

Varicella (chickenpox)

VARICELLA-ZOSTER (CHICKENPOX) VACCINES FOR AUSTRALIAN CHILDREN: INFORMATION FOR IMMUNISATION PROVIDERS

Disease and epidemiology

- Varicella (also known as chickenpox) is a viral illness caused by primary infection with the varicella-zoster virus (VZV). It is characterised by vesicular skin lesions and fever.
- Complications of chickenpox occur in approximately 1% of cases. There were ~1500 hospitalisations per year in Australia prior to universal immunisation, most of which were in otherwise healthy young children.

Who should be vaccinated

- In Australia, varicella vaccine is available on the National Immunisation Program as a single dose at 18 months of age. Children aged 10–13 years are also offered 1 dose of varicella vaccine as part of a ‘catch-up’ program delivered in schools if they do not have a history of chickenpox or previous vaccination.
- People >14 years of age who are not immune to chickenpox require 2 doses of varicella vaccine at least 1 month apart.
- Varicella vaccination is particularly recommended for people in certain groups if they have not previously had chickenpox. This includes health care workers, child care workers and household contacts of immunosuppressed people.

Vaccines

- One dose of varicella vaccine (in children up to 13 years of age) will prevent varicella in ~80–85% of cases. The vaccine effectiveness against severe varicella (defined as >500 lesions) is greater at ~95–98%.
- ‘Breakthrough varicella’ is the name given to infection (with wild-type varicella) in a vaccinated person. Disease in vaccinated children is often mild with <50 lesions in ~70% of cases.
- Common side-effects from varicella vaccination include fever and injection site reactions. Rashes can occur, either at the injection site or generalised, in 3–5% of vaccinees.

The disease

The varicella-zoster virus (VZV) is one of eight herpes viruses that cause infections in humans. It is a double-stranded DNA virus and is most closely related to herpes simplex virus types 1 and 2. These viruses rapidly proliferate, invade and destroy infected cells. Like other herpes viruses, VZV has the unusual ability to establish a latent infection in nerve ganglions and later reactivate.

Primary infection with VZV causes varicella or ‘chickenpox’, whereas reactivation of latent VZV causes herpes zoster (HZ, also known as zoster or ‘shingles’).

Chickenpox is usually a self-limiting disease most commonly resulting in a general malaise, fever and vesicular rash. Complications of chickenpox infection occur in approximately 1% of cases, with the most

common being secondary bacterial infection of the skin lesions. Other complications include pneumonia, encephalitis and cerebellar ataxia, thrombocytopenia and hepatitis. Infection in adolescents and adults is usually more severe than infection in children. The average number of skin vesicles is usually 250–500 but >500 lesions may occur in severe cases.

HZ is characterised by a localised vesicular rash, and often associated with pain. Pain from HZ can persist for >3 months (known as post-herpetic neuralgia, or PHN), especially in the elderly.

VZV is transmitted via the respiratory route with viral particles present in respiratory droplets from 24–48 hours before the appearance of the rash and in the fluid of the skin lesions of an infected person.¹ The secondary attack rate from a case with primary varicella to susceptible children has been estimated to be between 61% and 100%, whereas secondary attack rates following contact with shingles are lower at ~15%.^{2,3}

Epidemiology

In unvaccinated populations, varicella is primarily a childhood illness with more than 90% of the population in temperate countries developing clinical or serological infection by early adulthood. The highest attack rates are in children aged 5–9 years.^{4,5} Australian data suggest a slightly later age of acquisition, with 83% of children infected by 10–14 years of age.⁶ Prior to the use of varicella vaccine there were about 240,000 cases, 1,500 hospitalisations and approximately 7 deaths each year from varicella in Australia.^{7–10} Although the risk of severe disease and complications is greater in adolescents and adults, or people with a suppressed immune system, the majority of hospitalisations are in otherwise healthy children because disease incidence is far higher in childhood.¹¹

In the USA, a universal varicella vaccination program has been in place since 1995.¹² This program has resulted in a decline in varicella disease by 85% and hospitalisations by 91% in children <10 years of age, the age group targeted by the vaccination program.^{13–15} In addition, reductions in incidence rates and hospitalisation rates have also been detected in older children and adults, due to herd immunity.¹⁶ A 92% reduction in deaths due to varicella was also observed in the 1–4 years age group with a decline also seen in all age groups under 50 years of age.¹⁷ In Australia, where varicella vaccine has been recommended since 2003, and funded under the National Immunisation Program since late 2005, preliminary data

suggest a decrease in hospitalisations in young children, particularly those aged 1–4 years.¹⁸

The incidence of HZ increases with age and most cases occur after the age of 50. For further information, see the NCIRS fact sheet [Zoster vaccine for Australian adults](#).

Who should be vaccinated

National Immunisation Program (NIP)

Varicella-containing vaccines have been available in Australia since 2000, and were recommended for use in children from late 2003. Varicella vaccine was added to the NIP as a single dose at 18 months of age from 1 November 2005. Children 10–13 years of age are also offered 1 dose of varicella vaccine as part of a catch-up program under the NIP. This is delivered in schools and is available for children who do not have a reliable history of chickenpox or previous vaccination. Further detailed information on the national varicella vaccination program in Australia for both immunisation providers and the general public is available at the [Immunise Australia website](#).¹⁹

Others recommended for vaccination

Varicella vaccine is particularly recommended for non-immune persons at high risk of exposure to, or complications from, varicella, such as health care workers, child care workers, non-immune women before pregnancy and parents. Vaccination of non-immune household contacts of immunosuppressed persons is also important to minimise opportunities for transmission of varicella to the immunocompromised person (for more details see *The Australian Immunisation Handbook*).²⁰

Two doses of vaccine, given at least 1 month apart, are required for non-immune adolescents (>14 years of age) and adults, but are not funded under the NIP. Detailed information about these recommendations is available in *The Australian Immunisation Handbook*.²⁰

Vaccines

Two monovalent vaccines containing live attenuated (weakened) varicella-zoster virus are currently available in Australia (Varilrix[®] and Varivax Refrigerated[®]). These vaccines are both derived from the Oka varicella-zoster virus strain.

Two new combination vaccines that include varicella together with measles, mumps and rubella (known as MMRV vaccines) have been registered for use in Australia in children <12 years of age (Priorix-Tetra[®] and ProQuad[®]) but are not yet available. When these vaccines become available in Australia, recommendations for the

use of MMRV will be posted on [The Australian Immunisation Handbook website](#).²⁰

Administration

The dose of monovalent varicella vaccines is 0.5 mL, administered by SC injection.

Vaccine efficacy/effectiveness

In clinical trials of the varicella vaccine in children, undertaken before vaccine licensure, the efficacy after 1 dose was reported to be ~96%.²¹⁻²³ However, many post-licensure studies, mostly conducted in the USA, have determined that the vaccine effectiveness of 1 dose given early in childhood is less than this original estimate, and is actually ~80–85% for the prevention of any disease, with 95–98% effectiveness in preventing severe varicella.¹²

At the time of implementation of a universal varicella vaccination program in Australia, a single dose was considered adequate for protection of infants and children <14 years of age. However, recent data from the USA suggest that a second dose of varicella-containing vaccine in children is optimal to provide an immune response more like natural infection, reducing the risk of vaccine failure and increasing population immunity. Only one randomised trial has compared the efficacy of 1 dose versus 2 doses of varicella vaccine in children, and found that, after 10 years of observation, both groups showed long-term protection. However, the vaccine efficacy after 2 doses was 98% compared to 94% for 1 dose.²⁴

The response to a single dose of varicella vaccine decreases as age increases; hence, healthy adolescents (14 years and older) and adults require 2 doses, 1–2 months apart.²⁵ A 2nd dose of varicella vaccine can be considered in children <14 years of age to provide enhanced protection.

Breakthrough disease (natural varicella infection in vaccinated individuals)

Vaccine failure is known as 'breakthrough varicella' and is defined as a case of wild-type varicella infection >42 days post vaccination. The majority of cases of breakthrough varicella are mild and result in fewer skin lesions (usually <50), although up to 28% of breakthrough varicella cases may be severe (>500 lesions).² In mild breakthrough cases, the skin lesions may not be vesicular and systemic symptoms, such as fever, occur less frequently.² Because of this, breakthrough disease may not be recognised, or may be misdiagnosed. However, breakthrough varicella can still be contagious and exclusion from child care or school is recommended. A study of household secondary attack

rates found that contagiousness is related to the number of lesions. Vaccinated cases with more than 50 lesions were as contagious as unvaccinated cases, but when vaccinated cases presented with fewer than 50 lesions, they were only one-third as contagious.²

Recent studies have suggested higher rates of breakthrough varicella in 1-dose vaccinees compared with 2-dose vaccinees, in single dose vaccinees more than 5 years after vaccination, and in settings of close contact such as households.^{24,26} Long-term follow-up of 7,500 children aged 12–23 months found no difference in rates of breakthrough varicella between those vaccinated at 12–14 months of age and those vaccinated at 15–23 months of age.²⁷

Vaccine safety

Vaccine reactions following monovalent varicella vaccination are generally mild, and include fever (in 15% of vaccinees) and injection site reactions (in ~7–30% of vaccinees).

A varicella-like rash may develop following vaccination, occurring at the injection site (3–5%) or generalised (3–5%), and typically consists of 2–5 lesions.²⁸ Rashes occurring within 14 days of vaccination (median 8 days) are usually due to coincident wild VZV infection, while rashes due to the vaccine strain VZV occur a median 21 days (range 5–42 days) after vaccination (see *The Australian Immunisation Handbook*).²⁰ Vaccine virus transmission is extremely rare and most rashes after varicella vaccination are due to other causes, especially in children. However, if a rash develops, vaccinees should avoid contact with immunosuppressed persons.

More serious adverse events occurring soon after vaccination have been reported at a rate of 2.9 per 100,000 doses by passive surveillance.²⁹ A causal, as opposed to coincidental or temporal, relationship to the vaccine has not been established. However, this is plausible for some reactions such as anaphylaxis following vaccination, thrombocytopenia, ataxia and encephalitis. These latter three are rare complications of natural varicella infection.²⁹ Adverse events occurring after vaccination should be reported to the Adverse Drug Reactions Advisory Committee (ADRAC), via specific State/Territory reporting mechanisms.²⁰

Reactivation of the varicella vaccine strain to cause shingles in vaccine recipients is extremely rare. Cases of shingles in vaccine recipients have been reported but are usually due to wild-type virus.

Concomitant administration

Monovalent varicella vaccines are safe to administer at the same time as all other recommended vaccines on the schedule (given subcutaneously at a separate site). As MMR is a live attenuated vaccine, it should either be administered at the same visit or at least 4 weeks apart from the monovalent varicella vaccine. This is because there is evidence of higher vaccine failure rates if MMR is given within 4 weeks of the varicella vaccine (unless given on the same day).²⁰

Contraindications/precautions

- The varicella vaccines are live attenuated viral vaccines and are contraindicated in pregnancy, and pregnancy should be avoided for 1 month following vaccination. However, in women inadvertently vaccinated during pregnancy, including those known to be seronegative prior to vaccination, no adverse effects attributable to vaccination have been reported.³⁰
- Varicella vaccination is contraindicated for immunocompromised persons, but their household contacts should be vaccinated, if non-immune, to protect the immunocompromised person against infection.
- Previous anaphylactic reaction to neomycin is a contraindication to all varicella-containing vaccines and gelatin anaphylaxis is a contraindication to vaccination with Varivax Refrigerated[®].²⁰
- Precautions for varicella vaccination relate to vaccination within 4 weeks of receipt of another live attenuated vaccine, receipt of immunoglobulin or blood products 3–9 months before vaccination or within 3 weeks after vaccination, and persons on long-term aspirin or salicylate therapy. Providers should refer to *The Australian Immunisation Handbook* for more details.²⁰

Other considerations

Serologic testing

In children <14 years of age, serologic testing prior to vaccination is not necessary as a reliable history of varicella infection in this age group correlates well with immunity. If the history of past varicella infection is uncertain (or absent), the individual should be considered susceptible, and should be immunised. Vaccination of individuals who are already immune to varicella is well tolerated so prior serologic testing is not essential, but testing is useful for those over the age of 14 years as many without a history of varicella infection will actually be seropositive. Serologic testing after vaccination is not

required or recommended (for more details see *The Australian Immunisation Handbook*).²⁰

Herpes zoster (shingles)

In those previously infected with varicella, it appears that the immune system may be boosted by exposure to others with varicella, and that this may reduce the risk of developing shingles later in life. Based on this observation, mathematical modelling has suggested that rates of shingles in adults may temporarily increase over time following the introduction of universal varicella vaccination because of a reduced exposure to the virus in the community. However, preliminary studies show that rates of shingles in the USA are so far unchanged.³¹ Surveillance mechanisms are in place in the USA and in Australia to continue to monitor the rates of shingles and varicella. The incidence of shingles is likely to be lower over time in varicella vaccinees compared with those infected naturally with wild-type varicella. This is suggested from preliminary data from the USA in which lower rates of shingles have been reported in varicella vaccinated immunocompromised children^{32,33} and healthy adults.³⁴

A vaccine to prevent shingles in older adults has recently been recommended in Australia. For further information, see the NCIRS fact sheet [Zoster vaccine for Australian adults](#).

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