

## *Pertussis—Is there a place for Health Care Worker (HCW) vaccination?*



Canterbury is in the middle of yet another whooping cough outbreak and nervousness about respiratory illness among HCW and the public appears to be steadily increasing (not helped by the recent emergence of Influenza A (H1N1) 2009 (aka “swine Flu”).

Pertussis or “whooping cough”, caused by the agent *Bordetella pertussis*, has been visiting societies in epidemic cycles every 3 to 4 years presumably for numerous decades (disease descriptions reach as far back as the 16<sup>th</sup> century). It causes an acute respiratory illness mainly characterised by its prolonged cough and substantial morbidity and mortality in the very young.

The bacterium *B. pertussis* produces several toxins deemed to be important virulence factors in the disease process, including pertussis toxin and tracheal cytotoxin, contributing to increasing respiratory secretions and cell damage.

### **NZ immunisation history and local epidemiology**

The first vaccine to be administered in NZ was the monovalent pertussis vaccine from 1945 until 1953, thereafter to be combined with the diphtheria vaccine.

Routine use as part of the childhood vaccination schedule started in 1960 as a triple vaccine, adding the tetanus vaccine to the other two.

Acellular pertussis vaccine was introduced in August 2000 and the current schedule of vaccine administrations is at 6 weeks, 3 months, 5 months, with boosters at 4 years and 11 years of age. Despite this NZ has seen regular pertussis outbreaks (Figure1).

A National Immunisation Coverage Survey performed in 2005 showed that the overall pertussis coverage during the first year of life was 89%, but only 52% received the third dose on time. In the period from 1 April 2008 to 1 April 2009 the percentage quoted by the NZ Ministry of Health (MoH) for immunisation coverage for

NZ children at 12 months of age was 82% (Table 1).

It is estimated that a vaccination coverage rate of 95% would reduce the number of notified pertussis cases to one hundredth of the cases notified prior to vaccine introduction. It is clear therefore that coverage and on time vaccinations need to be significantly increased in NZ in order to substantially decrease the annual disease burden.

Above all that it is important to remember that vaccination against pertussis is unlikely to confer life-long immunity. As with some other vaccinations the level of antibodies can drop below protective levels with increasing age.

### **Transmission**

The most vulnerable group of patients to develop severe disease with highest mortality are infants in the first year of life. Commonly infections in this age group are transmitted from adults in the household, unimmunised older children and HCWs. Transmission occurs via large droplets produced during coughing, sneezing or talking.

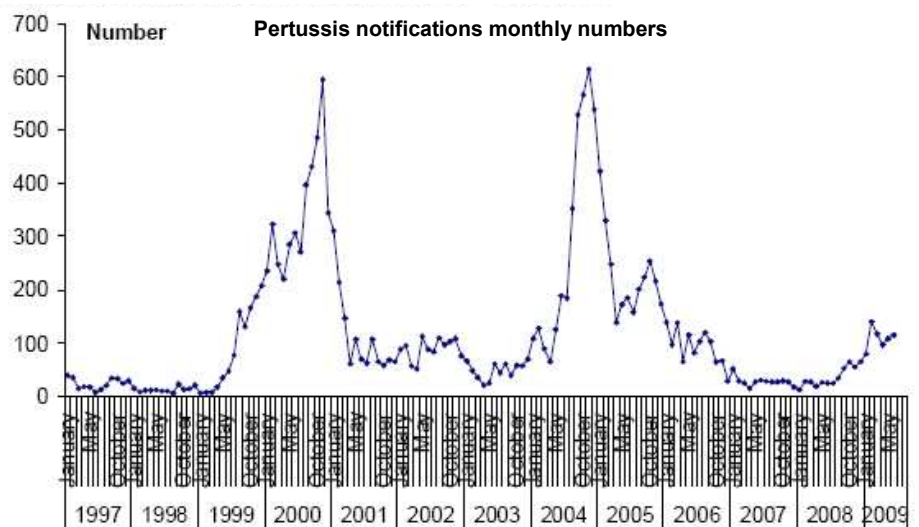


Figure 1: Pertussis notifications by months, 1997 – 30 June 2009 (adapted from NZ MoH website). Note: notification numbers for recent months are provisional

## ***Pertussis - Is there a place for Health Care Worker (HCW) vaccination?***

**Table 1: National Immunisation Coverage**

12 month reporting period ending March 2009 (Adapted from <http://www.moh.govt.nz/moh.nsf/indexmh/immunisation-coverage>) The following table shows the immunisation coverage of children who turned the milestone age (a 12 month reporting period) from 1 April 2008 to 1 April 2009 and who have completed the their age appropriate immunisation.

Milestone Age	Number Eligible	Fully Immunised for Age	%
6 month	65,112	40,548	62%
12 month	65,214	53,703	82%
18 month	64,617	43,431	67%
24 month*	62,482	48,218	77%

- 'Number Eligible' – the number of children who turned the milestone age in the 3 month or 12 month reporting period.
- 'Fully Immunised for Age' – the number of eligible children who have completed all of their age appropriate immunisations by the time they turned the milestone age.

Generally the droplets travel less than 1 metre distance. Hence, implementation of droplet precautions in the healthcare setting is invaluable to prevent spread from a suspected or confirmed case.

### **Impact of whooping cough in health care settings**

Symptoms in adults can differ significantly from the classic symptomatology in the non-immunised infant. Although cough is usually protracted it might not be accompanied by the typical whoop or episodes of hypoxia. Therefore, disease in adults can remain unrecognised for some time, which may lead to undiagnosed, but infectious HCWs to be the cause of outbreaks in paediatric and neonatal care settings, resulting in significant morbidity and cost.

In one of the largest reported outbreaks in Cincinnati, US, in 1993, 206 HCWs were investigated for a respiratory illness, 87 of which met

clinical or laboratory criteria for pertussis. 79 of those 87 HCWs required 5 days off work and on antibiotics and 622 employees received antimicrobial prophylaxis. Pertussis exposures in the health care setting are defined as face-to-face exposures within 1 metre with a symptomatic case (unless a surgical mask is worn by the HCW) and direct contact with secretions from an infected person or being in a confined space with an infected individual for more than 1 hour.

The cost associated with pertussis exposures are medical (GP visits, A&E visits, hospitalisations, diagnostic tests and prescription medication) and non-medical (time off work, transportation, over-the-counter-medications). In the US the cost per adult with pertussis outside the healthcare setting has been estimated to be at minimum US \$773 per case, in studies including children the cost could increase to US\$3561 per case.

In health care settings the cost cited

during some outbreaks were in the range of US\$30000-43000, mainly due to extensive diagnostic testing, antimicrobials, work-time lost and involvement of Infection Control resources and Occupational Health.

The consideration of cost savings due to functioning HCW vaccination programs, of course, have to be weighed up against vaccine safety, especially as pertussis is usually administered in a combined vaccine with tetanus, and acceptability to staff. In the US, a recommendation has been supported by the Healthcare Infection Control Practices Advisory Committee (HICPAC) to implement pertussis vaccination programmes in health care settings.

The acceptability of a vaccine to staff can be questioned as a valid reason when talking about transmission of a highly pathogenic agent to vulnerable patients, particularly in areas of paediatric and neonatal care.

Would now be a good time to reflect on how to deal with cost and resource constraints in the NZ health care setting, as well as and in particular, on our obligation as HCWs to protect others from harm in whatever way we can?

### **References**

- <http://www.moh.govt.nz/moh.nsf/indexmh/immunisation-diseasesandvaccines>
- Ministry of Health. 2006. Immunisation Handbook
- Sandora T. et al. Pertussis vaccination for Health Care Workers. 2008. Clin Micro Rev, Vol 21, No 3, p 426-434.
- MMWR, CDC, December 15, 2006, Vol 55, No RR-17. Preventing tetanus, diphtheria, and pertussis among adults: use of tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccine.