

Adult pertussis vaccinations as a preventative method for infant morbidity and mortality

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Pertussis, or whooping cough, is a potentially fatal respiratory illness caused by the *Bordetella pertussis* bacteria. It commonly occurs in infants who have not completed their primary vaccination schedule. [1]

Since 2001, Australia's coverage rate with the three primary doses of the diphtheria, tetanus and acellular pertussis-containing vaccine (DTPa) at twelve months has been greater than 90%. [2] Despite this high coverage rate, there has been a sharp increase in the incidence of pertussis. In 2008, the Victorian Government received notification of a 56% increase in reported cases (1,644 cases in 2008 compared to 1054 cases in 2007). That same year, New South Wales also reported over 7,500 cases, more than tripling their 2007 total. [3] Given these startling statistics, we must ask ourselves why we are seeing such a significant rise in the incidence of pertussis.

One well researched explanation for this increase is that the pertussis vaccine is not conferring lifelong immunity. A North American study investigating the effectiveness of the pertussis vaccine found that there was a significant increase in laboratory-confirmed cases of clinical pertussis in children aged eight to 13 years. This correlated to the interval after the end of the preschool vaccinations. [4] Other studies have suggested that immunity can wane anywhere between three to 12 years post vaccination, creating ambiguity as to when we become susceptible again. [5,6] This limitation is due to the current non-existence of a clear serologic marker correlating with protection from pertussis. Approximately two years after vaccination, pertussis toxin antibodies have reached minimal levels; however, protection from the disease remains. This suggests immunity is multifactorial. [5]

Despite this, there is widespread agreement that adults with waning immunity and who

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are in close contact with non-immune infants are a major source of transmission. [6,7] In 2001, a study was published which analysed the source of infection in 140 infants under the age of twelve months who had been hospitalised for pertussis. In the 72 cases where the source of infection could be identified, parents were the source in 53% of cases and siblings accounted for another 22%. [8] The Australian paediatric surveillance unit study of 110 hospitalised infants with pertussis demonstrated adults to be the source in 68% of cases, 60% of which were the parents of the infant in question. [9] Other potential sources that have been identified include grandparents and paediatric health workers. [6]

Since the establishment in 2001 of the international collaboration, the Global Pertussis Initiative (GPI), strategies to decrease the incidence of pertussis have been extensively discussed, with particular emphasis on reducing adult transmission to unprotected infants. [6] In general it has been noted that the control of pertussis requires an increase in immunity in all age groups, especially in adults. [10] Although the GPI agrees that universal adult vaccination would be an effective strategy to protect non-immune infants, this would be too difficult to implement. [2,8] Furthermore, we must be aware that the success of herd immunity is dependent upon the level of population coverage and also the degree of contact between the infected and the non-immune infants. [11]

Due to the difficulties with implementing universal adult vaccinations, more targeted vaccination strategies have been proposed. [10] The concept of a 'cocoon' strategy, in which adults in close contact with unprotected infants are given booster vaccinations, [11] has been trialed throughout

Australia in various forms. [12] This strategy is simpler to implement, as new parents and family members are easier to access via their contact with health services and their motivation to protect their children. [6] Moreover, because of this motivation, it may be reasonable to assume new parents would be willing to pay for this vaccine out of their own pockets, reducing the economic burden of the increased use of vaccines on our health system.

One model has suggested routine adult vaccination every ten years from the age of 20 years, combined with the 'cocoon' strategy of vaccination, would best reduce the rate of infant pertussis infections. However, to date there are no clinical data confirming this strategy to be effective. [11] Furthermore, this particular model is unlikely to receive public funding due to the large expense required.

Another strategy, recently recommended by the Advisory Committee on Immunisation Practices (ACIP), is that of implementing maternal vaccinations. The ACIP reviewed data in 2011 that showed preliminary evidence that there were no adverse effects after the administration of the pertussis vaccine to pregnant women. This strategy would significantly reduce the risk of infection to infants before they were even born. [13]

As one can see, the question of how to increase immunity in our community is complex, given that current strategies are expensive and difficult to implement. As infant deaths from pertussis are easily avoidable, developing effective preventive strategies should be of high priority.

Conflict of interest

None declared.

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