



## Community awareness and predictors of uptake of pertussis booster vaccine in South Australian adults



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### ARTICLE INFO

#### Article history:

Received 27 April 2015

Received in revised form 9 October 2015

Accepted 12 October 2015

Available online 26 October 2015

#### Keywords:

Pertussis

Whooping cough

Knowledge

Vaccination

Vaccine

Community awareness

### ABSTRACT

**Objective:** Pertussis is a highly virulent vaccine preventable disease that remains a global challenge. This study aimed to assess community knowledge of pertussis infection as well as awareness and uptake of adult pertussis booster vaccine.

**Methods:** A cross-sectional survey was conducted of randomly selected households in South Australia by Computer Assisted Telephone Interviews in 2011. Survey data were weighted to the age, gender and geographical area profile of the population.

**Results:** From 3124 randomly sampled contactable households, 1967 interviews were conducted (participation rate 63%) with individuals aged 18–93 years, including 608 parents of children aged <18 years. The majority of respondents (97%) had heard of pertussis (whooping cough) and 18% reported that a household member had previously contracted whooping cough infection. Most respondents considered whooping cough to be highly contagious (73%) and severe for infants (89%). Over half (51%) of those surveyed were aware that family members commonly transmit pertussis to infants. Despite high knowledge, pertussis vaccine uptake was low, with only 10% of respondents reporting pertussis vaccination in the previous five years. Whilst 61% of respondents were aware of the availability of an adult pertussis booster vaccine, only 8% ( $n = 154$ ) reported their Family Physician had discussed it with them. If provided free, 77% agreed that they would be more likely to accept a booster pertussis vaccination. Independent predictors of recent pertussis vaccination included higher education, larger household size, perception of greater disease severity for infants and discussion with a Family Physician about pertussis vaccination. **Conclusions:** Whilst knowledge regarding transmission and severity of *Bordetella pertussis* was high, uptake of pertussis vaccination for adults is remarkably low amongst the South Australian community. Improved awareness regarding the availability of a booster pertussis vaccine through Family Physicians and/or provision of funded pertussis vaccination for adults has the potential to improve pertussis vaccine coverage.

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**Abbreviations:** ABS, Australian Bureau of Statistics; CATI, Computer Aided Telephone Interview; CI, confidence interval; FP, Family Physician; NIP, National Immunisation Program; PROS, Population Research and Outcomes Studies; SA, South Australia; WHO, World Health Organisation.

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### 1. Background

Despite long standing immunization programs, control of pertussis continues to be a challenge globally with a substantial disease burden of morbidity and mortality. In 2008, the World Health Organisation (WHO) estimated that approximately 195,000 children died as a result of pertussis infection [1]. Pertussis epidemics occur every 3–4 years in Australia [2], with its recent epidemic between 2009 and 2011 the worst since the introduction of pertussis vaccination in the 1940s. At the peak of the Australian epidemic in 2011, almost 38,000 cases of pertussis were notified, with incidence rates increasing to 450/100,000 for infants and

young children [3]. Between 2006 and 2011, 11 pertussis deaths were reported, with 10 of these occurring in infants less than 6 months of age [4].

In Australia, vaccination against pertussis is funded for infants and children through the National Immunisation Program (NIP) offering free pertussis-containing vaccinations at 2, 4 and 6 months of age, with a booster vaccination at four years and again for adolescents when 10–15 years of age. Pertussis vaccination is also recommended for toddlers at 18 months of age and any adult who wishes to reduce the likelihood of illness from pertussis, but these recommendations are not currently funded as part of the NIP [2]. To reduce the risk of pertussis occurring in infants or others at increased risk of severe pertussis, healthcare workers, childcare workers and adult household contacts/carers of young children are strongly recommended to receive vaccination against pertussis with boosters every 10 years. At the time of the study, women planning a pregnancy, pregnant (third trimester) or post-partum and those in close contact with infants and children were also recommended to receive a single dose of pertussis containing vaccine if five or more years have elapsed between prior pertussis vaccination and expected delivery date. Recently, these guidelines have been updated to include a recommendation for pregnant women to receive pertussis vaccination during their third trimester of pregnancy, with this vaccine provided as part of a funded program in most states of Australia [2].

Epidemiological evidence indicates that adults are a significant reservoir for pertussis infection and transmission. A review of South Australian data has shown the majority of cases of notified pertussis that occurred during the first 18 months of the 2009–2011 epidemic, occurred in adults, with 66% of the notifications for individuals over 24 years of age [5]. It has also been established that the most common source of transmission of pertussis infection to vulnerable young infants are parents and siblings [6,7]. Strategies proposed to improve pertussis prevention are targeted at young infants who are at most risk of severe disease and/or death. These have included the cocooning strategy, which involves vaccinating members of the household to reduce the risk of transmission to newborn babies [8]. More recently, maternal immunization to facilitate maternal antibody transfer to vulnerable infants during their first few months of life [9].

High uptake of effective vaccines is necessary for successful infectious disease prevention programs. Neither infection nor vaccination provide long term immune protection against *Bordetella pertussis*, with duration of immunity following acellular pertussis vaccines estimated at less than 5 years [8,10,11]. Vaccine coverage in Australian infants is high, with national data indicating that more than 92% of infants have received the recommended three doses of pertussis containing vaccine by 12 months of age [12]. There are no current systematic processes for capturing adult population immunization rates and therefore pertussis vaccine uptake in Australian adults remains largely unquantified [13]. As adults are a common reservoir for transmission of infection to vulnerable infants, it is important to understand their knowledge of pertussis disease and immunization strategies and estimate pertussis vaccine coverage and associated factors.

## 2. Methods

This cross-sectional study was conducted as part of the 'Health Monitor' program conducted by the Population Research and Outcomes Studies (PROS) unit, University of Adelaide, South Australia (SA) [14]. The random sampling process was based on the South Australian electronic White Pages household telephone listings in both metropolitan and rural areas. This residential telephone listing comprises primarily of landline number listings which are included

by default, with mobile numbers only included upon request of the owner.

The household contact identified the adult in the household (aged  $\geq 18$  years) who most recently had a birthday. The interviews were conducted by the Computer Assisted Telephone Interviewing (CATI) method. Up to six call-backs were made to interview the identified individual if they were not available at the time of the telephone call. Phone calls were made to households at different times between 9am and 9pm over 7 days per week. A pilot study of 50 randomly selected households was completed in March 2011 to test the question formats and sequence prior to commencement of the main study.

The structured survey was designed to determine the level of knowledge and community awareness of pertussis disease and the availability and uptake of the adult pertussis booster vaccines. Respondents were asked about prior pertussis vaccination, knowledge and experience with pertussis infections. For simplicity, the term 'whooping cough' was used throughout the survey rather than 'pertussis'. Participants were asked to rate how severe whooping cough infection was in infants aged less than six months on a scale from 1 (very mild) to 10 (extremely severe). Respondents were also asked to rate the ease of spread of pertussis from person to person on a scale of 1–10, with 1 being not at all contagious and 10 being extremely contagious. Participants were also nominated who they thought young infants were most likely to catch whooping cough from (with multiple responses allowed).

For the purpose of the current study, a sample size of >1500 respondents enabled the proportion within the community who had knowledge of pertussis, or who had been vaccinated against pertussis in the last 5 years, to be estimated with a  $\pm 2.5\%$  precision at a 95% confidence level.

All survey responses were weighted to ensure that survey findings were applicable to the South Australian population. Survey weights were calculated from the inverse probability of selection of a household and re-weighted to sex, age and geographical area profile (metropolitan or rural) according to ABS 2009 Estimated Residential Population data for South Australia [15].

Estimates of population percentages for respondent characteristics with 95% confidence intervals (95% CIs) are presented. Univariate log binomial regression models were used to assess factors associated with awareness and uptake of pertussis booster vaccination with outcomes reported as risk ratios (RR) with 95% CI. Multivariable models were developed to assess adjusted associations and including univariate predictor variables with a  $p$ -value  $\leq 0.1$ . All analyses were carried out using Stata version 11 (StataCorp, Texas). A two-tailed  $p$ -value of less than 0.05 was considered to be statistically significant.

Research ethics approval was obtained from the Women's and Children's Health Network Human Research Ethics Committee and the University of Adelaide Human Research Ethics Committee.

## 3. Results

### 3.1. Study population (weighted data)

From 4400 households selected to participate (from a total of 660,461 households in South Australia) [16], 3124 were able to be contacted. From these households, 1967 adults completed a computer aided telephone interview during March and April 2011 with a participation rate of 62.9% (Fig. 1).

The age of respondents ranged from 18 to 93 years with a mean age of 47.5 years (median age 46 years; interquartile range 33–62 years). Almost half of adults were male (47.4%,  $n=962$ ) and 608 respondents (30.9%) interviewed were parents with at least one child (aged <18 years) residing in the household. The

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