



Pertussis

immunisation
in pregnancy

New Zealand is slowly emerging from its most recent outbreak of pertussis. The highest-risk period for pertussis in infants is in the first six months of life, prior to the completion of their full course of infant immunisation. Almost all deaths due to pertussis occur in infants aged six months or under. Improving total immunisation coverage remains the best means of protecting young children from pertussis. However, pertussis immunisation of the mother while pregnant provides some passive immunity to the infant during their first six months of life, so is strongly recommended.

The pertussis epidemic is waning, but immunisation is still important

New Zealand is slowly emerging from its most recent outbreak of pertussis. At present, the number of notifications for pertussis is still high, but is declining. There were 169 notified cases in January, 2014, compared with 566 in January, 2013, and 444 in January, 2012*.¹ Since the outbreak began in August, 2011, there have been a total of 10,060 pertussis notifications, resulting in 560 hospitalisations and three deaths.¹

Pertussis in infants is almost always severe. Infants aged under one year account for less than 10% of notifications, but approximately 60% of hospitalisations.¹ Approximately 90% of pertussis fatalities occur in infants.² There are three stages to pertussis infection: the catarrhal stage, the paroxysmal stage and the convalescent stage. Classically, pertussis in infants will cause a clinical illness of six to twelve weeks or longer.² The paroxysmal stage, which generally occurs in the second to third week of clinical illness, is associated with severe, forceful coughing followed by massive inspiratory effort (this is the archetypal “whoop” of whooping cough).² Severe coughing may cause vomiting and cyanosis. Common complications include pneumonia and otitis media. Seizures and encephalopathy can occur due to cerebral hypoxia occurring with severe paroxysms.² Rarer complications include pulmonary haemorrhage, subdural and spinal epidural hematoma, epistaxis, gastrointestinal haemorrhage, subconjunctival haemorrhage, rupture of the diaphragm,

umbilical and inguinal hernia, rectal prolapse, apnoea, rib fracture and severe alkalosis with associated tetanic seizures.² Bronchopneumonia is present in most fatal cases of pertussis; pulmonary hypertension, pulmonary or cerebral haemorrhage and atrophy are also reported.²

Pertussis outbreaks continue to occur in New Zealand, and most other developed nations, every three to five years. This is primarily because immunity to pertussis declines over time following either infection or immunisation, but is also compounded by inadequate levels of immunisation.³

Improving total immunisation coverage remains the best means of protecting young children from pertussis. All infants should receive three doses of the pertussis vaccine by age six months (DTaP-IPV-HepB/HiB), with booster doses at ages four (DTaP-IPV) and eleven years (Tdap).⁴ Delay in receiving any of the three infant doses of pertussis vaccine is associated with a significantly increased risk of hospital admission for pertussis.^{3,5} In addition, delay in receiving the first vaccination is a strong predictor of subsequent incomplete vaccination.³

The highest-risk period for pertussis in infants is in the first six months of life, prior to the completion of their full course of infant immunisation. Almost all deaths due to pertussis occur in infants aged six months or under.⁶ Pertussis immunisation of a mother while pregnant provides some passive immunity to the infant during these first six months,⁶ so is recommended.⁷

 For further information on pertussis and the recent epidemic, see “Pertussis: halting the epidemic by protecting infants”, BPJ 51 (Mar, 2013).

* Figures for 2012 represent 7 January, to 3 February, rather than the whole of the month, as data was recorded differently in 2012.

The pertussis vaccine in women who are pregnant

The pertussis vaccine remains subsidised for women who are pregnant

The pertussis vaccine is subsidised during times of epidemics for women who are pregnant; pertussis vaccination is currently still subsidised. Women who are pregnant are eligible for the subsidy if given the Tdap vaccine (Boostrix) between weeks 28 – 38 of pregnancy.

Evidence for the efficacy of immunisation of pregnant women

The uptake of the pertussis vaccine in New Zealand in women who are pregnant is reported to be low (estimated around 13%). There is evidence for the efficacy of pertussis vaccination in women who are pregnant, in providing immunity to both the mother and the infant, and it is considered safe. In one large United States study analysing a birth cohort of 131 019 infants, vaccination during pregnancy (between 28 – 38 weeks) reduced infant pertussis cases by 33%, hospitalisations by 38% and deaths by 49%.⁸

Maternal pertussis antibodies are readily transferred to infants across the placenta, and antibody concentration in infants at birth are approximately equal to that of the mother.^{6,9} However, pertussis antibodies gradually decline following infection (antibodies decline over four to 20 years)

or immunisation (antibodies decline over four to 12 years).⁹ As a result, the majority of infants are born to mothers with pertussis antibody titres below the level that is considered necessary to provide functional protection against pertussis infection.⁶ In addition, after birth the infant's antibody level falls rapidly, and by age four to six months, most infants who have not been immunised will have no measurable antibody to pertussis.^{6,9} Even when infants are immunised at age six weeks, antibody levels will be too low to reliably prevent infection for the first weeks and months of life.

With maternal immunisation during pregnancy, the level of antibody in infants is significantly increased,^{6,9} and there is a strong likelihood that newborn infants whose mothers are immunised will have some protection against pertussis.⁶ The infant's pertussis antibody levels will still decline following birth, but sufficient immunity is thought to persist until the active immunisation of infants begins at age six weeks.⁶ The primary series of vaccinations does not provide optimal protection until all three vaccinations have been received,³ although it is likely that maternal antibodies still provide some increased protection beyond the initial vaccination.

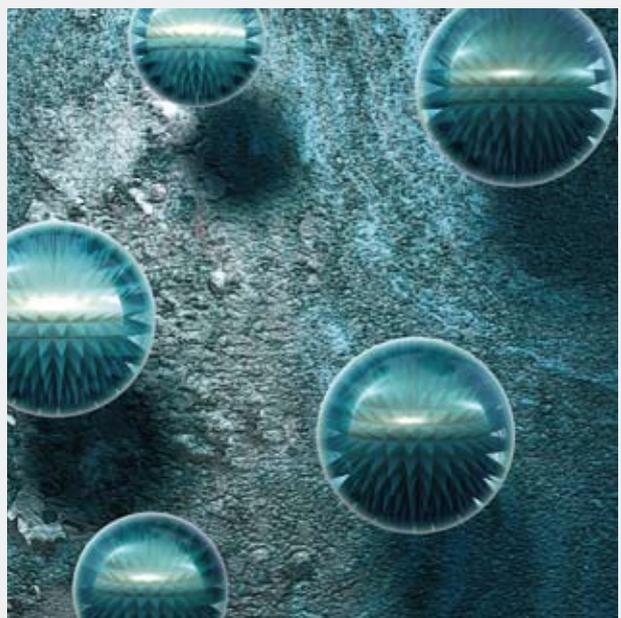
Timing the vaccine

The timing of pertussis vaccination is important. Adult antibody levels peak approximately two weeks following vaccination, and have then been shown to decrease rapidly. Antibody levels in women vaccinated prior to pregnancy or early in pregnancy may be insufficient to provide effective

Treating pertussis in women who are pregnant

If women who are pregnant contract pertussis late in their pregnancy, there is a significant increase in the risk of passing the infection to the infant at or soon after birth.¹² Because of this, women who are pregnant who present with pertussis should be prescribed antibiotics regardless of when symptoms started. While antibiotic treatment is unlikely to alter the course of the patients illness or reduce their symptoms, it has been shown to reduce transmission rates.¹³

Erythromycin, 400 mg, four times daily, for 14 days, is the recommended first-line antibiotic in women who are pregnant.



passive immunity to the infant after birth.¹⁰ The vaccine should be given between 28 – 38 weeks gestation, as it allows enough time for passive transfer of immunity from the mother to the infant to occur.¹¹ The vaccine is subsidised from 28 weeks gestation to facilitate the best timing.

The safety of the vaccine in pregnancy

Vaccination in pregnancy with the Tdap vaccine, which contains acellular pertussis (inactivated), is considered safe.⁴ No elevation or unusual patterns of serious adverse effects have been identified in women who are pregnant receiving the vaccine.⁸ In addition, the tetanus and diphtheria components, as Td vaccine, have been safely used in women who are pregnant for several decades.⁸

The only contraindication to use of the pertussis vaccine is an anaphylactic reaction to a prior dose or any component of the vaccine.⁴

Cocooning can also be used to protect infants from pertussis

In the United States, in 76 – 83% of fatal cases of pertussis in infants since 2004 (90% of whom were aged under three months), the infection was transmitted by a family member, most often the mother.⁹ Immunising adults and older children, that have regular contact with infants, such as fathers, siblings, grandparents and other caregivers, can be used to provide a “cocoon of immunity” to help prevent infection until the infant’s pertussis immunisations are completed.⁴ One dose of Tdap vaccine (Boostrix) is sufficient in this group.⁴ This will usually be unsubsidised.

If a woman does not get vaccinated during pregnancy or declines vaccination during pregnancy, and has never received Tdap before, vaccination immediately following birth is recommended (but not funded).¹¹ While this will not have the same benefit in providing maternal antibodies to the infant, it may help to limit the infant’s exposure to pertussis. The vaccine can safely be given if the mother is breast feeding; there is limited evidence as to whether maternal antibodies can be passed on via breast feeding.

It is recommended that other adults with significant contact with infants, such as healthcare workers and early childhood service workers, are also immunised against pertussis (one dose, repeated at ten-yearly intervals).⁴ Outbreaks of pertussis have been linked to healthcare organisations and childcare facilities, and infant fatalities due to nosocomial spread have been reported.³ As a result, some New Zealand DHBs have begun implementing pertussis immunisation programmes for staff who have frequent contact with infants.³

References

- 1 Environmental Science and Research (ESR). Pertussis reports. 2014. Available from: https://surv.esr.cri.nz/PDF_surveillance/PertussisRpt/2014/PertussisreportJanuary2014.pdf (Accessed Apr, 2014).
- 2 Mattoo S, Cherry J. Molecular pathogenesis, epidemiology, and clinical manifestations of respiratory infections due to Bordetella pertussis and other Bordetella subspecies. *Clin Microbiol Rev* 2005;18:326–82.
- 3 Grant C, Reid S. Pertussis continues to put New Zealand’s immunisation strategy to the test. *N Z Med J* 2010;123:46–61.
- 4 Ministry of Health (MoH). Immunisation Handbook 2011. Wellington, New Zealand: MoH 2011. Available from: www.health.govt.nz (Accessed Apr, 2014).
- 5 Grant C, Roberts M, Scragg R. Delayed immunisation and risk of pertussis in infants: Unmatched case-control study. *BMJ* 2003;326:852–3.
- 6 Gall S, Myers J, Pichichero M. Maternal immunization with tetanus-diphtheria-pertussis vaccine: effect on maternal and neonatal serum antibody levels. *Am J Obstet Gynecol* 2011;204:334–5.
- 7 Ministry of Health (MOH). Whooping cough. 2014. Available from: www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/whooping-cough (Accessed Apr, 2014).
- 8 Terranella A, Beeler G, Messonnier M, et al. Pregnancy dose Tdap and postpartum cocooning to prevent infant pertussis: A decision analysis. *Pediatrics* 2013;131:1747–57.
- 9 Bechini A, Tiscione E, Boccalini S, et al. Acellular pertussis vaccine use in risk groups (adolescents, pregnant women, newborns and healthcare workers): A review of evidences and recommendations. *Vaccine* 2012;30:5179–90.
- 10 Healy CM, Rench MA, Baker CJ. Importance of timing of maternal combined tetanus, diphtheria, and acellular pertussis (tdap) immunization and protection of young infants. *Clin Infect Dis Off Publ Infect Dis Soc Am* 2013;56:539–44.
- 11 Centers for Disease Control and Prevention (CDC). Guidelines for vaccinating pregnant women. 2013. Available from: www.cdc.gov/vaccines/pubs/preg-guide.htm#tdap (Accessed Apr, 2014).
- 12 Nooitgedagt J, Greeff S, Elvers B, et al. Seroprevalence of Bordetella pertussis infection during pregnancy measured by IgG antibodies against pertussis toxin. *Clin Infect Dis* 2009;49:1086–9.
- 13 Faulkner A, Skoff T, Martin S, et al. VDP Surveillance Manual. Pertussis Chapter 10. Atlanta: Centres for Disease Control and Prevention 2011. Available from: www.cdc.gov/vaccines/pubs/surv-manual/chpt10-pertussis.html (Accessed Apr, 2014).