

Polio vaccines. Grading tables

Table III: Persistence of protective antibodies* following immunization with OPV or IPV

Settings: Global

Question: What is the level of scientific evidence for $\geq 80\%$ long-term (>5-10 years) persistence of protective antibodies following $\geq 3-4$ doses of OPV or IPV before school age, according to national schedules?

Conclusions: Low scientific evidence for $\geq 80\%$ long-term (>5-10 years) persistence of protective antibodies following $\geq 3-4$ doses of OPV or IPV.

*Presence of neutralizing antibodies against poliovirus is a reliable marker of protection against poliomyelitis

| Quality assessment | | | | | | Summary of Findings |
|--------------------|-----------------------|-------------|---------------|--------------|-------------|---------------------|
| No of studies | Design | Limitations | Inconsistency | Indirectness | Imprecision | Quality |
| III (1): OPV | | | | | | |
| 5 | Observational studies | No serious | No serious | No serious | No serious | Low ¹ |
| III (2): IPV | | | | | | |
| 5 | Observational studies | No serious | No serious | No serious | No serious | Low ¹ |

¹With observational studies, the level of scientific evidence will not normally exceed “low”, according to the Grade system

1. Persistence of protective antibodies following $\geq 3-4$ doses of OPV before school age

Nishio O et al (1984) investigated the persistence of neutralizing antibody (NA) against poliovirus after two doses of OPV in 67 children. After 5 years, more than 80% of them retained NA against all three types of poliovirus.

Kelley PW et al (1991) using micro-neutralization assay to investigate susceptibility to poliovirus types 1, 2, and 3 among young US Army recruits believed to have received polio vaccination (mainly OPV) 15-25 years earlier. The seronegativity rates for poliovirus types 1, 2, and 3 were 2.3%, 0.6%, and 14.6%, respectively; deviating trends by age, sex, and race-ethnicity were generally unremarkable.

Faden H et al (1993) found that immunization with OPV, eIPV, and combinations of the two vaccines confers long-term (>5 year) immunity.

Viviani S et al (2004) studied vaccine-induced antibody prevalences in representative samples of 8–9 year-olds as compared to 3–4 year olds (*Fortuin M et al, 1995*) in The Gambia. The geometric mean concentration of

antibodies in children 8-9 years of age was lower than in the 3-4 year-old children; 88% of 3-4 year-olds and 89% of 8-9 year-olds had detectable antibody levels against poliovirus type 1. Fewer children at 8-9 years of age had antibodies against poliovirus type 3 than 3-4 year-olds (78% vs. 89% $P < 0.001$).

2. Persistence of protective antibodies following $\geq 3-4$ doses of IPV before school age

Faden H et al (1993) found that all of the 86 children who by one year of age had received 3 doses of OPV and/or eIPV according to one of 4 different schedules (OPV-OPV-OPV, eIPV-eIPV-eIPV, eIPV-OPV-OPV, and eIPV-eIPV-OPV) exhibited an initial 10- to 100-fold decline in neutralizing antibody to poliovirus types 1, 2, and 3 during the first 2 years of follow-up; thereafter antibody titers stabilized.

Böttiger M (1990) found persisting neutralizing antibodies against polio in all of the 250 Swedish children who had received 3 doses of killed polio vaccine (IPV) 18 years earlier. Among 64 children who were tested more frequently, a marked fall of antibody titers was observed during the first few years after vaccination, then the decline leveled off to a mean decrease in titer of 0.05-0.10 log₁₀ per year. Children who had a fourth dose of IPV at 10 years of age rather than at the scheduled age of 6 years had significantly higher antibody levels at 18 years of age.

Swartz TA et al (1986) showed adequate levels of neutralizing antibody persisting for five years after immunization with a 2 + 1 dose schedule of a combined DTP-IPV vaccine.

Carlsson RM et al (2002) found neutralizing antibodies against polioviruses in 96% - 99% of 180 vaccinees who 4.5 years earlier had received IPV-containing combination vaccines. There were no clinically relevant differences between children who had been vaccinated in their infancy according to a 3, 5 plus 13 months schedule versus a 2, 4, 6 plus 12 months schedule.

Langue J et al (2004) evaluated the persistence among 5-6 year old French children of antibodies against poliovirus types 1, 2, and 3 following primary immunization at 2 and 4 months and subsequent booster doses at 12-16 months and 5-6 years, using an IPV-containing tetravalent vaccine. Before the second booster, more than 90%, and 1 month after the second booster 100% of children had protective antibody titers.

Literature on duration of protection: OPV

Nishio O, Ishihara Y, Sakae K, Nonomura Y, Kuno A, Yasukawa S, Inoue H, Miyamura K, Kono R. The trend of acquired immunity with live poliovirus vaccine and the effect of revaccination: follow-up of vaccinees for ten years. *J Biol Stand.* 1984 Jan;12(1):1-10.

Kelley PW, Petruccioli BP, Stehr-Green P, Erickson RL, Mason CJ. The susceptibility of young adult Americans to vaccine-preventable infections. A national serosurvey of US Army recruits. *JAMA.* 1991 Nov 20;266(19):2724-9.

Faden H, Duffy L, Sun M, Shuff C. Long-term immunity to poliovirus in children immunized with live attenuated and enhanced-potency inactivated trivalent poliovirus vaccines. *J Infect Dis.* 1993 Aug;168(2):452-4.

Viviani S, Mendy M, Jack AD, Hall AJ, Montesano R and Whittle HC. EPI vaccines-induced antibody prevalence in 8-9 year-olds in The Gambia. *Tropical Medicine and International Health* volume 9 no 10 pp 1044-1049, October 2004.

Fortuin M, Maine N, Mendy M, Hall A, George M, Whittle H. Measles, polio and tetanus toxoid antibody levels in Gambian children aged 3 to 4 years following routine vaccination. *Trans R Soc Trop Med Hyg.* 1995 May-Jun;89(3):326-9.

Literature on duration of protection: IPV

Faden H, Duffy L, Sun M, Shuff C. Long-term immunity to poliovirus in children immunized with live attenuated and enhanced-potency inactivated trivalent poliovirus vaccines. *J Infect Dis*. 1993 Aug;168(2):452-4.

Böttiger M. Polio immunity to killed vaccine: an 18-year follow-up. *Vaccine*. 1990 Oct;8(5):443-5.

Swartz TA, Roumiantzeff M, Peyron L, Stopler T, Drucker J, Epstein I, Leitner L, Goldblum N. Use of a combined DTP-polio vaccine in a reduced schedule. *Dev Biol Stand*. 1986;65:159-66.

Carlsson RM, Claesson BA, Fagerlund E, Knutsson N, Lundin C. Antibody persistence in five-year-old children who received a pentavalent combination vaccine in infancy. *Pediatr Infect Dis J*. 2002 Jun;21(6):535-41.

Langue J, Matisse N, Pacoret P, Undreiner F, Boisnard F, Soubeyrand B; Pentavac study group. Persistence of antibodies at 5-6 years of age for children who had received a primary series vaccination with a pentavalent whole-cell pertussis vaccine and a first booster with a pentavalent acellular pertussis vaccine: immunogenicity and tolerance of second booster with a tetravalent acellular vaccine at 5-6 years of age. *Vaccine*. 2004 Mar 29;22(11-12):1406-14.