to receive vaccination during pregnancy whether accompanied by an offer or not, but acceptance is higher among those receiving both recommendation and offer [20]. In

other studies, vaccine acceptance rates for recommendation alone were approximately 33–48% [20]. This survey was conducted in a managed care population, and the high rate of provider recommendation among unvaccinated women suggests that additional interventions are needed to improve vaccine uptake.

Consistent with prior studies, unvaccinated women in our survey had doubts about the safety or effectiveness of the vaccine for themselves or their babies [10,21–23]. Pregnant women are frequent consumers of health information via sources outside the health care system, including the Internet, but they do not always discuss the information with providers [24]. Providers may reduce vaccine hesitancy by coupling their recommendation with clear messages regarding vaccine safety, effectiveness, and benefits. For example, a randomized study of message framing found vaccine efficacy and disease susceptibility to be crucial messages to promote immunization among women with no history of seasonal influenza immunization [18]. Another study found that mothers were influenced by the 'two-for-one' benefit of vaccine for both themselves and their baby. After becoming aware of this, some reported motivation for future vaccination [25]. The *Opinion on Influenza Immunization During Pregnancy*, which was released by the American College of Obstetrics and Gynecology after this study, supports an approach by providers to expand the recommendation to include counseling on the safety and benefits for the mother and the fetus [26].

The strengths of this study include relatively large sample size and inclusion of women from four geographically diverse health systems. Women were surveyed by phone by trained interviewers and many questions in our survey were adapted from annual CDC internet panel survey. There were also several limitations. Some women were surveyed up to a year after the 2016–2017 influenza season, which may have affected accurate recall of vaccine timing and provider recommendation. This study was not intended to assess overall attitudes and vaccine coverage among pregnant women, since we stratified our sample by receipt or non-receipt of influenza vaccine while pregnant. Results are not generalizable to all pregnant women in the United States since the study population was restricted to managed care participants at VSD sites. Finally, only a minority of people in the sample were contacted. There was a modest selection bias in the study sample with a 5% higher vaccinated proportion among respondents versus non-respondents.

5. Conclusions

Provider recommendations for influenza vaccination were common in this population, with obstetric providers most often cited as the source. However, doubts about safety and effectiveness of influenza vaccination were reported as barriers to vaccination for some pregnant women. Receipt of influenza vaccination during pregnancy was highly associated with history of influenza vaccination in previous years. Our findings are generally consistent with prior studies in other populations and seasons. The beliefs found among women in our study suggest that vaccination rates in pregnant women may be improved by coupling targeted discussions of vaccine safety and effectiveness with provider recommendations. Promotion of vaccination during pregnancy should be supplemented with efforts to increase annual influenza vaccination among all women of childbearing age.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations:

ACIP	Advisory Committee on Immunization Practices
ACOG	American College of Obstetricians and Gynecologists
CDC	Centers for Disease Control and Prevention
ICD-10	International Classification of Diseases, Tenth Revision
KAB	Knowledge, attitudes, and beliefs
VSD	Vaccine Safety Datalink

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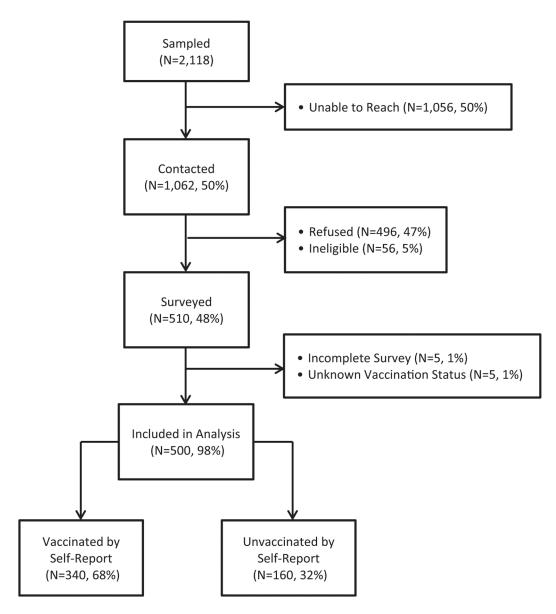
Fig. 1.
Flow diagram of survey participation.

Table 1

Descriptive characteristics of survey respondents compared to non-respondents.

Characteristic	Respondents[a] (N = 510)		Non-Respondents (N = 1608)		p-value
Electronic Record of 2016–17 Influenza Vaccine[b]	275	(53.9)	787	(48.9)	**0.05**
Trimester Associated with Selected Prenatal Visit Code					0.87
First	134	(26.3)	401	(24.9)	
Second	122	(23.9)	412	(25.6)	
Third	130	(25.5)	409	(25.4)	
Unknown	124	(24.3)	386	(24.0)	
VSD Site					**<0.01**
A	89	(17.5)	408	(25.4)	
B	199	(39.0)	351	(21.8)	
C	115	(22.6)	421	(26.2)	
D	107	(21.0)	428	(26.6)	
Age in Years[c], Mean (SD)	30.6	(5.2)	30.2	(5.6)	0.19

[a]Includes N = 10 with incomplete survey or unknown vaccination status.

[b]From electronic records as of December 31, 2016.

[c]As of September 1, 2016.

Table 2

Descriptive characteristics of respondents by self-reported vaccination status in the 2016–17 influenza season (N = 500).

Characteristic [a]	Vaccinated (N = 340)		Unvaccinated (N = 160)		p-value
Age in Years	30.4	(5.2)	30.8	(5.0)	0.38
Pregnancy Status at Time of Survey					0.41
Still Pregnant	41	(12.0)	26	(16.3)	
Live Birth	290	(85.3)	129	(80.6)	
Negative Pregnancy Outcome [b]	9	(2.7)	5	(3.1)	
Gravidity					**0.02**
Primigravida	129	(37.9)	43	(26.9)	
Multigravida	211	(62.1)	117	(73.1)	
Race/Ethnicity [c]					0.35
White, Non-Hispanic	247	(72.6)	113	(70.6)	
Hispanic	38	(11.2)	25	(15.6)	
Other	54	(15.9)	22	(13.8)	
Education					**0.01**
<Bachelor's Degree	168	(49.4)	98	(61.3)	
Bachelor's Degree	172	(50.6)	62	(38.7)	
Employed in Health Care [c]					**<0.01**
Yes	104	(30.6)	20	(12.5)	
No	235	(69.1)	140	(87.5)	
Underlying Medical Condition					0.67
Yes	28	(8.2)	15	(9.4)	
No	312	(91.8)	145	(90.6)	
No. Healthcare Visits in the Last Year Unrelated to Pregnancy [d]					0.27
0 Visits	110	(32.4)	61	(38.1)	
1–2 Visits	180	(52.9)	70	(44.8)	
3–5 Visits	32	(9.4)	20	(12.5)	
6+ Visits	18	(5.3)	8	(5.0)	
VSD Site					0.60

Characteristic[a]	Vaccinated (N = 340)		Unvaccinated (N = 160)		p-value
A	60	(17.7)	26	(16.2)	
B	133	(39.1)	63	(39.4)	
C	80	(23.5)	32	(20.0)	
D	67	(19.7)	39	(24.4)	
Self-Reported Flu Vaccination Frequency					<0.01
Every Year	191	(56.2)	7	(4.4)	
Some Years	79	(23.2)	35	(21.9)	
Only Because Pregnant	70	(20.6)	1	(0.6)	
Never	0	(0.0)	117	(73.1)	

Data are presented as n (%) for categorical variables and mean (SD) for numeric variables.

For categorical variables, n may not add to N and % may not add to 100% due to missing values.

[a]Age and VSD site were obtained from electronic VSD data. All other characteristics were self-reported.

[b]Negative pregnancy outcome includes spontaneous abortion (miscarriage), stillbirth, or elective termination.

[c]Value missing for 1 vaccinated woman.

[d]Value missing for 1 unvaccinated woman.

Table 3

Primary reasons for vaccination and non-vaccination among women pregnant during the 2016–17 influenza season.

Primary Reason for Vaccination (N = 330)[a]	n	%
To protect self/baby from flu	233	(70.6)
Medical professional recommended flu vaccination	46	(13.9)
Flu vaccination is required for job	26	(7.9)
To protect friends/family from flu	7	(2.1)
Always get the flu vaccine	6	(1.8)
Other reason	12	(3.6)
Primary Reason for Non-Vaccination (N = 150)[b]	**n**	**%**
Concerned about negative effects of flu vaccine	44	(29.3)
Don't normally get the flu vaccine/flu vaccine not necessary	34	(22.7)
Don't believe the flu vaccine works	26	(17.3)
Don't think vaccines are safe in general	17	(11.3)
Don't think vaccines are safe for their baby	12	(8.0)
Other	17	(11.3)

[a] 10 missing, did not provide a primary reason for vaccination.

[b] 10 missing, did not provide a primary reason for non-vaccination.

Table 4

Responses to knowledge, attitudes, and beliefs questions among self-reported vaccinated and unvaccinated women pregnant during the 2016–17 influenza season (N = 500).

KAB Question & Likert Scale	Vaccinated (N = 340)		Unvaccinated (N = 160)		p-value[a]	Pr(V > U)[b]	Pr(V < U)[b]	Pr(V = U)[b]
	n	%	n	%				
How effective do you think the flu vaccination is in preventing pregnant women from getting the flu?								
Very effective (1)	140	(41.2)	9	(5.6)	**<0.01**	0.073	0.655	0.272
Somewhat effective (2)	167	(49.1)	59	(36.9)				
Not too effective (3)	14	(4.1)	39	(24.4)				
Not at all effective (4)	7	(2.1)	26	(16.3)				
Rather not say/Not sure[c]	12	(3.5)	27	(16.9)				
When a pregnant woman receives the flu vaccination, how effective do you think it is in protecting her baby from the flu?								
Very effective (1)	127	(37.4)	7	(4.4)	**<0.01**	0.081	0.714	0.205
Somewhat effective (2)	137	(40.3)	37	(23.1)				
Not too effective (3)	17	(5.0)	39	(24.4)				
Not at all effective (4)	13	(3.8)	34	(21.3)				
Rather not say/Not sure[c]	46	(13.5)	43	(26.9)				
How safe do you think flu vaccinations are for pregnant women?								
Completely safe (1)	103	(30.3)	11	(6.9)	**<0.01**	0.103	0.740	0.157
Very safe (2)	160	(47.1)	20	(12.5)				
Somewhat safe (3)	52	(15.3)	59	(36.9)				
Somewhat unsafe (4)	15	(4.4)	41	(25.6)				
Very unsafe (5)	4	(1.2)	11	(6.9)				
Completely unsafe (6)	0	(0.0)	11	(6.9)				
Rather not say/Not sure[c]	6	(1.8)	7	(4.4)				
When a pregnant woman receives the flu vaccination, how safe do you think that vaccination is for her baby?								
Completely safe (1)	89	(26.2)	9	(5.6)	**<0.01**	0.102	0.747	0.151
Very safe (2)	169	(49.7)	19	(11.9)				
Somewhat safe (3)	48	(14.1)	49	(30.6)				
Somewhat unsafe (4)	20	(5.9)	39	(24.4)				

KAB Question & Likert Scale	Vaccinated (N = 340)		Unvaccinated (N = 160)		p-value[a]	Pr(V > U)[b]	Pr(V < U)[b]	Pr(V = U)[b]
	n	%	n	%				
Very unsafe (5)	4	(1.2)	18	(11.3)				
Completely unsafe (6)	0	(0.0)	11	(6.9)				
Rather not say/Not sure[c]	10	(2.9)	15	(9.4)				
If a pregnant woman gets sick with the flu, how likely is it that the flu will harm her?								
Very likely (1)	77	(22.7)	18	(11.3)	<0.01	0.259	0.437	0.304
Somewhat likely (2)	145	(42.7)	68	(42.5)				
Somewhat unlikely (3)	70	(20.6)	48	(30.0)				
Very unlikely (4)	33	(9.7)	21	(13.1)				
Rather not say/Not sure[c]	15	(4.4)	5	(3.1)				
If a pregnant woman gets sick with the flu, how likely is it that the flu will harm her baby?[d]								
Very likely (1)	54	(15.9)	13	(8.1)	0.01	0.278	0.414	0.308
Somewhat likely (2)	140	(41.3)	59	(37.9)				
Somewhat unlikely (3)	89	(26.3)	61	(38.1)				
Very unlikely (4)	41	(12.1)	19	(11.9)				
Rather not say/Not sure[c]	15	(4.4)	8	(5.0)				
Pregnant women should get the flu vaccination.								
Strongly agree (1)	157	(46.2)	8	(5.0)	<0.01	0.043	0.826	0.131
Agree (2)	158	(46.5)	24	(15.0)				
Disagree (3)	14	(4.1)	89	(55.6)				
Strongly disagree (4)	3	(0.9)	25	(15.6)				
Rather not say/Not sure[c]	8	(2.4)	14	(8.8)				

Abbreviations: Pr = probability, V = vaccinated, U = unvaccinated.

[a] Two-sided Jonckheere-Terpstra test.

[b] Estimated probabilities that a randomly selected vaccinated woman has a larger (Pr(V > U)), smaller (Pr(V < U)), or equal (Pr(V = U)) Likert-scale response compared to a randomly selected unvaccinated woman. Values in each row sum to 1.0.

[c] Category excluded from statistical analysis.

[d] Missing value for 1 vaccinated woman.