

Maternal Vaccination Against *Bordetella Pertussis*: What Do Pregnant Women Want?

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Abstract

Background: Whooping cough, caused by *Bordetella pertussis* (Bp) is a highly contagious disease affecting the respiratory tract. It can cause severe morbidity and death in young infants who are too young to be immunized the incidence of whooping cough is rising. Maternal vaccination may reduce morbidity and mortality caused by Bp in infants.

Objectives: To evaluate the perspective of pregnant women towards maternal vaccination to protect newborns against Bp in The Netherlands.

Design: Cross sectional survey.

Methods: A total of 300 pregnant women visiting the obstetric outpatient department were surveyed by questionnaire concerning their perspective on maternal vaccination against Bp.

Results: The response rate was 42%. Of the respondents (126), three quarters (95% CI 0.67-0.85) had a positive attitude towards maternal vaccination against Bp. Almost half (45%) of all women with a positive attitude would consider participation in a research setting. Responders with a positive attitude did not differ in age, parity and religion compared to responders with a negative attitude.

Conclusion: There is a moderate positive attitude towards maternal vaccination against Bp among pregnant women. Conducting a vaccination study against Bp in pregnant women seems feasible.

Keywords: Pertussis; Whooping cough; Questionnaire; Incidence; Prevention; Maternal vaccination; Immunity

Introduction

Whooping cough, caused by *Bordetella pertussis* (Bp), is a highly contagious bacterial disease involving the respiratory tract. Despite improvement of vaccination coverage, pertussis remains a major cause of reported childhood morbidity and mortality from a vaccine-preventable disease [1]. Since approximately 1996 the incidence increased worldwide and remained higher than before, despite the change to an acellular vaccine in the vaccination program [1-3].

Postulated causes for the increased incidence are an improved surveillance of the disease, an increasing number of immigrants and bacterial evolution. The waning of naturally derived and vaccine induced immunity in older children and adults is as well a suggested determinant, resulting in increased susceptibility [1,2,4].

Mooi and de Greeff suggested that maternal vaccination against Bp may reduce the related morbidity and mortality of infants [2]. Newborns or partially vaccinated infants, prior to the completion of their primary series of vaccinations, are especially susceptible. Vaccinating pregnant women would result in immunization and protection of the unborn child against whooping cough from birth until the primary vaccination program starts. Ultimately, morbidity and mortality rates of young infants will decrease [5-7]. During the development of a vaccination trial against pertussis in pregnant women an evaluation of the attitude of women towards vaccination in pregnancy was held in order to evaluate whether such a trial would be acceptable to pregnant women.

Methods

From January 2008 to July 2008 a total of 300 questionnaires were distributed at the outpatient clinic of the obstetric department of the Groene Hart Ziekenhuis, a general teaching hospital in Gouda the Netherlands. All pregnant women visiting the outpatient clinic were

included and were asked to answer a Dutch written questionnaire.

The following items were included (Figure 1):

1. Demographics (age, gestational age of current pregnancy, parity and religion),
 - a. Attitude towards maternal vaccination in general,
 - b. Attitude towards maternal vaccination against Bp after patient information was given about pertussis and the vaccination.
2. The women with a positive attitude towards maternal vaccination against Bp were requested to answer some additional questions:
 - c. Attitude towards maternal vaccination if the efficacy and safety of the vaccine is not entirely clear;
 - d. Attitude towards participation in a clinical trial regarding maternal vaccination.

Women who refused answering the questionnaire and non-respondents were not further pursued.

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Fill in or circle the answer that applies to you.

Demographic factors:

Present date?

Date of birth?

How many times have you been pregnant?

In what week of pregnancy are you?

How many children do you have?

What is your religion?

A. Christian B. No religion C. Other

Question (a): Would you agree with maternal vaccination in this pregnancy to prevent or reduce the effect of a disease that could harm the newborn?

A. Yes B. No

If your answer to the last question is "no", can you define your reasons?

A. Religious reasons

B. Fear of harm to the fetus

C. Fear of needles

D. Other:

Read the following patient information:

Pertussis, also known as whooping cough, is a common disease caused by the bacteria *Bordetella pertussis*. In newborns a pertussis infection can lead to severe damage and it can even be fatal. Adults are as well susceptible for infection with the *B. pertussis* but often the course of the disease is mild and therefore not recognized. An infected adult can be a source of infection for newborns. Adverse effects of pertussis exposure during pregnancy are not known.

When pertussis occurs, antibodies against the disease are formed. In pregnancy these antibodies pass the placental to the fetus. This leads to protection against pertussis until their primary vaccination program starts, two months after birth.

In the Netherlands, the majority of the population is vaccinated against pertussis through the national immunization program with the first vaccination two months after birth and the last in the fourth year of life. After complete vaccination is reached, antibodies persist up to 4-12 years. It is possible that in pregnancy too little, or no more antibodies are present in the maternal blood. The pregnant woman is then prone to pertussis infection and the newborn might not be protected against pertussis by the maternal antibodies either.

Given the severe effects of a pertussis infection in infants and knowing that having maternal antibodies against pertussis is a protective factor, it would be desirable for all pregnant women to be vaccinated against pertussis in the third trimester of pregnancy.

Fill in the following questions.

Question (b): Would you agree with maternal vaccination during this pregnancy against *B. pertussis* after reading the patient information?

A. Yes B. No

If your answer to the last question is "no", can you define your reasons?

A. Religious reasons

B. Fear of harm to the fetus

C. Fear of needles

D. Lack of trust in medical science as it is described in the patient information.

E. Other:

If your answer to question (b) is "No", this survey is completed. If you answered "Yes" in question (b), we kindly ask you to continue the questionnaire.

Question (c): Would you agree with vaccination if efficacy and safety of the vaccine is not entirely clear?

A. Yes B. No

Question (d): Would you like to participate in a clinical trial regarding maternal vaccination against *B. Pertussis*?

A. Yes B. No

Figure 1: Questionnaire.

Statistical analyses

The frequencies of each response were analyzed. Descriptive analysis of the study variables including demographics were performed using Chi-square testing. A *p*-value of 0.05 or less was considered significant.

Results

In Figure 2, the results of the survey are shown. A total of 300 questionnaires were distributed, 132 were returned (response rate 44%) and 126 questionnaires were suitable for analysis (42%). Six questionnaires were answered incompletely and therefore excluded.

Before any patient information was given, 95 pregnant women (75%) would approve maternal vaccination against a disease that could be harmful to the newborn (Figure 2a). Arguments for a negative attitude towards vaccination amongst the remaining women (N=31, 24.6%) were fear of harm to the foetus (N= 22, 71.0%), religious reasons (N=2, 6.4%), insufficient information and the preference to discuss this matter with their partner before deciding (N=7, 23%).

In Table 1 the demographics of the participants are presented. The mean age of the participants was 32 years; the mean gestational age of pregnancy was 25 weeks. There were no differences in demographics between women who had a negative attitude compared to women with a positive attitude towards maternal vaccination (Table 1). No significant differences were found regarding parity (*p*=0.26) or religion (*p*=0.27) of the pregnant women with a positive attitude towards maternal vaccination after reading the patient information.

After reading the provided patient information, 99 of the 126 (79%) woman would consent to maternal vaccination against Bp (Figure 2b). Patient information did not significantly influence attitude towards maternal vaccination (*p*=0.45). The reasons for a negative attitude were not different after reading the patient information compared to before reading.

When given information that efficacy and safety of the vaccine is not entirely clear, the majority 79 of the 94 women (84%), changed their formerly positive attitude towards maternal vaccination to a negative one (*p*< 0.05) (Figure 2c).

Of the 55 participants that answered the question about the attitude towards participation in a clinical trial for Bp vaccination, 25 women would agree to participate (45%) (Figure 2d). However 39 women avoided making a clear response to the question.

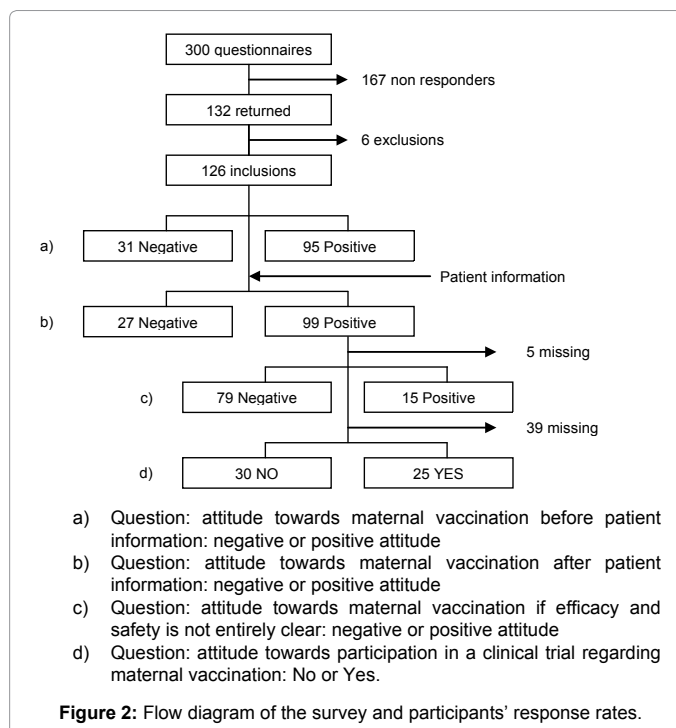
Demographics:	Total N	Mean (SD)	Positive attitude N (%)*	95% CI (%)	p-value
Age (y)		32 (5)			
Gestational age (w)		25 (10)			
Parity:	70				0.26
0	24		20 (83)	63-95	
≥1	46		37 (80)	66-91	
Religion:	118				0.27
Christian	53		42 (79)	66-89	
No Religion	54		43 (80)	66-89	
Other**	11		7 (64)	31-89	

Y: Years; w: weeks; SD: Standard Deviation; 95% CI: 95% Confidence Interval;

*Positive attitude after provided patient information;

** Other religion like Muslim or Hinduism / Buddhism. No Jewish or Jehovah's participate

Table 1: Demographic factors of the pregnant women that participated in the questionnaire survey Binary logistic regression were performed and chi square testing was used.



Discussion

We studied the importance of patient information regarding Bp vaccination in pregnancy and the influence of this information on agreeing to be vaccinated in order to protect their unborn baby against Bp.

In general it is plausible that pregnant women agree to something that promotes the health of their children. But when we asked the women if they wanted to be vaccinated against a disease that could be harmful to the newborn, three quarters did agree to vaccination before receiving any information about the disease and the vaccination. A reason for this high percentage may be fear of getting the disease and the consequences of the disease for the newborn. The women with a negative attitude in particular wanted more information about the disease and the vaccination before deciding.

In 2010 much commotion occurred concerning the H1N1 influenza epidemic. Worldwide people were massively vaccinated. Little was known about the safety and the efficacy of the vaccine. The disease might have fatal consequences for elderly, children, sick people and pregnant women. Consequently many pregnant women agreed to vaccination.

In a recent study about acceptance of the H1N1 vaccine by pregnant women, Tucker et al. found that willingness to receive the H1N1 vaccine was more related to a higher risk perception about the probability of getting H1N1 and the susceptibility to H1N1 influenza than to distrust of the health care system. They also found that worry about acquiring the disease was a stronger predictor of willingness to be vaccinated, than risk perceptions, distrust, or worry about vaccine safety [8]. Some other researchers found that pregnant women or parents do not necessarily base their acceptance of a vaccine upon a rational process of weighing risks, or upon scientific evidence [9,10]. These facts may be an explanation why there was no significant difference in our study between the attitudes of the pregnant women towards maternal vaccination against Bp before and after patient information was provided.

After patient information was given, there were a few more pregnant women who would agree to maternal vaccination, which implies that patient information possibly can positively influence decisions.

Cheng et al. showed in a cross sectional survey that women who had discussed the postpartum Bp vaccination with their clinicians or who were educated about Bp were more likely to receive vaccination than those who had not [11]. Some other studies reported that pregnant women whose healthcare providers recommended influenza vaccine during pregnancy were more likely to be vaccinated than women who did not receive such suggestions [12,13]. Patient information therefore may be very useful to help people deciding but the result depends on how and by whom it is given.

As we found in our survey, when confronted straightforwardly with uncertainty about safety and efficacy, most pregnant women changed their positive attitude into a negative one. Only 15% of the women would still agree to maternal vaccination against Bp. This is a clear difference, compared to the response of pregnant women towards maternal vaccination after reading the patient information from our study, in which information about the disease, but no assurance on safety and efficacy of the vaccine was given.

Daly et al. and Black et al. reported that women would accept maternal vaccination provided there is strong evidence of its safety and it is widely used. These studies encountered great difficulty recruiting pregnant women into a vaccine trial. The percentage of pregnant women who agreed with maternal vaccination in these studies was between 7.5-19% [14,15].

In our study almost half of the women would like to participate in a trial involving maternal vaccination against Bp. The difference between our results and the results of other studies may be explained by the fact that in our study we only asked if they would consider participating in the program.

Nowadays recommendations in among others the USA, Great-Britain and the Netherlands advocate maternal vaccination against Bp at the beginning of the third trimester [16-20].

The pregnant woman should be informed about data on the safety and efficacy of pertussis vaccination in pregnancy from older and recent studies [21-24].

Several limitations of the study should be addressed:

Firstly, the study was conducted in a single medical centre in the Netherlands, making it difficult to generalize the results.

Secondly, our findings should be considered in the light of their general applicability and validity. Respondents were mostly Caucasian and Dutch speaking and the sample size was small. Religious background was shown not to cause any significant difference in the decision whether or not to be vaccinated ($p=0.27$), so we may expect no major bias from the ethnical background. Validity of the results may be affected by response bias as 66% of questionnaires were not returned and some respondents purposefully or inadvertently skipped some of the questions. We also have no information about the non-respondents.

Thirdly, we used a cross sectional study design. Such design precludes determination of causal relationships between various on-going factors and study outcomes.

Conclusion

Despite the study limitations we conclude that pregnant women

are willing to cooperate in vaccination against pertussis in pregnancy when they are given sufficient information about the protection of their child and safety issues. This information might be important for health authorities to consider more research on maternal vaccination against pertussis in pregnancy and the introduction, promotion and delivery of such a vaccine for the protection of the young infant after birth.

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