

# A STATE-WIDE INFORMATION CAMPAIGN DURING A PERTUSSIS EPIDEMIC IN NEW SOUTH WALES, 2010

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## Abstract

Pertussis notifications increased dramatically in New South Wales in 2008, exceeding the rates in previous epidemic years. A state-wide, multi-faceted campaign was launched in March 2009 to provide information about pertussis prevention. A population-based survey was conducted using a Computer Assisted Telephone Interviewing facility to assess the effectiveness of sending letters to households with young infants. A representative sample of 1,200 adults across all 8 area health services was interviewed between July 2009 and September 2010, with responses weighted against the state population. Many respondents (39.7%) reported receiving the letter, while fewer (29.6%) reported receiving an adult pertussis booster in the last year, mostly in response to General Practitioner advice (40.4%). Letter receipt was associated with the uptake of an adult pertussis booster in the past 12 months by respondents (OR 5.8; 95%CI 4.1, 8.2) and other adults in the household (OR 5.1; 95%CI 3.5, 7.5), as well as knowledge about pertussis prevention. Health providers remain crucial for vaccination decision making; however letters may have contributed to an increased uptake of pertussis booster vaccination and knowledge. Health authorities may consider mailing households in future pertussis epidemics as a component of a wider communication strategy. *Commun Dis Intell* 2014;38(3):E201–E207.

**Keywords:** pertussis, communication, letter, cocoon, evaluation, vaccination, knowledge, behaviour

## Introduction

Pertussis is a significant cause of morbidity and hospitalisation in Australia, with cyclical transmission driving outbreaks every few years.<sup>1</sup> The true burden of pertussis is underestimated. Rates of infection remain highest in infants,<sup>2</sup> particularly those aged less than 6 months.<sup>3</sup> Findings from recent population-based serosurveys are consistent with pertussis infection in the previous 12 months in a significant proportion of adolescents.<sup>3</sup> Pertussis among the elderly is becoming increasingly recognised in settings with high coverage diphtheria-tetanus-pertussis acellular vaccine (DTPa) programs.<sup>4</sup> While pertussis affects people of all ages, infants less than 2 months of age are at the greatest risk of severe disease, hospitalisation

and death.<sup>5</sup> Mothers, fathers, siblings and adult carers have all been shown to be important sources of pertussis infection for infants in the Australian setting.<sup>6–8</sup>

Pertussis notification rates increased dramatically in New South Wales in 2008, exceeding those of previous years, with infants less than 1 year of age most affected.<sup>2</sup> At this time, the national immunisation schedule provided DTPa for infants at 2, 4 and 6 months of age, with a booster dose at 4 years of age. Since 2003 a single booster dose of dTpa for adults has been recommended nationally for adults planning a pregnancy, working with children and health care workers.<sup>9</sup> From March 2009, two time-limited outbreak control measures were implemented in New South Wales: 1) pertussis vaccination became funded for new parents and adult carers of infants aged less than 12 months, and 2) the 1st infant dose of DTPa was recommended to be brought forward to 6 weeks of age. Subsequently, it was estimated the latter of these measures would reduce the average notifications, hospitalisations, and hospital bed-days by 8%, 9%, and 12%, respectively, with larger reductions in an epidemic year.<sup>10</sup>

To provide timely information about the latest pertussis prevention and control recommendations to adult carers of young infants, a state-wide information campaign was launched in March 2009.<sup>11</sup> The campaign included direct communications to clinicians about pertussis and recommendations for immunisation of infants and their carers as well as the production of posters and leaflets for health care facilities and the public. Another key component of the campaign was a letter to households through the Australian Childhood Immunisation Register (ACIR) (on behalf of NSW Health). ACIR contains contact details for nearly all children registered with Medicare.<sup>12</sup> Letters were mailed to households with children born in the previous 12 months in March 2009, and households with children born after this date were prospectively mailed each month following registration with Medicare at the time of birth. The campaign cost an average of about \$1 per letter sent. The letter recommended that parents and adult carers ensure their infant received its vaccinations on time and provided information that the 1st dose could be given as early as 6 weeks of age; that parents and other adults with regular close contact with their

child receive a free booster vaccination; and that parents keep the child away from people with a coughing illness.

## Aim

To assess whether targeted letters to adult carers in households with young infants were associated with the increased uptake of adult pertussis vaccination or recall of pertussis prevention messages.

## Methods

### Study design

A pertussis questionnaire was included in the New South Wales population based household survey, continuously conducted by the Health Survey Program to monitor the health of the New South Wales population using computer assisted telephone interviewing (CATI).<sup>13</sup> The questionnaire collected self-reported information on parents' knowledge of pertussis and related behaviours. Telephone interviews were conducted by the NSW Health CATI survey facility from July 2009 to the end of September 2010. An amendment to the existing New South Wales Population Health Survey for the inclusion of the pertussis questionnaire was granted by the New South Wales Population and Health Services Research Ethics Committee in June 2009.

### Survey sample

The study population was all New South Wales residents with a private telephone, living in households with at least 1 child less than 3 years of age. The CATI program uses addresses from the electronic telephone white pages assigned to each of the 8 NSW Health Services Areas by geo-coding. Households were contacted using list assisted random digit dialling. One person from the household was randomly selected to participate in the survey, using age order, having firstly identified the position of the household reporter. Respondents aged less than 16 years were interviewed via a parent or carer selected as a proxy respondent.<sup>13</sup> Up to 7 calls were made to establish initial contact with a household, and 5 calls were made in order to contact a selected respondent.

### Sample size calculation

We estimated the baseline prevalence of adults receiving a pertussis booster vaccination in the previous 12 months to be 11%, increasing to 20% among the 50% who reported receiving the intervention. The sample size required (power = 80%, alpha = 0.05, design effect=2) to detect this difference in the uptake of pertussis booster vaccination

between those who reported receiving a letter and those who did not was at least 548 in each group. The sample size requirement, including a 10% buffer, was estimated at 1,200.

### Questionnaire development

The pertussis questionnaire module gathered information to assess the impact of the letter on the self-reported recall of knowledge and behaviours relating to pertussis prevention, including vaccination uptake, as well as barriers to adoption of the recommendations. Participants were asked about the recent pertussis vaccination history of adult responders as well as other adults in the household. Adults who reported receiving pertussis vaccination within the previous 12 months were asked about the main prompt for this. The vaccination status of children in the household as well as the recall of individual pertussis prevention measures was also collected. Information on demographics and household characteristics were taken from other modules within the NSW Health Survey. Responses for households who reported receiving a letter (intervention group) were compared to those who did not report receiving a letter. Response categories were divided into indicators of interest, don't know and those who refused were removed.

### Participation rates

Response and cooperation rates for the NSW Health survey were calculated in line with established guidelines.<sup>14</sup> In brief, the minimum response rate was calculated as the number of complete interviews divided by the number of interviews (complete plus partial) plus the number of non-interviews (refusal and break-off plus non-contacts plus others) plus all cases of unknown eligibility (unknown if housing unit, plus unknown, other). The minimum cooperation rate was the number of complete interviews divided by the number of interviews (complete plus partial) plus the number of non-interviews that involve the identification of and contact with an eligible respondent (refusal and break-off plus other).

### Statistical analysis

The survey data were weighted to adjust for probability of selection and for differing non-response rates among males and females and different age groups, the number of household members, number of residential telephone connections and the sampling fraction in each health area. Further information about the weighting process is provided elsewhere.<sup>13</sup> Design based analysis was undertaken to account for features of the sample design and provide approximately unbiased estimates and standard errors. Data were manipulated

and analysed using SAS version 9.3. The association between the reported receipt of letter status and knowledge and behavioural outcomes were examined using SAS procedures SURVEYFREQ and SURVEYLOGISTIC to analyse the data and calculate prevalence and odds ratio estimates and 95 per cent confidence intervals.

## Results

The NSW Health survey response rate during the period the pertussis survey was conducted was 42.2%, and the cooperation rate was 62.6%. Refusal rates and contact rates for the overall survey during the study period were 25.3% and 79.0% respectively. There were 1,200 participants across all 8 areas health services: 424 households in 2009 and 776 in 2010. The sex, remoteness, Aboriginality, English as a second language and number of children less than 3 years of age in the household of respondents did not differ by reported receipt of letter status. There was a significant dif-

ference by reported receipt of letter status in the proportion of households that had private health insurance (Table 1), but not for household income or socioeconomic disadvantage quintile.

Overall, less than half (39.7%) the respondents reported receiving a letter, while 29.6% of all respondents reported receiving a pertussis booster in the last year, mostly in response to general practitioner (GP) advice (40.4%) but also in response to the letter (10.0%) as the primary prompts. Of the adults that did not receive a booster, about half (48.3%) were not aware of the recommendation, while less (11.1%) decided not to be vaccinated. The majority of respondents (82.9%) recalled one or more key messages about how to protect babies from pertussis. The strength of association between reported receipt of letters and pertussis adult boosters was modestly higher in males. There was an increasing trend of reported letter receipt over time, and with an increasing number of children in the household.

**Table 1: NSW Health Survey participants: socio-demographic characteristics by reported letter receipt, 2009 to 2010**

Variable		Letter %	No letter %	OR %	(95%CI)	
Socio demographic characteristics	Sex	Female	55.3	54.6	0.97	(0.71, 1.32)
		Male	44.7	45.4		
	Remoteness	Major cities	63.4	63.9	1.29	(0.46, 3.63)
		Inner regional	27.3	23.8	1.11	(0.39, 3.20)
		Outer regional	8.4	11.7	1.77	(0.59, 5.25)
		Remote & very remote	0.0	0.0	Reference category	
	Language other than English spoken at home	Yes	18.3	22.0	0.79	(0.53, 1.19)
		No	81.7	78.0		
	Socio economic disadvantage quintile	1st least disadvantaged	19.1	16.8	0.84	(0.51, 1.39)
		2nd	22.2	23.2	1.00	(0.62, 1.61)
		3rd	21.9	20.4	0.89	(0.55, 1.43)
		4th	16.9	18.7	1.06	(0.63, 1.78)
		5th most disadvantaged	20.0	20.9	Reference category	
	Not Aboriginal or Torres Strait Island Origin	Yes	2.3	4.2	0.56	(0.24, 1.29)
		No	97.7	95.8		
	Private Health Insurance*	Yes	60.6	50.3	1.52	(1.11, 2.06)
		No	39.4	49.7		
	Household income	More than \$80,000	47.0	42.9	1.30	(0.57, 2.98)
		\$60,000-\$80,000	17.0	13.0	0.73	(0.34, 1.56)
		\$40,000-\$60,000	13.6	13.0	0.59	(0.28, 1.25)
\$20,000-\$40,000		9.1	15.4	0.70	(0.35, 1.40)	
\$10,000-\$20,000		4.7	6.1	Reference category		
Number of children under 3 in household	1	82.0	82.5	0.96	(0.65, 1.43)	
	2 & 3	18.0	17.5			

\* Significant difference between groups,  $p < 0.05$

Adult participants who reported receipt of a letter had higher odds of reporting uptake of pertussis vaccination in the last year (OR 5.8; 95%CI 4.1, 8.2), and reporting other adults in the house were vaccinated for pertussis in the last year (OR 5.1; 95%CI 3.5, 7.5) (Table 2). Participants who reported receipt of a letter also had higher odds of recalling knowledge of various personal prevention measures, including: get the baby vaccinated (OR 1.6; 95%CI 1.1, 2.2), check that siblings are vaccinated (OR 2.4; 95%CI 1.5, 3.8), other adults should be vaccinated (OR 1.9; 95%CI 1.3, 2.7) and to keep the baby away from coughing people (OR 1.6; 95%CI 1.1, 2.1) (Table 3). There was no difference in reported household pertussis incidence and reports of receiving a letter.

## Discussion

State-wide population level communication can positively impact on knowledge and attitudes to the use of personal protective measures among the general public and among health professionals during multi-faceted campaigns.<sup>15,16</sup> In our study, reported receipt of the information letter was positively associated with knowledge of the recommendations to ensure: 1) adults in the household are vaccinated; 2) siblings and others are vaccinated; 3) the baby is vaccinated; and 4) the baby is kept away from coughing people.

During the 2009 influenza pandemic, adoption of non-pharmaceutical protective measures was associated with perceptions of disease severity, risk of acquisition, outbreak duration, public trust

**Table 2: NSW Health Survey participants: personal protective behaviours by reported letter receipt, 2009 to 2010**

Variable		Letter %	No letter %	OR %	(95%CI)	
Personal protective behaviours	Reported had adult whooping cough booster in past 12 months*	Yes	52.9	16.2	5.83	(4.14, 8.21)
		No	47.1	83.8		
	Reported other children up to date with vaccinations	Yes	94.1	95.5	0.76	(0.29, 1.97)
		No	5.9	4.5		
	Reported other adults had pertussis booster vaccine in last 12 months*	Yes	42.4	12.6	5.09	(3.47, 7.45)
		No	57.6	87.4		
	Reported all children <3 years up to date with vaccinations	Yes	94.6	93.7	1.18	(0.61, 2.29)
		No	5.4	6.3		

\* Significant difference between groups,  $p < 0.05$

**Table 3: NSW Health Survey participants: pertussis knowledge of personal protective measures by reported letter receipt, 2009 to 2010**

Variable		Letter %	No letter %	OR %	(95%CI)	
Knowledge of personal protective measures	Know to get the baby vaccinated*	Yes	71.6	61.3	1.60	(1.14, 2.23)
		No	28.4	38.7		
	Know to get the baby's first vaccine at 6 weeks	Yes	7.2	5.0	1.46	(0.80, 2.69)
		No	92.8	95.0		
	Know to get all scheduled vaccines on time	Yes	8.0	7.1	1.13	(0.65, 1.96)
		No	92.0	92.9		
	Know to check that siblings and other people in the house are vaccinated*	Yes	15.1	6.9	2.38	(1.48, 3.83)
		No	84.9	93.1		
	Known that adults in the household should get vaccinated*	Yes	25.6	15.5	1.87	(1.30, 2.69)
		No	74.4	84.5		
	Know to keep the baby away from coughing people*	Yes	40.7	30.6	1.56	(1.14, 2.14)
		No	59.3	69.4		

\* Significant difference between groups,  $p < 0.05$ .

in the health authorities, soundness of information, the public's ability to control their risk, and whether specific behaviours were effective in risk reduction.<sup>17</sup> Decision making regarding the use of pharmaceutical interventions such as vaccination is similarly complex and driven by multiple factors, including the emotional and experiential.<sup>18</sup> However, the use of vaccination reminder messages has demonstrated their effectiveness in influencing decision making to improve immunisation coverage across a variety of settings, modes (text, letter, postcard and phone), age groups and vaccines,<sup>19</sup> but not in some rural settings.<sup>20</sup> Reminders may be particularly effective at prompting vaccination when parents are not familiar with changes in vaccine recommendations<sup>21</sup> such as occurred during the New South Wales pertussis outbreak. In our study, receipt of a letter in households with infants was associated with a 6-fold increase in the uptake of the pertussis booster by adult respondents (OR 5.8; 95%CI 4.1, 8.2) and other adults in the household (OR 5.1; 95%CI 3.5, 7.5). This stands to reason as letters: 1) were sent during an outbreak when risk perceptions may have been high; 2) were sent directly from trusted health authorities; and 3) provided information about the severity of disease in infants, and how to obtain effective, freely available interventions to enable recipients to control the risk within their household.

There were several limitations to the study. We could not establish causality with this study methodology and did not evaluate the GP or mass media component of the campaign, which may have been a source of confounding. We relied on self-reported vaccination status, creating the potential for misclassification bias. While previous CATI surveys measuring vaccination status have identified significant bias and the need for validation,<sup>22</sup> the NSW Health Survey program methodology has been validated for the collection of health information at the population level.<sup>23</sup> Households without a residential telephone were excluded from the survey, which may have decreased the proportion of younger people and females in the sample.<sup>24</sup> Respondents were asked about how many children aged less than 3 years were in the household. As such, we were not able to analyse the results by age. In addition, we did not measure the extent to which the letters contributed to decision making as the non-primary prompt. However, given that the repetition of messaging is crucial for behaviour change,<sup>25</sup> it is conceivable the letters may have contributed to vaccination decision making more broadly. The increasing trend of letter recall over time, and with an increasing number of children in the household may have been due to an increased likelihood of recall associated with being sent a

letter with each newborn infant during the mail out period and an increasing proportion of those eligible to receive a letter sampled over time.

Importantly, letter recall was not associated with parental knowledge that babies could get their first vaccination at 6 weeks of age. It is conceivable this message may have held less relevance for the proportion of mothers who would have received the letter retrospectively, after their baby would have already received the 1st dose in their primary course of pertussis vaccinations, but this would not be an explanation for the parents who were sent a letter prospectively. In comparison, getting other household members vaccinated, including adults who were more likely to be unvaccinated, may have held greater relevance. Recent data from other sources indicates that the continued provision of information to parents to bring forward the first vaccination for pertussis has increased the proportion of infants vaccinated at 6 weeks.

Outbreak communication is most effective when standardised messages are disseminated through multiple channels.<sup>26</sup> While some media-only communication interventions designed to alter public behaviour directly have had little impact on behaviour, when media communication is used in combination with a community component, significant changes in behaviour have been reported.<sup>27</sup> While we did not evaluate the impact of NSW Health's complementary communication strategy through mass media and with general practitioners, previous studies have demonstrated that communication disseminated directly to GPs, who are known to influence parental vaccination decision making,<sup>28</sup> prepared them to effectively respond to disease outbreaks<sup>29</sup> and increased their awareness and knowledge of health issues.<sup>30</sup> Previous studies have found GPs to be the key health information provider and decision influencer for families. In our study, 10.0% of adults reported receiving a pertussis booster in response to the letters, while 40.4% reported it was following GP advice (as the primary prompt). Direct communication to GPs during the outbreak is likely to have contributed to parental vaccination decision making, complementing the direct communication to parents of young infants and newborns.

While targeted reminder letters to parents have been previously used to prompt vaccination of children, their use at a population level in an outbreak scenario to provide prevention and control messages to new parents was a novel approach. This targeted messaging, in combination with broader public and clinician communications, was associated with a 6-fold increase in pertussis boosters by adult respondents in the study. Given that recent evidence has shown that vaccinating mothers prior

to giving birth (pre-conception or third trimester) is the most effective indirect way to protect infants from pertussis,<sup>31</sup> it will be important to consider similar targeted mechanisms to provide pertussis prevention information to women who are planning, or approaching the third trimester of pregnancy. The potential for broader social media strategies to complement such targeted approaches should be further explored.

## Conclusion

Health providers remain crucial for vaccination decision making. However, direct correspondence with households may have contributed to increased uptake of pertussis booster vaccination and knowledge, as a component of a wider communication strategy. Many respondents reported receiving a letter and some reported it as the main prompt to get vaccinated. Health authorities may consider mailing households in future pertussis epidemics as a component of the wider communication strategy.

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