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Short report

Evaluation of enhanced follow-up for pertussis in children aged 5–9 years in Sydney Local Health District, NSW

Kwendy Cavanagh, Emma Quinn, Alexandre S Stephens, Zeina Najjar, Essi Huhtinen and Leena Gupta

Background

Pertussis remains endemic in Australia despite a long-term national vaccination program, with waning immunity[1] contributing to epidemics every 3–5 years.[2] Pertussis is a notifiable disease in NSW[3] and public health units (PHUs) actively follow-up cases in children aged 0–4 years and women in the last month of pregnancy to protect those most at-risk of severe disease, i.e. infants aged less than six months.[4] This follow-up aims to prevent transmission to infants by ensuring timely treatment of cases and contact tracing to identify any high-risk close contacts who require post-exposure prophylaxis (PEP).[4]

During the 2010–2011 epidemic in NSW, notification rates were highest in children aged 5–9 years in both NSW[5] and in Sydney Local Health District (SLHD), an inner-Sydney region (Figure 1). In late 2014, pertussis notifications resurged across NSW and SLHD, again predominantly in school-aged children (Figure 1). Evidence demonstrates that both parents[6,7] and siblings[8] are potential sources of infant pertussis. More recent data also suggest that school-aged children are most likely to introduce pertussis to households.[9] Therefore, in response to this evidence, SLHD PHU commenced enhanced surveillance of children aged 5–9 years during 2015.

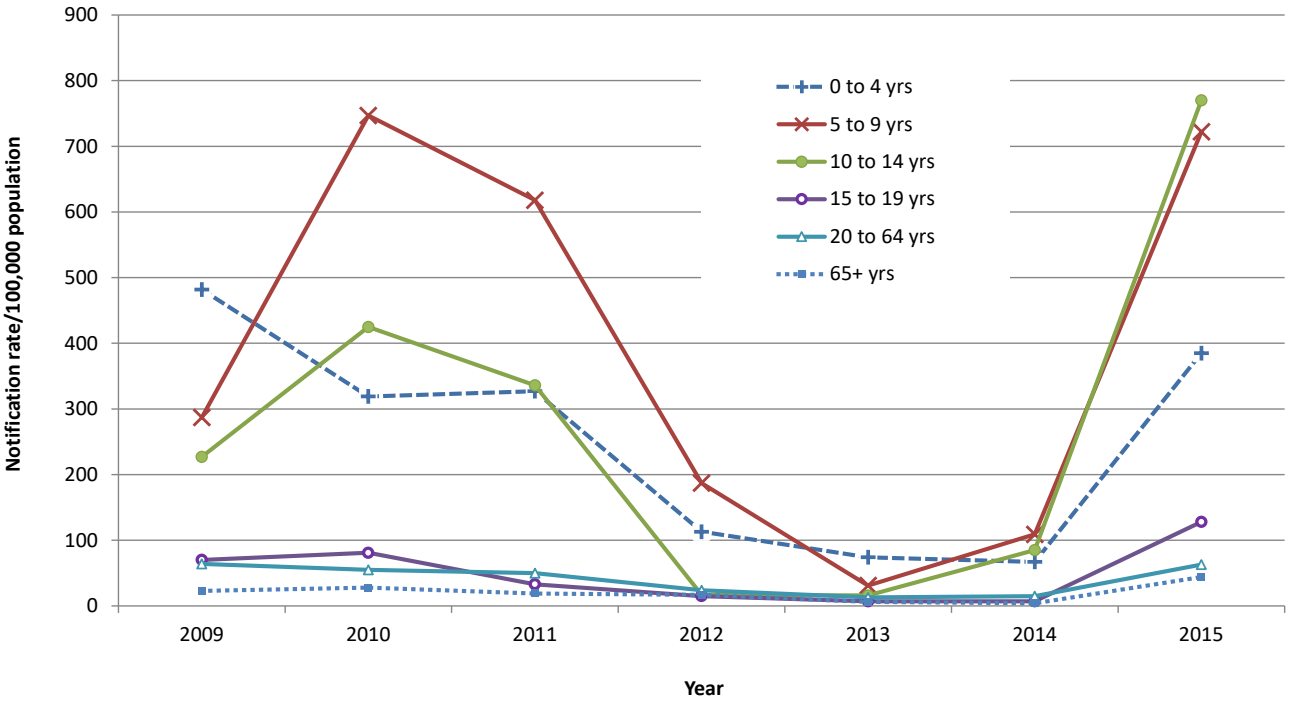
Keywords: pertussis, source of illness, pertussis vaccination, contacts

Methods

We evaluated the effectiveness of the enhanced follow-up in children aged 5–9 years in SLHD during 2015 by determining: (i) differences in notification and hospitalisation rates in children aged 0–9 years in 2015 compared to 2011; (ii) the key sources of illness for cases aged 0–4 years in 2015 compared to 2011; and (iii) the incremental cost-benefit of following up children aged 5–9 years, by calculating the ratio of additional cases with high-risk contacts identified for PEP per unit of PHU staff time.

Numbers and rates of notifications and hospitalisations related to pertussis for the two epidemic years (2011 vs 2015) in SLHD were compared using the NSW Communicable Disease Register (CDR). These periods were chosen because children aged 0–9 years were offered the same vaccination schedule. The CDR links data from the Notifiable Conditions Incident Management System (NCIMS) with the Admitted Patient Data Collection (APDC), amongst other data. Confirmed pertussis cases in SLHD were identified based on condition code, case classification and geography of residence. Hospitalisations related to pertussis were identified by merging confirmed notifications with APDC data where the hospitalisation date was within 22 days of the notification date.[10] Only hospitalisations with a respiratory-related cause based on

Figure 1. Age-specific rates of pertussis by age group per 100,000 population in Sydney Local Health District (SLHD)



Source: Data from the Notifiable Conditions Incident Management System from within the NSW Communicable Disease Register, accessed through the Secure Analytics for Population Health Research and Intelligence (SAPHaRI) portal. Date of extraction and analysis 10/05/2017.

ICD-10 codes, excluding nested transfers were counted. Age-specific rates were calculated using mid-year population estimates from the Australian Bureau of Statistics. CDR data were analysed using SAS Enterprise Guide software, Version 9.3™.

PHUs routinely follow-up pertussis cases aged 0–4 years by interviewing both the doctor and the caregiver to collect epidemiological data which is entered into NCIMS[4]. During the study period of 1 November 2014 to 1 November 2015, SLHD PHU also followed up cases of pertussis in children aged 5–9 years using the same process. Sources of illness for cases aged 0–4 years were extracted from NCIMS and analysed in Excel. NCIMS data on cases in children aged 0–9 years in 2015 were audited to ascertain the existence of high-risk contacts requiring PEP. The average time to complete one case was estimated by PHU staff. Ethical approval was obtained from the SLHD Human Research Ethics Committee under section 5.1.22 of the National Statement on Ethical Conduct in Human Research.[11] The CDR is made available under the Public Health and Diseases Registers provisions of the NSW Public Health Act 2010.

Results

Notifications and rates of pertussis in the 0–1 year age group were similar in both years, whereas notifications in older age-groups increased in 2015 compared to 2011 (Table 1). Conversely, the number of hospitalisations for children under 5 years was lower in 2015 compared to 2011 (Table 1).

Although source of illness data was missing or not known in at least 35% of cases for both years, during 2015 the most frequent source of illness for pertussis cases aged 0–4 years was another child at their childcare centre (Table 2). Siblings were the source of illness for approximately 20% of cases aged 0–4 years in both epidemic years (Table 2).

Case investigation consumed approximately 40 minutes of staff time per case, irrespective of the

Table 1. Comparison of pertussis notifications and hospitalisations in children aged 0–9 years in Sydney Local Health District, 2011 compared to 2015 (when enhanced surveillance was in place)

Period of follow-up and notification data	2011	2015*
Number of notifications by age group		
0–1yrs	43	49
2–4yrs	76	120
5–9yrs	172	248
Age-specific notification rate (per 100 000 population)		
0–1yrs	270	283
2–4yrs	371	522
5–9yrs	629	749
Number of hospitalisations by age group†		
0–1yrs	13	6
2–4yrs	2	1
5–9yrs	2	2
Age-specific hospitalisation rate (per 100 000 population)		
0–1yrs	81.7	34.7
2–4yrs	9.8	4.4
5–9yrs	7.3	6.4

* Notifications were extracted for the full calendar year of 2015. Rates were also calculated for the full 2015 calendar year.

† Hospitalisations with a respiratory-related cause, within 22 days of notification date.

NB: Numbers of notifications from NCIMS may change over time depending on the date of extraction from the database.

Source: Data from the NSW Communicable Disease Register, accessed through the Secure Analytics for Population Health Research and Intelligence (SAPHaRI) portal. Date of extraction and analysis 08/01/2018.

Table 2. Comparison of source of illness for pertussis cases aged 0–4 years in Sydney Local Health District in the year 2011 compared to 2015.

	2011		2015	
Source of illness for cases aged 0–4 years	N	%	N	%
Parent	9	7.6	9	5.2
Sibling	28	23.5	36	20.7
Other household (including grandparents)	4	3.4	2	1.1
Other non-household	12	10.0	20	11.5
Child at CCC	13	10.9	45	25.9
Unable to be identified/not stated	53	44.6	62	35.6
Totals	119	100	174	100

NB: Numbers of notifications in NCIMS may change over time depending on the date of extraction.

Source: Data from the Notifiable Conditions Incident Management System accessed through the Secure Analytics for Population Health Research and Intelligence (SAPHaRI) portal. Date of extraction and analysis: 18/01/2018

case's age or number of high-risk contacts. Of the 186 cases aged 5–9 years followed up during 2015, eight cases (4.3%) were identified with high-risk contacts requiring PEP (i.e. equated to a total 15.5 hours to identify one case with high-risk contacts), compared to routine follow-up of 129 cases aged 0–4 years, which identified 15 cases (11.7%) with high-risk contacts requiring PEP (5.7 hours to identify one case with high-risk contacts).

Discussion

The evaluation of our enhanced surveillance policy suggests that active follow-up of pertussis notifications in children aged 5–9 years during the epidemic year of 2015 may have led to lower hospitalisation rates for children aged 0–4 years when compared to the previous epidemic year of 2011, though notification rates of pertussis were higher in all age groups in 2015. Additionally, we identified a greater proportion of cases of pertussis in children aged 0–4 years likely acquired from another child at a childcare centre rather than a sibling, when compared to 2011. However, enhanced surveillance greatly increased PHU workload while identifying only a much smaller proportion of cases with high-risk contacts, compared to follow-up of cases aged 0–4 years only. Therefore, our results suggest little incremental benefit from extending routine follow–up of children aged 0–4 years to those aged 5–9 years.

The lower hospitalisation rates for children aged 0–1 years during 2015 when compared to 2011 is noteworthy but confounded by the introduction of the maternal pertussis vaccination program in April 2015.[12] The significant protective effect of maternal vaccination for infants[13] may have contributed to this lower rate. During 2015, the PHU also regularly sent out advice promoting testing to doctors and parents, which may have led to better detection and therefore higher notification rates for children overall.

Although siblings have been implicated as the most important source of pertussis for children aged 0–4 years[7], our data indicates that during 2015, childcare centres were the most likely source of pertussis for these children. This epidemiological trend is unlikely to be sustained with new legislation requiring all children to be age-appropriately vaccinated prior to childcare enrolment[3] and reintroduction of a pertussis booster for those aged 18 months on the national immunisation program.[14]

Our evaluation was limited by a small sample size and therefore lacking power to make confident statistical comparisons. Secondly, immunity from vaccination wanes over time[1] and changes in vaccination policy may have contributed to different levels of population susceptibility at different times, confounding any differences in data found in our evaluation. Thirdly, although we compared age cohorts of children offered the same vaccination schedule from birth, the comparison of data in 2011 versus 2015 was confounded by the introduction of the maternal pertussis vaccination program.[12]

Overall, our results suggest that there is little cost-benefit of actively following up pertussis cases aged 5–9 years, however, evaluation studies with larger cohorts of children over longer periods of time with more complete information on source of illness are needed to help confirm these results.

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