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Coverage of recommended vaccines during pregnancy in Flanders, Belgium. Fairly good but can we do better?

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ABSTRACT

Background: In Flanders, Belgium, pertussis vaccination is recommended since 2013 and available free-of-charge in every pregnancy between 24 and 32 weeks of gestation. Influenza vaccination is recommended for more than 10 years with a co-payment system in the second or third trimester of pregnancy, when pregnancy coincides with the influenza season. This study aims to estimate the coverage of pertussis and influenza vaccination during pregnancy in 2016 and to determine predictors for missing vaccination.

Methods: Postpartum women were visited at home for a vaccination coverage survey using an Expanded Program on Immunization (EPI)-based two-stage cluster sampling design. Predictors for missed vaccination were identified using a multiple logistic regression model.

Results: Among 481 participating women, 69.3% were vaccinated against pertussis and 47.2% were vaccinated against influenza. Moreover, 65.3% of pertussis vaccine recipients and 96.9% of influenza vaccine recipients were vaccinated within the recommended gestational window.

Surprisingly, among women who were completely informed (i.e. on disease-associated risks, maternal vaccination costs and recommendations), still 12.4% were unvaccinated against pertussis and 23.9% against influenza.

In the final models, the only common predictor of missing maternal pertussis and influenza vaccination was multiparity. Significant predictors of maternal pertussis vaccination were family income (less likely if unknown or low (< €3000) than if moderate (€3001-€4000)) and hospital of delivery (less likely if >800 annual deliveries than <800). Significant predictors of maternal influenza vaccination, though with less straight-forward associations, were maternal ethnicity and educational level, involvement of a gynaecologist in pregnancy follow-up, and characteristics of the hospital of delivery.

Conclusion: In Flanders, more than two-third of pregnant women receives pertussis vaccination but less than half of them receives the influenza vaccine. Further improvement for both maternal vaccination programs can be achieved by targeting the underserved populations and diminishing vaccination hurdles.

1. Introduction

Despite a good universal compliance to infant vaccination [1–3], the *Bordetella pertussis* pathogen remains responsible for a substantial disease burden, especially among neonates, who are most susceptible to develop severe or even fatal disease [4]. Several vaccination strategies have been set forward to prevent pertussis infection in infants too young to be immunized: (i) cocoon vaccination as parents have been identified to be among the main source of infection [5], (ii) development of new-generation pertussis vaccines, (iii) the immunization of pregnant women to generate transplacental transport of IgG antibodies from mother to infant [6,7]. Considering the consequences of pertussis among infants, and the demonstrated effectiveness and safety of pertussis-containing vaccines among pregnant women [8,9] in preventing pertussis in their children, various National Immunization Technical Advisory Groups (NITAGs) have adopted this strategy. The Belgian NITAG has recommended maternal pertussis immunization

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during every pregnancy since August 2013, preferably between 24 and 32 weeks of gestation [10]. Furthermore, postpartum vaccination is indicated if the vaccine was not administered during pregnancy. The Belgian NITAG also advocates for the cocoon strategy whereby all adults, especially those in close contact with infants, are recommended to receive a single booster dose in adulthood [10]. In Flanders, pertussis containing vaccines for adults are available free-of-charge.

For over a decade, influenza vaccination during the second or third trimester of pregnancy is recommended in case this period coincides with the influenza season, with a co-payment modality [11].

To evaluate compliance with the national recommendations, the Flemish government commissioned the conduct of a survey to estimate the uptake of pertussis and influenza vaccines in pregnant women at the recommended gestational age and to identify underserved groups in order to develop strategies that augment and maintain high maternal vaccination coverage. Additionally, knowledge and trust in maternal vaccination were assessed.

2. Methods

The methodology of the Expanded Program on Immunization (EPI)-based two-stage cluster sampling design for vaccination coverage studies in Flanders was extensively described elsewhere but will be briefly outlined here [12,13]. The primary endpoints of the study were to determine the overall coverage of pertussis and influenza vaccination during pregnancy in Flanders. Power calculations determined that a sample size of 660 women would be sufficient for this analysis based on a minimal anticipated coverage of 64% [14], a design effect of 1.5, a margin error of the confidence interval (CI) of 2.5%, and a drop-out rate of 10.0%. The clusters of the mothers were proportionally distributed over the 5 different Flemish provinces. Per cluster, five mothers were randomly selected, based on the date of birth of their latest child (January or February 2016) as registered in the Flemish register of natural persons. Selected families were surveyed at home by a trained interviewer. Families were replaced only if (i) the family could not be contacted after three home visits, (ii) the interviewee was not able to understand Dutch, or (iii) the family no longer lived on the designated address. Mothers who refused to participate were not replaced.

Surveys were performed between April 4th and August 16th, 2016. After obtaining informed consent from the mother, the following information was collected through a standardized electronic questionnaire (SNAP software): socio-demographic characteristics, vaccination history (documented and by recall) and medical information related to the pregnancy. The vaccination data obtained at home were first checked against the Flemish immunization registry (Vaccinnet) [12] and requests were sent to the mother's general physician (GP) or gynecologist (if contact information was available) to verify, correct and/or complete missing or questionable vaccination data.

To assess the knowledge of pregnant women regarding pertussis and influenza, they were asked if they were aware of (i) the risks of the pathogen for either the neonate or fetus, (ii) the recommendations regarding vaccination during pregnancy, (iii) the costs for pertussis and influenza vaccination. In case they were aware, their information source was asked for.

Trust in immunization during pregnancy was assessed using an adapted version of the vaccine hesitancy survey tool developed by WHO [15].

This study was authorized by the National Privacy Commission and received approval on March 8th 2016 from the ethics committee of the University of Leuven.

IBM SPSS Statistics 23 was used for descriptive analysis. Survey-based vaccination coverage with its 95% confidence interval (CI) as well as odds ratios predicting missed vaccination from bivariate and multiple logistic regression analyses were calculated using R version 3.3.2. Variables in the final (multiple) models were selected using backward selection, p-values < 0.05 were considered statistically significant.

3. Results

A total of 627 mothers were approached of whom 486 mothers agreed to be interviewed at home (refusal rate = 22.4%), but five were excluded afterwards due to a lost informed consent form resulting in a final sample size of 481 mothers. Participating mothers were unequally distributed among the clusters which was accounted for by weighing. Demographic characteristics of participants (Table 1) were highly comparable with the census-data in Flanders, except that mothers with higher education were slightly overrepresented.

The weighted pertussis vaccination coverage during pregnancy was 69.3% (95% CI: 63.9–74.3%). Less than one-fifth of vaccinated women (18.0%) had documented proof of pertussis vaccination, and therefore the majority of the data was based on recall, of which a substantial proportion (62.1%) was confirmed using Vaccinnet. Pertussis containing vaccine was in most cases administered by the GP (71.9%), and in 18.9% of cases by the gynecologist. Remarkably, 34.7% of the vaccinated women received the vaccine outside the recommended gestational window and among these women, the majority (55.2%), received the vaccine after 32 weeks of gestation.

Mothers who were not vaccinated against pertussis during pregnancy stated that the vaccine was not recommended or offered by the health care provider (27.0%) or that they had even been advised against vaccination (17.5%), usually because of recent pertussis vaccination in a previous pregnancy (90.5%). However, less than one-fourth of women not vaccinated during pregnancy had received a pertussis vaccine during the previous 10 years, and 30.0% of these vaccines were administered in the postpartum period. Only a minority of the unvaccinated women (5.1%) reported that they made a deliberate choice not to vaccinate due to fear of adverse effects of the vaccine.

The weighted influenza vaccination coverage during pregnancy was 47.2% (95% CI: 42.1–52.3%). Approximately one-third of vaccinated women (30.3%) had documented proof of influenza vaccination during pregnancy, and the remainder provided answers based on recall, of which only 11.7% was confirmed using Vaccinnet and 14.9% through contact with a health care provider. Influenza vaccination was performed by the GP in 68.0% of pregnancies, followed by the occupational physician (15.3%) and the gynecologist (10.8%). Few vaccinated women (3.1%) reported being vaccinated during the first trimester of pregnancy. The main reason provided for not being vaccinated against influenza was that the vaccine was not recommended, offered, or was even discouraged by the health care provider (39.5%). Over one-fourth of women (28.9%) reported to have made a deliberate choice not to vaccinate against influenza, either due to fears concerning possible adverse effects or because they had never been vaccinated against influenza before.

Assessing the combined vaccination status of pertussis and influenza vaccination showed that in case the pregnant woman was immunized against influenza, a pertussis vaccination was generally administered too (44.3%). More than one-fourth of women (27.8%) received neither vaccine (Fig. 1).

Several predictors of missed vaccination in pregnancy were identified by multiple logistic regression. Pertussis vaccination coverage was lower among multiparas, mothers whose monthly

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