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Project: The impact of vaccination on hospital admission rates for bacterial meningitis in New Zealand children

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Introduction:

Streptococcus pneumoniae (*S. pneumoniae*), *Haemophilus influenzae* type B (Hib) and *Neisseria meningitidis* (*N. meningitidis*) are the most common causes of bacterial meningitis, septicaemia and epiglottitis in developed countries. These diseases, cumulatively referred to as “invasive bacterial diseases”, can lead to severe illness and death in extreme cases. However, they are vaccine-preventable.

Since the early 1990s, three vaccines have been introduced onto the National Immunisation Schedule to prevent invasive bacterial disease in New Zealand children: Hib conjugate vaccine (introduced in 1994), MeNZB vaccine (in our schedule from 2004 to 2006) and pneumococcal conjugate vaccine (PCV; introduced in 2008). Long-term trends of hospital admission rates for these infections have not been reported and the impact of the introduction of these vaccines has not been analysed over a long-term timeframe. This project looks at the trends of hospital admission rates for these infections in New Zealand children under the age of 15 across the last 24 years (from 1991 to 2014).

Aim:

1. To analyse the impact of the three vaccines (Hib, MeNZB, PCV) on hospital admission rates for New Zealand children under the age of 15 across the last 24 years.
2. To compare the rates calculated from the NMDS data to those calculated from ESR notifications data.
3. To compare hospital admission rates for the invasive bacterial diseases and the impact of the three vaccines for Maori and non-Maori patients.

Method:

We have compared the two ways in which these infections are reported in New Zealand: data from National Minimum Datasets (NMDS), which report hospital admissions using an international coding system called “International Statistical Classification of Diseases and Related Health Problems” (ICD) and data from the Environmental Science and Research Institute (ESR) of laboratory-confirmed notified cases of these diseases. NMDS data for hospital admissions with the ICD codes for meningitis and septicaemia due to Hib, *N. meningitidis* and *S. pneumoniae* and acute epiglottitis from 1991 to 2014 were analysed. These datasets included information on the patients’ ethnicity, age at admission and year and month of admission.

We calculated rates from both the NMDS data and the ESR data using the New Zealand Census data as our population. We then age-standardised these rates. Hospital admission rates were calculated separately for Maori patients for each of the New Zealand Census years: 1996, 2001, 2006 and 2013.

Results:

Hospital admission rates for Hib disease dropped by 92% following the introduction of Hib vaccine, from a peak of 21 cases per 100 000 children in 1991 to 1.7 cases per 100 000 in 2014.

Hospital admission rates for meningococcal disease dropped by 94% from a peak of 57 cases per 100 000 in 1997 to 3.6 per 100 000 in 2014 and remained low after stopping the vaccine in 2006.

Hospital admission rates for invasive pneumococcal disease dropped by 81% from a peak of 14 cases per 100 000 in 2001 to 2.6 cases per 100 000 in 2014. Hospital admission rates were highest in infants under the age of 1 (peak of 80 cases per 100 000 in 2001).

Hospital admission rates were very similar to ESR notifications rates, except for invasive pneumococcal disease, where there was a disparity observed (ESR rates were higher than hospital admission rates).

Hospital admission rates were higher in Maori children compared to the total paediatric population for both meningococcal and pneumococcal disease in the Census years. However, Maori rates were very similar to the total rates for Hib disease.

Conclusion:

Hib conjugate vaccine was very effective in reducing hospital admission rates of invasive Hib disease, as was PCV. However, the impact of MeNZB on the declining rates of meningococcal disease in New Zealand is inconclusive, as rates were declining prior to its introduction and continued to decline following its cancellation from the National Immunisation Schedule. ESR notifications rates compared very closely to hospital admission rates for all invasive bacterial diseases, except for invasive pneumococcal disease, for which there was a disparity between the two datasets. For Hib disease, hospital admission rates for Maori patients were very similar to those of the total paediatric population following the introduction of Hib conjugate vaccine. For meningococcal disease, hospital admission rates were considerably higher amongst Maori children compared to the total paediatric population, in all Census years. For pneumococcal disease, hospital admission rates were higher amongst Maori children compared to the total paediatric population, but the disparity between the rates of the two populations decreased following the introduction of PCV in 2008.