Controlling pertussis in New Zealand by improving our immunisation rate

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Prevention of disease by immunisation has been recognised by the World Bank as one of the public health investments that provides the greatest health gain per dollar spent. The success with which New Zealand achieves control of vaccine preventable diseases is one of the key indicators of the performance of our health care system.

Unfortunately, included among the many things with which New Zealand will greet the new millennium will be yet another pertussis epidemic. Pertussis cases have been reported from several regions of New Zealand over the past twelve months. Based upon experience gained over the past 30 years an increase in cases of pertussis in late winter and spring heralds the beginning of an epidemic which will affect the country for the next eighteen to 24 months.

How does pertussis epidemiology in New Zealand compare with other developed countries?

Many other countries have pertussis epidemics. Although the number of reported cases in developed countries has declined markedly since the introduction of pertussis vaccines, epidemics continue to occur. Epidemics have been reported in recent years in Australia and the USA. Several Canadian provinces have reported increased numbers of pertussis cases during the 1990s. While being substantial and, in Australia, prolonged over several years with a number of deaths, these epidemics have been many magnitudes smaller in size than those prior to the introduction of pertussis immunisation. They have been a cause for concern though, because they represent a reversal of a trend for a steady decline in pertussis notifications over the preceding 20 to 30 years.

Over the time period when it has become less prevalent in many developed countries such as Canada, the UK and the USA, pertussis has remained prevalent in New Zealand. Based upon hospitalisation data there has been no decrease in the number of children hospitalised with pertussis over the past 30 years (Figure 1). When comparisons are made between New Zealand, the UK and the USA for rates of bacteriological isolation of Bordetella pertussis, of pertussis notifications and of hospitalisations for pertussis, it is apparent that over the past 20 years New Zealand has had five to ten times as much pertussis as either of these two countries.

Are our pertussis vaccine, immunisation schedule and coverage comparable to other countries?

Our immunisation schedule is comparable to those elsewhere. New Zealand has a four dose schedule with immunisations at ages six weeks, three months, five months and fifteen months. The UK has a three dose schedule with doses given at ages two months, three months and four months. The USA has a five dose schedule with five doses given at ages two, four and six months, twelve to eighteen months and four to six years.

The whole cell pertussis vaccine currently used in New Zealand has been shown to be very effective. During the 1996 pertussis epidemic, the reported vaccine effectiveness was 88% for five to fourteen month olds and 80% for fifteen month to four year olds. Of whole cell vaccines currently available, the one used in New Zealand is more effective than many others and at least as effective as the newer acellular pertussis vaccines.

The primary reason for our excessive disease is the low immunisation rate. According to the UNICEF report “The State of the World’s Children 1998”, of the 193 countries listed, 102 had higher rates than New Zealand for pertussis immunisation of their children at age one year. Countries with higher immunisation rates include Azerbaijan, India, Iran, Iraq, China, Colombia, Gambia and Kazakhstan. When the same statistics are examined for the Pacific region
the relative performance of New Zealand is even worse, with the Cook Islands being the only other Pacific nation with a lower immunisation rate (Table 1).

<table>
<thead>
<tr>
<th>Country</th>
<th>Immunisation rate</th>
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<tbody>
<tr>
<td>New Zealand</td>
<td>84%</td>
</tr>
<tr>
<td>Tuvalu</td>
<td>87%</td>
</tr>
<tr>
<td>Tonga</td>
<td>95%</td>
</tr>
<tr>
<td>Samoa</td>
<td>95%</td>
</tr>
<tr>
<td>Fiji</td>
<td>97%</td>
</tr>
<tr>
<td>Niue</td>
<td>100%</td>
</tr>
<tr>
<td>Samoa</td>
<td>95%</td>
</tr>
<tr>
<td>Cook Islands</td>
<td>75%</td>
</tr>
</tbody>
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National trends in immunisation rates need to be examined. From 1990 to 1996 the immunisation rate in New Zealand for the three infant doses of pertussis vaccine increased from 81% to 84%. Over this same time period, the comparable immunisation rates in the UK increased from 91% to 94% and in the USA from 88% to 94%. However, the increase in New Zealand has been slower than both the UK and USA. These differences in immunisation rates may seem small. But small increases in pertussis immunisation coverage above 85% result in large reductions in disease prevalence. Whereas pertussis vaccine uptake rates of 80% to 90% reduce pertussis notifications to approximately one tenth of that before immunisation was introduced, vaccination rates of 95% reduce notifications to approximately one hundredth.

How do we measure immunisation coverage in New Zealand?
Over the past 20 years it has been difficult to know precisely what is the immunisation rate in New Zealand. Figure 2 provides a best guess for completed immunisation. It should be noted that only one data point on this graph is based upon a coverage survey method recommended by the World Health Organisation. The remainder are based upon regional surveys and immunisation benefit claims data. If one draws a linear trend line through these points we estimate that by the year 2010 the immunisation rate should be greater than 95%.

Figure 2. Estimates of percentage of children fully immunised against pertussis in New Zealand.

More detailed immunisation information has recently become available through the national immunisation benefit claims data but immunisation claims data, can provide only a measure of receipt of each vaccine, ie what percentage of children have received each of the four doses of Diphtheria-Tetanus-Pertussis-Haemophilus vaccine (DTPH). It cannot inform on what percentage of children received all four DTPH doses or if they were given on time. Furthermore, the immunisation benefits claim data set is incomplete. Capitated practises do not usually make immunisation benefit claims. The proportion of capitated practices and the availability of immunisation data from them varies considerably around the country.

Despite these deficiencies, these data are the best available and provide a frequency of measurement that can be used to describe recent trends in detail. The data for receipt of the third dose of DTPH for the past four years are summarised in Figure 3. When a linear trend line is superimposed upon the data there is a clear decline in immunisation rates evident over time.

Figure 3. Percentage of New Zealand birth cohorts receiving the third dose of Diphtheria-Tetanus-Pertussis-Haemophilus (DTPH) vaccine based upon Health Benefits Claims data.

Why is immunisation coverage in New Zealand failing?
Three factors have contributed: biased media reporting, the anti-immunisation movement and the lack of quality in our primary health care system.

Mansoor et al, who originally reported this downward trend attributed it, at least in part, to media reports that denied confidence in immunisation. Examples included media prominence given to the claimed link between Measles-Mumps-Rubella vaccine (MMR) and Crohn’s Disease, but the lack of reporting of subsequent research demonstrating no such association. Similarly, in 1998 prominent media coverage was given to a report linking MMR and autism. The accompanying editorial outlining methodological flaws in the study and the subsequent studies that failed to show such a link, received no coverage.

The whole cell pertussis vaccine has generated more anti-immunisation sentiment than any other vaccine. In a number of countries (Sweden, Japan, UK, West Germany and Australia) this anti-immunisation sentiment has been sufficient to disrupt immunisation. Other countries sustain high rates of whole cell pertussis vaccine coverage with little or no disruption by anti-immunisation movements. The incidence of pertussis is ten to 100 times higher in countries where disruption has occurred, compared with countries where no disruption has occurred.

The most significant contributor is the lack of quality of our primary health care system, in terms of its ability to deliver immunisation to the whole population. We have a primary care system where any child can have zero, one or several primary care providers. Children do not have to register with a single provider. One primary care provider will not necessarily know whom the other providers are and there is no standardised means by which immunisation information can be shared between providers. There are no incentives for the parent or the primary care provider to encourage immunisation. In fact based upon a recent analysis from Wellington it costs a general practitioner (GP)
How has immunisation coverage been improved in other developed countries?

Other countries found themselves in the same situation that we are in today. Following a large measles epidemic in 1990 the USA identified the need for a comprehensive review of their immunisation delivery system. There were four key components to their strategy to improve immunisation coverage: increased national funding for immunisation, development of national standards for immunisation delivery, establishment of a national immunisation coverage system, and increased support for families, communities and health professionals, based upon a greater understanding of the barriers to immunisation and interventions that increase immunisation rates.

What were the effects of these strategies? Goals were met in terms of reduction in immunisation preventable disease with eradication of indigenous cases of measles reported in October 1999. Goals for immunisation coverage targets were met and a comprehensive sustainable immunisation delivery system is in place in many parts of the country. Immunisation rates in USA for the three doses of pertussis vaccine scheduled to be given in infancy are now at 95%.

In response to their recent large pertussis epidemic which killed a number of infants, Australia developed a national immunisation strategy. In 1997, the Minister for Health and Family Services developed the seven-point plan to increase the proportion of fully immunised children in Australia. This included monetary incentives for parents and GPs, a measles eradication strategy, a range of educational initiatives, school entry legislation and a national immunisation coverage data system. The effect has been dramatic. The rate for full immunisation with DTPH vaccine at age twelve months has increased from 81% in December 1997 to 88% in September 1999.

How can pertussis control in New Zealand be improved?

Improving control of pertussis in New Zealand should not be viewed as some sort of mystery. To improve control, we must increase the percentage of children who receive four doses of pertussis vaccine on time. This can be achieved by doing what Australia and USA have done. The detail will be a little different but the fundamentals must be the same: finance vaccine delivery; improve delivery at a practice level; monitor delivery and vaccine preventable disease at a national level; inform, educate and support families and health providers; and understand more about what are the barriers and what are the interventions to overcome these barriers.

The cornerstone to this activity is the development of a national information system that identifies not only all of the children who are due immunisations but also the health denominator(s) who is/are responsible for immunising each child. Such a system will establish both the denominator that would allow us to accurately define our immunisation rate and the professional accountability that is required to ensure 95% or more of our children are immunised on time.

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