



Short communication

Pertussis vaccination in a cohort of older Australian adults following a cocooning vaccination program



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ABSTRACT

Background: While recommendations to vaccinate adults against pertussis exist, information on uptake for adult tetanus-diphtheria-pertussis vaccine (Tdap) among older adults is limited.

Methods: We used data from the 45 and Up Study, a prospective cohort of adults aged ≥ 45 years who completed a questionnaire between 2012 and 2014 asking about pertussis vaccination. We evaluated Tdap uptake following a program providing free vaccine for adults in contact with young children between 2009 and 2012.

Results: Among 91,432 adults (mean age = 66.3 years, SD = 9.6), 3.1% (n = 2823) reported receiving Tdap prior to the program. This increased seven-fold to 21.8% (n = 19898) after the program finished. Tdap coverage was almost twice as high in women compared to men and among adults more likely to be grandparents than those not.

Conclusion: These findings suggest that funding for a targeted program can help to substantially increase vaccination coverage as well as decrease disparities in the uptake of Tdap in different sub-groups.

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1. Introduction

Pertussis is increasingly recognised as an important infection in adults [1,2] with rising incidence of disease leading to recommendations to vaccinate adults at risk [3,4]. Currently in Australia adult tetanus-diphtheria-pertussis vaccine (Tdap) is recommended for pregnant women, parents of new infants, grandparents and carers of young children, health care workers and adults aged ≥ 65 years [4]. Despite these recommendations, there are limited data describing Tdap uptake in the general adult population.

In New South Wales (NSW), Australia's most populous state, in response to increasing rates of pertussis, between 2009 and 2012 the state-funded a "cocooning" vaccination program to reduce infections in infants. Free Tdap was provided for all close adult contacts of infants aged 0–12 months [5]. Close contacts included parents and other carers (such as grandparents). The free vaccination was available through health care providers, mostly general practitioners [6]. In July 2012 the program was restricted to only providing free vaccination to new mothers and then was replaced in

2013 by a recommendation to vaccinate women pre-pregnancy, in the third trimester of pregnancy or directly after delivery [5], as maternal vaccination was found to be safe and effective [7]. We used data from a cohort of older adults residing in NSW to investigate uptake of Tdap and the changes in the characteristics of vaccinated participants following program implementation.

2. Methods

The Sax Institute's 45 and Up Study is a prospective cohort of 267 153 adult's resident in NSW, aged 45 years or older at recruitment. The Australian government-funded universal health insurance database was used as the sampling frame and at recruitment participants completed a postal questionnaire distributed from 2006 to 2008 which included detailed demographic, health and behavioural information. There was oversampling of those aged 80 years and older, and rural and remote residents [8]. Approximately five years after recruitment, a follow-up questionnaire was distributed, which contained, among other things, questions regarding pertussis vaccination (see <https://www.saxinstitute.org.au/our-work/45-up-study/questionnaires/>). This questionnaire was sent to 41 288 participants in September 2012, 85 251 participants in November 2013, and another 52 377 in 2014.

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For this analysis, 105 902 participants (59.2% of total invited) had completed and returned this questionnaire.

In the follow-up questionnaire, participants were specifically asked 'Have you ever had the adult whooping cough vaccine?' and 'If yes, when did you last have the adult whooping cough vaccine?' and were classified as receiving Tdap if they answered yes to the question on vaccine receipt and provided a valid year of vaccination. Those with unknown Tdap vaccination status or invalid year of vaccination were excluded from analyses of vaccination status. The percentage of adults reporting Tdap receipt was calculated for the time period when Tdap was first available to prior to funding commencement (2001–2008) and then following the introduction of funding (2009 onwards). The number of adults reporting receipt of Tdap in each year was also estimated using date of reported vaccination. We examined uptake according to various participant characteristics including age at questionnaire completion (45–64, 65–74 and 75+ years), sex, annual household income (<\$AUD50 000, ≥\$AUD50 000), country of birth (English speaking, non-English speaking), region of residence (major city, inner regional, outer regional, or remote [9]), education (university, no university), having children, and whether their children were themselves of child-bearing age (20–40 years), smoking status (never, past, current), and body mass index (BMI) (4 categories). All analyses were based on data provided on the follow-up questionnaire (i.e. collected at the time Tdap was reported) except for BMI, country of birth and whether they had children; these latter variables were derived from the baseline questionnaire. Differences in the proportions were examined using chi-square tests excluding those with unknown or missing values. Analysis was undertaken using Stata 12.0.

3. Results

From a total 105,902 participants who returned a questionnaire, 91,432 (mean age 66.3 years (SD 9.6)) provided their Tdap vaccination status. Reported Tdap coverage in the cohort prior to program commencement (2001–2008) was 3.1% (n = 2823), increasing to 21.8% (n = 19898) after program implementation (see Fig. 1). This represented a seven-fold relative and 18.7% (n = 17075) absolute increase in Tdap uptake in the cohort following the program. The

total number of adults reporting vaccination in 2013 and 2014, after funding ceased, decreased compared to the period 2009–2012 however as the questionnaire was distributed in batches in 2012, 2013 and 2014, this was likely due to the fact there were fewer adults eligible in 2013 and 2014 to report vaccination in these years (see Fig. 1).

Table 1 shows the distribution of characteristics of participants according to reporting Tdap receipt and coverage before and after the program. Both prior to and after the program women were about twice as likely as men to be vaccinated (4.2% vs 1.6% and 27.5% vs 14.5%; both $p < 0.001$). Based on whether adults had a child of childbearing age, those more likely to have grandchildren were also substantially more likely to be vaccinated than those without and this was the case both prior to and after the vaccine program commenced (prior to program 4.0% vs 2.3% and after 28.2% vs 16.1%; both $p < 0.001$).

4. Discussion

There have been two other general population surveys to ascertain Tdap uptake in Australia, as well as annual reporting of coverage in the United States of America (USA) and Canada. The 2009 Australian Adult vaccination survey [10] sampled 10,231 adults aged ≥18 years nationally at a time when there was no funding for Tdap vaccine for adults, and found vaccination coverage of 11.3%. In 2011, 10.3% of 1967 persons ≥18 years reported vaccination in South Australia [11], which briefly funded Tdap to a restricted adult cohort [5]. Adult Tdap vaccination is recommended but not funded for those without insurance in any State or Province in the USA and Canada. Coverage of 20.1% was reported in the USA among a national sample of 36 324 adults aged ≥19 years in 2013 [12]. In Canada, of 3290 adults ≥18 years surveyed in 2014, 9.3% reported Tdap receipt [13]. Because of the different ages of participants sampled, it is difficult to make direct comparisons between findings in our cohort and that of other surveys. However, it is worth noting that despite our study participants being significantly older than the other Australian surveys, our overall estimates of Tdap uptake were almost twice as high suggesting program impact in NSW. It has previously been observed that targeted programs rarely achieve coverage in excess of 30% [14–16], and this finding

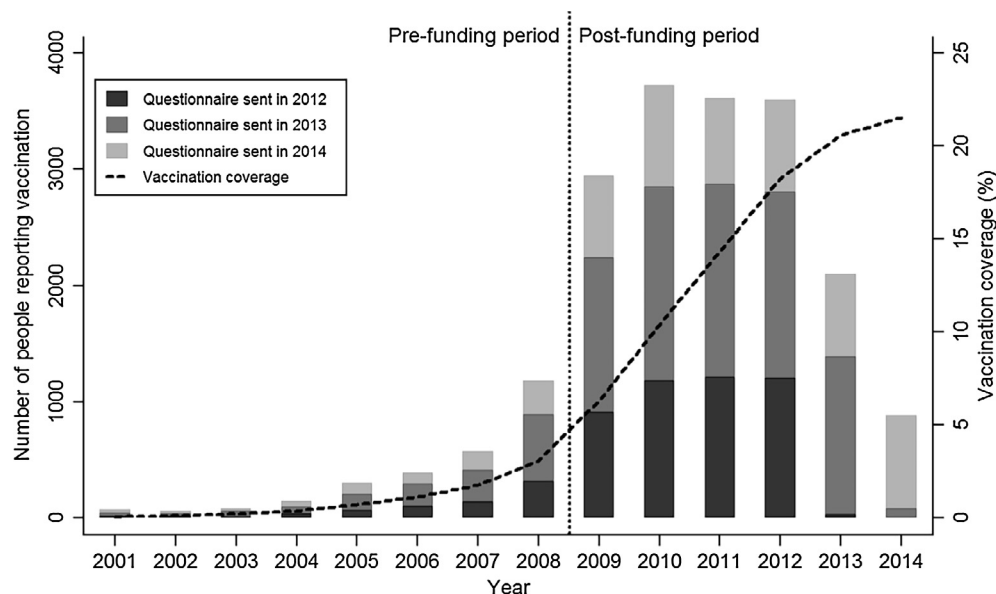


Fig. 1. Number and cumulative percentage of adults receiving Tdap by year. Note: Graph does not include 199 participants who reported vaccination in 2015 for whom the questionnaire was sent in either 2013 or 2014. These participants were included in other analyses (see Section 2).

Table 1

Distribution of characteristics of all study participants and vaccine coverage prior to or during the pertussis cocooning program.

	All participants (%)	Never vaccinated (%)	Ever vaccinated (%)	Unknown/missing vaccine status (%)	Vaccine coverage pre-program (2001–2008) n/N (%)	Vaccine coverage post-program (2009 onwards) n/N (%)
Total population	105,902	71,534	19,898	14,470	2823/91432 (3.1)	19898/91432 (21.8)
<i>Age group, years</i>						
45–64	52,073 (49.2)	34,278 (47.9)	10,919 (54.9)	6876 (47.5)	1558/45197 (3.4)	10919/45197 (24.2)
65–74	33,162 (31.3)	21,618 (30.2)	7129 (35.8)	4415 (30.5)	1027/28747 (3.6)	7129/28747 (24.8)
75+	20,665 (19.5)	15,638 (21.9)	1850 (9.3)	3179 (22.0)	238/17488 (1.4)	1850/17488 (10.6)
<i>Sex</i>						
Men	46,840 (44.2)	34,355 (48.0)	5826 (29.3)	6659 (46.0)	660/40181 (1.6)	5826/40181 (14.5)
Women	59,062 (55.8)	37,179 (52.0)	14,072 (70.7)	7811 (54.0)	2163/51251 (4.2)	14072/51251 (27.5)
<i>English speaking country of birth</i>						
Yes	95,987 (94.7)	64,118 (90.4)	18,753 (94.8)	13,116 (91.5)	2676/82871 (3.2)	18753/85871 (22.6)
No	895 (5.3)	6836 (9.6)	1021 (5.2)	1217 (8.5)	126/7857 (1.6)	1021/7857 (13.0)
<i>Place of residence</i>						
Major cities	53,372 (51.5)	36,624 (52.3)	9242 (47.5)	7506 (53.0)	1356/45866 (3.0)	9242/45866 (20.2)
Inner regional	38,404 (37.0)	25,446 (36.3)	7833 (40.2)	5125 (36.2)	1099/33,279 (3.3)	7833/33,279 (23.5)
Outer regional/remote	11,928 (11.5)	8009 (11.14)	2389 (12.3)	1530 (10.8)	315/10398 (3.0)	2389/10398 (23.0)
<i>Education</i>						
University educated	30,357 (28.9)	19,749 (27.9)	6178 (31.2)	4430 (31.0)	1015/25927 (3.9)	6178/25927 (23.8)
Non-university educated	74,596 (71.1)	51,118 (72.1)	13,598 (68.8)	9880 (69.0)	1789/64716 (2.8)	13598/64716 (21.0)
<i>Annual household income</i>						
<\$50 000	43,011 (42.0)	30,335 (43.9)	7002 (36.2)	5674 (40.8)	948/37337 (2.5)	7002/37337 (18.8)
≥\$50 000	59,334 (58.0)	38,757 (56.1)	12,352 (63.8)	8225 (59.2)	1815/51109 (3.6)	12352/51109 (24.2)
<i>Likely to be grandparents</i>						
Have children of child bearing age #	48,071 (46.5)	30,068 (43.0)	11,800 (60.6)	6203 (44.0)	1665/41868 (4.0)	11800/41868 (28.2)
Have children of child bearing age or no children	55,355 (53.5)	39,780 (57.0)	7657 (39.4)	7897 (56.0)	1084/46581 (2.3)	7559/46581 (16.1)
<i>Smoker</i>						
Never	63,581 (60.8)	42,165 (59.7)	12,909 (65.4)	8507 (59.9)	1839/55074 (3.3)	12909/55074 (23.4)
Past	36,725 (35.1)	25,249 (35.7)	6325 (32.1)	5151 (36.3)	903/31574 (2.9)	6325/31574 (20.0)
Current	4239 (4.1)	3208 (4.54)	490 (2.5)	541 (3.8)	61/3698 (1.6)	490/3698 (13.3)
<i>BMI (kg/m²)</i>						
<18.5	944 (0.9)	679 (1.0)	147 (0.8)	118 (0.9)	20/826 (2.4)	147/826 (17.8)
18.5–25	37,077 (37.4)	25,178 (37.6)	7094 (37.9)	4805 (35.8)	1040/32272 (3.2)	7094/32272 (22.0)
25–<30	39,693 (40.1)	26,970 (40.3)	7315 (39.1)	5408 (40.3)	1043/34285 (3.0)	7315/34285 (21.3)
>30	21,352 (21.6)	14,081 (21.1)	4176 (22.3)	3095 (23.0)	577/18257 (3.2)	4176/18257 (22.9)

* Percentages are of those vaccinated in each period, excluding those with missing or unknown values.

was confirmed by this study. Funding of vaccination is one of the few initiatives shown to increase coverage substantially above 30% [10,17].

We did not have sufficient information about participants to determine if vaccine uptake increased in the groups specifically targeted by the vaccination program (i.e. parents and carers of babies). However, we could look at women and adults who had children of childbearing age as a proxy. Our results show that Tdap uptake was already substantially higher in these groups prior to the program although it increased dramatically following the program. There was also some suggestion that the program resulted in reductions in disparities in Tdap uptake with a reduction in the relative difference in uptake between adults with higher and lower education and household incomes. These are groups who are often identified as having reduced access to preventative health care measures such as immunisation [18]. While disparities decreased, women, those with university education and those with a household income of ≥\$50 000 remained more likely to be vaccinated following the program.

Caution must also be taken in interpreting the Tdap uptake reported after 2012 as some participants were sent and returned their questionnaire in 2012 so it was not possible to report receipt after this year. The large numbers of older adults reporting receiving vaccine after the end of the program in 2013 may reflect greater knowledge and awareness among providers, possibly due

to length of time since the program started. Our study used self-report to ascertain Tdap status and unlike influenza vaccination there is little data to look at how reliably this is reported in adults. We did not check the self-reported responses against vaccination records. It is possible that our results could be biased if reporting differed according to the timeframes and characteristics examined. The estimated proportion of adults receiving Tdap from this study may not be generalisable to the Australian population as this cohort has been shown to be healthier than the general NSW population [7]. Also, information about health care worker status, contact with children, or Aboriginal and Torres Strait Islander status, was not available.

Our findings show a substantial increase in the proportion of older adults receiving Tdap following a free 'cocooning' vaccination program, with a seven-fold increase in coverage from 3.1% to 21.8% after the program commenced in 2009. These findings suggest that funding for a targeted program can help to increase vaccination coverage as well as decrease disparities in the uptake of Tdap in different sub-groups.

5. Ethical approval

All participants provided written informed consent. The conduct of the 45 and Up Study was approved by the University of

New South Wales Human Research Ethics Committee (HREC). This specific study was approved by the NSW Population Health Research Ethics Committee, and the University of New South Wales Human Research Ethics Committee (2010/12/292).

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