

Infections in Pregnancy and the Role of Vaccines



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KEYWORDS

- Influenza • Pertussis • Zika • Influenza vaccine • Tdap vaccine
- Maternal vaccination

KEY POINTS

- The Advisory Committee of Immunization Practices recommends administration of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis with each pregnancy and inactivated influenza vaccine in influenza season.
- There are other vaccines that may (or should) be used in pregnancy under certain circumstances.
- As women's health providers, we have come a long way in the arena of maternal vaccination, and continued research is paramount.

INTRODUCTION

Infectious disease remains a major cause of mortality worldwide, but before the advent of modern medicine, was the leading cause of mortality in the United States.¹ The 3 leading causes of death reported in 1900 in America were pneumonia, tuberculosis, and diphtheria, causing one-third of all deaths.¹ Between 1900 and 2000, the life expectancy for a person born in the United States increased from 47.3 to 76.8 years¹ with decreased mortality attributed in part to advances in vaccinology.² Avoidance of

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millions of deaths are attributed to expanded coverage of measles, polio, and, more recently, pneumococcal vaccines.²

At present, 17 vaccine-preventable diseases are covered by 14 routine vaccines, 2 of which are recommended during most pregnancies.³ Starting in 1997, the Centers for Disease Control and Prevention's (CDC) Advisory Committee of Immunization Practices (ACIP) recommended annual vaccination against influenza in all women pregnant during influenza season.⁴ In October of 2012, the tetanus–diphtheria–acellular pertussis vaccine was recommended in pregnancy in response to increased rates of pertussis infection.^{5,6} Pregnant women are at risk for infection just as their nongravid counterparts and, in some cases, may have more significant morbidity and mortality than their peers.^{7,8} This review outlines the following:

1. Maternal immunization and types of immunizations,
2. Immunizations recommended during pregnancy,
3. Conditional vaccines to be considered,
4. Research frontiers in immunization, and
5. The role of obstetrician/gynecologists as vaccinators.

MATERNAL IMMUNIZATION BENEFITS

Maternal immunization is a purposeful, successful strategy to prevent or mitigate the severity of infections in pregnant women and their newborn infants. The prevention of illness during pregnancy impacts the health care system 2-fold by keeping the mother–infant dyad intact and healthy.⁹ For example, flu vaccinated pregnant women seem to have longer pregnancies with larger neonates.^{10,11} Pregnancy, by virtue of innate physiologic changes, increases a woman's susceptibility to illness.⁷ Ensuing flu seasons have revealed that infected pregnant women have higher rates of hospitalization, cardiopulmonary complications, and death compared with the general public.^{8,12,13} Pregnancy increases a woman's exposure to the health care system and to a provider with whom she can build a relationship, giving time for education, planning, vaccine administration, and follow-up.⁹ The majority of pregnant women report visits to their obstetric provider more than 6 times during pregnancy, allowing many opportunities to discuss and give vaccines.¹² Immunization in pregnancy also seems to have maternal, neonatal, and obstetric benefit, with several studies showing improved birth outcomes.^{10,14}

Types of Vaccines

Pregnancy modulates the baseline immune response in a protective effort to diminish an inflammatory reaction to the fetus.⁷ A shift occurs from T-helper cells, which produce cytokines that facilitate pregnancy loss, to T-helper 2 cells, which render and permit fetal antigen tolerance.⁷ This modulatory effect diminishes maternal protection, yielding gravid women vulnerable compared with their nongravid counterparts as evidenced by the 1918, 1959, and 2009 pandemic flu seasons.^{15–17} In the 2009 pandemic, pregnant women were 4 times more likely to be hospitalized secondary to flu-related complications and represented 5% of flu-related mortalities despite only representing 1% of the US population.¹⁶ Thus, vaccination can help to combat the disproportionate representation of pregnant women in morbidity and mortality statistics.

Vaccines are categorized into 2 basic groups: inactivated or live attenuated (**Table 1**). Inactivated vaccines consist of a component of the infectious pathogen rendered incapable of causing clinical disease. For example, the tetanus vaccine contains the tetanus toxoid, which is produced by *Clostridium tetani*. As such, the pathogen is not introduced, but produces a humoral immune response to the toxoid, conferring immunity. Other types of components used in vaccines include whole

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