

Invasive pneumococcal disease in North Queensland, 2001

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Abstract

This report provides information on the 93 locally-acquired cases of invasive pneumococcal disease (IPD) notified in children and adults in north Queensland in 2001. Indigenous people represented 38 (41%) cases. Almost half (45) of all cases were in children under 15 years of age, 20 (44%) of these were in children less than 2 years of age and 20 (44%) in Indigenous children. Five severe cases of IPD occurred, all in non-Indigenous children under 2 years of age. Nine (10%) of the isolates from cases, mainly in young children, had some level of resistance to penicillin. Pneumococcal vaccination programs (including the Indigenous 'elderly and at-risk' adult program and the paediatric 'Indigenous and medically at-risk' conjugate vaccine program) are in place in Queensland although the vaccine is not currently funded for other at-risk groups. If vaccine recommendations had been adhered to in a timely fashion, two of the cases in children and one third (16) of the cases in adults that occurred in 2001 could potentially have been prevented. *Commun Dis Intell* 2002;26:520–524.

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Introduction

The 23-valent pneumococcal polysaccharide vaccine (23vPPV) was included in a statewide vaccination program in Queensland for at-risk Indigenous adults that began in 1998 but the vaccine had been used in some parts of north Queensland since the mid-1990s.¹ The efficacy of the vaccine is 50 per cent to 80 per cent in 'at risk' individuals (i.e. the elderly and those with chronic diseases).^{2,3}

The 7-valent pneumococcal conjugate vaccine (7vPCV) was licensed for use in Australia in early 2001. The vaccine is approximately 97 per cent effective in preventing invasive disease caused by vaccine serotypes.⁴ A previous study in north Queensland indicated the serotypes in the 7-valent vaccine accounted for approximately 62 per cent and 88 per cent of the isolates from IPD cases in Indigenous and non-Indigenous children under 5 years of age respectively.⁵ This suggests the vaccine should prevent approximately 60 per cent and 85 per cent of cases of IPD in Indigenous and non-Indigenous children in the region. The vaccine became available in north Queensland for Indigenous children up to 2 years

of age and other medically at-risk children up to 5 years of age in the latter part of 2001. Because of the need for education and training, staggered implementation took place in different parts of the region from July to September 2001.

IPD has been a notifiable disease in Queensland since 1996. This report describes cases of IPD in north Queensland in 2001, and examines whether cases were preventable according to vaccine recommendations.

Methods

A case of IPD is defined as an acute systemic febrile illness and the isolation of *Streptococcus pneumoniae* from a normally sterile site. Laboratories routinely notify the Tropical Public Health Unit (TPHU) of any such isolation; TPHU staff follow-up each notification and administer a standardised questionnaire to each case or his or her guardian. The vaccination status of each case is checked, where applicable, on the statewide computerised immunisation database. Each invasive isolate is serotyped, and the antibiotic susceptibilities determined, by the Public Health Microbiology Laboratory, Queensland Health Scientific Services.

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Results

There were 97 cases of IPD notified in north Queensland in 2001. Three cases were acquired in Papua New Guinea and one case elsewhere in Queensland. Of the remaining 93 cases, 45 cases (48%) were in children <15 years of age, and 38 cases (41%) were in Indigenous people.

Of the 45 cases that occurred in children, 20 cases (44%) were in children under 2 years of age and 20 cases (44%) were in Indigenous children. Forty-four of the isolates from children were serotyped and in total 31 cases (70%) had serotypes that are included in 7vPCV. However, only 11 (55%) of the 20 Indigenous children had isolates with a serotype included in 7vPCV, much lower than in non-Indigenous children (83%). Table 1 illustrates the percentage of isolates in Indigenous and non-Indigenous children in the less than 2 years and 2–14 years age groups, that had a serotype included in 7vPCV.

All but one of the Indigenous children with IPD had either pneumonia or bacteraemia; there were no cases of pneumococcal meningitis in this group. The remaining Indigenous child, aged 5 years, had pneumococcal septic arthritis of a hip. There were 3 cases of pneumococcal meningitis among the non-Indigenous children. All three were less than 2 years of age and all the isolates had serotypes included in 7vPCV.

Although there were no deaths among the children, five of the cases could be classified as 'severe' based upon associated complications or sequelae (Table 2). The isolate from a 5-month-old child with severe pneumococcal pneumonia

had intermediate susceptibility to penicillin (MIC=1.0 mg/L) and was resistant to cotrimoxazole. Otherwise, the isolates from the remaining children with severe IPD were sensitive to penicillin and other antibiotics.

Based upon current recommendations (and taking the timing of implementation of the vaccination program into account), only two of the cases in children could have been prevented had 7vPCV been administered in a timely fashion. Neither a 13-month-old Indigenous child with an IPD onset in late October, nor a 2.75-year-old non-Indigenous child with leukaemia whose onset was in early September, had received any doses of 7vPCV.

Of the 48 cases that occurred in adults 15 years of age or older, 18 cases (38%) were Indigenous adults. Forty-four of the isolates from adults were serotyped. Thirty-six cases (82%) had serotypes included in 23vPPV: 14 (78%) of those from Indigenous adults and 22 (85%) of those from non-Indigenous adults (Table 1).

Fifteen cases (31%) occurred in adults who had previously received 23vPPV: 9 (50%) of the affected Indigenous adults and 6 (20%) of the non-Indigenous adults (Table 3). Of the 9 Indigenous adults, five were vaccine failures and the features of these cases are presented in Table 4. The remaining four episodes of IPD were caused by non-vaccine serotypes (16F x2, 23A & 38). Five of the 6 cases in vaccinated non-Indigenous adults were vaccine failures.

Table 1. Cases of invasive pneumococcal disease and number of isolates in each group with a serotype included in the age-appropriate pneumococcal vaccine

Age group	Indigenous cases	Non-Indigenous cases	Total cases
Child	6 6 (100%) isolates in 7vPCV	14 12 (86%) isolates in 7vPCV	20
	14 5 (36%) isolates in 7vPCV	11 8 (73%) isolates in 7vPCV*	25
Adult	18 14 (78%) isolates in 23vPPV	30 22 (85%) isolates in 23vPPV†	48

* 1 isolate not typed in this group.

† 4 isolates not typed in this group.

Table 2. Features of the severe cases of invasive pneumococcal disease in children in north Queensland, 2001

Age (months)	Ethnicity	Diagnosis	Complication/ sequelae	Length of hospital stay (days)	Serotype
5	Non-Indigenous	Pneumonia	Empyema	22	14
7	Non-Indigenous	Meningitis	Seizures (prolonged)	16	23F
12	Non-Indigenous	Pneumonia	Empyema	10	6A
13	Non-Indigenous	Pneumonia	Empyema	7	6A
18	Non-Indigenous	Meningitis	Deafness (profound)	10	14

Table 3. Vaccination status of adults with invasive pneumococcal disease in north Queensland, 2001

	Vaccinated		Unvaccinated	
	Vaccine failure	Non-vaccine serotype	Eligible	Non-eligible
Indigenous	5	4	5	4
Non-Indigenous	5	1	13	11
Total (%)	10 (21%)	5 (10%)	18* (38%)	15 (31%)

* 16 of these cases had serotypes included in 23vPPV

Table 4. Features of the previously vaccinated Indigenous adults who developed invasive pneumococcal disease caused by serotypes included in 23vPPV (i.e. vaccine failures), 2001

Age (years)	Sex	Interval since vaccination	Risk factors for IPD	Serotype
39.9	M	2.5 months	Diabetes, renal failure	23F
40.7	M	4.3 years	Alcohol abuse	11A
41.8	M	2.3 years	Alcohol abuse, liver disease	3
45.7	M	4.4 years	Diabetes, alcohol abuse	19A
52.0	M	5 months	Aged, alcohol abuse	19A

Over half (55%) of the affected adults that were unvaccinated were eligible for vaccine (Table 3) including 6 non-Indigenous adults aged over 65 years who had not been vaccinated according to recommendations. Most (89%) of the group who were eligible but had not been vaccinated had isolates with serotypes that were in 23vPPV. Therefore 16 (33%) of all cases of IPD in adults were potentially preventable had there been adherence to vaccine recommendations.

There were 3 deaths from IPD in the adult cases, a case-fatality of 6 per cent. All three were in unvaccinated non-Indigenous males: an immunosuppressed alcoholic 42-year-old with serotype 19F pneumococcal pneumonia, an 83-year-old with serotype 3 pneumococcal pneumonia and an 87-year-old with pneumococcal pneumonia (serotype unknown).

Nine (10%) of the 93 invasive isolates had some level of resistance to penicillin. One was fully resistant and eight had intermediate level resistance. Seven of these cases were in children, two of whom were Indigenous (Table 5). Of note, one child with intermediate level resistance required prolonged in-patient hospital care (22 days) because of severe pneumococcal pneumonia (complicated by empyema) and the child with the fully resistant isolate was the unvaccinated leukaemic child. The cases with isolates with some level of resistance to penicillin occurred throughout the year.

Discussion

Indigenous children were over-represented in the paediatric cases of IPD. Indigenous children constitute approximately 14 per cent of the total population under 15 years of age in north Queensland, yet 44 per cent of the total IPD cases in this population were in Indigenous children. There were two notable issues however, in relation to IPD and Indigenous children in 2001. Firstly, although severe disease has occurred not infrequently in previous years and 3 deaths were recorded in Far North Queensland over the previous 9 year period,⁵ there were no severe cases in Indigenous children in north Queensland during the surveillance period; virtually all had relatively mild pneumonia or bacteraemia.

Secondly, the current vaccine program will take several years to make a substantial impact on the incidence of IPD in Indigenous children unless there is considerable cross-protection to related serotypes not included in 7vPCV, and the vaccine markedly reduces nasopharyngeal carriage of pneumococci. This is because the pneumococcal vaccination program in Queensland targets Indigenous children under 2 years of age, while only 30 per cent of the Indigenous cases were aged under 2 years. Furthermore, only approximately 35 per cent of the isolates from Indigenous children aged 2 years or older are included in 7vPCV. Previous data collected on cases of IPD in Far North Queensland likewise showed only 53 per cent of cases in Indigenous children 2–4 years of age had isolates with serotypes included in 7vPCV.⁵

Table 5. Features of the cases of invasive pneumococcal disease in children caused by pneumococci with reduced susceptibility to penicillin, 2001

Month of onset	Age (years)	Ethnicity	Diagnosis	Length of hospital stay (days)	Serotype	Penicillin MIC* (mg/L)
Jan	3.2	Non-Indigenous	Bacteraemia	3	9V	1.0
Feb	2.75	Non-Indigenous	Pneumonia	3	14	1.0
April	2.1	Non-Indigenous	Bacteraemia	3	?	0.75
April	1.4	Indigenous	Pneumonia	1	6B	0.25
May	1.3	Indigenous	Bacteraemia	1	6B	0.5
Sept	2.75	Non-Indigenous	Bacteraemia	?	9V	2.0
Sept	0.4	Non-Indigenous	Pneumonia	22	14	1.0

* Intermediate level resistance is defined by a minimum inhibitory concentration (MIC) of 0.1–1.0 mg/L, whereas an isolate with an MIC \geq 2.0 mg/L is defined as being fully resistant to penicillin.

The intriguing feature of the cases of IPD in children was that all cases of pneumococcal meningitis and all the severe cases of IPD occurred in non-Indigenous children under 2 years of age. Indeed, five (36%) of the IPD cases in non-Indigenous children under 2 years were classified as severe. The serotypes of the isolates from the 3 meningitis cases in 2001, and from three of the severe cases are included in 7vPCV. The two remaining severe cases were caused by serotype 6A; it is likely that cross-protection from the closely related serotype 6B (included in 7vPCV) also prevents disease caused by serotype 6A.⁶ In other words, there may be a case for extending the 7vPCV vaccination program to non-Indigenous children under 2 years of age, not just those in identified risk groups.

Although at-risk Indigenous adults have been targeted for vaccination with 23vPPV in north Queensland for over 5 years, Indigenous adults were over-represented among the adult cases of IPD. Indigenous adults constitute approximately 7 per cent of the total population in north Queensland aged 15 years or older, yet 38 per cent of the total IPD cases in this population were in Indigenous adults. This over-representation is a reflection of several factors: the very high risk of infection in this population,^{1,7} the inevitable vaccine failures and the suboptimal uptake of the vaccine among eligible Indigenous adults.

It is of concern that about one third of all cases of IPD in adults in 2001 could potentially have been prevented had those eligible for vaccination according to current National Health and Medical Research Council criteria³ been vaccinated. Many of the unvaccinated cases were elderly, and presumably the remainder saw a general practitioner on a not infrequent basis. Clearly more has to be done to promote 23vPPV in the private sector; it could, for example, be made freely available to all Australian adults 65 years and over.

Most episodes of IPD caused by pneumococci with some level of resistance to penicillin were in young children. In this group three serotypes were involved, all of which (6B, 9V, 14) are included in 7vPCV. Two cases were of particular concern. One of the isolates with an intermediate level of resistance (MIC=1.0 mg/L) caused a

severe illness (pneumonia with empyema) that led to the longest in-patient hospital stay (22 days) recorded among children with IPD in 2001. The only episode of IPD caused by a fully penicillin resistant isolate (MIC=2.0 mg/L) occurred in an immunocompromised (i.e. leukaemic) child, who was unvaccinated.

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