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RESEARCH PAPER

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# Vaccine attitudes and practices among obstetric providers in New York State following the recommendation for pertussis vaccination during pregnancy

Cynthia A Bonville[1], Donald A Cibula[2], Joseph B Domachowske[1], and Manika Suryadevara[1,*]

[1]Department of Pediatrics; State University of New York; Upstate Medical University; Syracuse, NY USA; [2]Department of Public Health and Preventive Medicine; State University of New York; Upstate Medical University; Syracuse, NY USA

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To determine factors associated with obstetric provider recommendation of pertussis vaccine (Tdap) to their pregnant patients following the Advisory Committee on Immunization Practices (ACIP) recommendation that Tdap be given in the third trimester of each pregnancy. Obstetric providers across New York State anonymously completed a standard set of questions to assess vaccine recommendation knowledge and practice. *Statistical analysis:* Descriptive statistical methods were used to define provider characteristics, knowledge and vaccine practices. Factors associated with recommendation were analyzed using odds ratios. 133 obstetric providers were included in the study. 11% and 13% expressed concern with pertussis vaccine safety and efficacy, respectively, in pregnant women. 92% of obstetric providers stated that they knew ACIP recommendations for Tdap during pregnancy, 80% recommended Tdap to all eligible patients, but only 67% provided Tdap vaccine in their office. Provider knowledge of recommendation (OR 23.33), routine provider recommendation of influenza vaccine (OR 12.5), and administration of pertussis vaccine in the office (OR 7.01) were all factors strongly associated with routine provider recommendation of Tdap vaccine to eligible pregnant women ($P < 0.05$). Providers expressed concerns with cost of Tdap, the need to administer Tdap with each pregnancy, vaccine safety, low incidence of pertussis in the area, and administration of pertussis vaccine at the hospital after delivery. Educational programs are needed to improve provider vaccine confidence and recommendation.



## Introduction

Pregnant women and their newborns are at increased risk of morbidity and mortality from vaccine preventable infections, such as influenza and pertussis. In particular, infants under a year of age are highly susceptible to developing complications from pertussis infection, including apnea, pneumonia, seizures, and death.[1] In the United States, the majority of pertussis related hospitalizations and deaths occur in infants younger than 2 months of age, a population too young to vaccinate.[1]

In 2005, in an effort to decrease transmission of pertussis from parents to infants, the Advisory Committee on Immunization Practices (ACIP) recommended the use of Tdap (tetanus-diphtheria-acellular pertussis) vaccine for postpartum women and household adult and adolescent contacts who have not previously received vaccine, a strategy known as "cocooning."[2] This strategy has proven difficult to implement widely, for both logistical and financial reasons.[3,4] While cocooning programs have been successful in vaccinating postpartum mothers, the vaccination of fathers and other household contacts has been limited.[3,4] In 2011, ACIP recommended, in addition to the cocooning strategy, that unvaccinated pregnant women receive Tdap during their third trimester, to provide antibodies that confer maternal protection from pertussis infection and that are transplacentally transferred to the fetus to provide direct protection to the infant.[4] In 2012, Tdap vaccine was recommended for pregnant women during the third trimester of each pregnancy, to optimize protection for each newborn.[5]

Despite these recommendations, with the goal of maternal and infant protection from pertussis infection, published rates of Tdap receipt during pregnancy varies widely, from 14% of publicly insured pregnant women in Michigan to 82% of pregnant women delivering at a university hospital.[6,7] Pertussis vaccine uptake in pregnant women is likely determined by a combination of patient and provider factors. Prior studies have shown that provider recommendation of influenza vaccine for pregnant women is strongly associated with increased vaccine uptake in this population.[8-12] However, few studies describe obstetric provider attitudes toward pertussis vaccination in pregnant women. In this study, we aimed to describe vaccine attitudes and practices

*Correspondence to: Manika Suryadevara; Email: suryadem@upstate.edu
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of obstetrical providers in New York State following the ACIP recommendation for pertussis vaccination in women in the third trimester of each pregnancy. Understanding these factors associated with provider vaccine recommendation is important to identify areas to target to increase vaccine coverage in this population.

## Results

A total of 133 (33%) of the 400 contacted obstetric providers returned completed surveys and were included in the analysis. Of the included providers, 98 (74%) were female (**Table 1**). 68 (51%) were physicians. The majority of the providers (123, 92%) worked in a private practice setting and had patients with private insurance (92, 69%). Only 99 (74%) of the providers stated that they themselves always get vaccinated annually with the annual influenza vaccine.

Obstetric providers were more likely to express concerns with pertussis vaccine safety in pregnant women (11%) than influenza vaccine safety (5%) ($p = 0.41$). Similarly, 13% and 8% of providers expressed concern with pertussis and influenza vaccine efficacy, respectively ($p = 0.16$). There were no statistical differences when analyzed by provider role.

While 123 (92%) of obstetric providers responded that they knew that ACIP recommend Tdap vaccine for women in the third trimester of each pregnancy, only 107 (80%) recommended Tdap to all eligible patients, and even fewer providers (89, 67%) actually provided Tdap vaccine in their office (**Table 2**). On the other hand, all of the surveyed providers responded that they knew the ACIP recommendation for influenza vaccine for pregnant women. Similarly, even though 126 (95%) recommended influenza vaccine to all eligible pregnant women, only 113 (85%) actually provided influenza vaccine in the office. There were no statistical differences when analyzed by provider role.

In total, 53 (40%) of the surveyed providers responded that they refer pregnant patients elsewhere for vaccinations. Twenty five providers, more than 2-thirds of whom were physicians, provided reasons for not administering vaccines in the office, with most common reasons including cost, safety concerns, not knowing vaccine recommendations, and discomfort with educating patients regarding vaccines (**Table 3**). When asked specifically about Tdap vaccine, providers expressed concerns with cost of vaccine, the need to administer vaccine with each pregnancy, vaccine safety, lack of vaccine safety and efficacy data, low incidence of pertussis in the area, and administration of pertussis vaccine at the hospital after delivery. Similarly, when asked about the influenza vaccine, hesitant providers stated that they do not believe in it, patients still get influenza infection after vaccination, they need to buy single dose vials (New York State public health law prohibits use of thimerosol-containing vaccine during pregnancy), the vaccine lacks long term studies, vaccine safety concerns, and patient concerns from non-medical sources.

Factors strongly associated with routine provider recommendation of Tdap vaccine to eligible pregnant women included provider knowledge of ACIP recommendation for pertussis vaccination during pregnancy (OR 23.33), routine provider recommendation of influenza vaccine to eligible pregnant women (OR 12.5), and administration of pertussis vaccine in the office (OR 7.01) ($P < 0.05$) (**Table 4**).

Providers who always receive influenza vaccine were more likely to recommend influenza vaccine to all eligible pregnant patients (OR 8.36, 95% CI 1.54, 45.4, $P < 0.05$). Of note, only 8 (6%) of obstetric providers responded that they routinely discuss pediatric immunizations with pregnant patients. Of these, 6 (75%) were physicians. There were no associations between provider beliefs and practices and provider demographics ($P > 0.05$).

**Table 1.** Demographics of surveyed obstetric providers

| Demographics | N (%) | Physicians | Mid-levels | Nurses |
|---|---|---|---|---|
| Total providers | 133 | 68 (51) | 41 (31) | 24 (18) |
| Gender | | | | |
| Male | 35 (26) | 35 (51) | 0 | 0 |
| Female | 98 (74) | 33 (49) | 41 (100) | 24 (100) |
| Years in practice | | | | |
| < 10 | 47 (35) | 28 (41) | 10 (24) | 9 (38) |
| 10 – 19 | 31 (23) | 12 (18) | 13 (32) | 6 (25) |
| 20 – 29 | 32 (24) | 18 (26) | 11 (27) | 3 (12) |
| ≥ 30 | 23 (17) | 10 (15) | 7 (17) | 6 (25) |
| Community served[a] | | | | |
| Rural | 61 (45) | 34 (50) | 17 (41) | 10 (42) |
| Urban | 34 (26) | 14 (21) | 12 (29) | 8 (33) |
| Suburban | 58 (44) | 34 (50) | 17 (41) | 7 (29) |
| Practice setting[a] | | | | |
| Private | 123 (92) | 64 (94) | 37 (90) | 20 (83) |
| Academic | 12 (8) | 3 (4) | 4 (9) | 5 (21) |
| Patient insurance[a] | | | | |
| Public | 59 (44) | 45 (66) | 18 (44) | 13 (54) |
| Private | 92 (69) | 28 (41) | 28 (68) | 17 (71) |
| Provider gets annual influenza vaccine | | | | |
| Always | 99 (74) | 56 (82) | 29 (71) | 14 (58) |
| Sometimes | 23 (17) | 7 (10) | 8 (20) | 8 (33) |
| Never | 11 (8) | 3 (4) | 4 (9) | 2 (8) |

[a]Percentages for community served, practice setting, and patient insurance add up to more than 100 because multiple answers could be given for these questions.

## Discussion

Here, we describe factors associated with obstetric provider pertussis vaccine attitudes and practices one year after the ACIP recommendation for Tdap vaccination for women in the third trimester of each pregnancy. In our study, 92% of surveyed providers stated knowledge of this ACIP recommendation, yet only 80% routinely recommended vaccine to eligible pregnant patients and even fewer (67%) administered vaccine in the office. Interestingly, 40% of surveyed providers referred patients elsewhere for vaccinations, rather than immunizing them on site. While provider recommendation of vaccine is associated with patient vaccine acceptance, not offering vaccine administration in the office is a known barrier to vaccine uptake among pregnant women as it creates an added obstacle to immunization

**Table 2.** Vaccine attitudes and practices of surveyed obstetric providers

| Provider characteristic | N (%) | Physician (%) | Midlevel (%) | Nurse (%) | p |
|---|---|---|---|---|---|
| Total enrolled | 133 | 68 | 41 | 24 | |
| Knows pertussis vaccine recommended for all eligible women in the 3rd trimester of each pregnancy | 123 (92) | 62 (91) | 37 (90) | 24 (100) | >0.05 |
| Believes pertussis vaccine is safe for pregnant women | 118 (89) | 59 (87) | 39 (95) | 20 (83) | >0.05 |
| Believes pertussis vaccine is effective for pregnant women | 116 (87) | 59 (87) | 37 (90) | 20 (83) | >0.05 |
| Recommends pertussis vaccine to all eligible pregnant women | 107 (80) | 53 (78) | 33 (80) | 21 (88) | >0.05 |
| Administers pertussis vaccine in the office | 89 (67) | 41 (60) | 28 (68) | 20 (83) | >0.05 |
| Knows influenza vaccine is recommended for all eligible pregnant women | 133 (100) | 68 (100) | 41 (100) | 24 (100) | >0.05 |
| Believes influenza vaccine is safe for pregnant women | 127 (95) | 66 (97) | 40 (98) | 21 (88) | >0.05 |
| Believes influenza vaccine is effective for pregnant women | 123 (92) | 61 (90) | 40 (98) | 22 (92) | >0.05 |
| Recommends influenza vaccine to all eligible pregnant women | 126 (95) | 64 (94) | 39 (95) | 23 (96) | >0.05 |
| Administers influenza vaccine in the office | 113 (85) | 56 (82) | 35 (85) | 22 (92) | >0.05 |
| Refers patient elsewhere for vaccines | 53 (40) | 30 (44) | 18 (44) | 8 (33) | >0.05 |
| Discusses pediatric immunizations with pregnant women | 8 (6) | 6 (9) | 1 (2) | 1 (4) | >0.05 |



delivery.[10,13] Understanding the reasons for not administering vaccines in the office may aid in the development of interventions to reduce this barrier to vaccine uptake.

In this study, the most commonly provided reasons for not administering vaccines in the office include cost of vaccine and lack of reimbursement, findings supported by published data.[13-15] In one study, over a quarter of obstetricians reported submitting claims for vaccine administration that were not paid.[15] On the other hand, in our study, 64% of the reasons provided for not offering vaccines in the office related to lack of understanding or comfort with vaccine discussion and administration during pregnancy. Specifically, providers stated concerns with vaccine safety during pregnancy. Despite the extensive research behind vaccine safety, physician concern regarding these results is not new, nor is it limited to the obstetricians.[11-12] Others in our study believed that pertussis vaccine does not need to be administered in the office because the patients would receive Tdap vaccine in the post-partum unit after delivery, revealing the need for more education as to the importance of maternal immunization to optimally protect the newborn from infection through passively delivered transplacental antibodies. Even more interestingly, some of our surveyed providers stated a lack of need to administer pertussis vaccine due to low incidence of pertussis infection in New York State. This reflects an ongoing lack of awareness of the ongoing pertussis public health impact burden despite widespread education and media efforts. Specifically, in New York State during 2012, there were 2,175 reported pertussis cases, (incidence of 24.2/100,000), excluding New York City.[16] The development of educational programs targeted directly for obstetric providers that detail local infection epidemiology, vaccine safety data in pregnancy, the importance of maternal immunization for transplacental transfer of antibodies and ultimately neonatal protection from infection, and informational sheets to provide to families to ease the discussion of vaccines in pregnant women may improve provider comfort with vaccines during pregnancy and ultimately more vaccines administered in the office.

We found, in this study, that factors associated with obstetric provider recommendation of Tdap to pregnant women included provider knowledge of ACIP recommendation, provider recommendation of influenza vaccine to pregnant women, and administering of pertussis vaccine in the office. It has been shown that women are more likely to receive vaccine during pregnancy if recommended to do so by an obstetric provider.[11,12,17,18] Even more specifically, women with negative vaccine attitudes who had a health care provider recommendation for vaccine were more likely to be immunized than those women with positive vaccine attitudes who did not have a health care provider vaccine

**Table 3.** Summary of common responses provided by surveyed obstetric providers who do not administer vaccines in the office

| Reasons why vaccines are not administered in the office | N (%)[a] | Physician (%)[a] | Midlevel (%)[a] | Nurse (%)[a] |
|---|---|---|---|---|
| Number who answered question | 25 | 17 | 6 | 2 |
| Cost | 11 (44) | 8 (47) | 3 (50) | 0 |
| Safety concerns | 5 (20) | 2 (12) | 3 (50) | 0 |
| Lack of reimbursement for administering vaccines | 4 (16) | 3 (18) | 1 (16) | 0 |
| Vaccines are administered elsewhere | 3 (12) | 2 (12) | 0 | 1 (50) |
| Lack of staff to administer vaccines | 2 (8) | 1 (6) | 1 (16) | 0 |
| Low patient uptake | 2 (8) | 1 (6) | 0 | 1 (50) |
| Unsure of vaccine recommendations | 2 (8) | 1 (6) | 1 (16) | 0 |
| Uncomfortable educating patients regarding vaccines | 2 (8) | 1 (6) | 1 (16) | 0 |

[a]Percentages add up to more than 100% because multiple answers could be given for this question.

**Table 4.** Factors associated with recommendation of pertussis vaccine to eligible women in the 3rd trimester of each pregnancy by surveyed obstetric providers

| | Recommends pertussis vaccine (n (%)) | | OR | 95% CI | p |
|---|---|---|---|---|---|
| | Always | Sometimes/ Never | | | |
| Knows pertussis vaccine recommended for all eligible women in the 3rd trimester of each pregnancy | | | 23.33 | 4.58, 118.87 | 0.001 |
| Yes | 105 (85) | 18 (15) | | | |
| No | 2 (20) | 8 (80) | | | |
| Recommends influenza vaccine to all eligible pregnant women | | | 12.5 | 2.27, 68.8 | 0.03 |
| Always | 105 (88) | 21 (17) | | | |
| Sometimes/Never | 2 (29) | 5 (71) | | | |
| Offers pertussis vaccine in the office | | | 7.01 | 2.73, 17.99 | <0.001 |
| Yes | 81 (76) | 8 (31) | | | |
| No | 26 (24) | 18 (69) | | | |

recommendation.[19] This further emphasizes the need for educational programs tailored to ensure that obstetric providers recommenda and administer vaccines during pregnancy.

In our study, only 6% of obstetric providers routinely discuss pediatric immunizations with their pregnant patients. Research has shown that parental vaccine decision-making begins prenatally.[20] Parents who refused or delayed vaccines were more likely to report thinking about vaccines before their child was born and that they constantly re-evaluate their vaccine decisions, thus making prenatal visits an important time to provide pediatric vaccine information prior to the infant's first direct contact with their pediatrician.[20] Despite more than half surveyed obstetric practices offering child health information, such as car seats, pets, and circumcisions, less than a quarter provided information regarding pediatric vaccines.[21] Bundling pediatric immunization information with maternal immunization information, both as methods to protect the newborn from infection, would facilitate transfer of this information to pregnant women during their prenatal visits.

Our study population of obstetric providers included physicians, mid-level providers, and nurses. While the physicians and mid-level providers are making the vaccine recommendation to the patients, the nurses are the first provider patients encounter at an obstetric visit, the ones to answer patient phone calls, and the personnel administering immunizations. It is important that all obstetric providers send a unified message regarding vaccines for pregnant women to improve patient understanding of vaccine importance for both the mothers and their newborns.[22]

Our observation that the single identified factor clearly associated with recommending influenza vaccine to pregnant women was provider receipt of influenza vaccine, with an OR of 8.36, is a powerful vaccine confidence message and should not be overlooked. Improving patient vaccine confidence starts with increasing provider confidence. Doing so, as role models, can only improve the health of our communities.

There are several limitations to our study. First, our response rate to the surveys provided to the obstetric practices was 33% and may therefore not be generalizable to the larger obstetric provider population. Previously published studies, using a similar methodology, reported response rates ranging from 14-39%.[23-25] Secondly, the results of this survey are based on recall of daily practice and may be an overestimation of obstetric provider vaccine recommendation. Prior studies have shown that more physicians state that they discuss vaccines with patients than women remember discussing vaccines with providers.[26,27] While we recognize the limitations of survey methodology, this study allowed us to describe obstetric provider attitudes and practices regarding vaccines during pregnancy, and determine areas for future interventions to increase vaccine coverage rates in this population.

**Table 5.** Standard set of questions answered by surveyed obstetric providers

1. Did you know about the following ACIP vaccine recommendations for pregnant women
Influenza vaccine should be given to all eligible pregnant women **Yes No**
Pertussis vaccine should be given in the 3rd trimester of each pregnancy **Yes No**
2. Circle the following vaccines you administer to pregnant women in your practice
Influenza vaccine
Pertussis vaccine
3. If you do not administer vaccines in your practice, circle the reasons:
**Cost Lack of reimbursement Uncomfortable educating patients**
**No time to educate patients Uncertain of vaccine recommendations**
**Safety concerns**
**Lack of staff to vaccinate Low uptake of vaccine by patients Other**
4. Do you recommend influenza vaccine to eligible pregnant women? **Always Sometimes Never**
5. Do you believe the influenza vaccine is safe in pregnant women? **Yes No Unsure**
6. Do you believe the influenza vaccine is effective in pregnant women? **Yes No Unsure**
7. Do you recommend pertussis vaccine to pregnant women? **Always Sometimes Never**
8. Do you believe the pertussis vaccine is safe in pregnant women? **Yes No Unsure**
9. Do you believe the pertussis vaccine is effective in pregnant women? **Yes No Unsure**
10. Do you refer pregnant women elsewhere to receive vaccines? **Yes No**
11. Do you provide pediatric immunization information to pregnant women? **Always Sometimes Never**

## Methods

The study team developed a one-page, self-administered, survey regarding provider vaccine attitudes and practices (**Table 1**). The survey was pilot tested with a convenience sample to ensure clarity of questions and ease of administration. The study team contacted, by telephone, obstetric practices in New York State to reach a total of 400 obstetric providers. The team explained the study goals, then faxed a cover letter and blank surveys to the practices. Practice providers, including physicians, nurse practitioners, physician assistants, and nurses, were asked to complete the survey, which was then returned, via fax, back to the study team. Completed surveys remained both anonymous and confidential. There were no incentives offered to the participants.

The first question on the survey, which determined study eligibility, asked the providers whether they provided care to pregnant women. Those who responded "No" to this question were excluded from the study. Demographic information, including provider gender, provider role, years in practice (<10 years, 10–19 years, 20–29 years, >30 years), community served (suburban, rural, urban), practice setting (private, academic), and patient insurance type accepted (public, private) were collected. Providers were able to identify more than one answer for community served and accepted insurance. Provider attitudes and practices were assessed regarding provider influenza immunization status, knowledge of vaccine recommendations in pregnancy, vaccines provided in the practice, provider beliefs regarding safety and effectiveness of influenza vaccine and pertussis vaccine in pregnant women, provider practice for recommendations of influenza vaccine and pertussis vaccine to their pregnant patients, and provider discussion of pediatric immunizations with their pregnant patients. Participant anonymity was maintained for this study. This study was determined to be exempt from approval by the SUNY Upstate Medical University institutional review board (IRB 480382).

Statistical analysis: Descriptive statistical methods were used to summarize provider characteristics and their knowledge, attitudes and practices concerning influenza and Tdap vaccines. Factors associated with recommending influenza and Tdap vaccines and administering vaccinations in the office were analyzed using odds ratios from binary logistic regression procedures. All statistical tests and interval estimation for odds ratios were 2-tailed and carried out with a priori $\alpha = 0.05$. SPSS Version23 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp) was used for data management and statistical procedures.

### Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.



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