Pertussis vaccines: WHO position paper - October 1, 2010
Grading of scientific evidence in support of key recommendations

Table III: Duration of protection following the primary series of wP or aP immunization

**Question:** What is the scientific evidence that following a primary series of wP or aP, protection against pertussis persists for at least 6 years?

**Settings:** Global

**Conclusion:** The scientific evidence suggests that following a primary series of vaccination with wP or aP vaccines, protection against pertussis wanes in subsequent years. However, further research is likely to change the estimated effects on health outcomes.

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<th>Quality Assessment</th>
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<td>Duration of protection, wP vaccines</td>
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<tr>
<td>1</td>
<td>OBS¹</td>
<td>No serious</td>
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<tr>
<td>Duration of protection, aP vaccines</td>
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<tr>
<td>4</td>
<td>OBS</td>
<td>No serious</td>
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¹ With observational studies, the level of scientific evidence will not normally exceed the level "Further research is likely to change the estimated effect on health outcomes" according to the Grade system, and one study only may result in reduction to "Available data are insufficient to provide a reliable estimate of the effect on health outcomes". However, the wP study (Jenkinson D et al) is not further down-graded as it is based on surveillance of a large community showing a consistent trend over 10 years of observation.

² Most observational studies show decreasing protection against pertussis with age following childhood vaccination. By contrast, Salmaso et al demonstrate that two different 3-valent aP vaccines can induce high
levels of protection that may persist at least up to the age of 6 years. As this result seems to contradict the findings of the other observational studies, the grading is reduced by one point due to inconsistency of findings.

The quality assessment was increased by one point due to studies demonstrating the effectiveness of a booster dose at protecting against waning immunity, thereby satisfying the dose-response gradient criterion.

In a 10 year observational study of pertussis in a general practice community in the USA, Jenkinson D et al (1988) found that wP vaccine effectiveness fell from 100% in the 1st year, 84% in the 4th, 52% in the 5th, to 46% in the 7th year following vaccination.

Epidemiological research supports the assumption that waning immunity with age explains, at least in part, the observed increase of pertussis in adolescents and young adults. Based on age-specific incidence rates of pertussis, Gustafsson L et al (2006) evaluated the long-term effectiveness of aP vaccination given at 3, 5, and 12 months of age as part of the Swedish national immunization programme. The incidence remained low (11 to 16 per 100,000) for approximately 5 years after the third vaccine dose, but increased to 32 and 48 per 100,000 person-years in children aged 6 and 8 years, respectively.

Quinn HE et al (2007) showed that in Australia, pertussis is well controlled in the 1-4 and 5-9 year age groups, but adolescents aged 10-19 years had high notification, and 63% of notifications are now in the 20-59 year age range.

Celentano LP et al (2005) based on pooled epidemiological data from 16 European countries for the period 1998-2002, concluded that although children <1 year of age had the highest incidence during the entire period, rates in the >14 years age group increased by 115% during the study period.

On the other hand, Salmaso S et al (2001) studied >4,000 Italian children who had been immunized at 2, 4, and 6 months of age with either of two different 3-component aP vaccines. Pertussis was defined as a) any cough for ≥7 days, b) laboratory-confirmed infection plus ≥14 days of spasmodic cough, or c) ≥21 days of spasmodic cough. At the age of 6 years, the respective rates of protection of the two vaccines increased from 76% and 78%, 78% and 81%, to 85% and 85%, depending on the strictness of the pertussis diagnosis.

There is evidence to support that a booster in the second year of life or later counters waning immunity. Immunological studies by Guiso N et al (2007) concluded that with a 3-dose primary series and a booster in the second year of life a further booster is not required for as many as 6-12 years. Gustafsson L et al (2007) concluded that following a 2-dose primary series and a booster at 12 months of age, a second booster was warranted at the age of 5-7 years. Bisgard KM (2005) found that among children who received a total of 4 vaccine doses, the risk of pertussis was 2.7 times higher for those who received dose 4 early (age ≤13 months), compared with children who received dose 4 at an older age (age ≥14 months).

References


Gustafsson L, Hessel L, Storsaeter J, Olin P. Long-term follow-up of Swedish children vaccinated with acellular pertussis vaccines at 3, 5, and 12 months of age indicates the need for a booster dose at 5 to 7 years of age. Pediatrics. 2006 Sep;118(3):978-84.

