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IMMUNISATION: A PUBLIC HEALTH SUCCESS

GUEST EDITORIAL

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Since the introduction of childhood vaccination for diphtheria in 1932—and the widespread use of vaccines to prevent tetanus, pertussis (whooping cough), and poliomyelitis in the 1950s, and measles, mumps and rubella in the 1960s—deaths in Australia from these vaccine preventable diseases (VPDs) have declined by more than 99 per cent, despite the Australian population increasing 2.8-fold. This striking reduction in deaths, and in the incidence of these diseases, has been closely associated with the introduction of specific vaccination programs (Table 1, Figure 1).[1] In fact, over this time vaccinations for diphtheria, pertussis, and tetanus have saved a total of at least 70,000 Australian lives and prevented untold morbidity. Poliomyelitis and measles vaccinations have prevented a further 8,000 deaths.

Recently, additional infections have become preventable by vaccination; for example, *Haemophilus influenzae* type b disease (Hib), hepatitis B, varicella, invasive pneumococcal disease and meningococcal disease. Hib causes meningitis, pneumonia and other life-threatening conditions. The introduction of Hib vaccine in 1993 was followed by an immediate fall in the incidence of the disease (Figure 2), and it is estimated that between 1993 and 2000 more than 100 deaths have been prevented in children under the age of five years.[1]

In contrast to those diseases for which there are specific therapeutic agents—such as antibiotics, antivirals, or antihypertensives—many VPDs, especially those caused by viruses (for example: poliomyelitis, measles, mumps, rubella, and hepatitis A) have no specific drug management. Even where specific therapy is available, the emergence of drug-resistant strains of some organisms (for example, Hib and pneumococcal infection) is a growing problem. Therefore, prevention is especially important.

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TABLE 1

DEATHS FROM DISEASES COMMONLY VACCINATED AGAINST, AUSTRALIA 1926–2000*

Period	Diphtheria	Pertussis	Tetanus	Poliomyelitis	Measles†	Population estimate
1926–1935	4073	2808	879	430	1102	6 600 000
1936–1945	2791	1693	655	618	822	7 200 000
1946–1955	624	429	625	1013	495	8 600 000
1956–1965	44	58	280	123	210	11 000 000
1966–1975	11	22	82	2	146	13 750 000
1976–1985	2	14	31	2	62	14 900 000
1986–1995	2	9	21	0	32	17 300 000
1996–2000	0	9	5	0	0	18 734 000

* Sources: Feery B. One hundred years of vaccination. *N S W Public Health Bull* 1997;8:61–3. Feery B. Impact of immunisation on disease patterns in Australia. *Med J Aust* 1981;2:172–6. Deaths recorded for 1966–1975 and 1996–2000 updated with data provided by ABS and the Australian Institute of Health and Welfare Mortality Database.

† Excludes deaths from subacute sclerosing panencephalitis.

Indicates decade in which community vaccination started for the disease.

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While many VPDs such as diphtheria, tetanus, and poliomyelitis, are presently controlled by vaccination and are no longer feared by the Australian community, experience overseas has shown that these VPDs can re-emerge if vaccination rates are not maintained. This happened in the newly-independent states of the former Soviet Republic when, between 1990 and 1997, over 150,000 cases of diphtheria occurred and caused more than 5,000 deaths.[2]

So, while Australia continues to control VPDs with high vaccination rates, the threat of outbreaks due to imported cases (for example, of poliomyelitis or measles) remains low. The community must, however, continue to maintain high participation in vaccination programs (currently close to 95 per cent of one-year-old and 90 per cent of two-year-old children are fully immunised),[3] with the aim that some of these diseases will ultimately be eliminated worldwide. This is anticipated for poliomyelitis by 2005 and for measles in the subsequent decade.[4]

In Australia, vaccination coverage has improved significantly over the past five years for all diseases, and is comparable to or better than most developed countries. However, pertussis continues to claim infant lives and its ultimate control will require innovative strategies.

NEW VACCINES

Prevention of diseases such as varicella and pneumococcal infection in childhood requires the routine use of vaccines that are now available in Australia but which are 10 or more times more expensive than the vaccines used for the prevention of the traditional VPDs. The cost-benefit ratio will be less for these vaccines and the institution of community-wide programs will require careful economic analysis and priority setting based on the burden of disease (Table 2).

Over the next 10–20 years, a portfolio of new vaccines will become available to prevent infectious diseases as diverse as neonatal sepsis, peptic ulcer and carcinoma of the uterine cervix.[5] This availability will greatly expand the diseases considered to be vaccine preventable.

IMMUNISATION ADVERSE EVENTS

As the traditional VPDs become less frequent, concerns about the real or perceived side-effects of vaccination appear relatively more important. Most of these concerns are readily addressed from a scientific standpoint, but these facts do not always provide individuals with the reassurance they seek. For this reason, it is essential that Australia uses the safest vaccines available and that all serious vaccine-related adverse events are reported promptly and assessed.

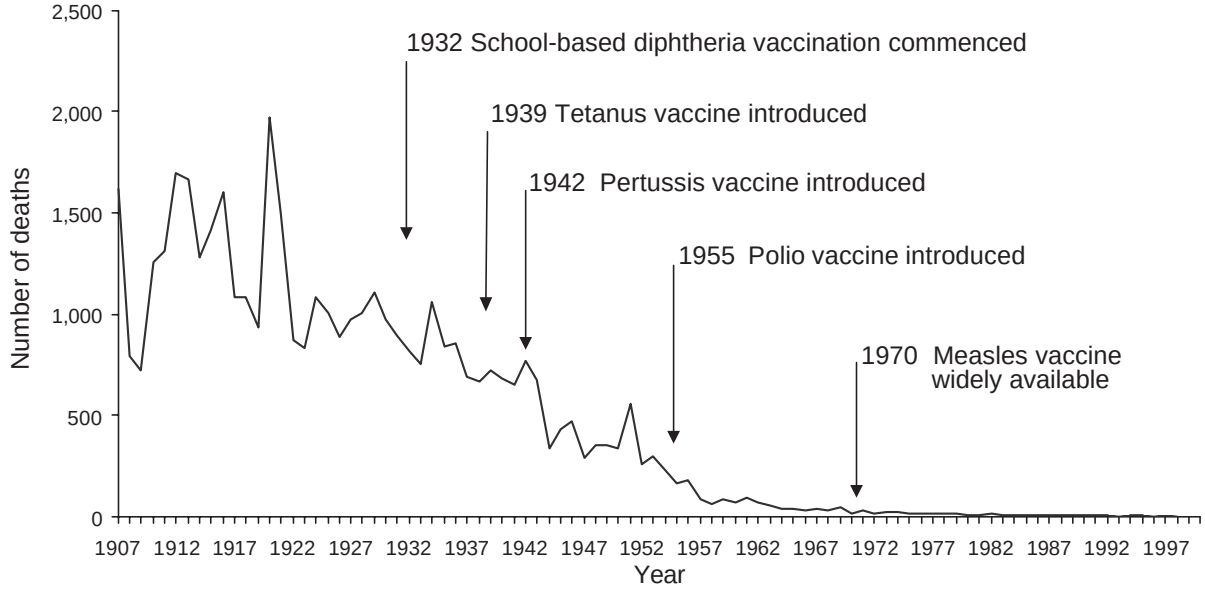
SURVEILLANCE

To evaluate the likely benefits of the introduction of the newer vaccines into routine vaccination programs, it is important to have reliable systems of regional and national surveillance to assess the burden of disease (deaths, disabilities and costs) and the effects of the proposed program. Good surveillance is also required to monitor both the ongoing effects of existing programs and any vaccine-related adverse events.

Surveillance of VPDs is difficult because Australia is a large continent, the population is scattered, and there are jurisdictional differences. Serosurveys can measure population immunity to a range of VPDs with sufficient accuracy to monitor trends in vaccination uptake, evaluate interventions and predict outbreaks. The first Australian national serosurveys have been carried out recently by the National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases (NCIRS) and have proved valuable in monitoring changes in measles and rubella immunity in response to the national Measles Control Campaign.[6] The serosurveys were also useful for assessing the need for vaccination programs for varicella, hepatitis A, and hepatitis B. The

FIGURE 1

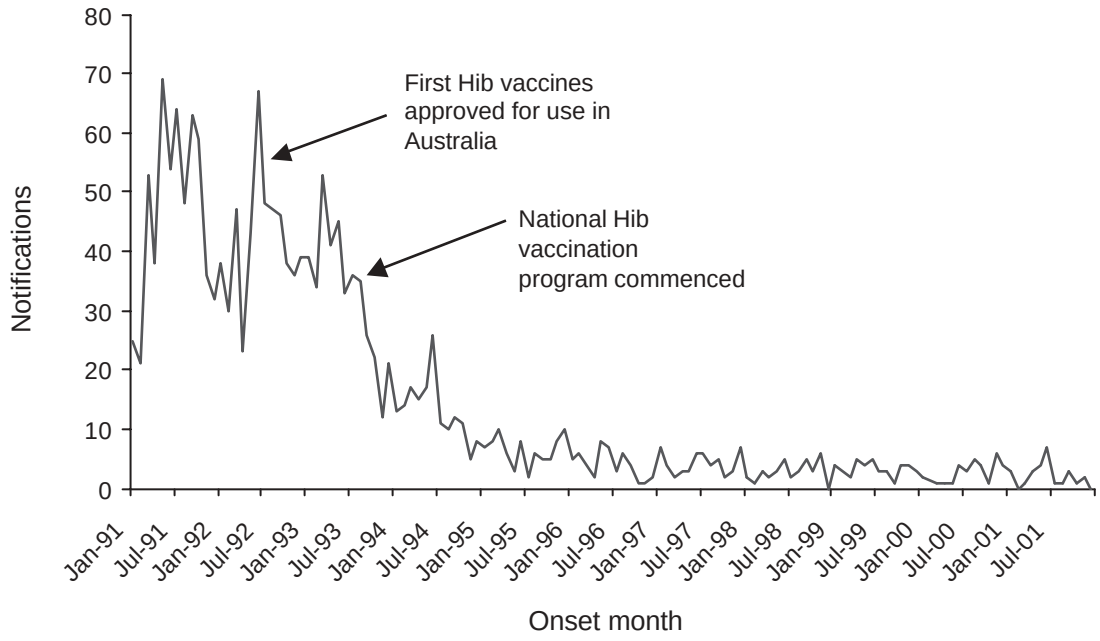
DEATHS FROM LEADING VACCINE PREVENTABLE DISEASES, AUSTRALIA, 1907–2000: INCLUDES MEASLES, PERTUSSIS, DIPHTHERIA, TETANUS AND POLIO



Source: Australian long-term trends in mortality. Canberra: Australian Institute of Health and Welfare; 2002.

FIGURE 2

NOTIFICATIONS OF INVASIVE HIB DISEASE IN AUSTRALIA, 1991–2001



Source: Communicable Diseases Network—Australia New Zealand—National Notifiable Diseases Surveillance System, personal communication.

TABLE 2

AVERAGE ANNUAL MORBIDITY AND MORTALITY FROM VACCINE PREVENTABLE DISEASES IN AUSTRALIA FOR THE TWO YEARS 1998–1999 TO 1999–2000*

Disease	Hospitalisations (average no.)		Hospitalisation rate/100 000 (average rate)		Hospital bed days (average no.)	Neurological complications** (average no.)	Deaths‡ (average no.)	
	Age		Age				Age	
	0–4 yrs	All ages	0–4 yrs	All ages			0–4 yrs	All ages
Diphtheria	0.5	1	0.0	0.0	3	¶	0	0
Hib§	37	54	2.9	1.1	260	39	0	0.5
Hepatitis A	20	716	1.6	3.8	4162	5.5	0	1.5
Hepatitis B‡	1.5	172	0.1	0.9	898	2.5	0	15
Influenza	902	4295	70.6	22.8	28758	¶	1.5	69
Measles	27	73	2.2	0.4	242	3.5	0	0
Meningococcal disease	293	783	23.0	4.2	6002	384	10.5	35
Mumps	10.5	56	0.8	0.3	247	2	0	1
Pertussis	239	372	18.7	2.0	2209	¶	0.5	0.5
Pneumococcal disease (invasive)#	291	851	22.8	4.5	9069	146	5	17
Polio‡	0	1.5	-	0.0	||	¶	0	0
Rubella	16.5	36	1.3	0.2	129	2.5	0	0
Tetanus	0.5	32	0.0	0.2	529	0	0	1
Varicella	783	1863	62.1	9.9	7823	48.5	0.5	7

* Hospitalisation data, Australian Institute of Health and Welfare (AIHW), July 1998–June 2000; and death data, AIHW National Mortality Database, January 1999–December 2000.

‡ Includes only principal diagnosis.

§ Data for *Haemophilus influenzae* disease include only cases aged 0–14 years of age.

|| These results are not presented due to limitations of the data.

¶ ICD-10-AM codes for these diseases do not specify neurological complications.

** Neurological complications include meningitis, encephalitis and hepatic coma.

†† Includes deaths from acute and chronic hepatitis B infection.

Includes pneumococcal meningitis and septicaemia only.

Australian Childhood Immunisation Register, established in 1996, is a unique initiative providing a valuable means of measuring vaccination coverage.[7]

RESEARCH

Australia has a strong record in vaccine research. At the present time, basic and clinical research on VPDs and vaccines takes place in a number of academic centres throughout the country, including the Collaborative Research Centre for Vaccine Technology. The establishment in 1997 of the National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases (NCIRS), supported by the Commonwealth Department of Health and Ageing and the NSW Department of Health, has strengthened and helped integrate VPD surveillance, research and evaluation.

THIS ISSUE OF THE *NSW PUBLIC HEALTH BULLETIN*

This and the April issue of the *NSW Public Health Bulletin* highlight some of immunisation's successes and challenges. In this issue, there is a brief account of the history of immunisation in Australia; we see how data from the Australian Childhood Immunisation Register is used to map coverage and conscientious objectors in NSW; how mathematical modelling can be used to predict epidemics; we look at hepatitis B vaccination coverage in pre-adolescents; we describe the work of an immunisation adverse events clinic and summarise the current status of adverse events reporting.

The first use of vaccines in Australia commenced with smallpox in 1804. As you read these two issues of the *Bulletin*, pause a moment to consider how the public health community might view their content 200 years from now.

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TEARS OFTEN SHED

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In seeking a theme for this Oration, I was drawn to a small volume on my bookshelf, given to me by Sir Lorimer Dods, who was the first Professor of Child Health in Australia. The book, entitled *Tears often shed*, was written by Dr Bryan Gandevia and was published in 1978.[1]

The book tells the history of child health in Australia from the first European settlement in 1788, and it emphasises the fact that the health of children very accurately reflects the living conditions of the entire community. As Gandevia writes: 'Children, their health and welfare, their morbidity and mortality, necessarily offer a most sensitive reflection of the social and physical environment in which they find themselves.' In tracing the history of child health in Australia from the time of the first penal settlement at Port Jackson, Gandevia noted the tears that 'were often shed' by parents of infants dying of communicable diseases which are now prevented by vaccination.

Today the Australian community is remarkably free of deaths from measles, diphtheria, tetanus, poliomyelitis and congenital rubella, all of which caused significant morbidity and mortality until 50 years ago. New vaccines are providing a wider spectrum of disease protection than ever before. In contrast, about two million children die each year globally from infections that could be prevented by vaccines that are currently available in the Australian vaccination schedule. However, as the diseases they prevent disappear, vaccines are more and more in the news, sometimes unfairly reported. Vaccine safety is of importance to all. Scientific rigour therefore must always inform the processes leading to the development, approval and introduction of new vaccination programs.

THE COLONIAL ERA

The long voyage from England to Botany Bay was one that, even in the late 1780s, was almost too much to contemplate. Smallpox, cholera and tetanus were common on board the transport ships and, in the colony, sexually transmissible infections were rife. By 1800 there were about 1,000 children in the settlement—almost half that number were orphans. Infant mortality was 11 per cent, 20 times higher than today's rate of 5.2 per 1,000, and 10 per cent of infant deaths were due to syphilis. Pertussis appeared for the first time about 1827, measles and diphtheria a few years later; the mortality from each was very high, especially from diphtheria (estimated to be about 150 per 100,000 population). There was a very large outbreak of measles in Sydney in 1880, by which time children's hospitals had been established in Melbourne, Brisbane, Adelaide and Sydney. However, child mortality remained high and Henry Lawson, a popular poet of the time, poignantly drew attention to this state of affairs:

Our first child took—a cruel week in dyin', …
I've pulled three through and buried two
Since then—and I'm past carin'.

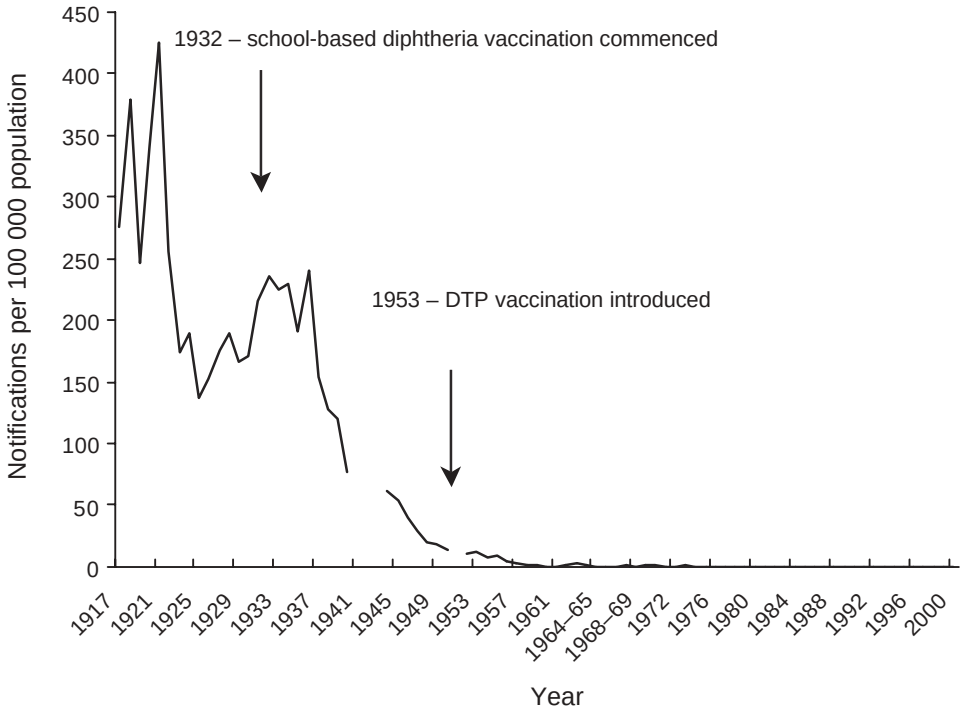
INTRODUCTION OF VACCINES

The first use of vaccines in Australia commenced with smallpox in 1804. It was not until the 1890s that plague and typhoid vaccines and diphtheria antiserum became available.[2]

A major milestone in the early 20th century was the establishment, by the Commonwealth Government, of the Commonwealth Serum Laboratories (CSL) in Melbourne in 1916. CSL rapidly commenced production of vaccines for typhoid, cholera, plague, smallpox and diphtheria antitoxin. In the 1920s childhood vaccination with a combined toxin–antitoxin vaccine resulted in a marked fall in the incidence of diphtheria (Figure 1), but this vaccine was withdrawn following a serious incident due to bacterial contamination of a multidose container of the vaccine in Bundaberg, Queensland.[2] Following the introduction of school-based programs (using diphtheria toxoid vaccine in single-dose vials) which became widespread by the mid-1930s, there was a further marked decline in diphtheria. Infant vaccination for diphtheria was not routine until the early 1940s, and emergency tracheostomy for diphtheria was still commonly seen in children's hospitals through to the early 1950s.

FIGURE 1

DIPHTHERIA NOTIFICATIONS, AUSTRALIA, 1917–2000



Source: Hall R. Notifiable disease surveillance, 1917 to 1991. *Commun Dis Intell* 1993;17:226–36. Updated with NNDSS data 1992–2000.

The late 1940s and early 1950s saw large outbreaks of poliomyelitis, many polio deaths and many young people handicapped for life. The introduction of inactivated poliovirus vaccine (IPV—Salk vaccine) in 1956 resulted in an immediate fall in the incidence of polio (Figure 2). Australia did not use live oral poliomyelitis vaccine (OPV—Sabin) until 1966.[3]

Another important milestone for Australia in the first half of the 20th century was the discovery, by the Sydney ophthalmologist Norman Gregg in 1941, that rubella in pregnancy could cause congenital malformations.[4,5] After the introduction of rubella vaccination in 1970, there was a rapid fall in the incidence of congenital infection: up to 200 cases had occurred nationally in some outbreak years. As a result of vaccination, there have been no cases of congenital rubella syndrome in Australia over the past five years, apart from one recent imported case (Forrest JM, personal communication).

In the 1990s, Australia was fortunate to have the early introduction of *Haemophilus influenzae* type b (Hib) vaccine. Hib infection was responsible for more than one-third of the cases of bacterial meningitis in children. It also caused epiglottitis, cellulitis, other localised infections and the aggressive early meningitis seen so extraordinarily frequently in Aboriginal and Torres Strait Islander children. Hib disease rapidly disappeared following the introduction of vaccination.[6]

CONTEMPORARY AUSTRALIA

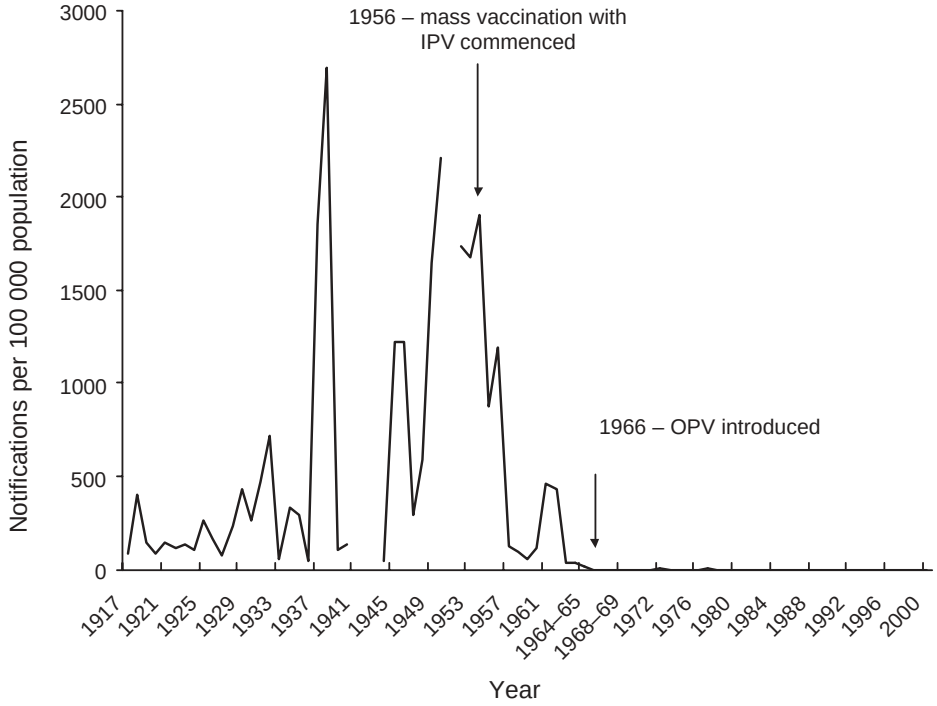
By the mid-1990s infant mortality had reached a rate (5.2 in 1000) only dreamt of by paediatricians such as Sir Lorimer Dods. The new generation of parents had no experience of the outbreaks and fears that surrounded polio, diphtheria and tetanus. Immunisation coverage had plateaued, and warning signals were seen in small but important outbreaks of vaccine-preventable diseases. About the same time there was a rebirth of interest in alternative therapies and anti-vaccination sentiment.

This situation set the scene for the Commonwealth's *Immunise Australia* program: the Australian Childhood Immunisation Register (ACIR) was established, parent and provider incentives were offered, the Measles Control Campaign was accomplished and the National Centre for Immunisation Research and Surveillance (NCIRS) was established.

These initiatives have been very successful. Australia now has the highest immunisation coverage ever recorded; the lowest rates of measles, rubella and Hib disease; and the lowest number of deaths from the diseases for which children are routinely vaccinated.[6,7] Studies of coverage indicate that 90–95 per cent of children receive all scheduled vaccines and that parent incentives have influenced at least four or five per cent to make sure their children are up to date with vaccination.[7] But two to three per cent of parents have serious concerns about or disagree

FIGURE 2

POLIOMYELITIS NOTIFICATIONS, AUSTRALIA, 1917–2000



Source: Hall R. Notifiable disease surveillance, 1917 to 1991. *Commun Dis Intell* 1993;17:226–36. Updated with NNDSS data 1992–2000.

IPV: Inactivated poliovirus vaccine (Salk) OPV: Oral poliomyelitis vaccine (Sabin)

with immunisation. It is not always easy to address these concerns—in doing so it is important to listen and respond to genuine concerns; to anticipate public reaction to new initiatives; to know the facts; to use graphic illustrations and convincing spokespersons; and to remember that statistics are frequently misunderstood.[8]

GLOBAL HEALTH

In contrast to Australia, communicable diseases, many of them preventable, cause 25 per cent of deaths worldwide and 63 per cent of child deaths. Globally, acquired immunodeficiency syndrome (AIDS), tuberculosis (TB) and malaria cause more than 13 million deaths each year. There is a great need to establish a regional vaccine manufacturing capacity. We need a huge increase in the availability of hepatitis B, Hib, and pneumococcal vaccines, and the development of new or more effective vaccines for measles, TB, rotavirus, malaria, human immunodeficiency virus (HIV) and meningococcal serogroup A infection.

Internationally, the polio elimination program is almost complete. In 2001 there were fewer than 500 cases notified to the World Health Organization (WHO). WHO recognises that we need better coverage for the routine Expanded Program for Immunization (EPI) vaccines, better infrastructure, waste disposal, cold chain (the 'chain of cold' required to keep vaccines effective from manufacture to delivery) and attention to adverse events. This goal requires finance, collaboration and technology transfer.

Vaccines, by improving child survival, can provide a key to global poverty. Child survival is closely linked with population control and therefore with economic progress at a local level. Economic progress reduces poverty and reinforces the cycle of improved child health. The Global Alliance for Vaccines and Immunisation (GAVI)—a consortium of WHO, United Nations Children's Fund (UNICEF), the World Bank and the Bill and Melinda Gates Foundation—is endeavouring to accelerate this cycle by providing money for the purchase of vaccines and the strengthening of immunisation infrastructures in the world's poorest countries. In this decade, we can anticipate worldwide eradication of poliomyelitis (by 2005) and possibly also of measles.

AUSTRALIA IN THE 21ST CENTURY

There is overwhelming public support in Australia for childhood immunisation and there are some wonderful opportunities, both nationally and internationally, in the decade ahead for prevention and treatment using vaccines.[9] Soon we will need to address questions related to the use of a number of new vaccines, probably in the first instance for rotavirus, intranasal live attenuated influenza, enterotoxigenic *Escherichia coli*, and *Helicobacter pylori*; and then later cytomegalovirus, human papilloma virus, group A streptococcus and HIV.

In assessing the need for these vaccines, we must first be sure that there is accurate information about the burden and cost of disease; we must know that the vaccines are safe, effective, easily administered and programmed, as well as cost-effective and acceptable to the community. It is also very important that there are satisfactory surveillance mechanisms in place to monitor disease incidences and vaccine-related adverse events.

As we enter an era where new vaccines are introduced that have been produced by sophisticated new biotechnologies, we will, at least in the short- to medium-term, see these vaccines costing very much more than previously. There will be a need to assess the community's willingness to pay for this progress.

Of over-riding importance will be working to obtain a better understanding of the communication of risk, and of the behavioural and social changes affecting attitudes in our community—especially among parents of young children.

Historically, vaccines have prevented countless deaths and have brought long-term benefits that go far beyond health.

This article has been adapted from the Feery Oration, which was presented at the 8th National Public Health Association of Australia Immunisation Conference in Melbourne, during May 2002.

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MAPPING IMMUNISATION COVERAGE AND CONSCIENTIOUS OBJECTORS TO IMMUNISATION IN NSW

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The Australian Childhood Immunisation Register (ACIR) commenced operation on 1 January 1996 and is now an important component of the *Immunise Australia Program*. Immunisations are generally notified to the ACIR either by electronic means—by email or the internet—or by hard copy notification forms.[1] Parents with children who have a personal, philosophical, religious or medical belief that immunisation should not occur can ask their doctor or immunisation provider to complete a conscientious objection form and send it to the ACIR. In practice, this form is usually only completed if a parent wishes to receive means-tested child-care benefits and maternity allowances that are not paid unless a child is fully immunised or a conscientious objection form has been lodged.

From the immunisation data finally entered in the ACIR, the Health Insurance Commission (HIC) provides regular quarterly immunisation coverage reports at the national and state and territory level. Coverage for these reports is calculated using the cohort method.[2] With this method, a cohort of children is defined by date of birth in three-month groups. This birth cohort has the immunisation status of its members assessed at the three key milestones of 12 months, 24 months and six years of age. Definitions of coverage are based on the Australian Standard Vaccination Schedule and are described elsewhere.[3,2]

Calculation of immunisation coverage estimates by the HIC at the national and state level can hide pockets of low coverage within a state, and within a capital city. By calculating immunisation coverage for smaller geographical areas, it is possible to examine differences in immunisation coverage within states, and within capital cities, to identify specific areas of low coverage.

Poor uptake of immunisation is generally a result of a host of factors including: issues related to the medical history of a child; issues related to beliefs about the risks and benefits of vaccination; parental forgetfulness or poor access to immunisation services.[4] The relative contribution of each of these factors to under-immunisation varies by population. One of the important

and unique features of the ACIR is the facility to record a conscientious objection to immunisation. Low coverage in particular areas may be partly a result of a high proportion of conscientious objectors to immunisation residing in that area. By calculating the proportion of conscientious objectors in small areas, we can assess how much this proportion influences estimates of low vaccination coverage calculated on data from the ACIR.

Using ACIR data at September 2002, this article describes the mapping of immunisation coverage in NSW, including estimates and proportions of conscientious objectors to immunisation.

METHODS

Immunisation coverage estimates for 'fully immunised' at 12 and 24 months of age, and for measles, mumps and rubella (MMR) at 24 months of age were calculated from ACIR data. Two cohorts of children registered with Medicare, with a NSW postcode of residence on the ACIR, were analysed. The cohort born between 1 July 2000 and 30 June 2001 (a 12-month cohort) was used to calculate coverage at 12 months of age for Australian Bureau of Statistics (ABS)-defined Statistical Subdivisions (SSD) and Statistical Local Areas (SLA).[5] The cohort of children born between 1 July 1999 and 30 June 2000 was used to calculate coverage at 24 months of age for the same geographical areas. We chose ABS-defined SSDs and SLAs as areas to be mapped because the mapping software we used, MapInfo, is restricted to these types of areas when creating maps. Coverage estimates were calculated for SSDs outside Sydney and for SLAs within Sydney. The number of children included in each cohort was approximately 86,000. As some 99 per cent of children born in Australia are registered with Medicare by one year of age, this source amounts to a census of all children born in NSW in these periods. Coverage was calculated using the cohort method described in *Communicable Diseases Intelligence*, March 1998.[2]

Rates of conscientious objection were calculated from the cohort of children registered with Medicare, with a NSW postcode of residence, born between 1 January 2001 and 31 December 2001. At the time of data extraction on 30 September 2002, the cohort was aged between nine and 20 months. We chose a different cohort when calculating the rates of conscientious objectors as we did not wish to include children under the age of nine months. The parents of these children would probably not have had enough time to object to immunisation as their children would have only received the first few of the due immunisations.

Maps were created using the MapInfo mapping software and the ABS Census Boundary Information.[6] As postcode is the only geographical indicator on the ACIR, the ABS *Postal Area to SLA Concordance 2001* was used to match ACIR postcodes to SSDs and SLAs, in order to create a SSD or SLA field for each child in the study cohort.[7]

FIGURE 1

NSW IMMUNISATION COVERAGE FOR 'FULLY IMMUNISED' CHILDREN AT 12 MONTHS, NSW, SEPTEMBER 2002

Source: Australian Childhood Immunisation Register

RESULTS

The latest published figures from the ACIR show that immunisation coverage for children 'fully immunised' at 12 months of age for NSW was around 90 per cent.[8] Figure 1 presents a map of immunisation coverage in NSW for 'fully immunised' at 12 months of age. Outside Sydney, the north coast SSDs of Lismore and Richmond–Tweed (including the Byron Bay SLA) and the lower south coast SSD (including the Bega Valley SLA) have the lowest coverage. Within Sydney, the lowest coverage was found in the inner-urban SLAs, from as low as 77 per cent in the Mosman SLA. Many other inner-urban SLAs have coverage less than 85 per cent—such as the Waverley, Woollahra, Sydney, South Sydney, Ashfield and Strathfield SLAs.

The latest published figures from the ACIR show that immunisation coverage for children 'fully immunised' at 24 months of age for NSW is around 88 per cent.[8] The pattern of immunisation coverage at 24 months of age in NSW was quite similar to that for coverage at 12 months of age. Figure 2 presents coverage for 'fully immunised' at 24 months and those same SSDs of low coverage at 12 months were apparent at 24 months: the north coast SSDs of Richmond–Tweed (including the Byron Bay SLA), Lismore, and Clarence (including the Maclean SLA and the Coffs Harbour hinterland SLA), and the lower south coast SSD (including the Eurobodalla SLA). Low coverage in Sydney was again concentrated mainly in the inner-urban SLAs, with coverage ranging from 70–79 per cent, including Sydney, Mosman, Manly, North Sydney, Pittwater, Woollahra, Waverley, Randwick, Auburn and Strathfield.

Figure 3 shows immunisation coverage for MMR (measles, mumps and rubella vaccine) at 24 months of age in NSW. Overall, coverage was higher for MMR than it was for 'fully immunised' at 24 months, with many areas in NSW reaching greater than 95 per cent coverage. Areas of less than 90 per cent coverage included the Lismore and Richmond–Tweed SSDs in the north, the Blue Mountains SSD, the Pittwater SLA in Sydney, and many inner-urban SLAs of Sydney including Sydney, Mosman, Manly, North Sydney, Woollahra, Waverley, Randwick, South Sydney, Ashfield, Auburn and Strathfield.

Figure 4 presents a map of the proportion of notified conscientious objectors to immunisation in NSW. The average proportion of conscientious objection to immunisation in NSW was 0.4 per cent, with four areas of high proportions of objectors: the north coast SSDs of Lismore and Richmond–Tweed; the mid-north coast SSD of Port Macquarie; the Upper Murray and Snowy Mountains SSDs in southern NSW; and the Blue Mountains SLA west of Sydney. The greatest concentration of conscientious objectors in NSW was found in the Lismore and Richmond–Tweed SSDs, with rates of 4.2 per cent and 3.1 per cent, respectively, more than seven times the state average. Within the Richmond–Tweed SSD, the Byron Bay SLA had nine per cent of this cohort of children registered as conscientious objectors.

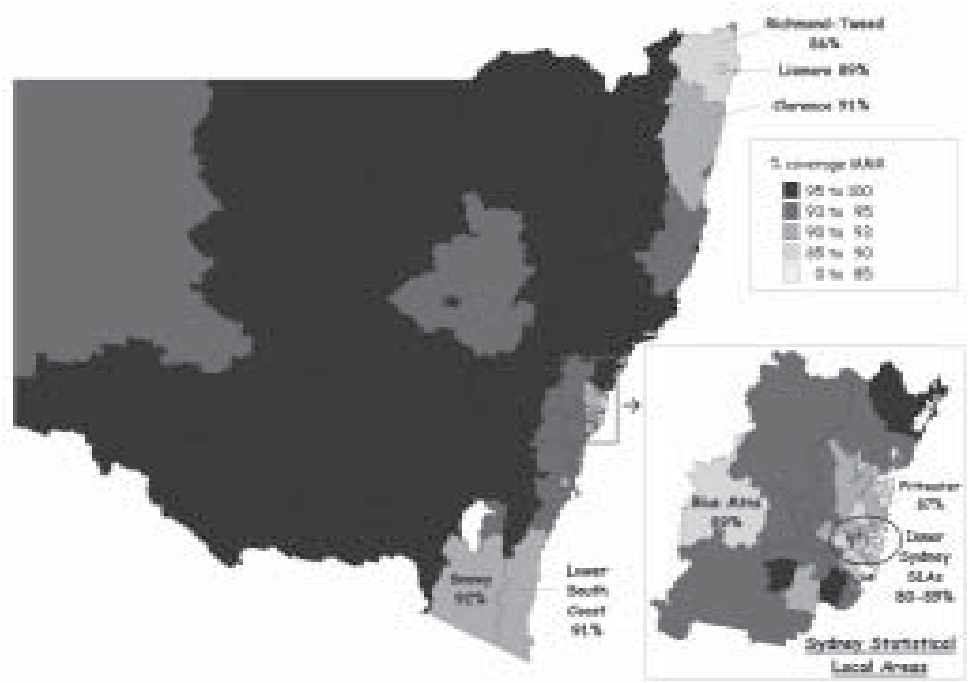
FIGURE 2

NSW IMMUNISATION COVERAGE FOR 'FULLY IMMUNISED' CHILDREN AT 24 MONTHS, SEPTEMBER 2002

Source: Australian Childhood Immunisation Register

FIGURE 3

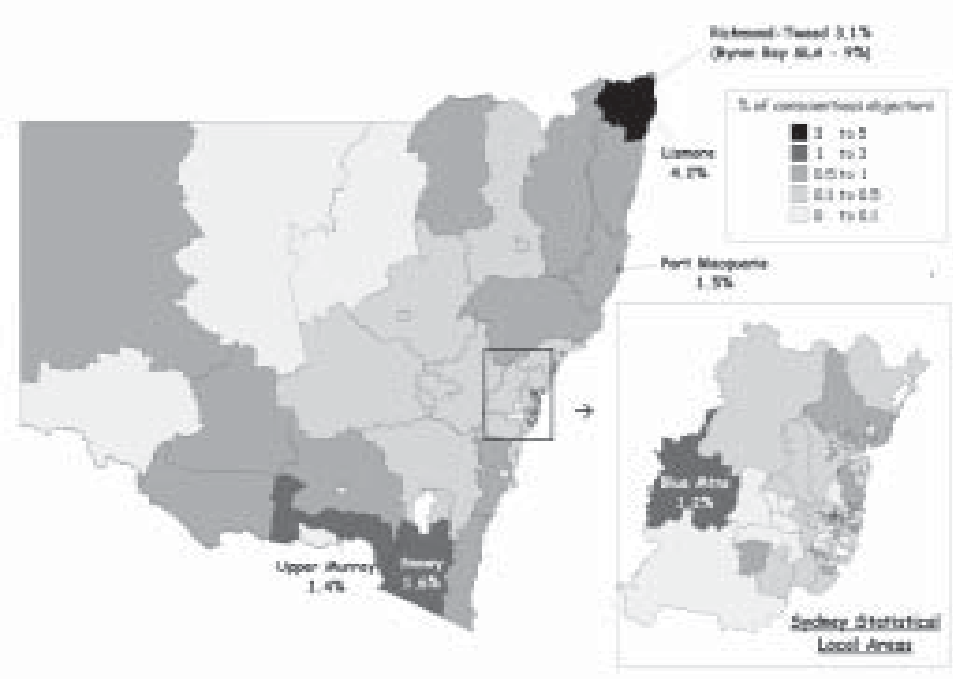
NSW IMMUNISATION COVERAGE FOR MMR, CHILDREN AT 24 MONTHS, NSW, SEPTEMBER 2002



Source: Australian Childhood Immunisation Register

FIGURE 4

THE PROPORTION OF OFFICIAL CONSCIENTIOUS OBJECTORS TO IMMUNISATION, NSW, SEPTEMBER 2002



Source: Australian Childhood Immunisation Register

DISCUSSION

Immunisation coverage in most of NSW is generally good with many areas achieving targets for coverage. Nevertheless, there are areas that have lower than optimal coverage across all vaccines and age groups, and the factors responsible for this may vary between urban and rural areas.

Coverage for the SSDs on the north coast was the lowest in the State, and these SSDs also had the highest level of registered conscientious objectors to immunisation. In contrast, those SLAs with low coverage in inner-urban Sydney do not exhibit the same high level of conscientious objection to immunisation, as recorded on the ACIR. There are two likely reasons for this difference. First, parents in inner-urban SLAs, such as Woollahra, Mosman, and Waverley, who object to immunisation are likely to have higher incomes than those in rural SLAs, and are therefore less likely to be eligible for means-tested child-care benefits and maternity allowances that are not paid unless a child is fully immunised or a conscientious objection form has been lodged. Therefore, many parents in inner-urban SLAs may have no real incentive to officially object to immunisation by filling in a conscientious objector form. Non-immunising parents, who object to immunisation, residing in the north coast SSDs of NSW, and to a lesser extent in the south coast SSDs, are likely to have lower incomes and are more likely to be eligible for means-tested child-care benefits and allowances. Therefore, there is an incentive for these parents to register their objection to immunisation, because they will not receive benefits and allowances unless a conscientious objection form is lodged with the ACIR. Second, lower coverage in inner urban SLAs of the five largest Australian capital cities was recently shown to be related to less complete notification of immunisations by providers (primarily general practitioners), compared with either outer urban or non-urban SLAs practitioners.[9]

CONCLUSION

Although immunisation coverage has greatly improved over the past five years in NSW, and many areas have reached coverage targets, there are areas in NSW where the level of registered conscientious objection to immunisation is great enough to affect immunisation coverage, as measured by the ACIR. One such area is northern NSW, and the Byron Bay SLA in particular, where the rate of conscientious objection is one of the highest in the country. Additionally, the proportion of conscientious objectors on the ACIR is likely to be an underestimate of the proportion of parents who don't immunise because they disagree with immunisation, particularly in more economically advantaged areas. There are some non-immunising parents who 'object to registering', and they will refuse to complete any government-provided form. There are also those philosophically opposed non-immunising parents who have no real incentive to officially object to immunisation such as those in inner-urban SLAs. In some local areas, coverage may be sufficiently low for outbreaks of disease such as measles to occur among groups of objectors to immunisation,[10,11] as recently observed in North Queensland.[12]

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MEASLES CONTROL IN NSW DIVISIONS OF GENERAL PRACTICE

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Measles is among the leading causes of death worldwide, and is responsible for more deaths than road traffic accidents or lung cancer.[1] The World Health Organization Western Pacific Region has declared a goal of measles elimination. Australia conducted a National Measles Control Campaign (MCC) in 1998 as part of a long-term strategy to eliminate measles from Australia.[2] This campaign consisted of changing the scheduled age of the second dose from 12 years to four years, as well as a catch-up campaign for children aged 5–12 years.

Communicable disease control is usually monitored by trends in notifications,[3] but these data are retrospective and are often not timely enough to initiate preventive measures. Future epidemics and disease control targets can be predicted by the use of mathematical modelling, which uses vaccine coverage or sero-epidemiological data to model projected levels of susceptibility to communicable diseases in the population.

Central to mathematical modelling is the concept of the reproductive number, *R*, which is the number of secondary cases generated from one index case of a communicable disease. The basic reproductive number, R_0, is the number of secondary infections produced by a typical infective case in a totally susceptible population. Factors affecting R_0 include the infectivity of an organism, the duration of infectiousness, and population mixing patterns. The effective reproductive number, R_t, is the number of secondary cases produced by a typical case in a given population, taking into consideration the level of population immunity to that disease.

When *R* is greater than one, cases increase from one generation to the next, and an epidemic may ensue. When *R* is less than one, cases decrease from one generation to the next, and an epidemic is not possible. The epidemic threshold is defined at *R* equals one. Endemic disease transmission is eliminated if *R* is maintained below the epidemic threshold (that is, *R* is less than one) for sustained periods.[4,5] In this article we aimed to determine variations in measles control by divisions of general practice (DGP) in NSW.

METHODS

Vaccine coverage estimates

Vaccine coverage estimates were obtained from the Australian Childhood Immunisation Register (ACIR),[6] a national register which records the immunisation status of all children aged 0–7 years for scheduled vaccines. The ACIR was first established in 1996, so coverage data at four years of age are only available for the first birth cohort of children born in 1996. To predict measles control, we used the ACIR measles-mumps-rubella (MMR) coverage data recorded in 2001 for the doses given at 12 months and four years (and recorded by five years of age).

NSW postcode data were used to examine coverage by DGPs, which are geographically defined administrative areas. There are 123 DGPs in Australia (37 in NSW), and 90 per cent of general practitioners (GPs) belong to a DGP.

Modelling

The population was stratified into five age groups: 0–4, 5–9, 10–14, 15–19, and 20+ years. The proportions susceptible in each age group x_i before and after the MCC were estimated from the seroprevalence data.[7] Projections of the proportion susceptible in subsequent years were based on the post-campaign susceptibility in each cohort, on the assumption that no immunity would be acquired through natural infection. In new cohorts the proportion susceptible was estimated from the expected vaccine coverage and vaccine efficacy (assumed to be 90 per cent after one dose, and 99 per cent after two doses).

The potential for measles transmission was summarised by the effective reproduction number, *R*, the average number of secondary cases produced by a typical infectious case.[8] *R* depends on the transmission potential for measles in a totally susceptible population and on the proportion susceptible in each age group. R_{0ij} is the average number of secondary cases in the *i*th age group caused by an infectious individual in the *j*th age group if all individuals in the *i*th age group are susceptible to infection. Values for R_{0ij} from previous studies in the UK and Canada were used.[9]

$$(R_{0ij}) = \begin{pmatrix} 0.96 & 0.43 & 0.43 & 0.43 & 0.43 \\ 0.48 & 4.99 & 1.80 & 0.48 & 0.48 \\ 0.48 & 1.80 & 7.48 & 0.48 & 0.48 \\ 0.48 & 0.48 & 0.48 & 8.73 & 0.48 \\ 5.23 & 5.23 & 5.23 & 5.23 & 5.23 \end{pmatrix}$$

If only a proportion x_i of the *i*th age group are susceptible to infection then R_{ij}, the number of secondary infections in that group caused by an infectious individual in the *j*th age group is given simply by $R_{ij} = R_{0ij}\, x_i$. The overall *R* is calculated as the leading eigenvalue of the next generation matrix R_{ij}.[10]

RESULTS

The mean vaccination coverage for the 37 NSW DGPs for two doses of MMR at five years of age was 54 per cent, with a range of 24–67 per cent. At five years of age, 11 per cent of NSW children had not received any doses of MMR, and 35 per cent had received only a single dose. Thus, we estimated that 15 per cent of five year olds remained

susceptible to measles (comprising 11 per cent with no doses, 3.5 per cent with a single dose, and 0.5 per cent who had received two doses of vaccine). The proportion susceptible at age five years ranged from seven per cent in the best DGP to 31 per cent in the DGP with the worst coverage.

Figures 1–4 show the average, best, and worst *R* values over time for NSW DGPs, grouped by geographic regions, and shows the projected time when each will exceed the epidemic threshold if vaccination coverage remains at current levels. There is a wide variation in the level of measles control between DGPs, with the poorest measles control in inner-urban DGPs.

DISCUSSION

The benefits of a catch-up campaign (such as the MCC) are transient.[9] Long-term measles control requires high levels of coverage with the routine two-dose schedule.[9] It is important that the success of the MCC be consolidated by improving and maintaining high levels of coverage with both the first and second doses of MMR. Our data indicate that 73 per cent of those who are susceptible at age five are children who received no doses of vaccine, with the remainder being children who received one or two doses but did not seroconvert. It is more important to target the unvaccinated children with a first dose than to give second doses to children who have already had one. Improving second dose coverage from 54 per cent to 89 per cent would still leave nearly 12 per cent of 5-year-old children susceptible.

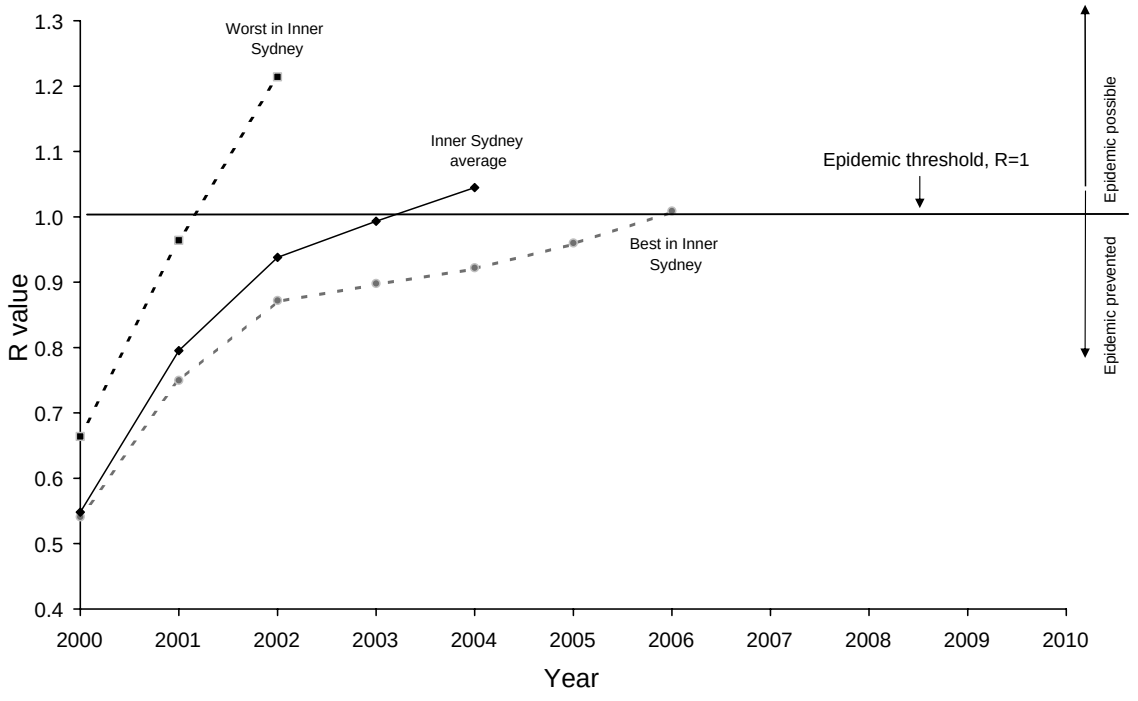
In the year 2000, the start of the study time period, all DGPs had a low value of *R*, reflecting the success of the 1998 MCC in reducing susceptibility to measles in the target age groups. However, modelling shows that *R* will gradually increase over time if coverage remains at current levels. The inner-urban DGPs appeared to have the worst measles control, with coverage levels as low as 24 per cent for two doses of MMR.

There is a wide variation in coverage of two doses of MMR in this cohort of children born in 1995, ranging from 24 per cent to 67 per cent, in NSW DGP. The modelling indicates that some DGPs may already be exceeding the epidemic threshold for measles. If wild measles virus is introduced into the community, these DGPs may be at risk of outbreaks. Some are known to have higher rates of conscientious objectors to vaccination, and may genuinely have lower coverage rates. However, differential levels of reporting of vaccine coverage by DGP may be a factor in this apparent variation. The extent to which under-reporting contributes to 'apparent' low coverage can only be determined by further ascertainment by DGPs.

In 1998, incentive payments for medical practitioners were introduced for scheduled vaccines at two, four, six, 12 and 18 months, but not for the four-year MMR dose.[6] Genuinely low coverage with two doses of MMR may be

FIGURE 1

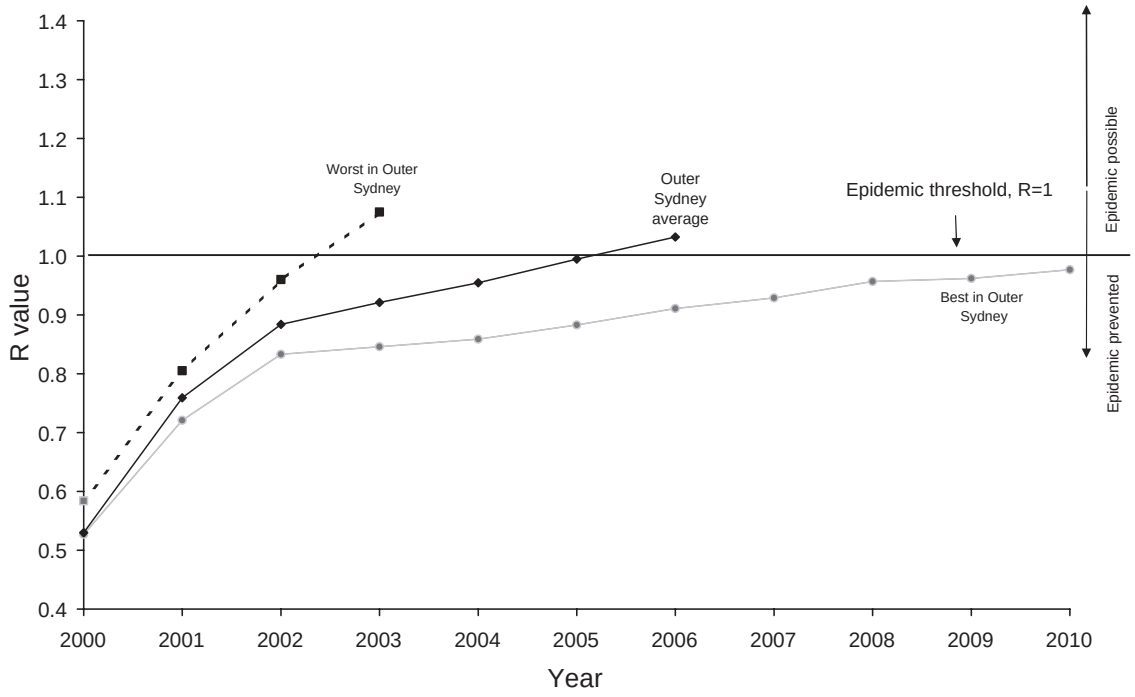
THE PROJECTED *R* VALUES OVER TIME FOR INNER SYDNEY DIVISIONS OF GENERAL PRACTICE



Source: The Australian Childhood Immunisation Register

FIGURE 2

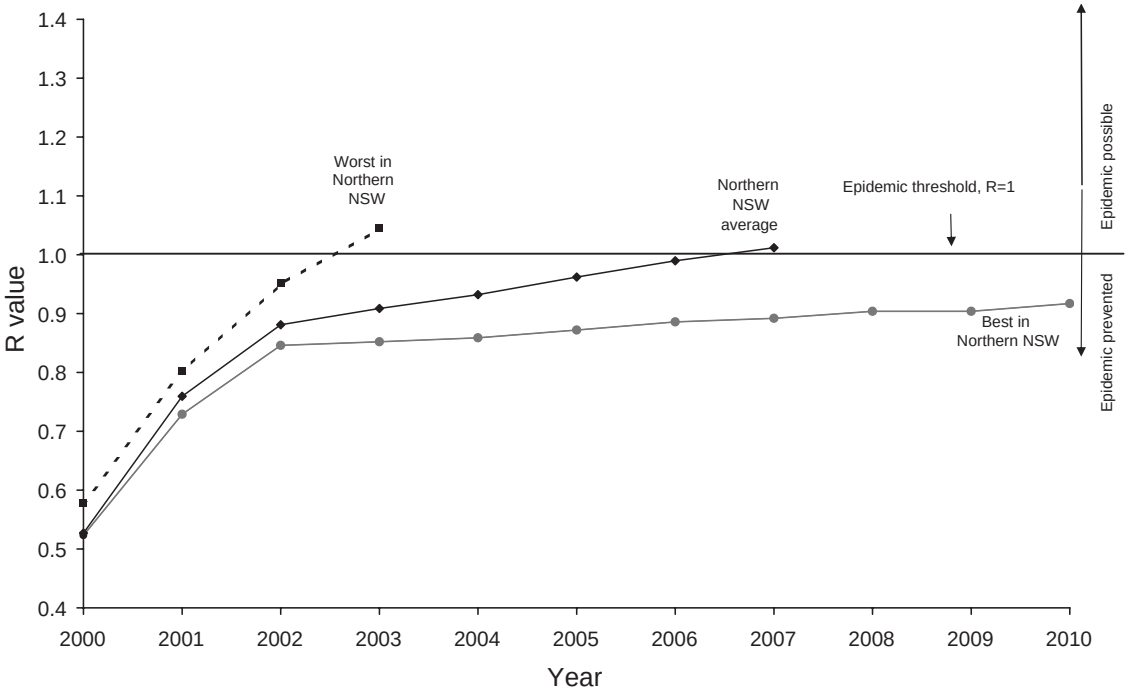
THE PROJECTED *R* VALUES OVER TIME FOR OUTER SYDNEY DIVISIONS OF GENERAL PRACTICE



Source: The Australian Childhood Immunisation Register

FIGURE 3

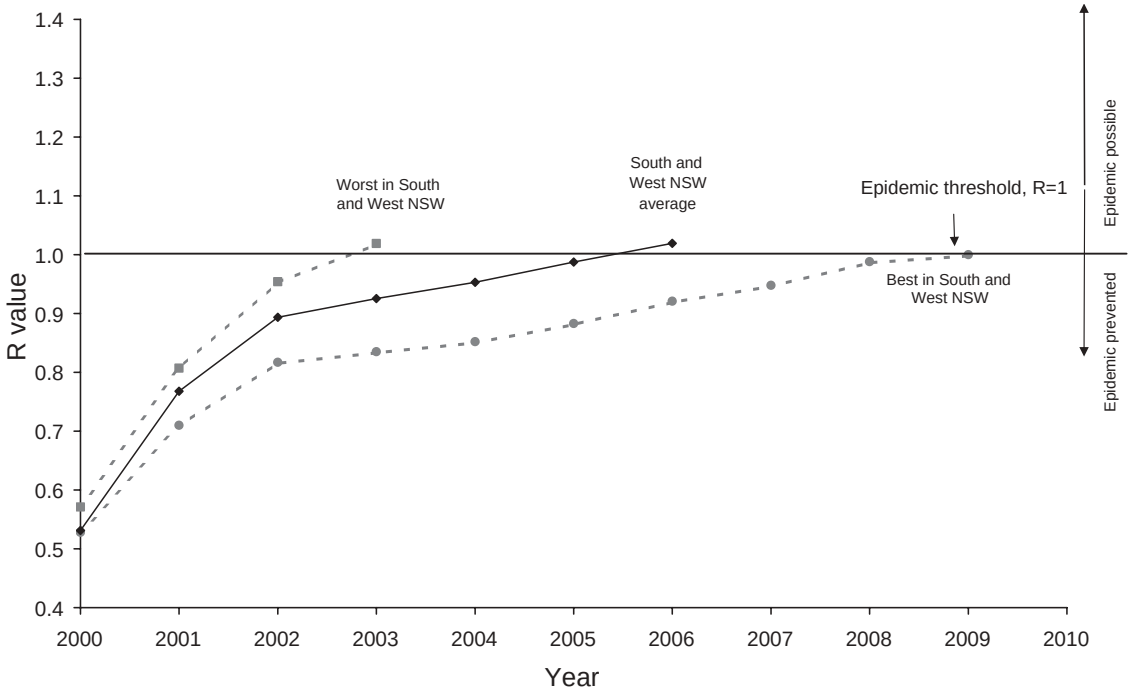
THE PROJECTED *R* VALUES OVER TIME FOR NORTHERN NSW DIVISIONS OF GENERAL PRACTICE



Source: The Australian Childhood Immunisation Register

FIGURE 4

THE PROJECTED *R* VALUES OVER TIME FOR SOUTHERN AND WESTERN NSW DIVISIONS OF GENERAL PRACTICE



Source: The Australian Childhood Immunisation Register

explained by the fact that the second dose of MMR is not subject to an incentive payment for medical practitioners. It has been shown that parental and provider factors play a role in uptake of the second dose of MMR. A UK study showed that MMR vaccination, particularly the second dose, is not perceived to be important for children's health.[11] Another UK survey of doctor attitudes to MMR vaccination showed that there was lack of consensus over the need for a second dose, with only 20 per cent of practitioners stating that they would unequivocally recommend the second dose to a wavering parent.[12] However, this study was performed in an environment where MMR was unfairly receiving considerable adverse publicity.

The limitation of using ACIR data for the calculation of vaccination coverage relates to the degree of under-reporting to the ACIR, leading to underestimation of coverage. A recent study showed that the ACIR under-estimates coverage by five per cent at two years of age.[13] In addition, the change of schedule for the second dose of MMR from 12 to four years in 1998 is not reflected in the personal immunisation record books of the study cohort. This may contribute to the study cohort having low coverage (because parents may not realise that the second dose is due) and may also result in underestimation of coverage (because the immunisation record book does not allow for a dose at four years to be recorded). These factors may reduce the absolute values of *R* slightly, but should not affect the differences between DGP or the trends we describe.

CONCLUSION

Mathematical modelling is useful in evaluating disease control as it can summarise susceptibility profiles by a single parameter, the reproduction number *R*, which quantifies the level of herd immunity in the population, and allows the prediction of epidemics.[8] This provides more information than disease notification data alone, and contributes to informed planning of vaccination programs.

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HEPATITIS B IMMUNISATION IN CHILDREN AGED 10–13 YEARS IN NEW SOUTH WALES, 2001

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Hepatitis B is a viral infection that is an important cause of morbidity and mortality globally. The World Health Organization estimates that about two billion people have been infected and 350 million are chronic carriers.[1] Between 1991 and 2001, just over 6,000 hepatitis B notifications per year were reported to the Australian health system, including an average of 250 per year which were identified as incident cases. Approximately half of all cases notified, and a quarter of incident cases, were resident in New South Wales (NSW).[2]

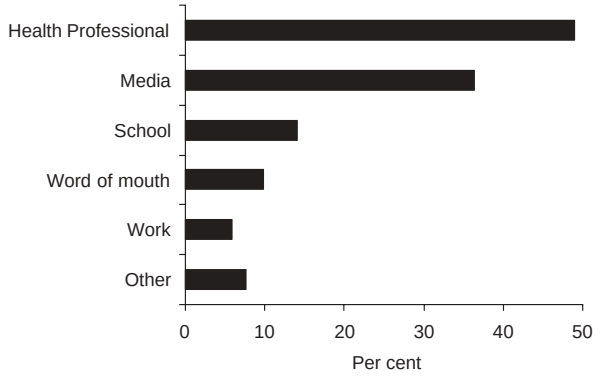
This article describes a survey of the parents or carers of children aged 10 to 13 years in NSW to assess hepatitis B immunisation coverage rates in pre-adolescent children. In Australia, hepatitis B vaccine has been available since the early 1980s and it has been recognised by the National Health and Medical Research Council (NHMRC) as safe and effective since 1983. NSW Health introduced a policy in 1983 which recommended hepatitis B immunisation of: household contacts and sexual partners of hepatitis B carriers; prisoners; residents of some institutions and hostels; health care workers; some patients; injecting drug users and men who have sex with men.[3,4] In 1986, the NHMRC recommended hepatitis B immunisation for children born into high-risk groups where at least 5 per cent of the population are hepatitis B surface antigen carriers. NSW Health implemented that recommendation in 1987.[5] NSW Health also recommended that pregnant women in NSW be screened for hepatitis B and that infants born to hepatitis B surface antigen positive mothers receive hepatitis B immunoglobulin and vaccine on the first day of life. Current data indicate that this program is very effective with over 99 per cent of women screened and 94 per cent of infants born to hepatitis B positive mothers receiving hepatitis B immunoglobulin within 12 hours of birth.[6]

In 1996, the NHMRC recommended hepatitis B immunisation for all adolescents aged 10–13 years and this was introduced in NSW in 1999.[7] This program has been mainly administered through general practitioners. From May 2000, the NHMRC recommended a birth dose of hepatitis B vaccine for all babies with a further three doses at two, four and six months of age.[8]

All childhood immunisations are reported to the Australian Childhood Immunisation Register for children aged less than seven years. Reliable estimates of hepatitis B immunisation in children aged 10–13 years are not available in NSW. To estimate the current uptake of hepatitis B immunisation among children aged between 10 and13 years in NSW, NSW Health interviewed a random sample of the parents and carers of adolescent children in this age group. The survey also sought to clarify reasons why parents did not seek free hepatitis B immunisation for their children.

FIGURE 1

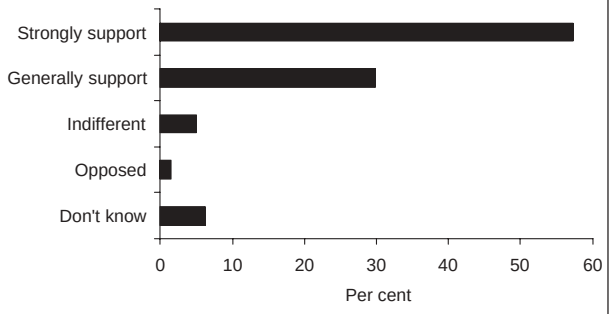
WHERE PARENTS OF CHILDREN AGED 10–13 YEARS HEARD ABOUT HEPATITIS B IMMUNISATION (N=1,093)



Source: NSW Health Survey program

FIGURE 2

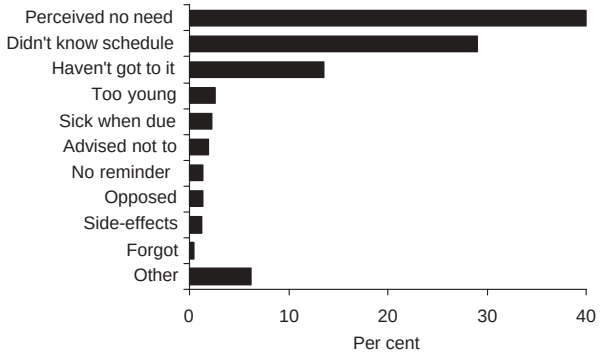
SUPPORT FOR IMMUNISATION AMONG THE PARENTS OF CHILDREN AGED 10–13 YEARS IN NSW (N=1,567)



Source: NSW Health Survey program

FIGURE 3

PARENTS' REASONS FOR NOT IMMUNISING CHILDREN AGED 10–13 YEARS IN NSW (N=1,651 UNIMMUNISED CHILDREN)



Source: NSW Health Survey program

METHODS

Selection of participants

This was the first time a survey investigating the uptake of hepatitis B vaccination in children aged between 10 and13 years had been carried out in New South Wales.

During October and November 2001, the parents or carers of children aged 10–13 years were interviewed to assess the hepatitis B immunisation coverage of their children. The sample was drawn at random from the population of all residents in NSW living in households with private telephones. Telephone numbers were randomly generated using methods described elsewhere.[9] When households were contacted, they were asked if they had any children aged 10–13 years, and the parent or carer who knew the most about the health of those children was invited to respond. Trained interviewers conducted the interviews consistent with methods that have been described elsewhere.[10]

Interview questionnaire

All parents were asked whether their children were immunised against hepatitis B. Children in NSW are routinely provided with a personal health record (Blue Book), which includes a record of the immunisations that they have received. Parents who reported that their children were immunised were asked to locate each child's personal health record (Blue Book) and provide the date of immunisation for confirmation. Parents who reported their children had not been immunised were asked to provide the reasons for not immunising and whether they were aware that free hepatitis B immunisation was available for this age group.

Additionally, all parents were asked questions about their knowledge and attitudes towards hepatitis B immunisation including their sources of information about hepatitis B. Parents were not prompted with options for their answers. Answers were categorised by the interviewer. Demographic information collected included: the number and gender of children in the household; parents' ethnicity, educational level; local government area; postcode; and number of residential phones.

Statistical analysis

All statistical analyses were performed using SAS version 8.02.[11] Parents were categorised as either having at least one immunised child or no immunised children as the main outcome variable. Associations between this outcome and prior knowledge and attitudes about immunisation, as well as demographic factors, were assessed using chi-squared tests. Significant factors from the univariate analysis were included in a multivariate logistic regression model.

RESULTS

There were 1,956 households contacted who had children in the target age group and of these, parents in 1567 households (80.1 per cent) agreed to participate. There

were 1,157 (74 per cent) households with one child, 382 (24 per cent) with two children and the remaining 28 (2 per cent) reported there were three or four children in the household in the target age group. Altogether, information was obtained for 2,010 children, 52 per cent of whom were male.

Of the 1,567 parents or carers interviewed, 676 (43 percent) initially stated that some or all of their children aged 10–13 years were immunised against hepatitis B, 422 (27 per cent) stated they had Blue Books, 315 (20 per cent) could access these books and 301 (19.2 per cent) confirmed that one or more children in their household were immunised against hepatitis B from Blue Book records. This corresponded to 359 (17.9 per cent) children who had been immunised against hepatitis B.

Nearly 70 per cent of parents indicated that they had heard about hepatitis B immunisation in the last two years. The most common source of information was health professionals (49 per cent) and the media (36 per cent) (Figure 1). There were 32 per cent who reported they had been advised to immunise their child against hepatitis B.

Parents indicated a high level of support for hepatitis B immunisation with 58 per cent strongly supporting it and a further 30 per cent generally supporting it (Figure 2). Among parents who reported their children were not immunised, 80.6 per cent indicated they were unaware that free hepatitis B immunisation was available. These parents were asked to provide reasons for not immunising their child, with 40 per cent stating that they had not perceived the need and 29 per cent that they were not aware it was on the immunisation schedule (Figure 3).

Associations between demographic characteristics and having one or more immunised child are summarised in Table 1. Level of the parent's education was not associated with having at least one immunised child. Adjusted analyses are summarised in Table 2. Parents who had been advised to immunise their child were significantly more likely to have immunised children than parents who had not been advised. Those who indicated that they strongly supported hepatitis B immunisation were also significantly more likely to have immunised children than those who did not indicate strong support.

DISCUSSION

This study found 19.2 per cent of parents reported having had one or more of their children aged 10 to 13 years immunised against hepatitis B corresponding to an immunisation rate of 17.9 per cent. Most parents (70 per cent) had heard about hepatitis B immunisation in the last two years, and most (88 per cent) were supportive of immunisation against hepatitis B. A lesser proportion (32 per cent) reported being advised to immunise their child. Support for hepatitis B immunisation and being advised to immunise by a health professional were significant predictors of having an immunised child, highlighting the importance of parental knowledge in determining whether children were immunised. Among those who reported not having immunised their children, deficits in knowledge were identified. Over 80 per cent stated they were unaware that free hepatitis B immunisation was available for their pre-adolescent children, 40 per cent that they did not see the need for hepatitis B immunisation and nearly one third were not aware it was included on the immunisation schedule.

TABLE 1

UNIVARIATE* ANALYSIS OF PREDICTORS FOR PARENTS HAVING CHILDREN AGED 10–13 YEARS IMMUNISED AGAINST HEPATITIS B IN NSW (N=1,567 PARENTS)

Parent characteristic	Child immunised *N* (%)	Child not immunised *N* (%)	Odds Ratio	95% Confidence Interval	*P*
Had heard about immunisation in the last two years					
No	68 (23)	406 (32)	1.00		
Yes	233 (77)	860 (68)	1.66	1.23–2.23	0.001
Advised to immunise					
No	135 (45)	927 (73)	1.00		
Yes	166 (55)	339 (27)	3.51	2.70–4.56	<0.001
Strongly support HBV immunisation					
No	73 (24)	595 (47)	1.00		
Yes	228 (76)	671 (53)	2.50	1.86–3.35	<0.001
Non-English speaking background					
No	245 (81)	1097 (87)	1.00		
Yes	56 (19)	169 (13)	1.46	1.05–2.04	0.025
Tertiary education					
No	212 (70)	936 (73)	1.00		
Yes	89 (30)	330 (26)	1.94	0.91–1.58	0.199

* Univariate analysis presents results for each variable without adjusting for the effects of other variables.

TABLE 2

MULTIVARIATE* LOGISTIC REGRESSION ANALYSIS OF PARENTS HAVING CHILDREN AGED 10–13 IMMUNISED AGAINST HEPATITIS B IN NSW

Characteristic	Odds Ratio	95% Confidence Interval	*P*
Had heard about immunisation			
No	1.00		
Yes	1.21	0.89–1.68	0.242
Advised to immunise			
No	1.00		
Yes	2.73	2.07–3.61	<0.001
Strongly support HBV immunisation			
No	1.00		
Yes	2.17	1.58–2.96	<0.001
Non-English speaking background			
No	1.00		
Yes	1.03	0.72–1.48	0.855

* Multivariate analysis presents results for each variable after adjusting for the effects of other variables.

A methodological limitation of telephone surveys is the dependence on self-report which is subject to the accuracy of the parent's recollection. To offset this, we chose hepatitis B immunisations that were confirmed in the child's Blue Book as the main outcome in our analyses. It is likely that this criterion resulted in some children who had been immunised being misclassified, as considerably more parents initially stated their children were immunised than those who were able to confirm it from Blue Book records. In most cases, parents either did not have, or could not find, their child's Blue Book. In some cases, parents had mistaken hepatitis B for another vaccine such as Hib (*Haemophilus influenzae* type b). We acknowledge the estimates we have presented may be conservative, but we consider this preferable to presenting overestimates.

In some other states in Australia, hepatitis B immunisation for pre-adolescents is administered in school-based programs while in NSW, general practitioner services are mainly used. Recent reports have identified a decline in bulk billing by Australian general practitioners,[12] increasing the expense of a visit to the GP for patients. It is possible that the cost of three visits to the GP required to complete the immunisation may have been a barrier to some parents having their children immunised against hepatitis B. In South Australia, hepatitis B coverage through school-based programs was 81 per cent in 2001[13] and in Victoria, 88 per cent,[14] far higher than the rates observed here.

Hepatitis B infection is a serious illness that affects large numbers of individuals in NSW each year. The long-term outcomes of chronic infection which include cirrhosis and primary liver cancer are significant both for individuals and the health system. The availability of a safe, inexpensive and effective vaccine, as well as the high level of community acceptance of hepatitis B immunisation, make achieving a high level of immunity in the population feasible.

The findings of this survey suggest that it is timely to consider other strategies for the delivery of hepatitis B immunisation programs in NSW, including school-based service provision.

ACKNOWLEDGEMENTS

Sue Campbell-Lloyd and Kim Stewart, AIDS–Infectious Diseases Branch, NSW Department of Health.

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MONITORING ADVERSE EVENTS FOLLOWING IMMUNISATION

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Surveillance of adverse events following immunisation (AEFIs) is an integral component of any immunisation program; it is as important as surveillance of both immunisation coverage and vaccine preventable diseases.[1,2] In this article we describe the purpose of AEFI surveillance and the methods used to monitor AEFIs in Australia and NSW. We also summarise NSW AEFI surveillance reports received between January 2000 and November 2002.

ROLE OF AEFI SURVEILLANCE

Successful immunisation programs depend on the use of safe vaccines, and on a public perception of safety. Unlike drugs, which are usually used to treat individuals who are ill, vaccines are given mainly to healthy children; received by a very high proportion of the population; usually given on government recommendation; and their purpose is to prevent disease rather than to treat illness.[3] As the incidence of vaccine-preventable diseases has declined due to the successful use of vaccines, public perceptions about vaccine safety and the risk of side-effects have gained prominence. While all vaccines licensed in Australia must meet strict standards of manufacture and safety evaluation, like all therapeutic agents, vaccines cannot be guaranteed to be 100 per cent safe.

The term 'AEFI' is recommended by the World Health Organization (WHO) to describe any immunisation-related adverse event.[4] AEFI describes any adverse event related to a vaccine or to its handling or administration. The term also encompasses the concept that an adverse event may be associated coincidentally with the timing of immunisation without necessarily being causally linked to either the vaccine or the immunisation process.

The primary purpose of AEFI surveillance is to detect rare, late onset, unexpected and population-specific adverse events that cannot be detected in the pre-licensure vaccine trials due to the numbers enrolled in the trials, the time-frame of follow-up, or in different populations or age groups. Routine ongoing monitoring of AEFIs after vaccine licensure also helps to identify specific problems related to vaccine manufacture, storage or administration (for example, batch contamination, freezing of vaccine and incorrect diluent). It allows detection of changes in AEFIs over time (for example, following the change from whole-cell to acellular pertussis vaccines). The maintenance and reporting of data specific to each country helps to maintain local public confidence in immunisation programs.[3,4]

Recent examples of AEFIs detected by post-licensure surveillance include excessive limb swelling after a fourth or fifth dose of acellular pertussis-containing vaccines,[5,6] and intussusception in infants who received the rotavirus vaccine in the USA.[7] The rotavirus vaccine was withdrawn from the market six months after licensure. The excessive limb swelling after acellular pertussis vaccines has been studied extensively; it resolves without sequelae and the benefit of pertussis vaccination far outweighs the risk of this adverse event.[5,6]

AEFI surveillance methods

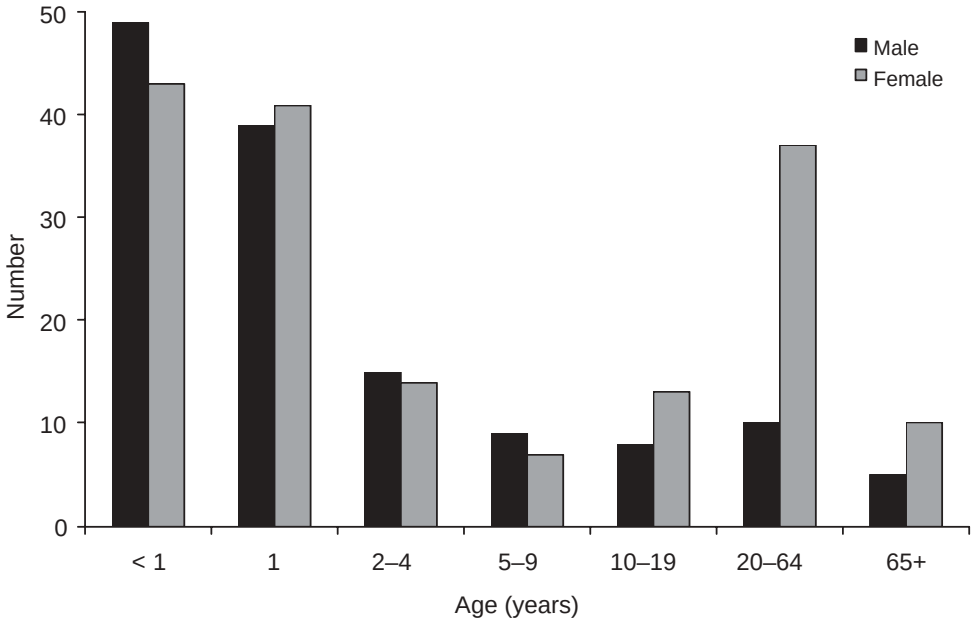
AEFI surveillance systems, worldwide and in Australia, are usually passive systems that rely on health service providers and members of the public notifying suspected AEFIs.[3,4,8,9] Data are monitored to identify 'signals' above background 'noise', and to identify events clustered by vaccine, time or place. If a signal or cluster is detected, specific epidemiological studies can be instituted to investigate these further. Under-reporting, particularly of less serious AEFIs, is a limitation. Passive surveillance is complemented by specialist clinics,[5] which function as sentinel surveillance sites for more serious AEFIs, enhanced surveillance during ad-hoc immunisation campaigns such as the 1998 measles catch-up campaign,[10] and active surveillance methods such as the Vaccine Safety Datalink project in the USA.[11]

Passive AEFI surveillance mechanisms differ for each Australian state and territory.[9] However, all rely on doctors, other health professionals and parents to report suspected AEFIs to a relevant authority and encourage reporting of specific conditions listed in the *Australian Immunisation Handbook*.[9] In NSW, doctors are required under the *NSW Public Health Act (1991)* to notify their local public health unit (PHU) of suspected AEFIs. The purpose of mandatory notification in NSW is to reduce under-reporting of suspected AEFIs by medical practitioners, and to allow individual case investigation by PHU staff. Other health service professionals and parents are also strongly encouraged to notify their local PHU of suspected AEFIs.

All AEFI reports from each jurisdiction are forwarded to the Adverse Drug Reactions Unit at the Therapeutic Goods Administration in Canberra for collation, review and analysis. Reports are assessed to determine the likelihood of a reaction being causally associated with the vaccine(s) administered. The criteria used to define the different levels of causality (certain, probable, possible, unclear, unknown) allow comparison with international AEFI data. All Australian data are also reviewed by the Adverse Drug Reactions Advisory Committee (ADRAC), which has

FIGURE 1

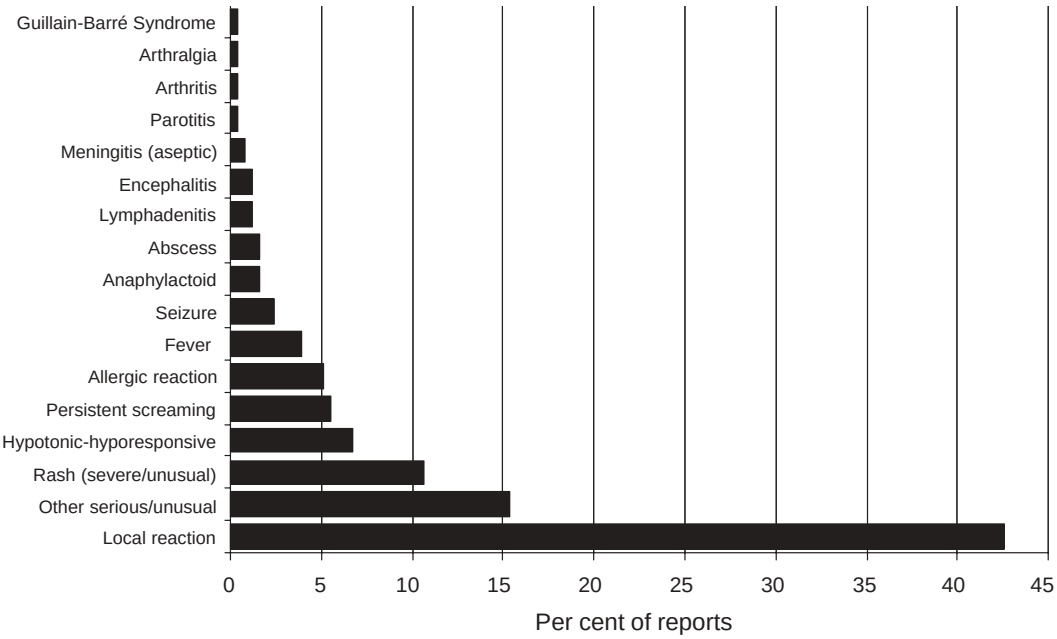
AGE AND GENDER DISTRIBUTION OF PEOPLE REPORTED WITH SUSPECTED ADVERSE EVENTS FOLLOWING IMMUNISATION, NSW, 1 JANUARY 2000–8 NOVEMBER 2002



Source: Notifiable Diseases Database (NDD), NSW Department of Health

FIGURE 2

DISTRIBUTION OF SUSPECTED ADVERSE EVENTS FOLLOWING IMMUNISATION, BY MOST SERIOUS REACTION REPORTED, NSW, 1 JANUARY 2000–8 NOVEMBER 2002

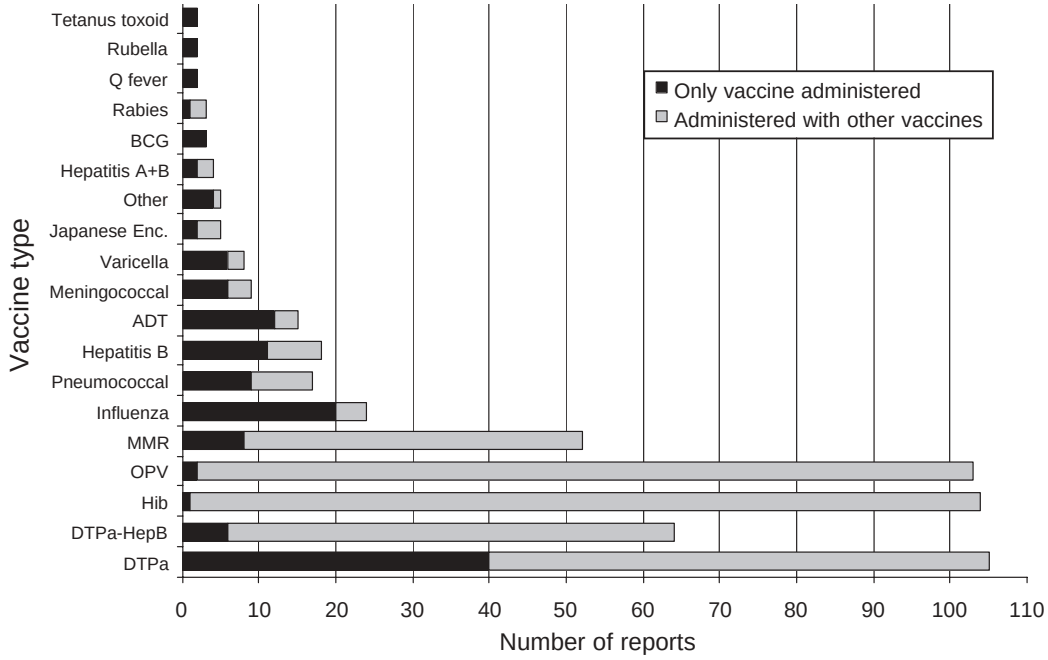


Note: The category of 'other severe–unusual' reactions included a wide range of reactions, such as bradycardia with apnoea, chest tightness, vomiting, lethargy, dizziness, and muscle spasms.

Source: Notifiable Diseases Database (NDD), NSW Department of Health

FIGURE 3

DISTRIBUTION OF VACCINE TYPES INCLUDED IN 301 REPORTS OF SUSPECTED ADVERSE EVENTS FOLLOWING IMMUNISATION, BY NUMBER OF VACCINES ADMINISTERED AT THE SAME VACCINATION EPISODE, NSW, 1 JANUARY 2000–8 NOVEMBER 2002



Note: BCG = Bacille Calmette-Guèrin; Japanese Enc = Japanese Encephalitis; ADT = adult diphtheria-tetanus; MMR = measles-mumps-rubella; OPV = oral poliomyelitis vaccine; Hib = *Haemophilus influenzae* type b; DTPa-HepB = diphtheria-tetanus-acellular pertussis combined with hepatitis B; DTPa = diphtheria-tetanus-acellular pertussis. 'Other' category included one report each of inactivated poliomyelitis vaccine (IPV), combined diphtheria-tetanus (CDT) vaccine, yellow fever vaccine, hepatitis B immunoglobulin and purified protein derivative (PPD).

Source: Notifiable Diseases Database (NDD), NSW Department of Health

overall responsibility for AEFI surveillance in Australia. Summary data are reported to the WHO.

NSW AEFI REPORTS SINCE 2000

AEFIs notified to NSW PHU staff are entered into the NSW Notifiable Diseases Database (NDD). Three hundred and one AEFI reports were received between 1 January 2000 and 8 November 2002. The majority were for children under two years of age (Figure 1). The gender ratio differed by age group, with slightly more males in the younger age groups and more females in the adolescent and adult age groups. The most frequent AEFIs reported were local reactions, other serious or unusual reactions, rashes and hypotonic–hyporesponsive episodes (HHEs) (Figure 2).

The vaccines most commonly included in AEFI reports were those recommended in the early childhood vaccination schedule, due between two and 18 months of age (Figure 3). These were diphtheria–tetanus–acellular pertussis (DTPa) vaccine alone or combined with hepatitis B vaccine (DTPa–HepB), oral poliomyelitis vaccine (OPV) and *Haemophilus influenzae* type B (Hib) vaccine. The majority of reports involved a DTPa vaccine plus Hib and OPV, reflecting the fact that these vaccines are usually given at the same time to young children. When more than one antigen is given at the same vaccination episode, it is not possible to identify which antigen might have caused the reported AEFI. Older age groups were more likely to report a suspected AEFI following receipt of a single antigen vaccine. In all age groups, the pertussis, diphtheria and tetanus-containing vaccines were most commonly associated with local reactions.

CONCLUSION

Surveillance of suspected AEFIs is an integral component of the national and NSW immunisation programs. As with all passive surveillance systems, under-reporting is likely to occur, although this is less of an issue for the most serious AEFIs. Over a period of almost three years, there were 301 reports of AEFIs to the NSW Department of Health, the majority of which were either local reactions

or less serious systemic reactions. During the same time period, approximately one million NSW children and adults received several million vaccinations. Vaccination coverage among children under two years of age has risen to over 90 per cent,[12] while the incidence of diseases such as measles and Hib meningitis has declined markedly in the past decade.[2] Continued effort on the part of immunisation service providers, public health practitioners and other health care workers is necessary to sustain and improve AEFI surveillance in Australia.

ACKNOWLEDGEMENTS

We thank everyone who has reported suspected AEFIs to the NSW Department of Health, and all PHU staff involved in AEFI surveillance.

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IMMUNISATION ADVERSE EVENTS CLINICS

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As the incidence of vaccine preventable diseases has declined, and more new vaccines are marketed, adverse events following immunisation have attracted greater attention from the public and from health care providers. At a population level, post-licensure monitoring of vaccine safety in many countries relies on notifications to passive surveillance systems, such as the Australian Adverse Drug Reactions Advisory Committee (ADRAC). Australia is better supplied with services to investigate and manage adverse events in individual patients through special immunisation services than most comparable countries. This article provides a brief background to the establishment of clinics that address adverse events following immunisation (AEFI), and describes the work of the Immunisation Adverse Events Clinic at The Children's Hospital at Westmead.

Vaccine-related adverse events clinics were first established in England in the 1980s,[1–4] following a major fall in the uptake of whole-cell pertussis vaccines (DTPw) after adverse publicity.[2] Similar clinics were set up in several Australian centres from 1994 onwards.[5] At first these clinics mainly addressed concerns about completing DTPw schedules in the context of a resurgence of pertussis.[6,7,8] In 1996, the Immunisation Adverse Events Clinic started at The Children's Hospital at Westmead. The first group of such clinics in the USA, called Clinical Immunization Safety Assessment Centers (CISA) was established in October 2001.[9]

IMMUNISATION ADVERSE EVENTS CLINIC, WESTMEAD

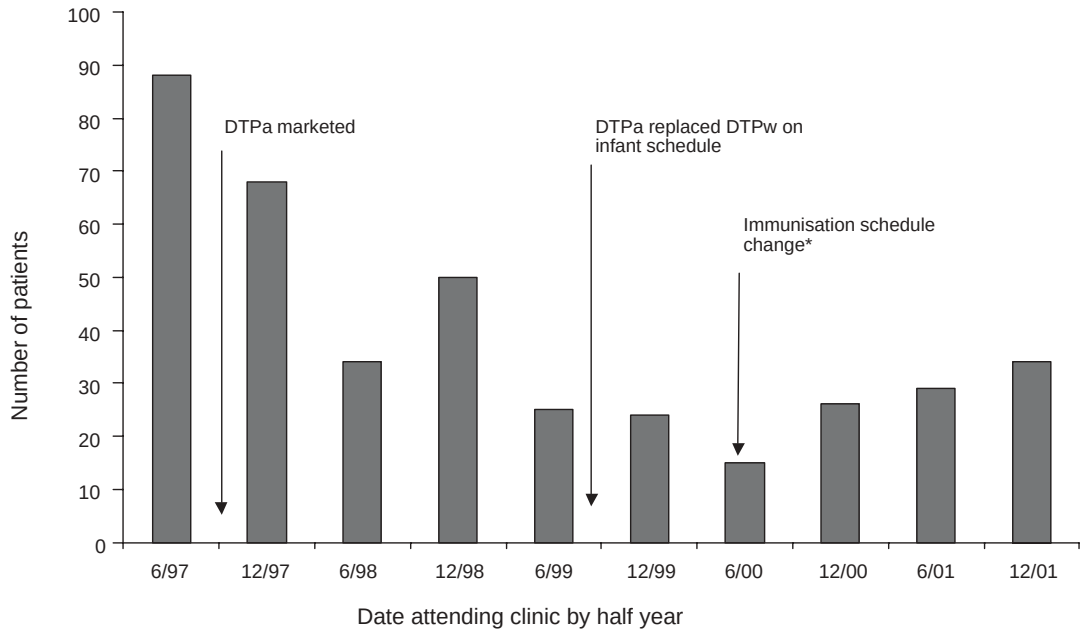
Referral

The Immunisation Adverse Events Clinic, Westmead, accepts referrals of children from health professionals, after screening by a clinical nurse consultant. The clinic is held fortnightly and is staffed by a consultant paediatrician, a paediatrician-in-training and a clinical nurse consultant.

Children who may be referred to the clinic are likely to have experienced one of the following adverse events after a previous vaccination: anaphylactoid reaction, encephalopathy, convulsion, very severe local reaction, severe hypotonic hyporesponsive episode (HHE), or a condition requiring hospitalisation after vaccination. Children with pre-existing medical conditions where vaccination could be contraindicated are also seen. However, parents who are reluctant to vaccinate a child, or who simply have questions about vaccination, should see a general practitioner in the first instance.

FIGURE 1

NUMBER OF ATTENDANCES AT THE WESTMEAD IMMUNISATION ADVERSE EVENTS CLINIC, 1999–2001



* indicates schedule change: introduction of universal hepatitis B vaccine (including a birth dose) and use of DTPa-hepatitis B combination vaccine.

TABLE 1

IMMUNISATION ADVERSE EVENTS: CASE STUDIES

Case 1

A nine-month old male infant was referred to the Clinic by his paediatrician for advice about his vaccinations, which were due at six months of age. Within 12 hours of the four-month vaccination with DTPa-HepB, Hib and oral polio vaccine, the infant had developed fever, lethargy, poor feeding, abnormal behaviour, and a papular erythematous rash. His parents brought him to the emergency department of The Children's Hospital at Westmead. Investigations revealed a monocytic cerebrospinal fluid (CSF) pleocytosis, slightly elevated CSF protein, reduced CSF glucose, and peripheral blood pleocytosis consistent with a diagnosis of viral meningoencephalitis. Two weeks after this episode he had completely recovered. Although no virus was isolated, the clinical course and CSF results are consistent with a coincidental viral meningoencephalitis, unrelated to his four-month vaccinations. After discussion with his parents, the infant was admitted overnight and given his routine six-month vaccinations without any AEFI.

Case 2

A five-month old female infant, who had been born prematurely, was referred to the Clinic by her general practitioner. She was born by emergency caesarean section at 28 weeks' gestation because of maternal pregnancy-induced hypertension. In the 24-hour period following her two-month (36 weeks corrected gestational age) vaccinations she experienced 12–15 apnoeas and bradycardias. She was nursed in increased oxygen for the first 24 hours and then in room air without subsequent problems; investigations revealed no cause for the apnoea.

She was admitted to The Children's Hospital at Westmead as a day-stay patient, aged five months, for her routine four-month vaccinations, which were tolerated without any AEFI.

Case 3

An eight-month old female was referred to the Clinic by her general practitioner. Following her two-month vaccinations, she had been irritable and hypersensitive to external stimuli, with high-pitched screaming for one hour. The symptoms persisted for 48 hours, after which she recovered completely. At 4.5 months of age, multiple protein intolerance and chemical insensitivity, managed with a hypoallergenic diet, were diagnosed.

When she was eight months old, she was admitted to The Children's Hospital at Westmead, as a day-stay patient for her routine four-month vaccinations, which were tolerated without recurrence of the adverse event; a catch-up schedule was recommended.

The parents of children seen at the Clinic are counselled about continuation of the standard vaccination schedule. Children may be vaccinated under supervision at the Clinic or admitted later as day-stay or overnight cases to be vaccinated with a longer period of observation. Such inpatient observation has proved very useful in encouraging re-vaccination after previous convulsions, HHEs, or apparent life-threatening events.[10] Children vaccinated at the Immunisation Adverse Events Clinic are routinely followed-up with a telephone interview 72 hours later, to ascertain any AEFI that may have occurred after vaccination.

Attendances

Between January 1997 and October 2002, the Clinic reviewed 453 patients, 40 per cent of whom had an underlying medical illness, such as asthma or atopy, or a developmental delay. Most of these patients (364/453 or 80 per cent) had had a previous suspected AEFI; the remaining 20 per cent were predominantly seen for advice about future vaccination: for example, MMR vaccination in the presence of an allergy to eggs.

The most common adverse events were fever, screaming, or severe local reactions, and most were associated with combinations of vaccines that included diphtheria, tetanus, and pertussis antigens—particularly combinations containing DTPw. Children who had experienced more severe adverse events, such as convulsions, HHEs, and encephalopathies, were also seen; in most cases they were able to continue their immunisation schedule.[11] The change from whole-cell to acellular pertussis vaccine (DTPa) in 1999 resulted in a fall in the number of referrals to the clinic of children with adverse events commonly associated with DTPw—such as fever, inconsolable crying, HHEs, and seizures (Figure 1).[12] Examples of cases are presented in Table 1.

DISCUSSION

The importance of adverse events following immunisation should not be underestimated. In the 1995 Australian national survey on childhood immunisation, carried out by the Australian Bureau of Statistics, 6.6 per cent of parents cited concerns about side-effects as reasons for not vaccinating their children. Changes to the immunisation schedule, introduction of new vaccines, and a tendency for the media to focus on adverse events increase both provider and parental concern.[13] While a telephone hotline can provide detailed information and a

response to queries and anxiety,[14] a personal consultation enables physical examination of the patient, detailed discussion of the pros and cons of continuing the vaccination series, discussion of written educational material, and re-vaccination if indicated. Information about vaccination, often anecdotal and misleading, is freely available on the Internet,[15] and the special clinics provide a means for parents to validate concerns and resolve any misconceptions about adverse events.

At a population level, special immunisation adverse events clinics can enhance surveillance of adverse events after immunisation in a number of ways that are described below.

Provision of clinical data

Adverse events seen at the Westmead Clinic are reported to the NSW Department of Health using the standardised 'blue' reporting form. Accumulated data from the Australian Adverse Drug Reactions Advisory Committee (ADRAC) can identify reactions that occur infrequently and which may be associated with vaccination, and can monitor for unusually high rates of adverse or previously undocumented events.

Development of case definitions and clinical protocols

The collection of detailed clinical data on AEFIs and collaboration with other centres enable case definitions of adverse events following immunisation to be developed.[16] Similarly, clinical protocols can be formulated to standardise the management of adverse events. The clinics are also a site for long-term neurodevelopmental follow-up of children who have experienced an AEFI.

Detailed investigation of adverse events

Evaluation of patients with similar adverse events can help determine genetic or other risk factors for these adverse events, including identification of possible serological and cellular markers predictive of adverse events.

Demonstration of the safety of re-vaccination after severe adverse events

Several reports have illustrated the effectiveness of these clinics in promoting the continuation of the immunisation schedule when vaccines would otherwise have been missed.[1,3–5,10] In particular, children with a history of severe AEFIs have been successfully re-vaccinated.[5,10,11] The clinics also have a role in dissemination of this information to a wider health provider audience.

THE FUTURE

The role of immunisation adverse event clinics will evolve, as the incidence of diseases prevented by vaccination declines further; as new vaccines and methods of administration are licensed; and as adverse events following immunisation assume greater significance. The clinics demonstrate to providers and parents that adverse events are taken seriously but rarely contraindicate further doses of vaccine.

For more information contact the Immunisation Clinical Nurse Consultant, Immunisation Adverse Events Clinic, The Children's Hospital at Westmead, by telephone on (02) 9845 2113.

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PUBLIC HEALTH ASSOCIATION OF AUSTRALIA CONFERENCES

2003

SECOND PHAA INCARCERATION CONFERENCE

Human Rights, Human Wrongs, Human Costs:

The health of prisoners and detainees in Australia in the 21st century

2–3 April 2003

Mercure Hotel, Brisbane

The health of incarcerated populations is often regarded as separate from, or unrelated to, the health of the general community. However, the reality is that the majority of incarcerated people return to the wider community after relatively short periods of time. Therefore, health gains for incarcerated individuals are health gains for us all, while missed opportunities for those incarcerated adversely affect us all. Health and other issues pertaining to incarceration have a significant affect on families, community health, political decisions, social policy, and ethical and moral deliberations. The diversity of incarcerated populations, such as adult prisons, youth detention centres, police watch houses, and immigration detention facilities, gives rise to special challenges in addressing the range of health needs among incarcerated groups. This conference will provide a forum for review and analysis of these important issues, as well as making recommendations for the way forward.

Conference sub-themes

Communicable diseases, alcohol and other drugs, mental health, healthy prisons, women's health, post release and family issues, Aboriginal and Torres Strait Islander issues, violence and injury, staff issues for clinical staff and custodial staff, and research.

THIRTY-FIFTH PHAA ANNUAL CONFERENCE

Essentials, Differentials, and Potentials in Health

28 September–1 October 2003

Brisbane Convention and Exhibition Centre, Brisbane

The three components of the Thirty-Fifth PHAA Annual Conference reflect important aspects of contemporary public health research and practice:

- *Essentials*—The essential disciplines required to research and conduct public health, as well as the essential requirements for the promotion and maintenance of health and wellbeing;
- *Differentials*—Understanding the differences in health status and associated causal factors, as well as appreciating how the variety of public health interventions can ameliorate differences in health need;
- *Potentials*—Visions for the future. What can we take from our present understandings to improve public health knowledge and practice into the future?

Conference sub-themes

Injury and indigenous health, social policy and social determinants of health, tobacco and health, chronic disease: risk factors beyond behaviour change, engaging the community in health policy, health equity, and sustainable environments.

2004

IMMUNISATION CONFERENCE

The 9th National Public Health Association of Australia's Immunisation Conference is to be held in Cairns, Far North Queensland, in late 2004.

Planning is underway to include issues from our Asian Pacific region with a focus on China, South East Asia and the Western Pacific.

Further information about these conferences can be obtained by visiting the Public Health Association of Australia website at **www.phaa.net.au/conferences/frame_conferences** or by contacting the PHAA Secretariat by email **conference@phaa.net.au** or by telephone (02) 6285 2373.

FACT*SHEET*

B O I L S A N D I M P E T I G O

WHAT IS A BOIL?

A boil is an infection of the skin, usually caused by *Staphylococcus* bacteria. Boils are tender, swollen sores, which are full of pus. The tenderness usually goes away, once the boil bursts and the pus and fluid drain.

WHAT IS IMPETIGO?

Impetigo is an infection of the skin caused by either *Staphylococcus* or *Streptococcus* bacteria. The symptoms of impetigo are either small blisters or flat, honey-coloured crusty sores, on the skin. Impetigo is sometimes called 'school sores'.

HOW ARE BOILS AND IMPETIGO TREATED?

If you have the symptoms of boils or impetigo:

- see your doctor for advice on the treatment of both;
- if sores are small or few, local antiseptic cream and hot compresses may help;
- your doctor may prescribe you antibiotic tablets or ointment. It is important to take the full course of antibiotics. If you don't, the sores may come back.

HOW ARE BOILS AND IMPETIGO SPREAD?

Boils and impetigo are spread between people by:

- touching or bursting a boil or impetigo;
- using soiled towels, clothes, or bed sheets that have been used by a person with a boil or impetigo;
- using grooming items (for example, nail scissors, tweezers, and razors) that have been used by a person with a boil or impetigo.

HOW CAN YOU STOP THE SPREAD OF BOILS AND IMPETIGO?

Wash your hands

Hand washing is the most important way to prevent the spread of boils and impetigo. Wash all parts of your hands (including between the fingers and under fingernails) vigorously with soap and running water for 10-15 seconds. Rinse well and dry your hands (with a paper towel if you can). Wash your hands:

- before and after touching or dressing an infected area or wound;
- after going to the toilet;
- after blowing your nose;
- before handling or eating food;
- before handling newborn babies;
- after touching or handling unwashed clothing or linen;
- after handling animals or animal waste.

Cover boils and impetigo

- Cover boils and impetigo with a watertight dressing during the daytime.
- Children with impetigo should not go to school or childcare until after they have been on treatment for one full day.

Do not share

- soiled towels, clothes or bed sheets. If you share a bed with someone, keep sores or wounds dressed overnight;
- grooming items such as nail scissors, tweezers, razors and toothbrushes.

For further information please contact your local public health unit, community health centre, or doctor.

January–February 2003

NSW HEALTH
Working as a Team

COMMUNICABLE DISEASES, NSW: JANUARY–FEBRUARY 2003

TRENDS

Notifications of communicable diseases were largely in line with seasonal expectations through to December 2002 (Tables 7 and 8, Figure 1). Data for December should be interpreted with caution, as there is likely to be some delay in the notification of some diseases because of the Christmas–New Year holiday period.

ENTERIC DISEASES

Hepatitis A

In November, the Northern Sydney Public Health Unit (NSPHU) investigated a cluster of eight cases of hepatitis A linked to a 'yum cha' restaurant. The cases had all eaten in the restaurant in late September. Officers from the NSPHU inspected the restaurant and did not identify any food preparation practices that were high-risk. The staff of the restaurant were interviewed and agreed to have blood tests for hepatitis A serology. No evidence of recent acute infection was found in any of the food handlers. Detailed interviews were conducted with the cases and other patrons but no obvious source of infection was identified.

A similar outbreak occurred in 1997 at a restaurant in South Eastern Sydney. In that investigation, a case-control study found the likely source to be undercooked imported prawns. While the exact cause of the outbreak in Northern Sydney remains unclear, it is likely it was from eating contaminated food, although exactly what food and how it was contaminated remains unclear. Given the negative serology of food handlers, it would seem most likely that a food product was contaminated at source (that is, where the food originates from), probably through exposure to human effluent.

Prevention of food-borne hepatitis A infection must focus on:

- effective surveillance, investigation, and timely intervention;
- hygienic food preparation practices;
- thorough hand washing with soap and running water after using the toilet and before eating or preparing food;
- exclusion of infected food handlers from work while infectious;
- establishing effective systems to control contamination of food 'at source';
- thorough cooking of foods such as prawns and shellfish that could be contaminated with faecal organisms.

Cryptosporidiosis

Notifications of this parasitic infection increased slightly in December 2002, mainly in rural areas in the north of the state. Epidemics seem to occur every few years in NSW, most likely linked to contaminated swimming pools. To help keep swimming pools clear of the highly infectious and chlorine-resistant *Cryptosporidium* parasites, NSW Health recommends that people with diarrhoea avoid entering swimming pools for at least a week after symptoms have completely resolved.

Salmonellosis

December was a busy month for food-borne disease notifications and investigations. There were over 250 notifications of salmonellosis this month with increases in infections from some unusual serovars: *S. montevideo* (22), *S. potsdam* (19) and *S. kottbus* (6). The Hunter Public Health Unit (HPHU) investigated an outbreak of *S. montevideo* in Newcastle and linked it to Egyptian tahini imported by a company in Sydney. Tahini is a paste made from sesame seeds and is used as an ingredient for humus. To date there have been 30 notified cases, 21 of these in the Hunter area. The HPHU investigation led to a consumer-level recall of products containing the tahini.

NSW Health identified an increase in the number of *S. potsdam* cases in early December. Other states and territories reported similar increases and an investigation was undertaken to determine the source of the outbreak. The cases spread from the mid-north coast of NSW to Tasmania in the south and South Australia in the west. There are about 60 cases to date. All jurisdictions have conducted hypothesis-generating questionnaires. The source of the outbreak remains unclear and the investigation is continuing.

ZOONOSES

Q fever remains the most commonly reported zoonotic disease throughout the year. Psittacosis has been the only other zoonosis reported in significant numbers this year, mostly related to an outbreak in the Blue Mountains in the first half of the year. An interim report of this outbreak will appear in the March issue of the *Bulletin*.

OTHER RESPIRATORY DISEASES

Relatively few notifications of Legionnaires' diseases were received in December 2002, and notifications of meningococcal disease declined as expected for this time of year.

INVASIVE PNEUMOCOCCAL DISEASE SURVEILLANCE, NSW, JANUARY–JUNE 2002

Invasive pneumococcal disease (IPD) became notifiable by all laboratories in NSW in 2001, and 2002 saw the start of enhanced surveillance for notified cases aged less than five years and 50 years and older. *Streptococcus pneumoniae* is a frequent cause of serious bacterial infections worldwide and not only results in infections of the lower respiratory tract but also invasive infections,

TABLE 1

CASES OF INVASIVE PNEUMOCOCCAL DISEASE, NSW, JANUARY TO JUNE 2002

Characteristics	Cases *N*	%	Standardised incidence per 100,000 (annual)
Age group (years)			
0–<1	28	8.3	65.9
1–<2	45	12.7	103.8
2–<5	45	13.4	34.7
5–<50	73	21.7	3.5
50–<65	46	13.7	9.1
≥65–79	55	16.4	17.3
80 +	43	12.8	44.3
Age not given	1	0.3	
Sex			
Male	189	56.0	
Female	147	44.0	
Area Health Service			
Central Coast	19	5.6	12.9
Central Sydney	34	10.2	13.8
Hunter	35	10.5	12.9
Illawarra	26	7.7	14.9
North Sydney	46	13.7	11.8
South Eastern Sydney	37	11.1	9.5
South Western Sydney	34	10.2	8.7
Wentworth	16	4.7	10.2
Western Sydney	53	15.8	15.4
Rural NSW	32	9.5	4.4
Area not given	1	1.0	
Total	333	100.0	10.3

Note:Rural NSW = Mid Western, Macquarie, Greater Murray, Northern Rivers, New England, Mid North Coast, Far Western and Southern Area Health Services.

such as bacteraemia. It is the second most common cause of bacterial meningitis in children. Only cases of invasive disease (defined as isolation of *S. pneumoniae* from culture of any normally sterile site including: blood, cerebral spinal fluid, pleural fluid, joint fluid and peritoneal fluid) are notifiable.

Since January 2001, all laboratories in NSW have been asked to forward isolates to The Children's Hospital at Westmead. Since January 2002, public health units have conducted the enhanced surveillance. Risk factors and information on immunisations are collected through the treating clinicians, hospital records, and case interviews, and is forwarded to the Communicable Diseases Branch of the NSW Department of Health for collation and reporting. Typing and antibiotic sensitivity testing are reported from The Children's Hospital at Westmead database.

From January to June 2002, 333 cases of IPD were reported in NSW (10.3 per 100,000 population). Children aged 1–2 years had the highest incidence (103.7 per 100,000) followed by children aged less than 1 year (65.9) and adults aged more than 80 years (44.3) (Table 1). The male to female ratio was 1.3:1. Western Sydney and the Illawarra Area Health Services had the highest incidence and South Western Sydney and South Eastern Sydney the lowest. The highest number of cases was reported in June (117).

Enhanced data was collected on all 118 children aged less than 5 years, and on 147 adults aged 50 years. Two-thirds of the children were males compared to just under half of adults. Four cases were identified in Indigenous people. Rates among children aged less than 5 years were highest in Western Sydney, Central Coast, and Northern Sydney Areas. In contrast, rates among adults aged more than 50 years were highest in the Hunter, Central Sydney and the Illawarra Areas (Table 2).

Bacteraemia (70 per cent) was the most common clinical presentation among children. Pneumonia (75 per cent) was the most common presentation of infection in adults. Meningitis was an uncommon presentation in both age groups, accounting for nine per cent of cases in children and four per cent in adults. Sixteen per cent of children and 73 per cent of adults had a predisposing condition. Forty deaths (16 per cent) were reported and all these cases who died were adults.

TABLE 2

INVASIVE PNEUMOCOCCAL DISEASE BY AREA HEALTH SERVICE, NSW, JANUARY TO JUNE 2002

Area of residence	Number of cases		Incidence rate per 100,000	
	< 5 y old	≥ 50 y old	< 5 y old	≥ 50 y old
Greater Sydney Area				
Western Sydney	24	11	92.3	13.0
Hunter	9	22	50.5	27.4
Central Sydney	8	17	54.0	26.0
Wentworth	8	7	66.3	19.7
Illawarra	8	13	69.8	24.3
North Sydney	20	19	89.9	15.9
Central Coast	9	9	90.9	18.8
South Eastern Sydney	12	18	54.9	16.2
South Western Sydney	12	11	39.0	12.0
Rural Areas				
Mid Western	3	7	51.8	28.5
Macquarie	1	2	25.2	13.3
Greater Murray	2	4	22.0	10.7
Northern Rivers	0	2	0.0	4.7
New England	0	1	0.0	3.8
Mid North Coast	1	1	13.1	2.1
Far Western	1	2	59.1	27.6
Southern	0	1	0.0	3.4
Total	**118**	**147**	**54.8**	**16.0**

Vaccination data were available for 93 (79 per cent) children aged less than 5 years and 62 (42 per cent) of adults aged 50 years or older. Fourteen of the adults (22 per cent) were reported to have been vaccinated but none of the children were.

Antibiotic sensitivity results reported for this time period are reported from the various participating laboratories. Not all laboratories use the same antibiotic testing methods, so results may vary. Resistance was reported in 9.4 per cent of cases, 8.5 per cent in children and 10.2 per cent in adults.

Serotyping was available on 82 per cent of all notified cases (*N*=272). Eighty-seven (90 per cent) of children aged less than 5 years had serotypes that were included in the 7-valent conjugate vaccine. Ten of the fourteen adults vaccinated had a serotype that was contained in the polysaccharide vaccine. Overall, 95 per cent of cases (aged more than15 years) had serotypes contained within the vaccine.

These data suggest that the incidence of IPD varies across the area health services. Within the rural areas of NSW, rates were very high for the Mid Western and the Far West Areas, both for adults and for children. These data may reflect the different practices for taking blood culture in the regions.

ACKNOWLEDGEMENT

With thanks to the public health units and microbiology laboratories across NSW, and especially to Dr Michael Watson and staff from the Microbiology Department, The Children's Hospital at Westmead, for work on laboratory surveillance and serotyping

BLOOD-BORNE AND SEXUALLY TRANSMISSIBLE INFECTIONS

Quarterly report: HIV notifications to end of September 2002

HIV notifications in NSW continue to decline in 2002. To the end of September 2002, the cumulative number of HIV diagnoses in NSW residents was 12,723. The number of HIV diagnoses for 2001 was 350, compared with 361 in 2000 (Table 3).

New HIV diagnoses

Of the 257 new cases of HIV diagnosed between 1 January and 30 September 2002, 233 (91 per cent) were males, 19 (7 per cent) were females, two (less than 1 per cent) were transgender, and for three (one per cent) their gender was not reported (Table 4). At the time of diagnosis, all notified cases were aged 20 years or older; 25 per cent were aged between 20–29 years; and 42 per cent were aged between 30–39 years. Eighty-five percent of cases

diagnosed were residents of Greater Sydney area health services (which include Central Sydney, North Sydney, Western Sydney, Wentworth, South West Sydney and South East Sydney).

Risk factors

Male-to-male sexual contact (with or without a history of injecting drug use) was reported for over two-thirds of cases, and heterosexual contact (as the only risk factor) was reported for 15 per cent (Table 4). Five (two per cent) cases reported injecting drug use as their only risk factor. This compared with 20 cases reported in the previous year. One case of vertical transmission was reported this year, giving a total of 39 cases of vertical transmission for NSW since the beginning of the epidemic. Risk exposure remains undetermined or unknown for 14 per cent of cases notified in 2002.

Newly-acquired HIV infections

For the period 1992 to 30 September 2002, there have been 1079 newly-acquired HIV infections (NAIs). A NAI is defined as HIV infection diagnosed within 12 months of a previous negative HIV test or following a seroconversion illness. This represents 21 per cent of all HIV notifications. The number of newly-acquired infections has risen slightly in recent years: 1997 (70); 1998 (72); 1999 (95); 2000 (87); 2001 (98). There were 77 NAIs reported from January to 30 September 2002. The increase in reporting is likely to be due to improvements in both quality and completeness of data.

AIDS diagnoses and AIDS deaths

The number of AIDS diagnoses and AIDS deaths continues to decline significantly, with only 39 AIDS cases and 17 deaths reported to 30 September 2002 (Table 3). Active AIDS surveillance through local public health units begins in November each year, which usually results in an increase in numbers of cases of AIDS and AIDS deaths reported in final quarter of the year. Therefore, the cumulative totals for 2002 should be treated with caution, until data for the final quarter is available. The cumulative AIDS diagnoses and AIDS deaths to 30 September 2002 is currently 5098 and 3494 respectively. The estimated number of people living with HIV in NSW was 9229 on 30 September 2002. An estimated 1604 were living with an AIDS-defining illness.

Combined HIV–AIDS database

From December 2002, the NSW Department of Health will be operating a combined HIV–AIDS database with a single patient record for HIV and AIDS diagnoses. One of the challenges of the new integrated system is matching of

TABLE 3

NOTIFICATION OF HIV, AIDS AND AIDS DEATHS BY YEAR, NSW, 1981–30 SEPTEMBER 2002

	HIV		AIDS		AIDS deaths	
Year	*N*	%	*N*	%	*N*	%
1981	1	0.01	1	0.02	1	0.03
1982	1	0.01	1	0.02	0	0.00
1983	2	0.02	3	0.06	1	0.03
1984	208	1.63	30	0.59	6	0.17
1985	1002	7.86	91	1.79	46	1.32
1986	1106	8.67	162	3.19	108	3.09
1987	1641	12.87	251	4.94	143	4.09
1988	1152	9.03	321	6.31	139	3.98
1989	991	7.77	355	6.98	239	6.84
1990	820	6.43	425	8.36	326	9.33
1991	824	6.46	443	8.71	344	9.85
1992	703	5.51	432	8.50	330	9.44
1993	594	4.66	481	9.46	379	10.85
1994	502	3.94	552	10.86	423	12.11
1995	537	4.21	473	9.30	356	10.19
1996	455	3 57	367	7.22	272	7.78
1997	429	3.36	199	3.91	125	3.58
1998	406	3.18	173	3.40	69	1.97
1999	379	2.97	108	2.12	63	1.80
2000	361	2.83	119	2.34	71	2.03
2001	350	2.74	69	1.36	36	1.03
2002 (to September)	257	2.27	39	0.85	17	0.49
Total	**12723**	**100.00**	**5098**	**100.00**	**3494**	**100.00**

TABLE 4

CHARACTERISTICS OF NSW RESIDENTS REPORTED WITH HIV INFECTION, AIDS, OR WHO HAVE DIED FROM AIDS, 1981 TO 31 SEPTEMBER 2002

Characteristic	All cases 1981–-Sep 2002						Cases for 2001						Jan–Sep 2002					
	HIV		AIDS		AIDS deaths		HIV		AIDS		AIDS deaths		HIV		AIDS		AIDS deaths	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Gender																		
Female	675	5.3	207	4.1	120	3.4	32	9.1	6	8.5	3	8.3	19	7.4	0	0.0	0	0.0
Male	11767	92.5	4878	95.7	3365	96.3	311	88.9	65	91.5	33	91.7	233	90.7	38	97.4	17	100.0
Transgender	24	0.2	13	0.3	9	0.3	0	0.0	0	0.0	0	0.0	2	0.8	1	2.6	0	0.0
Not stated	257	2.0	0	0.0	0	0.0	7	2.0	0	0.0	0	0.0	3	1.2	0	0.0	0	0.0
Age																		
0 - 2	28	0.2	7	0.1	3	0.1	0	0.0	0	0.0	1	2.8	1	0.4	0	0.0	0	0.0
3 - 12	37	0.3	11	0.2	8	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
13 - 19	206	1.6	13	0.3	9	0.3	3	0.9	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0
20 - 29	4028	31.7	758	14.9	539	15.4	84	24.0	7	9.9	4	11.1	63	24.5	2	5.1	1	5.9
30 - 39	4861	38.2	2119	41.6	1434	41.0	145	41.4	26	36.6	19	52.8	109	42.4	14	35.9	5	29.4
40 - 49	2405	18.9	1487	29.2	1021	29.2	75	21.4	22	31.0	8	22.2	57	22.2	15	38.5	8	47.1
50 - 59	776	6.1	531	10.4	350	10.0	21	6.0	12	16.9	2	5.6	17	6.6	8	20.5	3	17.6
60 +	271	2.1	172	3.4	130	3.7	9	2.6	4	5.6	2	5.6	6	2.3	0	0.0	0	0.0
Not stated	111	0.9	0	0.0	0	0.0	13	3.7	0	0.0	0	0.0	3	1.2	0	0.0	0	0.0
Exposure																		
Male homosexual-bisexual	7560	59.4	4136	81.1	2903	83.1	220	62.9	54	76.1	25	69.4	167	65.0	29	74.4	15	88.2
Male homosexual-bisexual and IDU	297	2.3	200	3.9	138	3.9	17	4.9	1	1.4	3	8.3	9	3.5	4	10.3	1	5.9
Injecting drug use	434	3.4	103	2.0	52	1.5	20	5.7	3	4.2	0	0.0	5	1.9	1	2.6	1	5.9
Heterosexual	901	7.1	308	6.0	149	4.3	57	16.3	7	9.9	5	13.9	37	14.4	5	12.8	0	0.0
Haemophilia- Coagulation disorders	114	0.9	52	1.0	46	1.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Blood-Tissue recipient/ NSI*	119	0.9	104	2.0	90	2.6	0	0.0	0	0.0	1	2.8	0	0.0	0	0.0	0	0.0
Vertical	39	0.3	14	0.3	7	0.2	0	0.0	0	0.0	1	2.8	1	0.4	0	0.0	0	0.0
Undetermined	3193	25.1	32	0.6	17	0.5	13	3.7	1	1.4	0	0.0	11	4.3	0	0.0	0	0.0
Not stated	66	0.5	149	2.9	92	2.6	23	6.6	5	7.0	1	2.8	27	10.5	0	0.0	0	0.0
Residence																		
Greater Sydney**	7057	55.5	4267	83.7	2934	84.0	310	88.6	54	76.1	28	77.8	218	84.8	35	89.7	14	82.4
Rest of New South Wales	831	6.5	674	13.2	425	12.2	38	10.9	16	22.5	8	22.2	21	8.2	4	10.3	3	17.6
Unknown	4835	38.0	157	3.1	135	3.9	2	0.6	1	1.4	0	0.0	18	7.0	0	0.0	0	0.0
Grand Total	12723	100	5098	100	3494	100	350	100	71	100	36	100	257	100	39	100	17	100

Source: NSW HIV–AIDS database, Communicable Diseases Branch, NSW Department of Health. Recent HIV data may contain duplicates

* Needle-stick injury

** Greater Sydney area health services include Central Sydney, North Sydney, Western Sydney, Wentworth, South West Sydney, and South East Sydney

the HIV and AIDS records, given that over 40 per cent of HIV notifications had inadequate identifiers (that is, details that make the record unique, such as name codes and date of birth), particularly before 1990. Once in operation, the combined HIV–AIDS database will further improve the timeliness and data quality of all notification data and reduce duplicates.

GLOSSARY OF TERMS

New HIV diagnosis refers to a person who is diagnosed for the first time with human immunodeficiency virus (HIV) infection

Newly-acquired HIV infection refers to a person with a new HIV diagnosis who tested HIV negative or reported a seroconversion illness in the 12 months before HIV diagnosis

AIDS refers to a person with HIV infection who develops one of several infections, malignancies or other medical conditions indicating immune depression consistent with the definition of the acquired immunodeficiency syndrome (AIDS)

AIDS death refers to a person who has died of any cause after being diagnosed with AIDS

VECTOR-BORNE DISEASES

Notifications of both Ross River virus and Barmah Forest virus infections were few for this time of year, possibly due to reduced mosquitoes activity associated with the drought.

VACCINE-PREVENTABLE DISEASES

There were no reports of measles for the three-month period to December 2002. Cases of pertussis increased a little in spring, which is typical for this infection.

Quarterly report: Australian Childhood Immunisation Register

Table 5 details the percentage of fully immunised children aged 12 months to less than 15 months in each area health service, reported by all service providers.

These data refer to five different cohorts of children whose age has been calculated 90 days before data extraction. The information contained in each of the reports has been extracted from the Australian Childhood Immunisation Register (ACIR) and may not reflect actual coverage due to under-reporting. Table 6 details the percentage of fully immunised children identified as Aboriginal or Torres Strait Islander in New South Wales, for the same cohort, reported by all service providers.

TABLE 5

PERCENTAGE OF FULLY IMMUNISED CHILDREN AGED 12 MONTHS TO LESS THAN 15 MONTHS BY AREA HEALTH SERVICE

Area Health Service	31 Dec 01	31 Mar 02	30 June 02	30 Sept 02	31 Dec 02
Central Coast	94	92	90	92	93
Central Sydney	87	88	89	90	90
Hunter	93	94	94	93	94
Illawarra	91	93	89	94	92
Northern Sydney	89	90	89	91	91
South Eastern Sydney	89	90	89	92	91
South Western Sydney	89	90	90	90	92
Wentworth	91	92	90	91	90
Western Sydney	89	90	90	91	92
Far West	94	92	90	90	89
Greater Murray	93	93	92	94	93
Macquarie	95	92	93	91	92
Mid North Coast	88	90	90	88	90
Mid Western	92	92	91	91	94
New England	94	94	92	91	93
Northern Rivers	84	80	84	84	85
Southern	89	93	90	91	91
NSW	**91**	**91**	**90**	**91**	**91**
Australia	**90**	**91**	**90**	**91**	**92**

TABLE 6

PERCENTAGE OF FULLY IMMUNISED CHILDREN IDENTIFIED AS ABORIGINAL AND TORRES STRAIT ISLANDER, AGED 12 MONTHS TO LESS THAN 15 MONTHS

	30 June 02	30 Sept 02	31 Dec 02
NSW	87	85	86
Australia	85	85	84

FIGURE 1

REPORTS OF SELECTED COMMUNICABLE DISEASES, NSW, JANUARY 1997 TO DEC 2002, BY MONTH OF ONSET

Preliminary data: case counts in recent months may increase because of reporting delays.
Laboratory-confirmed cases only, except for measles, meningococcal disease and pertussis
BFV = Barmah Forest virus infections, RRV = Ross River virus infections
LI = Legionella longbeachae infections, Lp = L. pneumophila infections
Gp C and Gp B = disease due to serogroup C and serogroup B infection,
other/unk = other or unknown serogroups

NSW population	
Male	50%
<5	7%
5–24	28%
25–64	52%
65+	13%
Rural*	42%

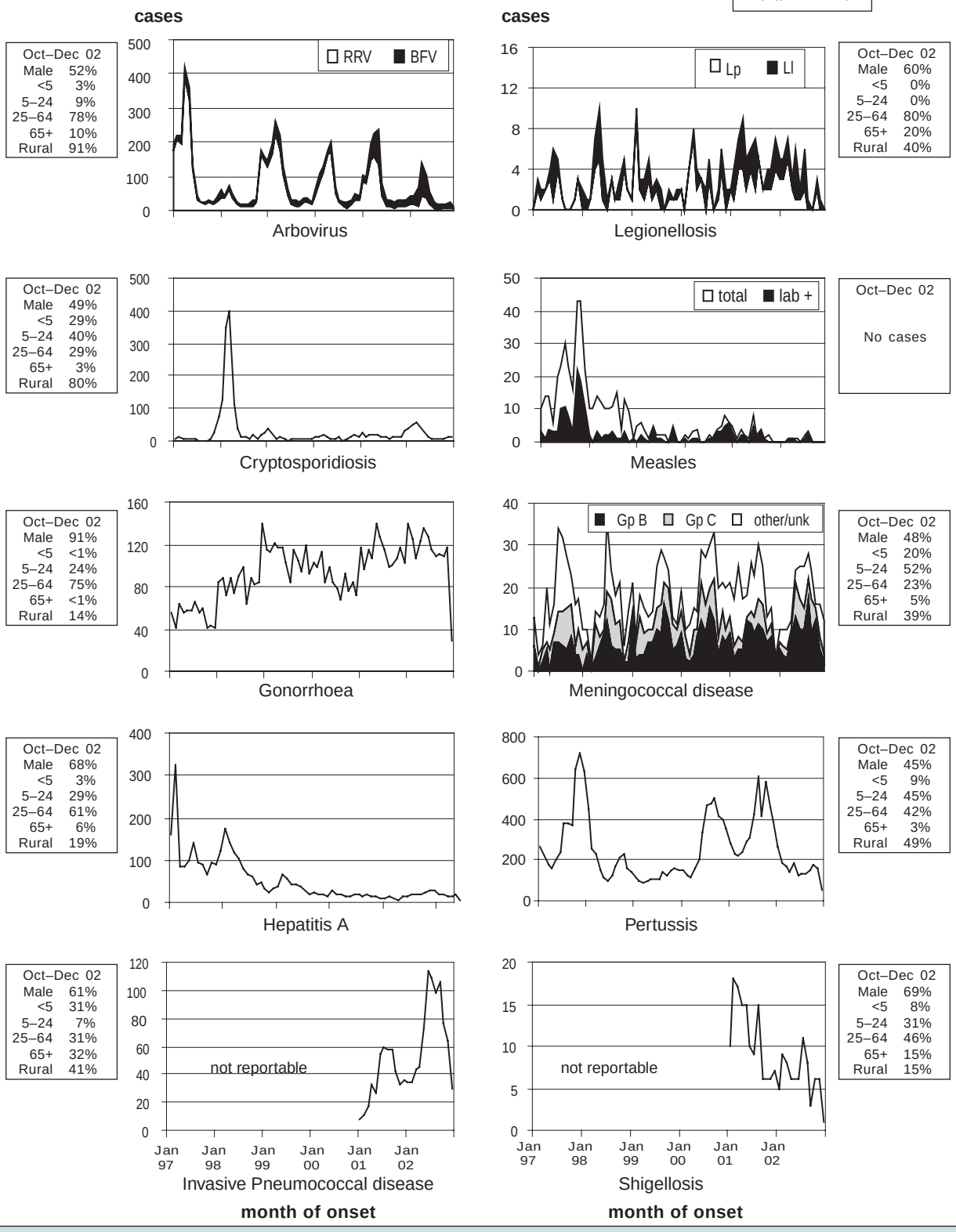

TABLE 7 REPORTS OF NOTIFIABLE CONDITIONS RECEIVED IN NOVEMBER 2002 BY AREA HEALTH SERVICES

Condition	Area Health Service																		Total	
	CSA	NSA	WSA	WEN	SWS	CCA	HUN	ILL	SES	NRA	MNC	NEA	MAC	MWA	FWA	GMA	SA	CHS	for Nov†	To date†
Blood-borne and sexually transmitted																				
Chancroid*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlamydia (genital)*	80	60	38	19	13	13	46	14	85	25	14	14	6	14	5	25	13	-	495	5,123
Gonorrhoea*	20	11	3	1	3	3	3	2	62	-	1	1	-	2	2	1	-	-	123	1,335
Hepatitis B - acute viral*	-	1	-	-	1	-	2	-	2	-	-	-	1	-	-	-	-	-	8	88
Hepatitis B - other*	69	38	71	5	12	5	8	3	29	1	4	2	3	-	-	2	4	-	257	3,660
Hepatitis C - acute viral*	-	1	-	-	-	-	2	-	-	-	-	-	1	-	-	1	-	-	5	134
Hepatitis C - other*	77	47	56	15	14	38	54	33	40	34	34	13	11	20	-	15	19	-	525	6,991
Hepatitis D - unspecified*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
Syphilis	8	3	9	-	9	3	-	-	29	-	3	3	2	-	-	-	4	-	74	662
Vector-borne	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Barmah Forest virus*	-	-	-	-	-	-	2	-	-	4	11	1	-	-	-	2	-	-	20	389
Ross River virus*	-	-	-	-	-	-	3	-	-	-	1	2	2	-	-	-	-	-	8	187
Arboviral infection (Other)*	1	-	-	-	-	1	-	1	3	-	-	-	-	-	1	-	-	-	8	78
Malaria*	1	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	5	103
Zoonoses		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Anthrax*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brucellosis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Leptospirosis*	1	-	-	-	-	-	2	-	-	-	2	2	-	-	-	-	-	-	7	36
Lyssavirus*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Psittacosis*	-	-	-	-	1	-	3	-	-	-	-	-	-	-	-	2	-	-	6	136
Q fever*	-	-	-	-	1	2	2	1	-	10	5	1	8	3	2	1	2	-	38	272
Respiratory and other		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Blood lead level*	4	3	-	2	1	1	9	2	-	-	1	-	-	-	-	1	-	-	24	462
Influenza*	4	3	3	4	-	-	-	2	10	1	-	3	-	-	-	-	-	-	30	1,127
Invasive pneumococcal infection*	5	6	10	3	12	1	10	3	5	2	-	-	2	-	2	2	1	-	64	779
Legionella longbeachae infection*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	22
Legionella pneumophila infection*	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	20
Legionnaires' disease (Other)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leprosy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meningococcal infection (invasive)*	-	1	2	2	-	-	3	1	3	-	-	-	-	-	-	-	1	-	14	198
Tuberculosis*	4	-	2	1	8	-	3	1	3	-	-	-	-	-	-	-	-	-	22	422
Vaccine-preventable		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Adverse event after immunisation	1	2	1	-	-	2	2	-	-	-	-	-	-	1	-	1	-	-	10	171
H. *Influenzae b* infection (invasive)*	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	2	11
Measles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
Mumps*	-	-	1	-	-	1	-	-	-	1	-	-	1	-	-	-	-	-	4	29
Pertussis	19	37	17	2	15	8	16	3	17	5	26	19	1	10	2	2	4	-	203	2,076
Rubella*	-	-	-	-	-	-	-	-	-	1	-	-	2	-	-	-	-	-	3	34
Tetanus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Faecal-oral		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Botulism	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cholera*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Cryptosporidiosis*	-	-	-	1	-	-	-	-	3	2	2	1	-	-	-	1	-	-	10	288
Food borne illness (not otherwise specified)	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	34
Gastroenteritis (in an institution)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,811
Giardiasis*	2	7	4	3	6	2	3	2	17	4	1	3	1	2	-	-	1	-	-	669
Haemolytic uraemic syndrome	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	7
Hepatitis A*	2	2	2	1	1	-	-	-	2	-	1	-	-	-	-	-	1	-	12	154
Hepatitis E*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
Listeriosis*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	9
Salmonellosis (not otherwise specified)*	7	16	16	13	13	6	16	3	22	19	4	5	6	4	-	10	3	-	163	1,948
Shigellosis*	2	1	-	-	1	-	-	-	2	-	-	-	-	-	-	-	-	-	6	77
Typhoid and paratyphoid*	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	34
Verotoxin producing *E. coli**	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5

* lab-confirmed cases only + includes cases with unknown postcode* * HIV and AIDS data are reported separately in the *NSW Public Health Bulletin*

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MWA = Mid Western Area
FWA = Far West Area
GMA = Greater Murray Area
SA = Southern Area
CHS = Corrections Health Service

TABLE 8 REPORTS OF NOTIFIABLE CONDITIONS RECEIVED IN DECEMBER 2002 BY AREA HEALTH SERVICES

Condition	Area Health Service																		Total	
	CSA	NSA	WSA	WEN	SWS	CCA	HUN	ILL	SES	NRA	MNC	NEA	MAC	MWA	FWA	GMA	SA	CHS	for Dec†	To date†
Blood-borne and sexually transmitted																				
Chancroid*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlamydia (genital)*	22	57	40	16	1	1	43	18	71	15	14	11	7	9	19	12	8	-	372	5,527
Gonorrhoea*	-	9	8	4	-	-	1	-	29	7	1	2	1	1	-	-	-	-	65	1,407
Hepatitis B - acute viral*	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	1	-	-	4	92
Hepatitis B - other*	29	30	28	4	1	2	1	4	32	2	-	1	2	1	5	2	1	-	145	3,842
Hepatitis C - acute viral*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	149
Hepatitis C - other*	42	22	20	18	-	5	50	33	13	33	21	16	7	11	4	7	11	-	319	7,359
Hepatitis D - unspecified*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
Syphilis	22	4	9	1	-	1	-	3	20	2	2	3	1	1	4	-	-	-	74	770
Vector-borne	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Barmah Forest virus*	-	-	-	-	-	-	1	1	-	1	9	-	1	-	-	-	1	-	14	403
Ross River virus*	-	-	-	-	-	-	-	-	-	-	3	-	2	-	-	1	-	-	6	194
Arboviral infection (Other)*	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	2	-	4	83
Malaria*	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	104
Zoonoses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Anthrax*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brucellosis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Leptospirosis*	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	2	38
Lyssavirus*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Psittacosis*	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	140
Q fever*	-	-	-	-	-	-	1	2	-	5	2	3	7	4	4	2	4	-	34	305
Respiratory and other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Blood lead level*	-	2	-	-	1	-	3	3	1	1	1	-	1	1	-	1	1	-	18	483
Influenza*	-	3	1	-	-	-	-	3	5	-	-	-	-	-	-	-	-	-	13	1,140
Invasive pneumococcal infection*	3	11	5	-	7	3	5	4	7	-	1	-	-	2	-	14	1	-	63	843
Legionella longbeachae infection*	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	24
Legionella pneumophila infection*	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	22
Legionnaires' disease (Other)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leprosy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meningococcal infection (invasive)*	1	2	2	1	-	-	4	2	1	-	-	-	1	-	-	-	-	-	14	212
Tuberculosis	5	-	2	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-	11	441
Vaccine-preventable	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Adverse event after immunisation	-	-	1	-	-	1	-	-	1	-	1	-	-	2	1	-	-	-	7	181
H. *Influenzae b* infection (invasive)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
Measles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
Mumps*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	30
Pertussis	13	13	19	3	12	1	15	6	17	5	15	7	4	-	-	-	5	-	135	2,214
Rubella*	1	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	3	37
Tetanus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Enteric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Botulism	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cholera*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Cryptosporidiosis*	-	-	1	-	1	1	5	1	-	-	4	7	-	-	-	-	-	-	20	308
Giardiasis*	-	8	9	1	2	-	9	6	1	2	1	3	3	-	4	2	-	-	51	853
Haemolytic uraemic syndrome	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
Hepatitis A*	1	1	-	-	1	-	1	-	-	-	2	-	-	-	-	-	-	-	6	160
Hepatitis E*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
Listeriosis*	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	3	12
Salmonellosis (not otherwise specified)*	6	24	6	8	17	1	26	5	30	22	5	7	3	5	1	8	5	-	179	2,130
Shigellosis*	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	3	80
Typhoid and paratyphoid*	1	-	-	-	1	-	-	-	2	-	-	-	-	-	-	-	-	-	4	38
Verotoxin producing *E. coli**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5

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