

THE REALITIES: DISEASES PREVENTABLE BY VACCINES

The following section shows the decline in vaccine-preventable diseases over time.

1. Diphtheria

Diphtheria is a serious communicable disease caused by toxigenic strains of *Corynebacterium diphtheriae*.

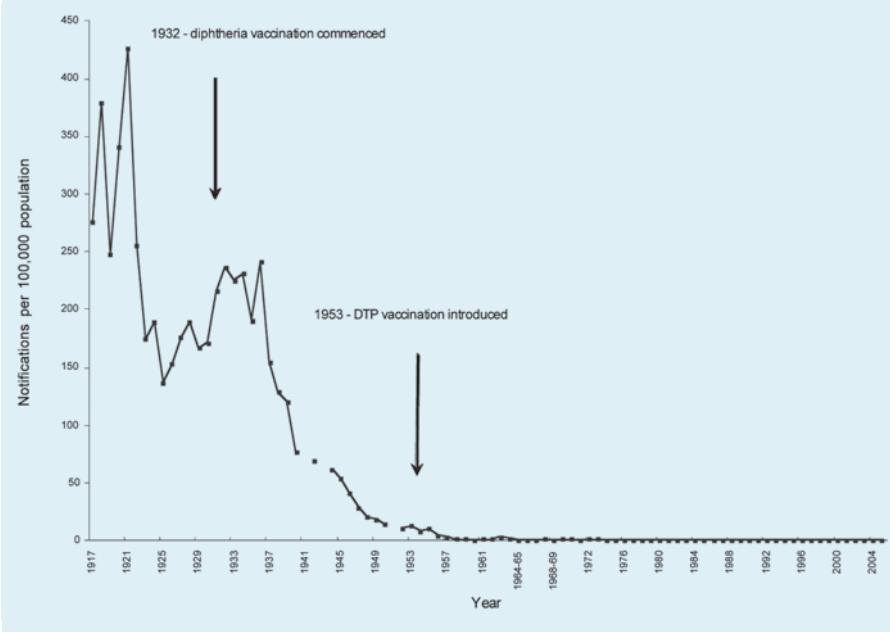
The case-fatality rate is 5% to 10% with the highest death rates occurring in the very young and the elderly.

Although diphtheria has become rare in Australia as a result of vaccination, the potential to encounter the disease remains, especially for travellers.

For example, outbreaks of diphtheria have occurred in areas in the former USSR in the last 10 years due to a decline in immunisation rates.

Figure 1

Diphtheria notifications, Australia, 1917–2005



Source: Brotherton J, Wang H, Schaffer A, et al. Vaccine preventable diseases and vaccination coverage in Australia, 2003 to 2005. *Communicable Diseases Intelligence* 2007;31(Suppl):viii-S152.

Further Reading

National Health and Medical Research Council (NHMRC). *The Australian Immunisation Handbook*. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

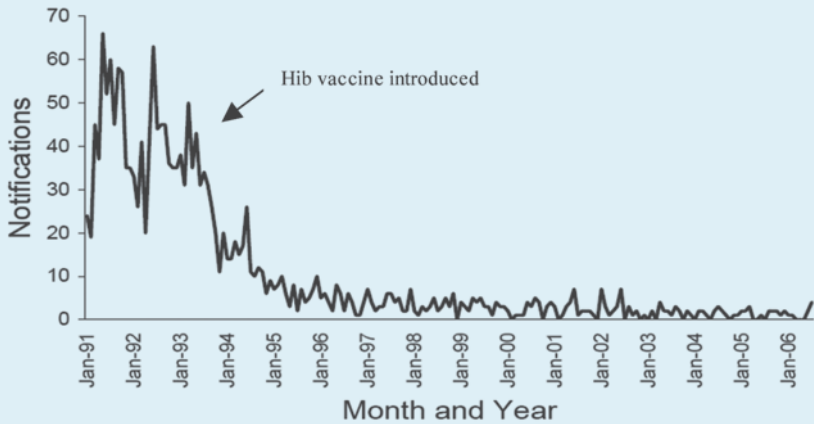
2. Haemophilus influenzae type b (Hib)

Hib is a bacterium which causes bloodstream infection, meningitis, epiglottitis, and pneumonia. Even with early treatment, meningitis has a case-fatality rate of 5% with many survivors having long-term disabilities. In Australia, before the introduction of Hib immunisation, there were approximately 500 cases each year, with 10–15 deaths.

Since Hib vaccine has been widely used in Australia from 1993 there has been a greater than 95% reduction in Hib cases in children less than five years of age, with less than 10 cases per year (see Figure 2). Of the few cases reported, most are in unimmunised children.

Figure 2

Haemophilus influenzae type b (Hib) notifications, Australia, 1991–2006



Source: Australian Government Department of Health and Ageing. Immunise Australia Program disease notifications. *Haemophilus influenzae* type b notifications, 1991–2006. 2007. Available at: <http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/program-disnotif> (accessed Jul 2007).

Further Reading

National Health and Medical Research Council (NHMRC). The Australian Immunisation Handbook. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

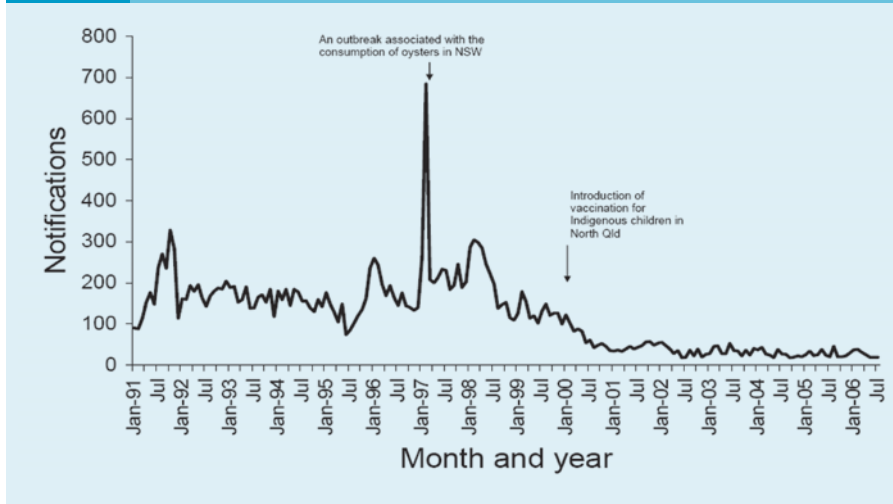
3. Hepatitis A

Hepatitis A is a virus which causes an acute hepatitis. It is transmitted by the faecal-oral route and is easily transmitted from person to person. Hepatitis A cases are highly infectious about one week before the symptoms become apparent and remain infectious for a further two weeks, generally following the appearance of jaundice. Infected people can unwittingly spread the disease to others living in the same household before the disease is diagnosed. The majority of notified cases of hepatitis A in Australia are seen in travellers returning from

overseas, particularly from areas in the Middle East, south-east Asia and eastern Europe. Routine hepatitis A immunisation is now recommended for all Aboriginal and Torres Strait Islander children in Queensland, the Northern Territory, Western Australia and South Australia where there are the highest population rates of disease.

Figure 3

Hepatitis A notifications, Australia, 1991–2006



Source: Australian Government Department of Health and Ageing. Immunise Australia Program disease notifications. Hepatitis A notifications, 1991–2006. 2007. Available at: <http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/program-disnotif> (accessed Jul 2007).

Further Reading

National Health and Medical Research Council (NHMRC). The Australian Immunisation Handbook. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

4. Hepatitis B

Hepatitis B is a virus which can cause acute or chronic hepatitis, liver cirrhosis (scarring) and liver cancer. It is transmitted by contact with blood and body fluids, for example by sexual intercourse, intravenous drug use or blood transfusion (which is now very rare because of routine blood screening procedures). In approximately 15% of cases, a readily identifiable risk factor for the infection is not found. Hepatitis B can also be transmitted from an infected mother to her baby around the time of birth.

This is particularly serious as babies infected at birth usually become chronically infected, known as ‘carriers’. Chronic infection may lead to cirrhosis or cancer of the liver. All children born in Australia are offered hepatitis B vaccine at birth and have another three doses in the first year of life.

Further Reading

National Health and Medical Research Council (NHMRC). The Australian Immunisation Handbook. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

5. Human papillomavirus (HPV)

Human papillomavirus (HPV) causes a common and usually asymptomatic viral infection of the genital mucosa. HPV infection is highly contagious and most people will be infected within

a few years of becoming sexually active. HPV infection rates vary greatly between geographic regions, but it is estimated that up to 79% of women worldwide will be infected with HPV at some point in their lives.

Most people clear HPV infection within 12–24 months. However, of the 40 genital HPV types, 15 of these are known as ‘high-risk’ types. These high-risk types can establish persistent cervical infection (in about 3–10% of infected women) which in turn can result in cervical abnormalities that, in some cases, will progress to cervical cancer. HPV types 16 and 18 cause 70% of cervical cancers. HPV types 6 and 11 cause 90% of genital warts. The subtypes that cause warts do not also cause cancer.

HPV vaccines act to prevent infection and disease associated with some of the high-risk HPV types. Vaccination will not treat or alter existing HPV infection or disease. Because the vaccine does not provide protection against all HPV types, women who have received a HPV vaccine still require two yearly cervical Pap screening, and Pap screening remains the most important preventive strategy against cervical cancer for women who are sexually active.

Further Reading

National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases (NCIRS). Human papillomavirus vaccines for Australians: information for GPs and immunisation providers (fact sheet). 2007. Available at: http://www.ncirs.usyd.edu.au/facts/hpv_jan_2007.pdf (accessed Mar 2007).

National Health and Medical Research Council (NHMRC). The Australian Immunisation Handbook. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

6. Influenza (‘flu’)

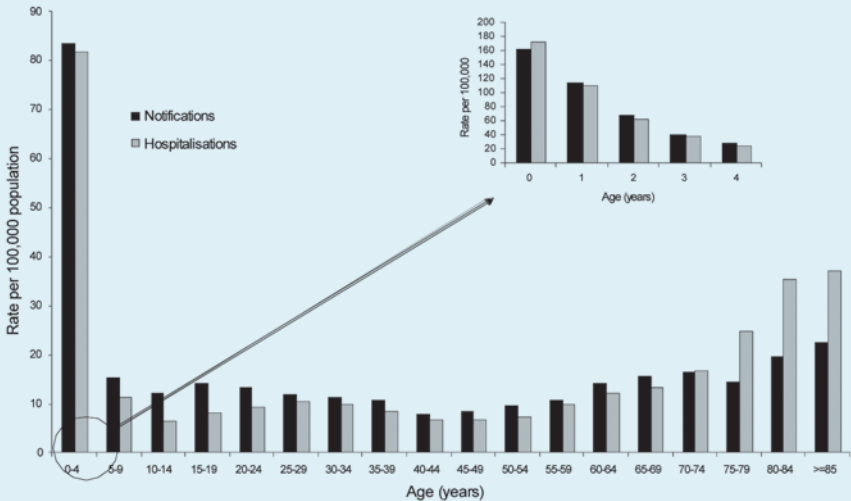
Influenza (flu) is an infectious disease caused by influenza virus. The symptoms of flu include sudden fever, headache, muscle aches and pains, fatigue, cough, sore throat, stuffy or runny nose. The virus can cause a mild or severe illness depending on the type of influenza virus and the age and general health of the affected person. The incubation period is around 24–72 hours followed by symptoms which may last up to a week.

People of all ages can become severely ill with influenza but, particularly in the elderly and persons with an underlying medical condition, complications following influenza can be fatal. There were 101 influenza-related deaths reported between 2002 and 2005 and over 9000 hospitalisations (see Figure 4). It is likely that influenza notifications are underestimated and as the figure below demonstrates, the greatest number of hospitalisations due to influenza actually occurs in children aged less than four years.

Annual influenza vaccination is provided free for all people over 65 years of age and for Aboriginal and Torres Strait Islander people over 50 years of age. In addition, adults and children with underlying medical conditions and pregnant women are recommended to receive annual influenza vaccination.

Figure 4

Influenza notification rates 2003–2005 and hospitalisation rates 2002/03–2004/05, Australia, by age group



Source: Brotherton J, Wang H, Schaffer A, et al. Vaccine preventable diseases and vaccination coverage in Australia, 2003 to 2005. *Communicable Diseases Intelligence* 2007;31(Suppl):viii-S152.

Further Reading

National Health and Medical Research Council (NHMRC). *The Australian Immunisation Handbook*. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

7. Measles

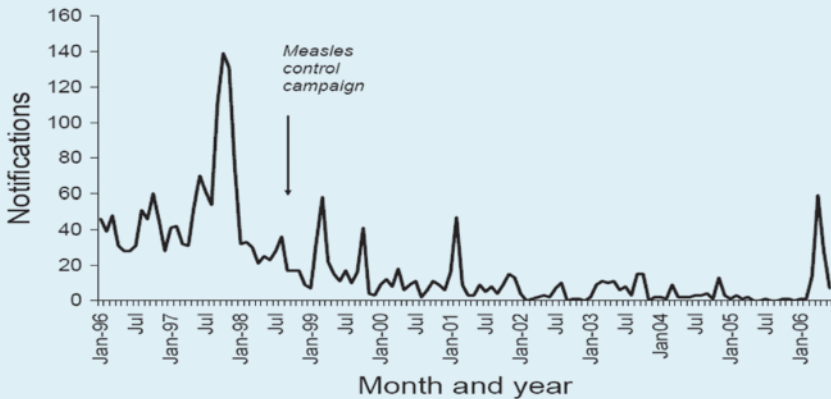
Measles is one of the most severe and highly infectious diseases of childhood and is virtually universal amongst unimmunised children in many countries. There has been a marked reduction in measles incidence in countries where vaccine has been widely used, but it remains a serious and common disease in many parts of the world, including popular holiday destination spots for Australians, such as Fiji and Indonesia.

One measles case in 70 requires hospital admission. Measles is complicated by otitis media in 5–9% of cases, pneumonia in 1–7% of cases, encephalitis in 1 in 1000 cases, convulsions in 0.5% of cases, and subacute sclerosing panencephalitis (SSPE) in 1 in 100,000 cases. SSPE is a delayed response to wild measles infection, occurring years afterwards, with severe encephalopathy and a uniformly fatal outcome. SSPE does not occur as a result of administration of measles vaccines.

Local transmission of measles has not occurred within Australia for some time now and recent cases have involved contact with a person(s) who has acquired measles from overseas.

In 2006, an increase in measles occurred which was linked to a national tour by a spiritual group (see Figure 5 below). Over 60 cases of measles occurred amongst people attending these meetings in several Australian cities, most of whom were unimmunised.

Figure 5 Measles notifications, Australia, 1996–2006



Source: Australian Government Department of Health and Ageing. Immunise Australia Program disease notifications. Measles notifications, 1996-2006. 2007. Available at: <http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/program-disnotif> (accessed Jul 2007).

Further Reading

Australian Government Department of Health and Ageing. National measles alert - update. Media release 28 April, 2006. Available at: <http://www.health.gov.au/internet/wcms/publishing.nsf/Content/cda-cdna-pr-measles-upd.htm> (accessed Mar 2007).

Centers for Disease Control and Prevention (CDC). Measles outbreak and response - Fiji, February-May 2006. *MMWR - Morbidity & Mortality Weekly Report* 2006;55:963-6. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mmm5535a3.htm> (accessed Mar 2007).

National Health and Medical Research Council (NHMRC). The Australian Immunisation Handbook. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

8. Meningococcal disease

Neisseria meningitidis (meningococcus) is a bacterium that can cause meningitis and septicaemia and only infects humans. The overall case-fatality rate is high, at about 10%, despite early and appropriate treatment. Asymptomatic carriage of meningococci in the upper respiratory tract is present in about 10% of the population at any given time. Factors associated with an increased risk of carriage include smoking and living in crowded conditions.

Most cases of meningococcal disease in Australia are now due to serogroup B organisms for which no vaccine is available. However, prior to vaccination, most of the clusters of meningococcal disease were due to serogroup C. Effective vaccines, which only protect against this serogroup, have been used in Australia since 2003 and have resulted in dramatic decreases in serogroup C cases.

Further Reading

Australian Meningococcal Surveillance Program. Annual report of the Australian Meningococcal Surveillance Programme, 2005. *Communicable Diseases Intelligence* 2006;30:211-21.

National Health and Medical Research Council (NHMRC). The Australian Immunisation Handbook. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

9. Mumps

Mumps is a viral disease that causes a febrile illness, often with swelling of the parotid glands, and sometimes with complications such as oophoritis (inflammation of the testes), pancreatitis, hepatitis, and inflammation of other organs or glands. Nerve deafness is a serious but rare complication. Since 2004 in

Australia, there has been an increase in mumps cases in young adults who have received no doses or only one dose of MMR vaccine. In the USA and the United Kingdom, there have recently been very large outbreaks of mumps, where the peak rates of disease have also been in the 18–24 year age group, many of whom have not been fully vaccinated.

Two doses of mumps-containing vaccine, usually given as MMR, are highly effective at preventing mumps infection, and are recommended for all persons who are not immune or previously vaccinated.

Further Reading

National Health and Medical Research Council (NHMRC). The Australian Immunisation Handbook. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

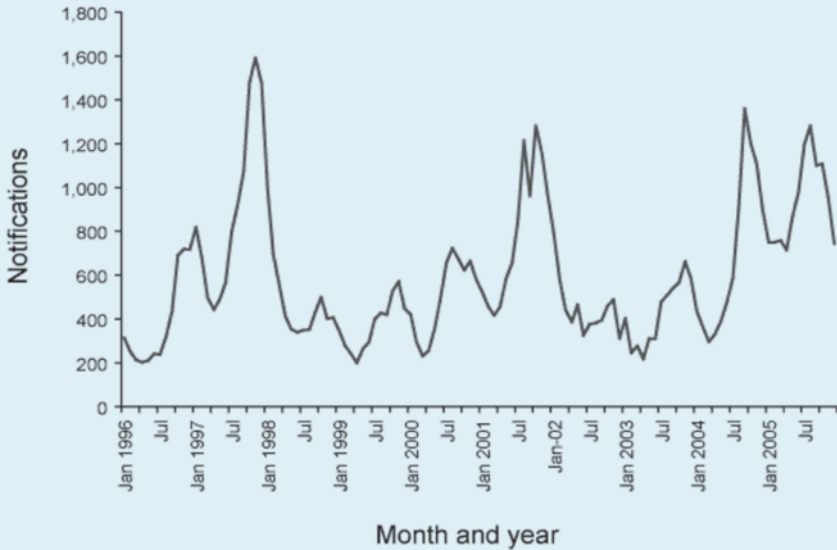
10. Pertussis (“whooping cough”)

Pertussis is a very infectious disease; up to 90% of unimmunised contacts in a household where there is a case will acquire the disease. The overall mortality from pertussis is 0.03% but the mortality in babies under six months of age is substantially higher (3.5%). Young infants also have the highest rates of hospitalisation and complications.

Pertussis causes significant morbidity. The cough may persist for six months or more and lead to sleep disturbance and significant weight loss. Severe complications, which occur almost exclusively in unimmunised people, include seizures and pneumonia. Increasing vaccination coverage has been associated with big reductions in disease in immunised children. However, large numbers of cases

continue to occur in older people. Figure 6 below demonstrates the seasonal fluctuations along with periodic increases in the number of cases every 2–3 years. In Australia, a booster dose of pertussis vaccine for adolescents has been recommended since 2003. Receipt of a booster dose of pertussis vaccine is also recommended for certain adults, such as health care workers or those in contact with young children.

Figure 6 Pertussis notifications, Australia, 1996–2005



Source: Owen R, Roche PW, Hope K, et al. Australia's notifiable diseases status, 2005: annual report of the National Notifiable Diseases Surveillance System. *Communicable Diseases Intelligence* 2007;31:1-70.

Further Reading

National Health and Medical Research Council (NHMRC). *The Australian Immunisation Handbook*. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

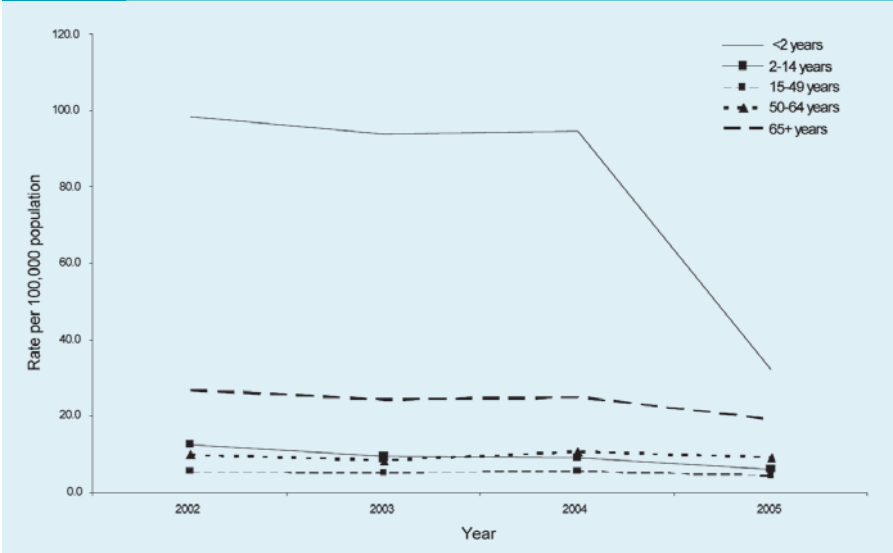
11. Pneumococcal disease

The bacteria *Streptococcus pneumoniae*, also known as the pneumococcus, causes a range of infections including pneumonia, bacteraemia, sepsis, meningitis, and middle ear infections. The most severe infections, bacteraemia and meningitis, are jointly referred to as invasive pneumococcal disease (IPD) and are the primary outcome that vaccination aims to prevent. Children under two years of age and the elderly are most susceptible to IPD.

All children are offered a conjugate pneumococcal vaccine (containing seven of the most common serotypes) at 2, 4 and 6 months of age and children with specific medical conditions are offered an extra dose at 12 months of age plus the polysaccharide pneumococcal vaccine (containing 23 serotypes) at 4–5 years of age. Figure 7 below demonstrates the impact the childhood vaccination program has had on pneumococcal disease notifications. All persons aged 65 years of age are eligible to receive a dose of the polysaccharide pneumococcal vaccine.

Figure 7

Pneumococcal disease notifications, Australia, 2002–2005, by age group



Source: Brotherton J, Wang H, Schaffer A, et al. Vaccine preventable diseases and vaccination coverage in Australia, 2003 to 2005. *Communicable Diseases Intelligence* 2007;31(Suppl):viii-S152.

Further Reading

National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases (NCIRS). Pneumococcal vaccine for Australian adults: information for GPs and immunisation providers (fact sheet). 2004. Available at: http://www.ncirs.usyd.edu.au/facts/pneumococcal_vaccines_for_adults_june_2004.pdf (accessed Mar 2007).

National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases (NCIRS). Pneumococcal vaccine for Australian children: information for GPs and immunisation providers (fact sheet). 2004. Available at: http://www.ncirs.usyd.edu.au/facts/pneumococcal_vaccines_for_children_nov_2004.pdf (accessed Mar 2007).

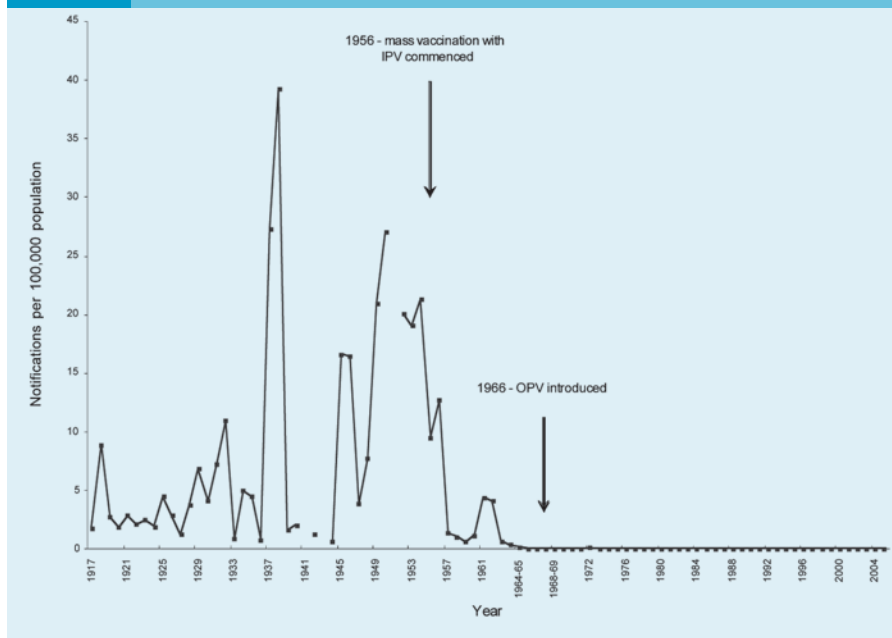
National Health and Medical Research Council (NHMRC). *The Australian Immunisation Handbook*. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

12. Poliomyelitis ('polio')

Poliomyelitis is caused by an enterovirus which commonly causes mild or asymptomatic illness but, in approximately 1% of cases, results in acute flaccid paralysis due to a specific effect on the anterior horn cells of the motor nerves in the spinal cord. There may be as many as 75–1000 cases of asymptomatic infections for each paralytic case, depending on the virus type, age of the population and environmental conditions. Australia has had only one case of wild-type paralytic poliomyelitis since 1978, but continues to be at risk of importation of the disease from overseas.

The World Health Organization planned global eradication of polio by the year 2005, but recent outbreaks in Africa and several south-east Asian countries have delayed this plan. In 2007, a person returning back to Australia from Pakistan flew whilst ill with poliomyelitis. The patient subsequently recovered from mild paralytic poliomyelitis. However, as a precautionary measure, persons on the same flight were notified and offered vaccination. This illustrates the importance of maintaining high coverage with polio vaccine, now given to all children as IPV (inactivated poliomyelitis vaccine).

Figure 8 Polio notifications, Australia, 1917–2005



Source: Brotherton J, Wang H, Schaffer A, et al. Vaccine preventable diseases and vaccination coverage in Australia, 2003 to 2005. *Communicable Diseases Intelligence* 2007;31(Suppl):viii-S152.

Further Reading

National Health and Medical Research Council (NHMRC). *The Australian Immunisation Handbook*. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

13. Rotavirus

Rotavirus is the most common cause of severe diarrhoea in young children worldwide. In addition to diarrhoea, rotavirus infection can also result in vomiting, fever and acute dehydration.

Rotaviruses are transmitted by the faecal-oral route. Large numbers of viral particles are shed in the faeces and the virus is stable in the environment, so contamination of hands and objects

(fomites) commonly helps spread the virus. Rotavirus infection occurs despite very high standards of hygiene.

In Australia, it is estimated that there are approximately 10,000 hospitalisations due to rotavirus in children less than five years of age each year. This translates to approximately one in 27 children being hospitalised with rotavirus gastroenteritis by the age of five years. On average, there is one death due to rotavirus each year in Australia.

Rotavirus vaccine is recommended for infants and is given orally in the first few months of life. Those who receive rotavirus vaccine are less likely to

be hospitalised, visit the Emergency Department, or see a doctor for gastroenteritis.

Further Reading

National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases (NCIRS). Rotavirus vaccines for Australian children: information for GPs and immunisation providers (fact sheet). 2007. Available at: http://www.ncirs.usyd.edu.au/facts/rotavirus_vaccine_for_children_june_2007.pdf (accessed Jul 2007).

National Health and Medical Research Council (NHMRC). The Australian Immunisation Handbook. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

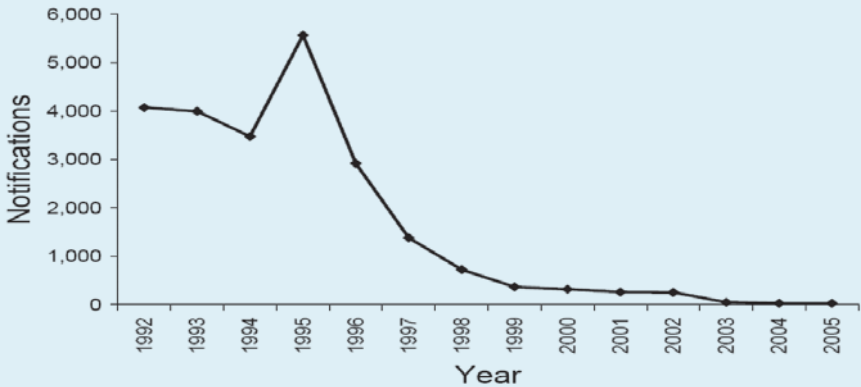
14. Rubella

Rubella is a viral illness that is generally mild with fever, rash and lymphadenopathy. Some adults who develop rubella can also develop severe arthritis. The greatest risk from rubella is due to infection occurring early in pregnancy. Maternal rubella infection during the first 8–10 weeks of pregnancy results in fetal damage in up to 90% of pregnancies.

There has been a steady fall in rubella cases due to increased immunisation rates, as most persons have received two doses of rubella-containing vaccine, given as MMR. However, it is important that women considering becoming pregnant should be checked for rubella immunity and vaccinated if necessary. Vaccination of both males and females is important to provide ongoing herd immunity against rubella.

Figure 9

Rubella notifications, Australia, 1992–2005



Source: Australian Government Department of Health and Ageing. Immunise Australia Program disease notifications. Rubella notifications, 1992–2005. 2007. Available at: <http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/program-disnotif> (accessed Jul 2007).

Further Reading

National Health and Medical Research Council (NHMRC). The Australian Immunisation Handbook. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

15. Tetanus

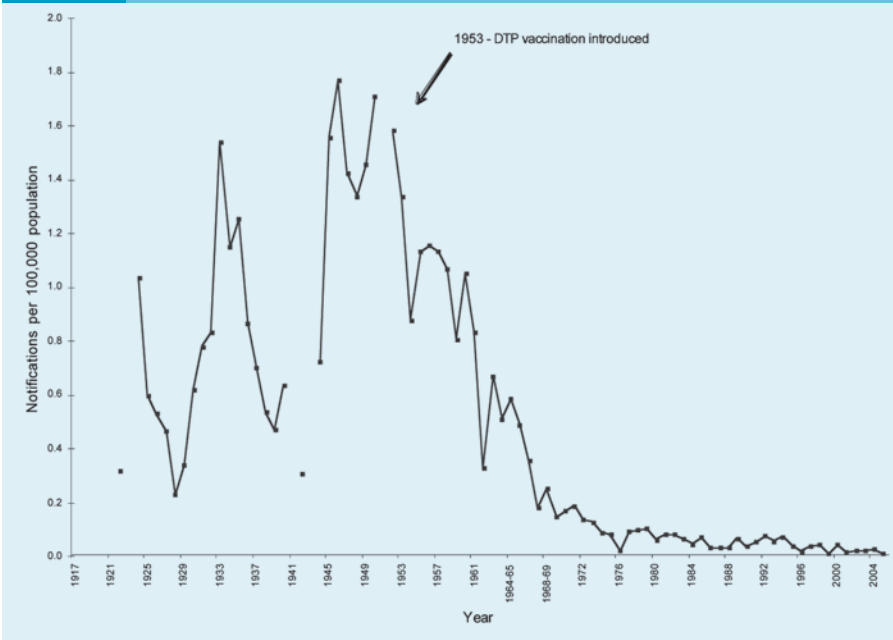
Tetanus is an acute, often fatal, disease caused by the toxin produced by the bacterium *Clostridium tetani*.

This neurotoxin acts on the central nervous system causing muscle rigidity with painful spasms. The disease usually occurs after an incubation period of 3–21 days (range one day to several months), with a median time of onset after injury of 10 days. Death may result from respiratory failure, hypertension, hypotension or cardiac arrhythmia. Tetanus only affects the individual and cannot be passed from person to person. The bacterium is found in soil everywhere and the only means of protection available to an individual is through immunisation.

In Australia, tetanus is now rare, occurring primarily in older adults who have never been vaccinated or who were vaccinated many years previously. During 2001–2002, there was one death from tetanus, in a person aged over 60 years.

Effective protection against tetanus is only provided by active immunisation, and even people who have had tetanus disease previously can remain susceptible. As tetanus can follow apparently trivial, even unnoticed, wounds, immunisation is the only certain protection.

Figure 10 Tetanus notifications, Australia, 1917–2005



Source: Brotherton J, Wang H, Schaffer A, et al. Vaccine preventable diseases and vaccination coverage in Australia, 2003 to 2005. *Communicable Diseases Intelligence* 2007;31(Suppl):viii-S152.

Further Reading

National Health and Medical Research Council (NHMRC). *The Australian Immunisation Handbook*. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

16. Varicella ('chickenpox')

Varicella or chickenpox is a highly infectious disease caused by the varicella-zoster virus (VZV) which is one of eight herpes viruses that cause illness in humans. Like other herpes viruses, such as the virus that causes cold sores (HSV), VZV has the unusual ability to establish a latent infection in nerve ganglions, which can later reactivate to cause shingles (herpes zoster).

Varicella is generally a benign, self-limiting illness in children but as almost all children develop chickenpox, even a small proportion with complications results in a large number of hospitalisations. Complications, such as secondary bacterial infection (most commonly cellulitis and bacteraemia), meningitis, encephalitis and pneumonia, can occur and result in hospitalisation. Prior to widespread vaccination, there were approximately 1500 hospitalisations and approximately eight deaths per year due to chickenpox.

Vaccination of children against chickenpox prevents serious or complicated disease and also ensures

that immunity is provided prior to reaching adolescence and adulthood when complications from the disease occur more commonly.

Further Reading

National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases (NCIRS). Varicella-zoster (chickenpox) vaccines for Australian children: information for GPs and immunisation providers (fact sheet). 2005. Available at: http://www.ncirs.usyd.edu.au/facts/varicella_zoster_for_children_sep_05.pdf (accessed Mar 2007).

National Health and Medical Research Council (NHMRC). The Australian Immunisation Handbook. 9th ed. Canberra: Australian Government Department of Health and Ageing, 2008.

Deaths from vaccine-preventable diseases

The figure below shows the substantial decline in deaths from diphtheria, pertussis, tetanus, polio and measles in Australia between 1956 and 2003.

Figure 11 Deaths in Australia from diphtheria, pertussis, tetanus, polio and measles, 1956–2003

