

## OBSTETRICS

# Effectiveness of hospital-based postpartum procedures on pertussis vaccination among postpartum women

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**OBJECTIVE:** Pertussis causes significant morbidity among adults, children, and especially infants. Since 2006, pertussis vaccination has been recommended for women after delivery. We conducted a prospective, controlled evaluation of in-hospital postpartum pertussis vaccination of birth mothers from October 2009 through July 2010 to evaluate the effectiveness of hospital-based procedures in increasing postpartum vaccination.

**STUDY DESIGN:** The intervention and comparison hospitals are private community facilities, each with 2000-6000 births/year. At the intervention hospital, physician opt-in orders for tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccine (Tdap) before discharge were implemented in November 2009, followed by standing orders in February 2010. The comparison hospital maintained standard practice. Randomly selected hospital charts of women after delivery were reviewed for receipt of Tdap and demographic data. We evaluated postpartum Tdap vaccination rates and conducted

multivariate analyses to evaluate characteristics that are associated with vaccination. We reviewed 1264 charts (658 intervention hospital; 606 comparison hospital) from women with completed deliveries.

**RESULTS:** Tdap postpartum vaccination was 0% at both hospitals at baseline. In the intervention hospital, the introduction of the opt-in order was followed by an increase in postpartum vaccination to 18%. The introduction of the standing order approach was followed by a further increase to 69% ( $P < .0001$ ). No postpartum Tdap vaccinations were documented in the comparison hospital. Postpartum Tdap vaccination in the intervention hospital did not differ by demographic characteristics.

**CONCLUSION:** In-hospital ordering procedures substantially increased Tdap vaccination coverage in women after delivery. Opt-in orders increased coverage that increased substantially with standing orders.

**Key words:** opt-in, postpartum, standing orders, Tdap, vaccination

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Clinical pertussis is a subacute cough syndrome in adults, albeit frequently unrecognized, and may lead to significant morbidity and death in very young infants.<sup>1</sup> The Centers for Disease Control and Prevention (CDC) Advisory Committee on Immunization Practices (ACIP) recommends routine vaccination

of infants against pertussis at 2, 4, 6, and 15-18 months of age.<sup>2</sup> The risk of infants being hospitalized because of pertussis is associated with the receipt of fewer doses of vaccines.<sup>3</sup> Therefore, infants <6 months old who are too young to have received the first 3 doses are at increased risk of experiencing this potentially

life-threatening infection.<sup>4-6</sup> In one CDC study, the mother was identified as the source of pertussis infection in 32% of infants; in 2012, 13 infants who were  $\leq 3$  months old died of pertussis.<sup>7,8</sup>

Since 2006, the ACIP has recommended tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccine (Tdap) vaccination for household contacts of very young infants, with particular emphasis on mothers getting vaccinated in the postpartum period.<sup>6,9</sup> In 2011, the ACIP expanded its recommendation to prefer Tdap vaccination during the late second or third trimester of pregnancy, as well as in the postpartum period.<sup>10</sup> Since that recommendation, however, uptake of Tdap among pregnant women has been only 2.6% among 1231 women who were surveyed through April 2012.<sup>11</sup> These data, in part, led to a revised recommendation in 2013 to vaccinate women at every pregnancy.<sup>11</sup> Despite national recommendations, uptake in pregnant women, mothers after delivery, and household contacts of

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infants remains limited. Therefore, the postpartum period remains an opportune and unique time to provide pertussis vaccination to previously unimmunized mothers.

Previous studies have described interventions that demonstrated increased Tdap vaccination coverage among women after delivery and have included the use of hospital-based procedures such as standing orders, availability of free Tdap vaccines, or computer-based clinical decision support algorithms.<sup>12-14</sup> However, these reports did not include a comparison or control hospital setting to account for potential confounders such as temporal trends in disease rates, vaccine practices and recommendations, or the impact of public awareness and interest, each of which has direct impact on vaccine coverage.<sup>15-18</sup> Our study aimed to evaluate the effectiveness of hospital-based procedures for increasing pertussis vaccination of women during the postpartum period compared with a non-intervention hospital chosen to reflect local community practices.

## **METHODS**

We conducted a prospective, controlled evaluation of the implementation of hospital-based procedures for postpartum Tdap vaccine administration from October 2009 to July 2010. The primary objective was to determine the impact of specific interventions in a single hospital on the rate of postpartum use of Tdap compared with a nonintervention hospital. Both hospitals stocked Tdap based on commercial pricing with accompanying insurance reimbursement. Postpartum care including length of stay was per standard community practices.

### **Intervention hospital**

The intervention hospital (hospital A) is located in Los Angeles, CA, and is a not-for-profit, private community hospital with an obstetrics and gynecology residency program and academic affiliation with a major university. Residents were not involved in the conduct of the study other than being considered one of the obstetrics providers. Approximately 80 obstetricians have privileges at this

hospital, with a core hospital-based obstetrics and gynecology practice of 8 physicians. This hospital has >6000 deliveries per year and serves a diverse ethnic population that is 58% white, 17% Hispanic, 14% Asian, 9% black, and 2% other. Hospital A serves patients who are insured by various carriers that include Medi-Cal, the Medicaid program in California. At the start of this study, the obstetrics physicians, prompted by a 2008 reissued statement of the ACIP for Tdap vaccination in the postpartum period, were supportive of a standardized approach to ensure postpartum vaccination with Tdap and influenza vaccines, if needed. Initially, an "opt-in" order as part of the pre-printed postpartum orders was implemented at the end of November 2009. This required providers to check the order for both vaccinations to be given to women after delivery before hospital discharge. Subsequently, to simplify delivery of vaccinations in the hospital, a policy with standing orders for postpartum vaccination for Tdap and seasonal and H1N1 influenza vaccination was implemented in February 2010. The standing orders empowered nurses to deliver influenza and/or Tdap vaccines without an additional order from the physician. Tdap would be administered, unless the patient refused or had a contraindication to immunization. Physicians were informed of the change in order sets during departmental meetings and by email, with an effort to provide rationale for these changes at the time of the first change to an opt-in process. Nurses were provided inservices before each change in order sets. Educational pamphlets targeted to physicians and patients were available for distribution. This report focuses on the results of these hospital-based interventions with regard to Tdap postpartum vaccination.

### **Control hospital**

The control hospital (hospital B) served as a comparison to evaluate contemporaneous standard community practice of obstetrics care related to vaccination of pregnant women and women after delivery. This hospital is a not-for-profit

community-based, intermediate tertiary facility with >2000 live-births per year that serves a population that is 45% white, 22% Hispanic, 28% Asian, and <5% black. It is 18 miles separated from hospital A, and no obstetric care was expected to be provided in both hospitals for any individual woman. There are 57 obstetricians with admitting privileges. Similar to hospital A, hospital B serves patients with various medical insurance plans, including Medi-Cal. At this hospital, postpartum vaccination occurred solely based on what individual providers deemed appropriate. This hospital was selected based on birth cohort size within a similarly diverse population without overlap with the population base for hospital A. Both hospitals are expected to have been exposed to the same public notices and/or publicity surrounding pertussis epidemiology in the State of California during the study period and attendant national recommendations for the use of pertussis vaccination in pregnant women and women after delivery.

## **Chart reviews**

Using a standardized data collection form, we reviewed approximately 60 obstetric charts per month at both hospitals from October 2009 to July 2010. The charts were a convenience sample selected (every fifth chart) from printed lists of discharged patients from the postpartum units that represented approximately 12% and 35% of the women after delivery discharged from hospital A and B, respectively, based on expected birth cohort during the study period. Data collected included postpartum Tdap vaccine administration dates (based on physician orders and confirmed with pharmacy record of administration reviewed from time of admission to discharge), contraindications to vaccination, previous receipt based on self-report for any adult pertussis-containing vaccine (and dates if available, obtained by nurses as part of the standard intake history) ethnic/racial identification, maternal age, receipt of prenatal care, gestational age of infant at time of delivery, medical payer information, and potential reasons for not receiving vaccination.

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