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## **Acellular Pertussis Vaccine Effectiveness Wanes After 5 Doses**

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## INFECTIOUS DISEASES

# Acellular Pertussis Vaccine Effectiveness Wanes After 5 Doses

**Source:** Misegades LK, Winter K, Harriman K, et al. Association of childhood pertussis with receipt of 5 doses of pertussis vaccine by time since last vaccine dose, California, 2010. *JAMA*. 2012;308(20):2126-2132; doi:10.1001/jama.2012.14939

Researchers from the Centers for Disease Control and Prevention (CDC) and the California Department of Public Health performed a retrospective case-control study to assess the risk of pertussis infection among children aged 4 to 10 years during the California pertussis epidemic of 2010. Cases were children with suspected, probable, or confirmed pertussis who were from 15 counties with high pertussis incidence or case count (40% of the state's population). Data were collected in standardized fashion from medical record reviews from 265 clinician offices; vaccine data were cross-checked using state and local registries. Each case was matched to 3 controls from the same clinician's office. The primary study outcomes were the association of pertussis with receipt of all 5 doses of acellular pertussis vaccine and time since completion of the 5-dose series. Time since completion was stratified as <12, 12-23, 24-35, 36-47, 48-49 or ≥60 months. The vaccine effectiveness (VE) of the 5-dose acellular pertussis vaccine series, and VE by years since receipt of the fifth dose, were calculated.

Data were collected on 1,039 children with pertussis (cases) and 3,194 controls; however, 357 (34.4%) cases and 1,178 (36.9%) controls were excluded from the analyses. Cases were 8.9-fold more likely to be unvaccinated than controls (7.8% vs 0.9%;  $P < .001$ ). Cases were also significantly more likely to be female and older than control children, despite the fact that 68.7% of cases and 71.9% of controls received their fifth dose at age 4 years. Compared to control children, those with pertussis were less likely to have received all 5 doses of pertussis vaccine (OR = 0.11; 95% CI, 0.06-0.21), yielding an estimated VE of 88.7% (95% CI, 79.4%-93.8%). Compared to an unvaccinated reference group, cases were significantly less likely than

controls to have received their fifth dose of vaccine in the prior 12 months (OR = 0.02), yielding an estimated VE of 98.1% (95% CI, 96.1%-99.1%) during the first year after immunization. This estimated VE declined incrementally when assessed at each time point, reaching 71.2% (95% CI, 45.8%-84.8%) by 60 to 83 months after the fifth dose.

The authors conclude that risk for pertussis disease is significantly higher among those who are unvaccinated, even in a highly vaccinated population. Furthermore, and more importantly, the study demonstrates that acellular pertussis vaccine-induced immunity wanes steadily over the years following the fifth dose, and confirms an increased burden of disease among those aged 7 to 10 years.

### PICO

**Question:** Among children 4 to 10 years of age, do receipt of pertussis vaccine and time since receipt of the final dose of acellular vaccine affect risk of infection?

**Question type:** Intervention

**Study design:** Case-control

### Commentary by

**Robert W. Tolan, Jr, MD, FAAP,** The Children's Hospital at Saint Peter's University Hospital, New Brunswick, NJ and Drexel University College of Medicine, Philadelphia, PA

*Dr Tolan has disclosed no financial relationship relevant to this commentary. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.*

Although recent studies<sup>1,2</sup> have suggested that acellular pertussis vaccine-induced immunity wanes after the fifth dose, this study is the first to analyze duration of protection in large and relatively representative cohorts of fully vaccinated and unvaccinated children. The results provide convincing evidence that VE diminishes each year after the fifth dose is given, likely explaining much of the observed resurgence of pertussis disease among those aged 7 to 10 years.<sup>3</sup>

In view of this limited duration of immunity, new strategies for prevention of pertussis are urgently required and re-evaluation of the existing vaccine strategy should be undertaken.<sup>4</sup> Pertussis mortality among infants too young to be vaccinated remains an important public health concern. One new initiative to protect newborns and young infants is the recommendation to immunize unvaccinated pregnant women during the second half of gestation.<sup>5</sup> We need to adopt this recommendation promptly, and to reconsider new vaccine schedules as well as new vaccines. (See also *AAP Grand Rounds*, July 2012;28[1]:3.<sup>6</sup>)

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**Key words:** pertussis, acellular vaccine, waning immunity

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