Differences in the patterns of Hib infection observed among Indigenous and non-Indigenous children in the pre-vaccination era were clearly documented in total disease incidence, age distribution, clinical manifestations and risk factors for disease. Since the implementation of the national vaccination strategy it is clear that incidence rates, and consequent morbidity and mortality, have dropped dramatically in both non-Indigenous and Indigenous populations, however Indigenous people continue to be at higher risk of invasive Hib disease than non-Indigenous people [1].

The pre-vaccination era

In the era preceding vaccination, Indigenous children, particularly those in rural areas, exhibited patterns of Hib infection similar to those documented in developing countries and among the most disadvantaged populations in developed countries [2] [3]. Meningitis and pneumonia were the most common manifestations, but epiglottitis was not reported among the Indigenous population [4]. Incidence estimates for Indigenous children from this period varied across geographic locations, but were consistently greater than those reported for non-Indigenous children [5]. In central Australia, incidence rates were higher than those reported anywhere else in the world [6]. Disease was typically contracted before the age of one [7] [3] and there was a greater risk of mortality and long-term morbidity [6] [8].
In contrast, non-Indigenous children demonstrated the epidemiological pattern observed in other developed countries, typically presenting with meningitis or epiglottitis. About half the cases occurred in children over 18 months of age. The case fatality rate was low [9]. Estimates of the incidence of Hib disease among non-Indigenous Australians under 5 years of age from various parts of Australia typically ranged between 25 and 60 per 100,000 population [9] [3] [10] [11] [12].

Factors contributing to Hib disease among Indigenous children

The high incidence rates and poor outcomes observed among Indigenous children in the pre-vaccination era suggest that other risk factors (additional to those typically associated with Hib infection) contributed to the burden of Hib disease suffered by the Indigenous population [3] [13]. There is evidence to suggest that the extremely high incidence of Hib disease observed among central Australian Aboriginal people prior to vaccination may have been due in part to their exposure to more virulent strains of Hib [14], or to genetic differences in susceptibility [7]. However, most of the factors that have influenced the risk of disease in Indigenous children have been associated with their poor social and environmental conditions.

Poor nutritional status is not uncommon among Indigenous children and may increase the risk of Hib infection. Low levels of breastfeeding among urban Indigenous populations are likely also to increase the risk. The poor living conditions frequently documented in Indigenous communities are considered ideal for the transmission of Hib, as they contribute to crowding and increase the risk of respiratory tract viruses that in turn facilitate infection with Hib [13] [15]. Other environmental conditions, such as exposure to woodsmoke, dust, and passive smoking, are thought also to compromise immunity and increase the susceptibility of Indigenous children to Hib infection [7]. Thus, a variety of factors may have contributed to the increased incidence of disease observed among Indigenous children in the pre-vaccination era.

In those in whom disease did develop, mucosal damage and/or increased mucosal colonisation may have facilitated invasion into the blood, the resultant bacteraemia and symptomatic disease [16].

Evidence of Hib disease among Indigenous children

Numerous studies reported high incidence rates of Hib disease among Indigenous children in the years immediately preceding the introduction of Hib vaccination. Except for reports about Hib meningitis, there were few reports, however, about the full impact of invasive disease.

Incidence

Before the introduction of immunisation, Indigenous communities had much higher incidence rates of Hib than non-Indigenous communities; some communities had rates as much as 10 times higher [5]. These incidence rates varied between States and Territories. Estimates ranged from a complete absence of the disease among Indigenous people in the ACT [17] to 115 per 100,000 in Qld [12], 225 per 100,000 in WA [10], 530 per 100,000 in the NT overall and 990 per 100,000 in central Australia [6]. The latter rate is higher than any reported internationally [14], and of an order of magnitude above and beyond that reported elsewhere in the nation [17].

Morbidity

Pneumonia, bacteraemia, and other forms of invasive Hib disease are all severe infections and may all require hospitalisation, but the higher incidence and serious outcomes associated with meningitis resulted in more detailed documentation of the short and long-term effects of this disease.

The short-term effects are exemplified in a study of bacterial meningitis among Indigenous children from the NT. The mean length of hospitalisation for Indigenous children was 15.5 days and significantly longer than the 9.9 days for non-Indigenous children [18]. The longer period of hospitalisation for Indigenous children could have been due to severity of illness, multiple diagnoses and/or subsequent complications. A Western Australian study of the long-term effects of Hib meningitis demonstrated a three-fold increased risk of severe sequelae (defined as severe or profound intellectual and/or physical disability, such as cerebral palsy) among Indigenous children [8]. All cases of severe sequelae in Indigenous children occurred among those from the remote north and east of the State, so delays in transportation, diagnosis and/or treatment may have contributed to the poorer outcomes.

Mortality

The mortality associated with invasive Hib disease among Indigenous children was low compared to that attributed to many other causes, and case fatality rates were minimised by the availability of evacuation services and intensive care facilities [6]. Despite these services, mortality rates for Hib were consistently higher for Indigenous children than for non-Indigenous children. In the NT, the case fatality rate of Hib meningitis in Indigenous children was 8.3% in the mid to late 1980s [6]. There were no deaths due to Hib meningitis among non-Indigenous children in the same period. Similar figures, ranging from 8.6% to 14%, were reported in a number of studies conducted in WA [8] [10] [19]. All Indigenous case fatality rates were significantly greater than those reported for non-Indigenous children.
The post-vaccination era

The medical and social importance of Hib infection generally, and within Indigenous populations particularly, resulted in the implementation in July 1993 of a fully-funded national infant program. Funding for a national ‘catch-up’ program targeting all children up to 5 years of age commenced in August 1993 [5][15]. Between 1993 and 2000, there were different vaccine schedules for Indigenous and non-Indigenous Australian children [13]. Since 2000, every Australian state and territory has achieved coverage rates above 90% for the primary and booster Hib vaccinations among Indigenous and non-Indigenous children [1].

Evidence of Hib disease among Indigenous children

Incidence of invasive Hib disease dropped markedly in both Indigenous and non-Indigenous populations after the vaccine was introduced [1]. The National Notifiable Diseases Surveillance System (NNDSS) documented a sharp decline from 617 notification of Hib among all Australian children in 1993-1994 to 167 in 1995-1996 [1]. This trend continued with notification numbers dropping within the range of 30 and 50 from 1999 to 2005. Between 1993 and 2000, notifications of Hib declined by 87% to 95% among Australian children below the age of five [5].


Table 1. Invasive Hib disease incidence and incidence rate ratios, by Indigenous status, 1993-2005

<table>
<thead>
<tr>
<th>Year of diagnosis</th>
<th>Indigenous</th>
<th>Non-Indigenous</th>
<th>Rate ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Rate per 100,000</td>
<td>n</td>
</tr>
<tr>
<td>1993-1994</td>
<td>35</td>
<td>4.5</td>
<td>582</td>
</tr>
<tr>
<td>1995-1996</td>
<td>11</td>
<td>1.3</td>
<td>156</td>
</tr>
<tr>
<td>1997-1998</td>
<td>11</td>
<td>1.3</td>
<td>81</td>
</tr>
<tr>
<td>1999-2000*</td>
<td>9</td>
<td>1.4</td>
<td>41</td>
</tr>
<tr>
<td>2000-2001*</td>
<td>4</td>
<td>0.6</td>
<td>34</td>
</tr>
<tr>
<td>2002-2003</td>
<td>15</td>
<td>1.6</td>
<td>35</td>
</tr>
<tr>
<td>2004-2005</td>
<td>5</td>
<td>0.5</td>
<td>27</td>
</tr>
</tbody>
</table>

Source: [1]
Notes:
* These are 18 month, instead of 12 months, periods

While incidence of invasive Hib disease has declined sharply among Indigenous people, Indigenous populations continue to be at higher risk of contracting Hib than non-Indigenous populations (Table 1) [1]. During 1993-1994, Indigenous people were 2.7 times more likely to be notified with invasive Hib than non-Indigenous people. This rate ratio has increased to 7.5 in 2004-2005, with the highest rate ratio of 17.5 in 2002-2003. The increased prevalence of invasive Hib among Indigenous Australians may be due to low-level nasopharyngeal colonisation (i.e. that Hib may be present but undetected in an individual’s nose and throat) which may be passed to others. It is likely that housing conditions, including overcrowding, and other environmental factors play a role in the increased prevalence among Indigenous people.

Deaths from Hib disease has also decreased. There were 16 deaths recorded in NNDSS between January 1995 and June 2000 for all Australian children, and seven deaths from June 2000 to December 2005 [1]. The fatality rate was just over 5% for both time periods. During 2005 there were no fatalities reported.

The persistence of Hib disease

Despite the rapid decrease in the number of reported Hib cases, Hib disease persists and invasive disease continues to occur [1]. Between 1997 and 2005, a total of 429 notifications of invasive Hib were reported to the NNDSS, resulting in 23 deaths (slightly over 5% of notifications, except for 2005 when no deaths were reported).

Almost 60% of notified Hib cases could be prevented [1]. The preventable cases occurred in children who were either not immunised or not fully immunised. Until all children are immunised in a timely manner there will continue to be preventable cases of invasive Hib disease.

Vaccine failures are accountable for 28 cases of invasive Hib in Australia between 2000 and 2005 [1]. Ongoing surveillance is therefore necessary to evaluate the continuing efficacy of the Hib vaccination program.

References

The Australian immunisation handbook (2008) National Health and Medical Research Council


The Australian Indigenous HealthInfoNet is an innovative Internet resource that contributes to ‘closing the gap’ in health between Indigenous and other Australians by informing practice and policy in Indigenous health.

Two concepts underpin the HealthInfoNet’s work. The first is evidence-informed decision-making, whereby practitioners and policy-makers have access to the best available research and other information. This concept is linked with that of translational research (TR), which involves making research and other information available in a form that has immediate, practical utility. Implementation of these two concepts involves synthesis, exchange and ethical application of knowledge through ongoing interaction with key stakeholders.

The HealthInfoNet’s work in TR at a population-health level, in which it is at the forefront internationally, addresses the knowledge needs of a wide range of potential users, including policy-makers, health service providers, program managers, clinicians, Indigenous health workers, and other health professionals. The HealthInfoNet also provides easy-to-read and summarised material for students and the general community.

The HealthInfoNet encourages and supports information-sharing among practitioners, policy-makers and others working to improve Indigenous health – its free on line yarning places enable people across the country to share information, knowledge and experience. The HealthInfoNet is funded mainly by the Australian Department of Health and Ageing. Its award-winning web resource (www.healthinfonet.ecu.edu.au) is free and available to everyone.