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Original Article

Factors associated with the intention to recommend pertussis vaccination for postpartum women: A survey in Taiwan of obstetrician–gynecologists' knowledge, beliefs, and attitudes

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Abstract

Objective: To examine obstetrician–gynecologists' knowledge, beliefs, and attitudes associated with the intention to recommend adult tetanus, reduced diphtheria, and acellular pertussis (Tdap) vaccination to postpartum women.

Materials and Methods: A survey instrument was mailed to a total of 2686 members of the Taiwan Association of Obstetrics and Gynecology to assess provider demographic characteristics, occupational information, pertussis knowledge, and beliefs and attitudes about vaccination. The intention to recommend pertussis vaccination to postpartum women was evaluated. Trend chi-square statistics and multivariate logistic models were used to determine variables that were significantly associated with intention to recommend vaccination.

Results: Of the 676 surveys returned (25.2%), 510 participants were active in obstetric practice. A statistically significant difference was found in mean ± SD knowledge scores for pertussis disease and pertussis vaccination between obstetrician–gynecologists who intended to recommend and those who did not intend to recommend postpartum Tdap vaccination (disease: 2.99 ± 2.2 vs. 2.31 ± 1.9, respectively, $p < .001$; vaccination: 2.64 ± 2.2 vs. 1.36 ± 1.8, respectively, $p < .001$). Obstetrician–gynecologists who were in favor of postpartum Tdap vaccination were more likely to: (1) rate the change in pertussis incidence among adults as increased; (2) rate pertussis disease among newborn infants as highly severe; (3) rate pertussis as highly contagious; and (4) understand the current recommendation of important organizations for protecting infants against pertussis.

Conclusion: Our study of obstetrician–gynecologists' attitudes and intentions concerning postpartum Tdap vaccination may be useful in guiding the design of effective perinatal Tdap immunization programs nationwide.

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Keywords: obstetrician–gynecologists; pertussis; postpartum; vaccination

Introduction

Pertussis, or whooping cough, which is caused by the organism *Bordetella pertussis*, continues to pose a public health threat worldwide despite highly effective childhood immunization programs [1]. Waning of vaccine-acquired immunity and decreased opportunities for boosting of immunity have been cited as possible reasons for the reemergence of pertussis after mass immunization programs [2,3].

Pertussis remains a serious potential health risk to infants. Most deaths occur in the first 6 months of life, in those too young to be vaccinated or in those who did not receive complete vaccination regimens [4]. In 2001, the Global

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Pertussis Initiative (GPI) was established as the expert scientific forum to analyze the status of pertussis globally and to evaluate immunization strategies for disease control [5]. The ultimate goal was to control and reduce pertussis morbidity and mortality in infants too young to be fully immunized. In the USA, the Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC) recommended in 2006 that targeted immunization, known as "cocooning", be implemented for postpartum women who were not vaccinated previously with adult tetanus, reduced diphtheria, and acellular pertussis (Tdap) vaccine in order to provide personal protection and reduce the risk of transmitting pertussis to their infants [6].

Although doctors in Taiwan are required to report pertussis cases to the Centers for Disease Control, the available data are incomplete because most Taiwanese physicians have limited access to laboratory facilities to confirm the pertussis diagnosis. As in many other countries, the level of awareness of pertussis in Taiwan is low, and the disease remains underdiagnosed and underreported in all age groups. Clinical opinion and commentary issued by the Taiwan Society of Perinatology in May 2009 supported routine pertussis vaccination for postpartum women. However, postpartum pertussis vaccination efforts may face barriers and challenges, because the concept of the cocooning strategy to prevent infant pertussis is poorly understood by health-care providers, let alone the general public, in Taiwan.

Obstetrician–gynecologists (ob–gyns) will play an important role in postpartum Tdap vaccination implementation, given that pregnant women are more likely to be seen by ob–gyns than any other type of health-care provider and that health-care providers are known to exert substantial influence on their patients' immunization decisions. Successful immunization delivery may be facilitated by knowing about ob–gyns' attitudes toward postpartum Tdap vaccination, especially if this information is available before the development of educational messages and materials for health-care providers and the public. The current study aimed to assess the knowledge, beliefs, and attitudes of a nationally representative sample of ob–gyns regarding postpartum pertussis vaccination and to determine how these characteristics affect the physicians' intention to recommend Tdap vaccine for women during the postpartum period.

Materials and methods

This cross-sectional study of knowledge, beliefs, and attitudes regarding infant pertussis disease and postpartum pertussis vaccination was carried out between 1 November 2009 and 31 March 2010 and was approved by the institutional review board of Chung Gung Memorial Hospital (CGMH-IRB-98-3338B). To acquire a nationally representative sample of ob–gyns, a mail survey methodology was employed to contact a total of 2686 members of the Taiwan Association of Obstetrics and Gynecology using member addresses provided by the association. A stamped, self-addressed envelope for return of the questionnaire was included with each mailing. Reminder cards were mailed 3 weeks after the initial mailing, and the complete survey was re-mailed 4 weeks later to nonresponders. The questionnaires were returned anonymously by mail.

The questionnaire was a six-page document consisting of 55 multiple-choice questions. It was developed on the basis of previous literature, with the assistance of experts in obstetrics and gynecology, infectious disease, neonatology, preventive medicine, and public health and in consultation with a survey design expert. Of the 55 questions, five addressed demographic characteristics, nine addressed occupational information, eight addressed general knowledge about pertussis (four items on pertussis disease and four items on Tdap vaccination), 10 dealt with beliefs regarding perceived risk of infant pertussis disease and perinatal Tdap vaccination, and 22 focused on attitude outcomes (discussion with women about perinatal pertussis prevention, normative beliefs, and vaccine-delivery issues). A single question was asked to evaluate ob–gyns' intentions to "recommend Tdap vaccination to any postpartum women," with response options of "yes" and "no." A respondent's beliefs about the severity and contagiosity of pertussis disease were analyzed according to the categories highly severe, reasonably severe, and not severe and highly contagious, reasonably contagious, and not contagious, respectively. Responses to attitude items were assessed using a 5-point Likert-type scale ranging from extremely likely to extremely unlikely. Finally, participants were asked to select the important factors out of 12 possible answers that influenced their attitudes toward recommending or not recommending Tdap vaccination. The survey was pilot-tested on 20 ob–gyns at two university hospitals in Taiwan. The 20 ob–gyns completed the survey and provided written feedback that was incorporated into the final survey.

The outcome variable in this study was intention to recommend postpartum Tdap vaccination for women. Chi-square statistics were used to evaluate the associations between ob–gyns' knowledge, belief variables, and attitude outcomes. Each knowledge variable was scored according to correctness; the four items on pertussis disease and four items on pertussis vaccination were added up separately to derive the summary knowledge scores in the two categories for each participant. Initial univariate frequencies were generated for each variable. Trend chi-square statistics were then applied to calculate the associations between demographic characteristics, occupational information, knowledge, belief variables, and attitude outcomes. A two-tailed alpha level of 0.05 was used as the threshold for statistical significance. Multivariate logistic models were built to determine significant variables for intention outcome. Collinearity and interactions were checked. Backward logistic regression was used to eliminate nonsignificant variables to obtain the final model. All analyses were conducted using SAS, version 9.1 (SAS Institute, Cary, NC, USA).

Results

Of the 676 questionnaires returned (25.2%), 166 were from physicians who did not provide prenatal care for pregnant

women or who worked in a setting that did not provide childbirth services. For the 510 participants who were active in obstetric practice, demographic characteristics, practice characteristics, and knowledge about pertussis disease and Tdap vaccination are summarized in Table 1. A total of 299 (58.6%) participants reported positively their intention to recommend postpartum Tdap vaccination to prevent infant pertussis disease. A statistically significant difference was found in the mean knowledge scores for pertussis disease and pertussis vaccination between ob–gyns who intended to recommend and those who did not intend to recommend postpartum Tdap vaccination (disease: 2.99 ± 2.2 vs. 2.31 ± 1.9, respectively, $p < .001$; vaccination: 2.64 ± 2.2 vs. 1.36 ± 1.8, respectively, $p < .001$) (Fig. 1). Participants' beliefs in relation to pertussis are shown in Table 2. Significant differences were found between ob–gyns who intended to recommend and those who did not intend to recommend postpartum Tdap vaccination in: (1) rating the change in pertussis incidence among infants; (2) rating the change in pertussis incidence among adolescents; (3) rating the change in pertussis incidence among adults; (4) rating the severity of pertussis among infants aged 0 to 6 months; (5) rating the contagiosity of pertussis; (6) knowing the main source of pertussis infection for infants; (7) understanding the "cocoon strategy" for protecting infants against pertussis; and (8) understanding the current recommendation of the ACIP for protecting infants against pertussis. Comparing ob–gyns who intended to recommend and those who did not intend to recommend postpartum Tdap vaccination, four variables remained significant in the final logistic regression model. Ob–gyns who were in favor of postpartum Tdap vaccination were more likely to: (1) rate the change in pertussis incidence among adults as increased; (2) rate pertussis disease among newborn infants as highly severe; (3) rate pertussis as highly contagious; and (4) understand the current recommendation of the ACIP for protecting infants against pertussis (Table 3). From a list of 12, ob–gyns selected the important factors that influenced their attitudes toward recommending or not recommending postpartum Tdap vaccination. The three most frequently selected reasons for recommendation were: (1) believing that the benefits of the vaccine outweigh the risk (68.6%); (2) trusting the recommendation of the international clinic guidelines (57.2%); and (3) believing that the immunization program is convenient (57.9%). On the other hand, the three most frequently selected reasons for disapproval of vaccination were: (1) a lack of official clinic guidelines on this issue (76.3%); (2) believing that postpartum women were not willing to take the vaccine (66.4%); and (3) believing that newborn infants were not at high risk for developing pertussis disease (55.0%) (Table 4). Regarding normative beliefs about pertussis vaccination, most ob–gyns reported that they would be affected by the

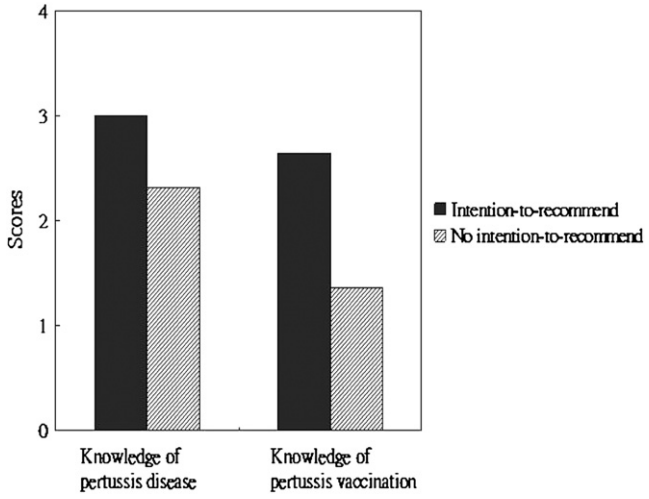

Fig. 1. Comparison of mean knowledge scores for pertussis disease and pertussis vaccination of obstetrician–gynecologists who intended to recommend postpartum pertussis vaccination versus those who did not intend to recommend it. Mean knowledge scores for both categories of knowledge were significantly higher in those who intended to recommend vaccination (disease: 2.99 ± 2.2 vs. 2.31 ± 1.9, $p < 0.001$; vaccination: 2.64 ± 2.2 vs. 1.36 ± 1.8, $p < 0.001$).

Table 1
Provider and practice characteristics ($n = 510$).

Characteristic	Category	n (%)
Age (y)	35 or under	59 (11.6)
	36–40	53 (10.4)
	41–45	72 (14.1)
	46–50	103 (20.2)
	51–55	101 (19.8)
	Over 55	122 (23.9)
Gender	Male	402 (78.8)
	Female	108 (21.2)
Educational qualification	Bachelor's degree	395 (77.5)
	Master's degree	69 (13.5)
	Doctor of philosophy	46 (9.0)
Location of practice	Urban	170 (33.3)
	Rural	331 (64.9)
	Other	9 (1.8)
Number of years in practice	1–5	11 (2.2)
	6–10	75 (14.7)
	11–15	79 (15.5)
	More than 15	345 (67.6)
Subspecialty[a]	General obstetrics and gynecology	283 (55.5)
	Gynecology	69 (13.5)
	Maternal-fetal medicine	119 (23.3)
	Reproductive endocrinology/infertility	59 (11.6)
	Gynecologic oncology	37 (7.3)
	Urogynecology	24 (4.7)
	Gynecologic endoscopy	18 (3.5)
Number of antenatal cases seen per week in practice	Under 10	207 (40.6)
	10–20	114 (22.4)
	21–30	39 (7.6)
	31–40	37 (7.3)
	41–50	24 (4.7)
	51–60	30 (5.9)
	61 or more	59 (11.6)
Number of newborns delivered per week in practice	Under 10	225 (44.1)
	10–20	128 (25.1)
	21–30	77 (15.1)
	31–50	61 (12.0)
	51–70	11 (2.2)
	71–90	8 (1.6)

[a] More than one response could be selected.

Table 2
Belief and knowledge variables of pertussis stratified by obstetricians and gynecologists' decision to recommend postpartum pertussis vaccination or not.

Variable	Total $n = 510$	Recommend $n = 299$ (%)	Not recommend $n = 211$(%)	p value
How do you rate the change in pertussis incidence among infants aged 0–6 months?				
Increase	267	191 (71.5)	76 (28.5)	< 0.001
No change	45	27 (60.0)	18 (40.0)	
Decrease	198	81 (40.9)	117 (59.1)	
How do you rate the change in pertussis incidence among adolescents aged 11–18 years?				
Increase	269	184 (68.4)	85 (31.6)	< 0.001
No change	55	35 (63.6)	20 (36.4)	
Decrease	186	80 (43.0)	106 (57.0)	
How do you rate the change in pertussis incidence among adults aged 19 years or over?				
Increase	272	203 (74.6)	69 (25.4)	< 0.001
No change	106	52 (49.1)	54 (50.9)	
Decrease	132	44 (33.3)	88 (66.7)	
How do you rate the severity of pertussis among infants aged 0–6 months?				
Highly severe	406	263 (64.8)	143 (35.2)	< 0.001
Reasonably severe	56	24 (42.9)	32 (57.1)	
Not severe	48	12 (25.0)	36 (75.0)	
How do you rate the severity of pertussis among adolescents aged 11–18 years?				
Highly severe	159	98 (61.6)	61 (38.4)	0.735
Reasonably severe	299	172 (57.5)	127 (42.5)	
Not severe	52	29 (55.8)	23 (44.2)	
How do you rate the severity of pertussis among adults aged 19 years or over?				
Highly severe	140	76 (54.3)	64 (45.7)	0.728
Reasonably severe	318	192 (60.4)	126 (39.6)	
Not severe	52	31 (59.6)	21 (40.4)	
How do you rate the degree of contagiosity of pertussis?				
Highly contagious	301	218 (72.4)	83 (27.6)	< 0.001
Reasonably contagious	182	74 (40.7)	108 (59.3)	
Not contagious	27	7 (25.9)	20 (74.1)	
Which age group do you regard as the main source of pertussis infection for infants aged 0–2 years?				
Infants aged 0–2 years	63	23 (36.5)	40 (63.5)	0.007
Children aged 3–10 years	118	57 (48.3)	61 (51.7)	
Adolescents aged 11–18 years	17	13 (76.5)	4 (23.5)	
Adults aged 19 years or over	312	206 (66.0)	106 (34.0)	
Do you understand the "cocoon strategy" for protecting infants against pertussis?				
Yes	275	199 (72.4)	76 (27.6)	< 0.001
No	235	100 (42.6)	135 (57.4)	
Do you understand the current recommendation of the Advisory Committee on Immunization Practices (ACIP) of the USA's CDC for protecting infants against pertussis?				
Yes	281	203 (72.2)	78 (27.8)	< 0.001
No	229	96 (41.9)	133 (58.1)	

recommendations of organizations, in particular the Department of Health of Taiwan (90.6%), Centers for Disease Control of Taiwan (86.5%), Bureau of Health Promotion of Taiwan (82.9%), Taiwan Association of Obstetrics and Gynecology (81.8%), and Taiwan Society of Perinatology (81.4%) (Table 5). Participants reported that the following strategies would be extremely or relatively important for successful delivery of pertussis vaccination to postpartum women in Taiwan: recommendation by the government health authorities (76.9%); recommendation by health-care physicians (70.6%); coverage by national health insurance policies (69.2%); availability at a reasonable cost (59.0%); and health education (57.6%) (Table 6).

Discussion

The risk for pertussis death or severe pertussis-related complications is highest among infants in the first 6 months of age and remains elevated until the completion of a primary infant pertussis vaccine program [2–4]. Household contacts, especially with their mothers, have been identified as the most important infection source leading to infant pertussis disease [7]. Several recent studies have indicated that vaccination of household members of newborns, known as the "cocoon strategy," resulted in a 70% reduction in cases of pertussis in infants under 3 months old [6,8]. Ob–gyns are uniquely positioned to vaccinate women given recent guidelines on postpartum Tdap vaccination. In this study, we examined ob–gyns' attitudes and intentions with respect to postpartum pertussis vaccination, which could become an important governmental public health policy to prevent infant pertussis disease in Taiwan. The survey revealed that 58.6% of the practicing ob–gyns who provide maternity care were likely to recommend the Tdap vaccine for women immediately after delivery during the postpartum hospital stay. Perceived risks regarding the incidence and severity of pertussis infection

Table 3
Final multivariate analysis of variables influencing obstetrician–gynecologists' attitudes toward recommending postpartum pertussis vaccination.

Variable	Point estimate *OR*[a] (95% CI)
Rate the change in pertussis incidence among adults	
Increase	3.1 (2.1–5.6)
No change	1.5 (1.1–2.7)
Decrease	Reference
Rate the severity of pertussis among newborn infants	
Highly severe	3.9 (2.6–6.9)
Reasonably severe	1.7 (1.5–3.1)
Not severe	Reference
Rate the degree of contagiosity of pertussis	
Highly contagious	3.3 (2.5–6.4)
Reasonably contagious	1.5 (1.3–2.9)
Not contagious	Reference
Understanding current Advisory Committee on Immunization Practices (ACIP) recommendations for pertussis vaccination	
Yes	5.7 (3.9–10.8)
No	Reference

[a] Odds ratio (95% confidence interval) adjusted for demographic and attitude/belief variables listed in Tables 1 and 2.

Table 4
The main reasons that influenced obstetrician–gynecologists' attitudes toward recommending pertussis vaccination for postpartum women or not.

Reason cited	*n* (%)
Recommend ($n = 299$)	
The benefits of the vaccine outweigh the risk	205 (68.6)
The international clinic guidelines recommend	171 (57.2)
The immunization program is convenient	173 (57.9)
Thought that it could benefit newborn infants' health	140 (46.8)
Other obstetrician–gynecologists have started to take such an action	127 (42.5)
Thought that pertussis is a severe disease among newborn infants	84 (28.1)
Thought that postpartum women might be the most common source of pertussis infection for newborn infants	73 (24.4)
Thought that newborn infants might be at high risk for developing pertussis disease	68 (22.7)
Thought that pertussis immunization was a mandatory part of postpartum care	40 (13.4)
Other	36 (12.0)
Not recommend ($n = 211$)	
Official clinic guidelines on the issue were lacking	161 (76.3)
Thought postpartum women were not willing to undergo it	140 (66.4)
Thought newborn infants were not at high risk for developing pertussis disease	116 (55.0)
Thought pertussis disease is not severe enough to warrant vaccination	99 (46.9)
Thought the vaccine is too costly	81 (38.4)
Thought natural pertussis disease is preferable to vaccine	79 (37.4)
Thought it could not benefit newborn infants' health	68 (32.2)
Thought pertussis vaccination was not a mandatory part of postpartum care	39 (18.5)
Avoid possible side effects in postpartum women	36 (17.1)
Other	22 (10.4)

were common reasons cited for the intention to recommend vaccination; other ob–gyns who were in favor of vaccination cited their belief that pertussis was a highly contagious disease. Our study also showed that ob–gyns with higher knowledge scores for pertussis disease or pertussis vaccination were significantly more likely to recommend Tdap vaccine to postpartum women.

Several studies have evaluated the interaction between patients and health-care providers when dealing with health information about vaccination for pregnant women. The interaction can best be described within the framework of the Systems Model of Clinical Preventive Care (SMCPC) proposed by Walsh and McPhee [9]. This model focuses on the many barriers involved in provision of patient care and influential factors that either promote or inhibit completion of preventive-care activities. Enabling factors for physicians within the SMCPC model include knowledge, beliefs, attitudes, prior clinical experiences, and personal health practices. It is logical that physicians' knowledge about an infectious disease and beliefs about its prevention strategy would be associated with intention to recommend vaccination. Prior research on ob–gyns' decision to recommend the influenza vaccine supports this result [10]. The research showed that health-care providers who were more knowledgeable about the influenza vaccine were more likely to initiate discussions about vaccination with their pregnant patients than were providers with less knowledge about the vaccine. Englund also demonstrated that maternity-care providers with high levels of knowledge and positive attitudes consistently discuss and recommend the influenza vaccine at higher rates than other providers [11]. Similarly, physician knowledge and attitudes regarding the association of human papillomavirus (HPV) with patients' sexual experience were associated with intention to recommend HPV vaccination [12,13].

Another component of the SMCPC model for health-care providers describes the perceived disease contagiosity and severity. In our survey, ob–gyns who perceived pertussis as a severe or contagious disease were more likely to recommend postpartum pertussis vaccination than were their peers who lacked these perceptions. Our study also showed that the main reason for ob–gyns to recommend the pertussis vaccine to postpartum women was that they believed that the benefits of the vaccine outweighed the risk. This emphasis on efficacy is also found in the literature to explain why physicians recommend vaccination. Silverman and Greif reported that physicians were more likely to offer vaccine to their patients if they believed pregnant women had an increased risk of influenza, or if they believed that vaccination during pregnancy also protected infants [10]. In a survey of gynecologists, Raley et al discovered likewise that beliefs about HPV vaccine characteristics such as efficacy were important predictors of physicians' recommendation [14].

Another key finding of our study was that the main reason for ob–gyns' refusal to recommend postpartum pertussis vaccination was that official clinic guidelines on the issue had not yet been issued in Taiwan. Nevertheless, our survey demonstrated that the recommendations of professional organizations and individuals also influenced ob–gyns' decision whether to recommend Tdap vaccine to postpartum women. This finding echoes the results of a recent study of maternity-care providers' attitudes toward influenza vaccination during

Table 5
The organizations/individuals whose postpartum pertussis vaccination recommendations are likely to be followed among obstetrician–gynecologists ($n = 510$).

Organizations/individuals	*n* (%)
Department of Health, Taiwan	462 (90.6)
Centers for Disease Control, Taiwan	441 (86.5)
Bureau of Health Promotion, Department of Health, Taiwan	423 (82.9)
Taiwan Association of Obstetrics and Gynecology	417 (81.8)
Taiwan Society of Perinatology	415 (81.4)
American College of Obstetricians and Gynecologists	328 (64.3)
International Federation of Gynecology and Obstetrics	220 (43.1)
Advisory Committee on Immunization Practices, USA	205 (40.2)
Colleagues	203 (39.8)
Pharmaceutical representative	57 (11.2)

pregnancy, in which providers aware of national recommendation guidelines were more than twice as likely to discuss and recommend vaccination than those who were unaware of the guidelines [15]. On the other hand, several studies on adolescent HPV vaccination found that the decision to recommend HPV vaccination among nurse practitioners, ob–gyns, and family physicians would be influenced by the recommendations of their professional organizations [14,16,17]. Furthermore, a survey conducted among obstetricians in the USA also found that they would support and follow the recommendations of the US Advisory Committee on Immunization Practices and the American College of Obstetricians and Gynecologists regarding administering Tdap vaccine to postpartum mothers [18].

A recent study conducted to assess the decision-making process of women who accepted or declined postpartum pertussis vaccine revealed a relatively low acceptance (53%) of vaccination in Taiwan [19]. There is some evidence that the willingness of Taiwanese pregnant women to undergo vaccination is generally poor, ranging from less than 1% against seasonal influenza to 7.2% against 2009 influenza A/H1N1. Ongoing education is needed to reduce and eliminate misinformation and to reinforce the importance of being vaccinated in this population. The pregnant population is very diverse, with a wide range of background knowledge. Educational intervention may need to be delivered by a variety of vehicles, at many different levels, perhaps in different languages, and certainly repeatedly, to reach the greatest number of women and ensure postpartum Tdap vaccine delivery before hospital discharge [8]. Furthermore, this study demonstrates that the percentage of physicians intending to recommend postpartum Tdap vaccination is lower in Taiwan than in western countries. The barriers to ob–gyns' recommending postpartum pertussis vaccination were poor knowledge, unfavorable beliefs, and lack of guidelines from authorities. Health-care providers are important sources of information for patients. In addition, patients value physicians' recommendations about health-related matters, including vaccination. The success of postpartum Tdap vaccination programs, therefore, will depend on physicians' willingness and ability to deliver the message of pertussis vaccination to pregnant women. This will undoubtedly involve developing skills to effectively communicate the advantages of vaccination for postpartum women and their infants. Within the SMCPC model described above, several opportunities exist for focused intervention efforts targeting both pregnant women and ob–gyns in Taiwan. Ob–gyns must have enough information about the current epidemiology of pertussis and the benefits of postpartum vaccination to feel comfortable in offering the vaccine and helping these women make informed decisions. Policy makers in Taiwan could take our findings into account in order to improve the vaccination strategy for women of childbearing age in future vaccination campaigns.

Table 6
The reported important and effective policies or strategies for successful delivery of postpartum pertussis vaccination ($n = 510$).

Policy or strategy	*n* (%)
Recommendation by the government health authorities	392 (76.9)
Recommendation by health-care physicians	360 (70.6)
Coverage by national health insurance policies	353 (69.2)
Availability at a reasonable cost	301 (59.0)
Health education on TV or radio	294 (57.6)
Health education in newspapers or magazines	267 (52.4)
Health education booklets	250 (49.0)
Prenatal health education classes	246 (48.2)
Health education through the Internet	223 (43.7)
Recommendation by health-care nurses	176 (34.5)

Several potential limitations inherent to the interpretation of these survey findings should be considered. First, the response rate was relatively low (25.2%), even though we devised a short and anonymous survey, sent a reminder card, and mailed a second questionnaire to nonresponders. Although the low response rate does not affect the internal validity of the study findings, it may decrease the generalizability of the results to all ob–gyns in Taiwan. However, participant characteristics were similar to those of a sample of all members of the Taiwan Association of Obstetrics and Gynecology and a sample of the Taiwan Society of Perinatology. Furthermore, because physicians tend to be relatively homogeneous with respect to attitudes and behaviors, the nonresponse bias may not be as critical to interpretation of data gathered from physician surveys with low response rates compared with the general population. Second, we used a cross-sectional study design, which precludes determination of causal relationships between different ongoing factors and study outcomes. No government recommendations or guidelines for postpartum pertussis vaccination had been initiated prior to this study in Taiwan. However, after our survey some educational efforts were made and clinical opinions presented by the Taiwan Society of Perinatology regarding perinatal pertussis immunization . This might have influenced the decision-making process of ob–gyns in a way that was not captured by the survey. Third, the outcome variable in this study was intention to recommend Tdap vaccine rather than actual recommendation or prescription, because the vaccine is not yet available for clinical use for some physicians. However, previous studies have demonstrated that behavioral intention, a consistent predictor of actual behavior, is associated with physician immunization behavior [20]. Nevertheless, there remains a need for additional studies after further development

of regional and national educational programs focused on strategies for the implementation of the vaccine. Despite these limitations, our study displays important strengths in providing insight into the decision-making process of ob−gyns regarding intention to recommend postpartum Tdap vaccination and in suggesting that the recommendations of various organizations cited and individuals are likely to be followed among ob−gyns in Taiwan.

In conclusion, our study of ob−gyns' attitudes and intentions concerning postpartum Tdap vaccination may be useful in guiding the design of effective perinatal Tdap immunization delivery programs nationwide.

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References

[1] Centers for Disease Control and Prevention (CDC). Pertussis - United States, 1997−2000. MMWR Morb Mortal Wkly Rep 2002;51:73−6.
[2] Salmaso S, Mastrantonio P, Tozzi AE, Stefanelli P, Anemona A, Ciofi degli Atti ML, et al. Stage III Working Group. Sustained efficacy during the first 6 years of life of 3-component acellular pertussis vaccines administered in infancy: the Italian experience. Pediatrics 2001;108:E81.
[3] Versteegh FG, Schellekens JF, Nagelkerke AF, Roord JJ. Laboratory-confirmed reinfections with *Bordetella pertussis*. Acta Paediatr 2002;91: 95−7.
[4] Vitek CR, Pascual FB, Baughman AL, Murphy TV. Increase in deaths from pertussis among young infants in the United States in the 1990s. Pediatr Infect Dis J 2003;22:628−34.
[5] Plotkin S. The global pertussis initiative: process overview. Pediatr Infect Dis J 2005;24(5 Suppl.):S7−9.
[6] Coudeville L, van Rie A, Andre P. Adult pertussis vaccination strategies and their impact on pertussis in the United States: evaluation of routine and targeted (cocoon) strategies. Epidemiol Infect 2008;136:604−20.
[7] Bisgard KM, Pascual FB, Ehresmann KR, Miller CA, Cianfrini C, Jennings CE, et al. Infant pertussis: who was the source? Pediatr Infect Dis J 2004;23:985−9.
[8] Gerbie MV, Tan TQ. Pertussis disease in new mothers: effect on young infants and strategies for prevention. Obstet Gynecol 2009;113:399−401.
[9] Walsh JM, McPhee SJ. A systems model of clinical preventive care: an analysis of factors influencing patient and physician. Health Educ Q 1992;19:157−75.
[10] Silverman NS, Greif A. Influenza vaccination during pregnancy: patients' and physicians' attitudes. J Reprod Med 2001;46:989−94.
[11] Englund JA. Maternal immunization with inactivated influenza vaccine: rationale and experience. Vaccine 2003;21:3460−4.
[12] Esposito S, Bosis S, Pelucchi C, Begliatti E, Rognoni A, Bellasio M, et al. Pediatrician knowledge and attitudes regarding human papillomavirus disease and its prevention. Vaccine 2007;25:6437−46.
[13] Ishibashi KL, Koopmans J, Curlin FA, Alexander KA, Ross LF. Paediatricians' attitudes and practices towards HPV vaccination. Acta Paediatr 2008;97:1550−6.
[14] Raley JC, Followwill KA, Zimet GD, Ault KA. Gynecologists' attitudes regarding human papilloma virus vaccination: a survey of Fellows of the American College of Obstetricians and Gynecologists. Infect Dis Obstet Gynecol 2004;12:127−33.
[15] Tong A, Biringer A, Ofner-Agostini M, Upshur R, McGeer A. A cross-sectional study of maternity care providers' and women's knowledge, attitudes, and behaviours towards influenza vaccination during pregnancy. J Obstet Gynaecol Can 2008;30:404−10.
[16] Mays RM, Zimet GD. Recommending STI vaccination to parents of adolescents: the attitudes of nurse practitioners. Sex Transm Dis 2004;31: 428−32.
[17] Riedesel JM, Rosenthal SL, Zimet GD, Bernstein DI, Huang B, Lan D, Kahn JA. Attitudes about human papillomavirus vaccine among family physicians. J Pediatr Adolesc Gynecol 2005;18:391−8.
[18] Clark SJ, Adolphe S, Davis MM, Cowan AE, Kretsinger K. Attitudes of US obstetricians toward a combined tetanus-diphtheria-acellular pertussis vaccine for adults. Infect Dis Obstet Gynecol 2006;2006:87040.
[19] Cheng PJ, Huang SY, Shaw SW, Kao CC, Chueh HY, Chang SD, et al. Factors influencing women's decisions regarding pertussis vaccine: a decision-making study in the Postpartum Pertussis Immunization Program of a teaching hospital in Taiwan. Vaccine 2010;28:5641−7.
[20] Millstein SG. Utility of the theories of reasoned action and planned behavior for predicting physician behavior: a prospective analysis. Health Psychol 1996;15:398−402.