Invasive pneumococcal disease in western Sydney, 2002–2010

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In January 2005 the 7-valent pneumococcal conjugate vaccine (7vPCV) was funded on the National Immunisation Program for all children as a three-dose regimen given at 2, 4 and 6 months of age with a catch-up program for children up to 3 years of age. In the same year, the 23-valent pneumococcal polysaccharide vaccine (23vPPV) was funded for all Australians aged 65 years and over. A 23vPPV nationally funded program for Indigenous Australians aged 50 years and over, as well as those aged 15–50 years with specified underlying medical risk factors, has been in place since 1999.[1]

We review the burden of invasive pneumococcal disease (IPD) in the former Sydney West Area Health Service (SWAHS) during the period 2002–2010 with particular attention to the proportion of IPD due to serotypes covered or not covered by the vaccines (Box 1).

Methods

IPD (defined by the isolation of *Streptococcus pneumoniae* from a normally sterile site such as blood or cerebrospinal fluid) has been a notifiable condition under the NSW *Public Health Act 1991* since January 2001. All New South Wales (NSW) laboratories are required to report positive culture results to their local public health unit (PHU). All serotyping was performed at the Institute for Clinical Pathology and Medical Research, Westmead, one of three reference laboratories for this purpose in Australia. PHU staff enter this information, including serotyping results if available, into a statewide database.[2]

The population investigated was that of the former SWAHS (estimated 2010 population of 1 168 076). To demonstrate vaccine impact on disease burden the population was divided into three age categories for analysis: 0–4 years, 5–64 years and 65 years and over. Non-Aboriginal people aged 5–64 years are not routinely vaccinated. Annual age-specific rates and Poisson confidence intervals were calculated from January 2002 to December 2010 in Microsoft Excel® using notification data and Australian Bureau of Statistics population estimates from a population health database held by the NSW Department of Health (Health Outcomes and Information Statistical Toolkit). The average annual age-adjusted rates for each of the three age categories for the period 2002–2004 (baseline) were compared to the 2006–2010 post-vaccination implementation period. The serotype incidence percentage was calculated by summing the total cases caused by that serotype divided by the total notified cases for that time period.

Results

Changing incidence of IPD over time by age category

All three age categories showed a reduction in the age-specific IPD incidence over time with the greatest reduction in the 0–4-year age group (Figure 1).

Comparison of average annual IPD notification rates for the two time periods also shows that the greatest reduction in IPD incidence has been in the 0–4-year age group (72.8% reduction) (Table 1). The 5–64-year age group had a 39.4% decrease which is greater than that seen in the

Table 1. Average annual age-specific invasive pneumococcal disease counts and incidence, Sydney West Area Health Service, 2006–2010 compared with 2002–2004

Age group (years)	Average annual count		Average annual rate/100 000		Relative reduction (%) (95% CI)
	2002–2004	2006–2010	2002–2004	2006–2010	
0–4	54	16	69	19	72.8 (66.1–78.5)
5–64	56	36	6	4	39.4 (29.9–47.9)
65 and over	36	27	35	24	31.4 (18.9–42.4)

Sources: NSW Notifiable Conditions Information Management System; Health Outcomes and Information Statistical Toolkit, NSW Department of Health.
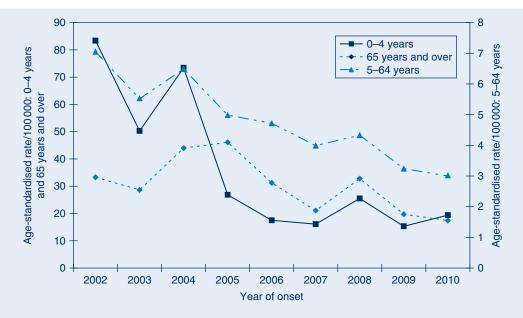
Figure 1.   Age-specific incidence rates, invasive pneumococcal disease, Sydney West Area Health Service, 2002–2010
Source: NSW Notifiable Conditions Information Management System.

65 years and over age group (31.4%), despite this population being targeted for 23vPPV.

Comparison of serotype incidence

The proportion of IPD cases due to serotypes contained in the 7vPCV was reduced in 2006–2010 compared with 2002–2004. Serotype 19A demonstrated the biggest increase, followed by serotype 3. Twelve of the 15 non-vaccine serotypes found in this population were relatively more common during 2006–2010. Non-vaccine serotypes caused 6% of all notified cases in 2002–2004 and 16% of all notified cases in 2006–2010.

Discussion

A significant reduction in the overall incidence of IPD occurred in the SWAHS population since the National Immunisation Program pneumococcal vaccines were introduced. The greatest reduction was in children aged less than 5 years, although significant reductions were noted across all age groups. These results are similar to those from

Box 1.   Serotypes covered by the three pneumococcal vaccines provided in NSW, 2004–2011

7-valent pneumococcal conjugate vaccine (7vPCV): 4, 6B, 9V, 14, 18C, 19F, 23F

13-valent pneumococcal conjugate vaccine (13vPCV): all 7vPCV serotypes plus 1, 3, 5, 6A, 7F, 19A

23-valent pneumococcal conjugate vaccine (23vPPV): all 7vPCV serotypes plus 1, 2, 3, 5, 7F, 8, 9N, 10A, 11A, 12F, 15B, 17F, 19A, 20, 22F, 33F

other settings where unvaccinated cohorts enjoyed a reduced incidence of IPD due to a herd immunity effect.[3–5]

Serotype epidemiology has also changed since the pre-vaccination period. All 7vPCV-containing serotypes have reduced in relative frequency across the entire population. Serotype 19A, a component of the 23vPPV, is now the dominant serotype. Factors in the emergence of 19A may include: poor 23vPPV coverage rates in the 65 years and over age group (54%);[6] inferior efficacy of the polysaccharide vaccine in elderly persons compared to that of 7vPCV in infants; and pressure from antibiotic use, as 19A is frequently resistant to penicillin and erythromycin.[7–10]

Conclusion

The introduction of the 7vPCV into the National Immunisation Program has significantly reduced the incidence of IPD across all ages but particularly in 0–4-year olds. Non-7vPCV serotypes now predominate, particularly serotype 19A. A 13-valent pneumococcal conjugate vaccine 13vPCV (which includes serotypes 19A and 3) will replace 7vPCV from July 2011 (Box 1). This is expected to reduce the incidence of IPD in the 0–4-year age group and potentially the remainder of the population through a herd immunity effect.

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Aboriginal identification in Hunter New England infants

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The delayed immunisation of Indigenous children in the first year of life is an important issue in Australia.[1] The proportion of Aboriginal infants not fully immunised at 12 months of age (15%) is over double that of non-Aboriginal children (7%) in the Hunter New England Local Health District (HNELHD).

In the past when Hunter New England Population Health received Australian Childhood Immunisation Register lists of children overdue for vaccination, Aboriginal children were identified in partnership with local Aboriginal health workers and followed up in an attempt to facilitate more timely future doses of vaccine. However, this meant that children were already overdue at an age when they were most vulnerable to many vaccine-preventable diseases. This 'lesson from the field' describes a new approach to improve both Aboriginal immunisation rates and the recording by health staff of mothers' identification of their baby's Aboriginal status.

The Hunter New England Aboriginal Health Partnership requested that action be taken to close the gap in Aboriginal infant immunisation. The Partnership is an executive steering group with membership consisting of the Chief Executive Officer of the HNELHD and the chairperson or elected representative of each of the nine Aboriginal Community Controlled Health Services in the district. The Partnership aims to improve the health of Aboriginal people in the Hunter New England region by providing leadership, ongoing advice on general health policy, strategic planning, service issues and equity of allocation of resources. The Partnership provides a forum and a process for sharing information and is committed to the practical application of the principles of Aboriginal peoples' self-determination, a partnership approach and intersectoral collaboration. To facilitate immunisation, the Partnership supported the use of newborn data from all routine health service records for the purposes of contacting the child's parents.

Through a new approach to improve the timeliness of Aboriginal infant vaccination the parents of newborn Aboriginal infants are contacted soon after birth by an Aboriginal immunisation officer in the Population Health Unit. The officer facilitates the early linking of mothers with providers of immunisation. The approach also emphasises the importance of the accurate recording by health staff of mothers' identification of their baby's Aboriginal status.

As the program aims to contact the family of Aboriginal infants prior to their first scheduled immunisation, its success depends on the accuracy and completeness of Aboriginal identification recording in newborn datasets. However, the Aboriginal immunisation officer employed to contact the mothers of Aboriginal infants noted that the

records held by the Community Health Information Management Enterprise (CHIME), the principal inpatient database, were often inaccurate and did not reflect community knowledge. Consequently, this prompted the systematic comparison of recorded Aboriginal identification in two datasets, CHIME and *ObstetriX*.[2]

Methods
The recorded identification of Aboriginal infants in two health service datasets was compared over a 3-month period, August–October 2010. Data from the NSW Health *ObstetriX* database were compared to the birth notification data available from the CHIME.

The *ObstetriX* database is completed in HNELHD maternity units. During the post-natal interview, midwives ask all mothers to nominate whether their baby will identify as Aboriginal and this information is then recorded in the *ObstetriX* database. Aboriginal births recorded in this database are supplied monthly to the Population Health Unit by the 15 maternity midwifery unit managers in HNELHD to permit follow up by the Aboriginal immunisation officer of these babies' mothers.

CHIME is the principal inpatient database in HNELHD and contains detailed patient demographic information collected during any presentation within the HNELHD. The CHIME data are automated and are available to the Population Health Unit within a few days of birth. However, Aboriginal identification of infants is not verified and defaults to the mother's recorded identity. This system populates all the HNELHD clinical records.

Results
Less than half (46%; 72/158) of newborns were recorded as Aboriginal in both data sets. Fifty-three percent of newborn Aboriginal children (84/158) were only recorded in *ObstetriX* and 1% (2/158) only in CHIME.

Discussion
Accurate recording by health staff of mothers' identification of their baby's Aboriginal status in medical information systems is essential to the success of the initiative linking Aboriginal infants and immunisation service providers. Strategies which allow Aboriginal people to identify themselves assist in the provision of services that can close the gap in health experience.[3]

The discordance between the *ObstetriX* and CHIME datasets identified by this study resulted in the HNELHD embarking on a program to encourage staff to support more complete identification by Aboriginal clients of the service. A training package for clerical staff who record demographic data was developed. Database managers now routinely compare Aboriginal identification data across databases, a quality measure initiated by this study.

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Why are children on the NSW North Coast not being vaccinated against chickenpox?

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In November 2005, varicella (chickenpox) vaccination administered at 18 months of age was included in the government funded National Immunisation Program for all children born after 1 May 2004.[1] Each month the former North Coast Public Health Unit received a report on children recorded as overdue to receive the vaccination according to the Australian Childhood Immunisation Register (ACIR). It appeared that a disproportionate number of children aged 20–60 months were recorded as overdue for varicella vaccine.

This study explored why 907 children living in northern New South Wales (NSW) and aged 20–60 months as at April 2010 had received, according to the ACIR, all their other due vaccinations but not varicella vaccination.

- Has your child been vaccinated against chickenpox?
  - If yes, give details of provider, date and batch number (from Baby Health Record)
  - If no, why not?
- Has your child had chickenpox (the disease)?
  - If yes, at what age did they have chickenpox?

Methods

The parents of children aged less than 5 years and identified as being vaccinated with all other scheduled vaccines except varicella were sent: a copy of their child's vaccination record; a chickenpox factsheet; a questionnaire; and a letter explaining that their child was overdue for varicella vaccination and highlighting the importance of the vaccination. As this study formed part of routine follow-up of children identified by the ACIR as being overdue for vaccination it did not require ethics approval. This is in accordance with NSW Health Policy Directive PD2005_098.[2]

The questionnaire included questions asking whether their child had been vaccinated and whether the child had also had chickenpox. See Box 1 for questions.

The ACIR records for all children were checked 12 months after the initial contact.

Results

A total of 406 questionnaires (45%) were returned to the Public Health Unit. More than a quarter of respondents ($n = 111$, 27.3%) indicated that their child had been vaccinated. This was verified by contacting their providers and updating the ACIR. Fifty respondents (12.3%) indicated that their child had experienced varicella infection and was therefore not vaccinated. Twenty-six of these children were reported to have had the infection before the age of 18 months.

The letter prompted 155 respondents (38.2%) to seek vaccination from their immunisation provider. Three percent of parents ($n = 12$) indicated that they had not been offered the vaccine by their vaccine provider, while approximately 6% ($n = 26$) indicated that they would rather their child got "natural disease". Other reasons for not vaccinating included wanting to wait until the child was older ($n = 2$), wanting to wait until the vaccine had been around for longer ($n = 2$) and medical contraindications (not registered with the ACIR) ($n = 4$). Some parents said that they had forgotten ($n = 7$).

Twelve months after the intervention, according to the ACIR 501 children (55%) remained unvaccinated and 42 parents (4.6%) had completed a conscientious objector form indicating they did not wish their child to receive the vaccine.

Discussion

Based on the returned questionnaires and verification with the immunisation provider, many children who had no varicella vaccine recorded on the ACIR had been vaccinated or had experienced self-reported varicella disease. The simple intervention of a letter indicating their child's status, describing the potential complications of chickenpox and encouraging vaccination, prompted almost 40% of the respondents to have their overdue children vaccinated against chickenpox.

Globally, many families and countries cannot afford to protect their children against varicella and it is not a public health priority in settings where vaccine-preventable pneumonia (pneumococcus), diarrhoea (rotavirus) and measles are common and must remain the focus of immunisation programs.[3] However, in Australia, where the vaccine is available free to children, greater effort should be made to encourage parents and providers to optimally protect their children.

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