

Editorial

PERTUSSIS CONTROL IN AUSTRALIA – THE CURRENT STATE OF PLAY

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Pertussis is highly contagious. Neither natural infection nor vaccination provides lifelong immunity. As a consequence, epidemic peaks of pertussis occur every 3–4 years against a background of endemic transmission. There is little doubt that the use of pertussis vaccines has significantly impacted the global burden of this disease and prevented millions of deaths. However, pertussis continues to be a public health concern with growing evidence of a pertussis resurgence in a number of developed countries and deaths still occurring in vulnerable young infants, demonstrating the inadequacies of current pertussis control.¹

Australia has long held the position of having one of the highest reported rates of pertussis in the world due to comprehensive laboratory surveillance for pertussis. Australia has been an early adopter of processes such as mandatory reporting by laboratories of positive test results to notification systems, serological testing for pertussis diagnosis in adults and widespread community use of polymerase chain reaction (PCR) testing for pertussis diagnosis. This issue of *Communicable Diseases Intelligence* (CDI) contains several articles on various aspects of pertussis in Australia.

The article by Pillsbury et al. reports changes in diagnostic testing of notified cases over time and among different age groups. As the authors conclude, there is little doubt that all Australian states and territories have recently experienced another pertussis epidemic. However the magnitude of notified cases has clearly been augmented by increased PCR testing. The ongoing use of this highly sensitive, rapid, relatively non-invasive and affordable diagnostic tool means that a new baseline for notified endemic pertussis rates in Australia has been established and notified cases numbers will never return to levels seen prior to 2008.

Pillsbury et al. also demonstrate the shift in notified disease, from older adolescents and adults to children, in the most recent epidemic. Whilst the largest burden and most severe disease has consistently occurred in the youngest infants, children aged 6 months to 9 years had elevated notification rates in the recent epidemic, which had not been seen since the introduction of acellular pertussis

vaccines. Vaccination coverage is not an issue; for the last decade coverage for the primary series of diphtheria-tetanus-pertussis acellular (DTPa)-containing vaccine and the pre-school booster have remained steady and high, at 92% for 3 doses at 12 months of age, increasing to 95% at 24 months, and 90% for 4 doses at 5 years of age. Instead, waning of vaccine induced immunity appears to be a factor. The increase in cases aged 6 months to 4 years may have resulted from the removal of the 18 month dose from the National Immunisation Program in 2003, thereby increasing the interval between the last dose of the primary series and the first booster dose. An Australian study showed that the vaccine effectiveness (VE) of 3 doses of DTPa against notified pertussis was 84% in infants aged 6–11 months, declining progressively from 2 years of age (71%) to less than 50% by 4 years of age.² Likewise for children aged 5 years or over, studies from both Queensland and the United States of America have demonstrated progressive waning of immunity with increasing age and time since last dose.^{3,4} It is clear that a third generation of pertussis vaccines, providing long lasting protection, are required. Options being considered include less reactogenic whole cell vaccines, acellular vaccines with new adjuvants or live attenuated vaccines; however these are all some years away.

Whilst the majority of these vaccinated children experience mild pertussis and do not require hospitalisation, they do pose a risk as a source of infection for vulnerable young infants, who suffer the greatest morbidity and mortality from pertussis. Although the most common source for infant pertussis is usually the mother, in settings where disease activity is high among young children, siblings can pose a significant risk.⁵ The article in this issue of CDI by Bertilone et al. has again confirmed this in the Australian setting, with siblings identified as the source for 35% of cases in a 4 year period in Perth, Western Australia. Among these sibling sources, the majority were aged 2–3 years and fully vaccinated for pertussis according to the National Immunisation Program.

There are a number of immunisation strategies aimed at preventing morbidity and mortality in young infants. Neonatal vaccination has been

trialled; however study results are mixed as to whether a birth dose negatively impacts on the efficacy of future immunisations. The cocooning strategy (vaccinating close contacts of infants to reduce the likelihood of exposure) has been recommended in Australia since 2003. Although never funded at a national level, some states and territories introduced funded cocoon programs in response to the recent epidemic, which varied by target group, length and delivery method. A study of the New South Wales cocoon program showed that when both parents were immunised at least 4 weeks prior to onset of disease in cases, the risk of pertussis before 4 months of age was reduced by 51%.⁶ However, the effectiveness of a cocoon strategy is limited by timely vaccine uptake among adult household contacts. The article by Spokes et al. in this issue describes a survey to assess the effectiveness of an information campaign conducted in New South Wales at the time of the epidemic, promoting adult vaccination and pertussis awareness. Receipt of a NSW Health letter about the pertussis epidemic and vaccination was significantly associated with the uptake of an adult pertussis booster by respondents and other adults in the household. As in previous studies, advice from a general practitioner was one of the key reasons for receiving an adult pertussis booster in those who had been vaccinated. Unfortunately, cocooning will only provide indirect protection to the infant, which may not be enough in settings with waning acellular pertussis vaccine immunity among children, who may also be the sibling of a young infant. Maternal vaccination provides another alternative strategy, with the passive transfer of antibodies from the mother giving the infant direct protection against pertussis. Maternal vaccination is one of the recommended strategies in the 10th edition of *The Australian Immunisation Handbook*. It is being used at a population level in countries such as the United States of America, England and New Zealand, and a funded program has recently commenced in Queensland. Recent

evidence from England and the United Kingdom suggests that maternal vaccination against pertussis is both highly effective and safe.^{7,8}

The control of pertussis in Australia will remain a challenge due to the continual fluctuations in pertussis immunity at a population level. As we await the development of better pertussis vaccines, ongoing monitoring of disease morbidity and vaccine effectiveness is necessary. This will inform considerations around the most appropriate policy options for pertussis control as the evidence arises.

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