



## Immunization Update IV

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- Pediatric vaccines

### Key points

- Several strategies have been suggested and several implemented to increase overall immunization rates with pertussis-containing vaccines, including cocooning of newborn infants too young to be vaccinated and vaccination of pregnant women.
- Other reasons for the increased numbers of ongoing cases of pertussis include waning immunity in vaccinated individuals over time, particularly those immunized with DTaP (diphtheria, tetanus and acellular pertussis) as opposed to the older whole-cell DTP (diphtheria, tetanus, pertussis) vaccine.
- The CDC recommends at least 1 dose of mumps, measles, and rubella (MMR) vaccine for children between the ages of 6 and 11 months who will be traveling outside the United States. Children 12 months and older, are considered immune as long as they have received 2 doses of MMR vaccine. If any child received the first dose before 12 months of age, that dose should not be counted and the child should receive 2 doses after 12 months of age with the second dose at least 28 days apart.
- Vaccines against all serogroups of *Neisseria meningitidis* are likely to be licensed in the near future. However, some important questions remain: their effectiveness on pathogenic strains with different geographic distribution, their impact on carriers, and the timing of the appearance of escape mutants once herd immunity has been achieved.
- In February 2012, the US Food and Drug Administration approved a new seasonal quadrivalent live attenuated influenza vaccine, FluMist Quadrivalent (MedImmune). This vaccine is not anticipated to be available until the 2013/2014 influenza season, at which time it is expected to replace the currently available seasonal trivalent, live, intranasal influenza formulation (FluMist, MedImmune).

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In 2012, both pertussis (whooping cough) and measles remained in the news in the United States. Both are microorganisms that have no nonhuman hosts or environmental niche and both are therefore entirely preventable with immunization. Theoretically, the availability of highly effective vaccines with wide-scale immunization programs across the globe should make this feasible. Why then has it not been possible to eradicate these highly contagious infectious diseases? The United States is in the grip of perhaps one of the largest epidemics of reported pertussis in 50 years. On September 20, 2012 approximately 29,000 cases of pertussis and 14 pertussis-related deaths mostly in infants less than 3 months of age had been reported by the Centers for Disease Control and Prevention (CDC) [1].

In 2011, 17 outbreaks of measles and 222 cases of measles were reported in the United States according to the CDC [2]. In 2000, measles was declared eliminated in the United States as a result of high vaccination coverage and effective public health measures. Although measles no longer occurs year round in the United States, it still remains endemic in several countries making it essential that immunization continues within the United States. This fourth article in a series on immunizations begins by trying to understand the potential causes of the resurgence of these vaccine-preventable diseases, and updates on recently approved vaccines, current immunizations, and related recommendations are presented.

## **OVERVIEW OF RECENT VACCINE-PREVENTABLE DISEASE OUTBREAKS**

Pertussis remains endemic in the United States. Universal immunization against pertussis reduced the average incidence of reported cases from 157 per 100,000 population in the early 1940s to less than 1 per 100,000 in 1973 [3]. This was in contrast to the prevaccine era when reported cases of pertussis reached epidemic proportions every 2 to 5 years; more than 265,000 cases were reported in 1934 [4]. Despite this dramatic decrease, however, cycles of outbreaks continue to occur (Figs. 1 and 2). The most recent outbreaks that occurred in California in 2010 and in Washington State in 2012 give us reason to pause and consider the potential causes of ongoing cases despite recommendations for universal vaccination of all children, adolescents, and adults.

The seeming resurgence of this vaccine-preventable disease is multifactorial [5]. Increased public awareness of pertussis as a cause of a prolonged cough illness in an adult as well as a severe and protracted cough illness in children has led to earlier recognition and care. Improved methods of diagnosis using polymerase chain reaction (PCR) assays also contribute greatly to better diagnosis of cases.

Pertussis has a high basic reproduction number ( $R_0$ ) close to 12 to 17, which is equivalent to the number of secondary cases resulting from 1 case introduced into a fully susceptible population [6]. Transmission extinguishes itself when  $R_0$  is less than 1. The goal of vaccination is to bring this number to less than 1, therefore 92% to 95% of the population must be protected to halt

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