

3.11 MEASLES

Virology

Measles is a paramyxovirus, genus *Morbillivirus*. It is an RNA virus with 6 structural proteins, 3 complexed to the RNA and 3 associated with the viral envelope. Two of the envelope proteins, the F (fusion) protein and the H (haemagglutinin) protein, are the most important in pathogenesis. The measles virus can survive up to 2 hours in air, but is rapidly inactivated by heat, light and extremes of pH.^{1,2}

Clinical features

Measles is a highly infectious, acute viral illness spread by respiratory secretions, including air-borne transmission via aerosolised droplets.² It is infectious from the beginning of the prodromal period and up to 4 days after the appearance of the rash. The incubation period is usually 10 to 14 days. The prodrome, lasting 2 to 4 days, is characterised by fever and malaise followed by a cough, coryza and conjunctivitis. The maculopapular rash typically begins on the face and upper neck, and then becomes generalised.

Measles is often a severe disease, frequently complicated by otitis media (in ~9%), pneumonia (in ~6%) and diarrhoea (in ~8%).^{1,2} Acute encephalitis occurs in 1 per 1000 cases, and has a mortality rate of 10 to 15%, with 15 to 40% of survivors suffering permanent brain damage.³ Subacute sclerosing panencephalitis (SSPE) is a late complication of measles, occurring on average 7 years after infection in approximately 0.5 to 1 per 100 000 measles cases.² SSPE causes progressive brain damage and is always fatal. Complications from measles are more common and more severe in the chronically ill, in children <5 years of age, and in adults.¹ Approximately 60% of deaths from measles are attributed to pneumonia, especially in the young, while complications from encephalitis are more frequently seen in adults.^{1,2} Measles infection during pregnancy can result in miscarriage and premature delivery but has not been associated with congenital malformation.¹

Epidemiology

Evidence suggests that endemic measles has been eliminated from Australia, an indigenous measles strain being absent for several years.⁴ Although measles outbreaks of limited duration continue to occur, they have usually been linked to imported cases.⁵⁻⁷ In a recent measles outbreak, linked to an imported case, 25% of notified cases were in children aged 1–4 years, most of whom were not vaccinated.⁸ Measles notifications and hospitalisations for the 5 years 2001–2005 have been the lowest recorded in Australia.^{9,10} In the 30 years (1976–2005) since measles vaccination was recommended in Australia, there have been 95 deaths

recorded from measles, 1 death in 2004 being the only one recorded since 1995.⁹⁻¹¹ High-level vaccination coverage is imperative to maintain measles elimination, requiring rates for each new birth cohort of >95% for a single dose and >90% for 2 doses.¹² In 2004, the Australian Childhood Immunisation Register (ACIR) recorded that 93.6% of children aged 2 years (born in 2002) had received at least 1 dose of measles-containing vaccine and 84.8% of children aged 6 years (born in 1998) had received both doses.¹³ It is likely that, when corrected for under-reporting, the target of 95% coverage for 1 dose of measles vaccine is reached at 2 years, but, if the second dose is not given until 4 years of age, 95% 2-dose coverage is not achieved.¹⁴ Scheduling of the second dose of measles-containing vaccine at 18 months of age (see 'Recommendations' below) will provide 2-dose protection at an earlier age and may also improve second dose coverage.

Following the National Measles Control Campaign (which took place in 1998 and resulted in 1.7 million primary school children being vaccinated), a national serosurvey in the first quarter of 1999 showed that 89% of children aged 2–5 years, 94% of those aged 6–11 years, and 91% of those aged 12–18 years, were immune to measles.^{15,16} The serosurvey evaluating the young adult MMR campaign in 2000 showed that those most at risk of measles infection in Australia were infants <12 months of age, 1–<2-year-olds due to delayed vaccine uptake, and individuals born in the late 1960s to mid 1980s (especially the 1978–1982 birth cohort).¹⁷ Young adults are recognised to be at a greater risk of measles infection. Many missed being vaccinated as infants (when coverage was low), while during their childhood a second dose was not yet recommended and disease exposure was decreasing.¹⁸

Worldwide, measles is thought to be the fifth leading cause of childhood morbidity and mortality with 770 000 deaths estimated to have occurred in 2000. More than half these deaths occurred in Africa.^{1,19} Following extensive vaccination campaigns, measles accounted for approximately 454 000 deaths worldwide in 2004.²⁰ The WHO is overseeing efforts to eliminate measles worldwide through immunisation and surveillance strategies that aim to interrupt the circulation of the virus.²¹

Vaccines

One measles-mumps-rubella (MMR) vaccine is currently available in Australia. It is anticipated that measles-mumps-rubella-varicella (MMRV) vaccines will become available in the near future. A monovalent vaccine is available for rubella where this is specifically required (see Chapter 3.19, *Rubella*). Separate administration of measles, mumps or rubella vaccine is not recommended as an alternative to MMR vaccine and no monovalent vaccines for mumps or measles are licensed in Australia.

Measles immunity induced by single-dose vaccination provides long-term immunity in most recipients.^{1,22} However, approximately 5% of recipients fail to develop immunity to measles after 1 dose.²³ Following a second vaccine dose,

approximately 99% of subjects overall will be immune to measles. Combination MMRV vaccines have been shown, in clinical trials, to produce similar rates of seroconversion to all 4 vaccine components compared with MMR and monovalent varicella vaccines administered at separate injection sites.^{24,25} Data on the use of MMRV vaccines are not available for people >12 years of age.

- **Priorix (MMR)** – GlaxoSmithKline (live attenuated measles virus (Schwarz strain), RIT 4385 strain of mumps virus (derived from the Jeryl Lynn strain) and the Wistar RA 27/3 rubella virus strain). Each 0.5 mL monodose of the reconstituted, lyophilised vaccine contains not less than $10^{3.0}$ CCID₅₀ (cell culture infectious dose 50%) of the Schwarz measles, not less than $10^{3.7}$ CCID₅₀ of the RIT 4385 mumps and not less than $10^{3.0}$ CCID₅₀ of the Wistar RA 27/3 rubella virus strains; lactose; neomycin; amino acids; sorbitol and mannitol as stabilisers.

Transport, storage and handling

Transport according to *National Vaccine Storage Guidelines: Strive for 5*.²⁶ Store at +2°C to +8°C. Protect from light. Do not freeze. Reconstituted vaccine should be used immediately, but can be stored at +2°C to +8°C for up to 8 hours before use.

Dosage and administration

For both children and adults, the dose of MMR is 0.5 mL, administered by either SC or IM injection.

MMR can be given at the same time as other vaccines (including DTPa, hepatitis B, MenCCV and varicella), using separate syringes and injection sites. If MMR is not given simultaneously with other live viral parenteral vaccines (eg. varicella vaccine), they should be given at least 4 weeks apart (see 'Precautions' below).^{27,28}

Recommendations

(i) Routine vaccination of children

Two doses of MMR are recommended for all children. The first dose should be given at 12 months of age and the second dose at 18 months of age. The minimum interval between doses is 4 weeks.

When MMRV vaccines are available, the 12 month and 18 month doses may be given as MMRV.

The scheduled age at administration of the second dose of measles-containing vaccine has been moved from 4 years of age to 18 months of age to provide earlier 2-dose protection against measles and to improve vaccine uptake (see 'Epidemiology' above). The second dose of measles-containing vaccine at 18 months of age can be given as either MMR or, when available, MMRV. Receipt of 2 doses of varicella vaccine (VV) provides increased protection against

varicella, and MMRV, when available, should be preferred over MMR for the second dose of measles-containing vaccine at 18 months of age. (For further information, see also Chapter 3.24, *Varicella*.)

(ii) Vaccination of adults and adolescents

Those born before 1966:

No vaccination is required (unless serological evidence indicates otherwise) as circulating virus and disease were prevalent before this time suggesting most people would have acquired immunity from natural infection. However, recent confirmed cases of measles have occurred in individuals born before 1966 and, if doubt exists, it may be more expedient to offer vaccination than serological testing.⁸

Those born during or since 1966:

Infants ≥ 12 months up to 18 months of age should have documented evidence of 1 dose of MMR (or MMRV when available), or serological evidence of protection for measles.

Those ≥ 18 months of age should have documented evidence of 2 doses of MMR (administered at least 4 weeks apart with both doses administered at 12 months of age or over), or serological evidence of protection for measles, mumps and rubella.

Catch-up vaccination of children who have not received MMR or MMRV at 18 months of age should occur at the 4-year-old schedule point, until all the relevant children have reached 4 years of age. It is also acceptable to use MMRV in place of MMR at the 4-year-old schedule point. This would have the added benefit of providing a 2-dose VV schedule to an additional 2.5 birth cohorts of infants who had received single-dose monovalent VV at 18 months.

There are no increased adverse events from vaccinating those with pre-existing immunity to 1 or more of the vaccine components.

(iii) Healthcare workers and those who work with children

All workers in these categories who were born during or since 1966 and are non-immune or who have only received 1 dose of MMR, should be vaccinated with MMR, and have documented evidence of 2 doses or serological evidence of protection for measles, mumps and rubella (see 'Vaccination of adults and adolescents' above). (See also Section 2.3, Table 2.3.6 *Recommended vaccinations for those at risk of occupationally acquired vaccine-preventable diseases*.)

(iv) Travellers

Those born during or since 1966 should be encouraged to complete the MMR vaccination schedule (using MMR or MMRV, when appropriate) before embarking on international travel if they do not have evidence of receipt of 2 doses of MMR (see 'Vaccination of adults and adolescents' above).

Infants travelling to endemic countries may be vaccinated with MMR between 9 and 12 months of age. In these cases, another dose of MMR (or MMRV) should be given at 12 months of age or 4 weeks after the first dose, whichever is later. This should be followed by the routine administration of the next dose of MMR or MMRV at 18 months of age. This is because maternal antibodies to measles are known to persist in many infants until 11 months of age and may interfere with active immunisation before 12 months of age¹ (see 'Vaccination during an outbreak' below).

Contraindications

If using MMRV vaccine, additional contraindications relating to the varicella vaccine component are outlined in Chapter 3.24, *Varicella*.

(i) Allergy to vaccine components

Vaccination is contraindicated where there has been:

- anaphylaxis following a previous dose of MMR or MMRV, or
- anaphylaxis following any component of the vaccine.

Providers should consult the product information regarding vaccine components when MMRV vaccines are available.

(ii) People with impaired immunity

Measles-, mumps-, rubella- and varicella-containing vaccines are contraindicated in individuals with impaired immunity. In addition, there are no clinical trials or post-licensure data to address the safety and immunogenicity of MMRV in children or adults with impaired immunity. However, based on recommendations for the component live attenuated vaccine viruses, both MMR and MMRV are contraindicated in the following groups:

- those with primary or acquired cellular immunodeficiency states, including impaired immunity due to HIV / AIDS or conditions in which normal immunological mechanisms may be impaired. MMR (but not MMRV) vaccine can be given to HIV-positive children who do not have impaired immunity (see 'Precautions' below),
- those taking high-dose oral corticosteroids (in children equivalent to either >2 mg/kg per day prednisolone (≥20 mg per day total) for >1 week or >1 mg/kg per day for >4 weeks) (see Section 2.3.3, *Vaccination of individuals with impaired immunity due to disease or treatment*),
- those receiving high-dose systemic immunosuppressive treatment, general radiation or x-ray therapy,
- those suffering from malignant conditions of the reticuloendothelial system (such as lymphoma, leukaemia, Hodgkin's disease).

(iii) Recent administration of antibody-containing blood product

- The expected immune response to measles, mumps, rubella and varicella vaccination may be impaired after receipt of antibody-containing blood products.^{23,27,29} The duration of interference with the response to measles vaccination depends on the amount of immunoglobulin contained in each product, and ranges from 3 to 11 months.²⁷ Vaccination with MMR or MMRV should be delayed after administration of antibody-containing products as indicated in Table 2.3.5 (see Section 2.3.5, *Vaccination of patients following receipt of other blood products including blood transfusions*).
- After vaccination with MMR or MMRV, immunoglobulin-containing products should not be administered for 3 weeks unless the benefits exceed those of vaccination. If immunoglobulin-containing products are administered within this interval, the vaccinee should either be revaccinated later at the appropriate time following the product as indicated in Table 2.3.5, or tested for immunity 6 months later and then revaccinated if seronegative.
- Blood transfusion with washed red blood cells is *not* a contraindication to MMR or MMRV vaccinations.
- Rh (D) immunoglobulin (anti-D) does not interfere with the antibody response to MMR vaccine and may be given at the same time in different sites with separate syringes or at any time in relation to each other.

(iv) Pregnant women

- If MMR vaccines are given to women of child-bearing age, pregnancy should be avoided for 28 days³⁰ (see Chapter 3.19, *Rubella*). Data on the use of MMRV vaccines in individuals >12 years of age are not available.

Precautions

- MMR can be administered on the same day as other live viral parenteral vaccines, such as monovalent varicella vaccine. However, if this is not possible, MMR should be deferred for at least 4 weeks after vaccination with other live viral parenteral vaccines.
- MMR can be given to asymptomatic or mildly symptomatic HIV-positive individuals providing they do not have severely impaired immunity.²³ (see Section 2.3.3, Table 2.3.4, *Immunological categories based on age-specific CD4 counts and percentage of total lymphocytes*). This is because the risk posed by measles infection is considered to be greater than the likelihood of adverse events from vaccination.³¹ As there are no data available on the safety, immunogenicity or efficacy of MMRV vaccine in HIV-infected children, MMRV vaccine should not be administered as a substitute for MMR when vaccinating these children.^{23,29}

- Children on daily doses of ≤ 2 mg/kg per day of systemic corticosteroids for < 1 week, and those on lower doses of 1 mg/kg per day or alternate-day regimens for longer periods, may be given live viral vaccines.
- Children receiving > 2 mg/kg per day or ≥ 20 mg per day in total of prednisolone (or equivalent) for > 14 days can receive live viral vaccines after corticosteroid therapy has been discontinued for at least 1 month.³¹ Some experts suggest withholding lower doses of steroids 2 to 3 weeks before vaccination with live viral vaccines if this is possible^{29,31} (see Section 2.3.3, *Vaccination of individuals with impaired immunity due to disease or treatment*).
- Use of salicylates (aspirin) is not recommended for 6 weeks following MMRV vaccination. This is because of the association between use of salicylates during natural varicella infection and Reye syndrome (see Chapter 3.24, *Varicella*). There is no need to avoid salicylates (aspirin) after MMR vaccination.
- Thrombocytopenia is a rare adverse event following vaccination with MMR.^{2,32,33} Authorities differ in their opinion about whether the risk of vaccine-associated thrombocytopenia is increased in those who have previously had immune thrombocytopenia.^{23,33} Post-marketing experience of live MMR vaccine in the USA indicates that individuals with current thrombocytopenia may develop more severe thrombocytopenia after vaccination. Recent studies found that children with immune thrombocytopenia before MMR had no vaccine-associated recurrences.^{32,33} There are no systematic studies of the outcome of a second dose of MMR in children who developed thrombocytopenia after a first dose.³³
- Children with a personal or close family history of seizures or convulsions should be given MMR or MMRV vaccine, provided the parents understand that there may be a febrile response 5 to 12 days after vaccination.²³ Advice for reducing fever with paracetamol and other measures should be given. Specialist advice should be sought rather than refusing to provide MMR or MMRV vaccination.
- Measles virus inhibits the response to tuberculin, so tuberculin-positive individuals may become tuberculin-negative for up to a month after measles infection or administration of measles-containing vaccines.²³ Mantoux testing is therefore unreliable for at least 4 weeks after the administration of MMR or MMRV. As measles infection may cause exacerbation of tuberculosis, there is a theoretical concern that measles-containing vaccine may exacerbate tuberculosis. Patients with tuberculosis should be under treatment when vaccinated.
- Children with egg allergy, even anaphylactic egg allergy, can be safely given MMR or MMRV vaccine.^{2,34} Skin testing has been shown to be of no value in the management of these cases.² Although measles and mumps (but not rubella or varicella) vaccine viruses are grown in chick embryo tissue cultures,

it is now recognised that MMR (and MMRV) vaccine contains negligible amounts of egg protein (see 'Variations from product information' below).

- MMR and MMRV vaccines can be administered to susceptible children who have mild illnesses (eg, diarrhoea or upper respiratory infection), with or without low-grade fever (<38.5°C).

Adverse events

(If using MMRV vaccine, additional adverse events relating to the varicella vaccine component are outlined in Chapter 3.24, *Varicella*.)

- Malaise, fever and/or a rash may occur after MMR vaccination, most commonly 7 to 10 days (range 5–12 days) after vaccination and lasting about 2 to 3 days. High fever (>39.4°C) occurs in approximately 5 to 15% (common to very common), and rash occurs in approximately 5% (common) of MMR vaccinees.^{1,23} The risk for febrile seizures is approximately 1 case per 3000 doses of MMR vaccine administered.²³ Slightly higher rates of fever were observed in clinical trials of MMRV vaccines, as compared with giving MMR and monovalent varicella vaccine at the same time but at separate sites.^{24,25}
- A varicelliform rash may occur after vaccination with MMRV (see Chapter 3.24, *Varicella* 'Adverse events'). The appearance of a rash after monovalent varicella vaccine occurs in <5% (common) of vaccinees, and similar rates are observed with the use of MMRV.³⁵
- Adverse events are much less common after the second dose of MMR and MMRV than after the first dose.
- Anaphylaxis following the administration of MMR is very rare (less than 1 in 1 million doses distributed).²³ Although no cases of anaphylaxis were reported in MMRV clinical trials, the incidence is likely to be similar to that occurring with use of MMR. Anaphylaxis after vaccination is likely due to gelatin or neomycin anaphylactic sensitivity, not egg allergies (see 'Precautions' above).
- It is uncertain whether encephalopathy occurs after measles vaccination. If it does, it is at least 1000 times less frequent than as a complication from natural infection.^{1,23}
- Other rare adverse events attributed to MMR vaccine include transient lymphadenopathy and arthralgia (see Chapter 3.19, *Rubella*). Parotitis has been reported rarely.²³
- Thrombocytopenia (usually self-limiting) has been very rarely associated with the rubella or measles component of MMR occurring in 3 to 5 per 100 000 doses of MMR vaccine administered.^{2,23,32,33} This is considerably less than after natural measles, mumps and rubella infections³³ (see also Chapter 3.19, *Rubella*). Any association with MMRV vaccine is expected to be similar.

- It is recommended that parents/vaccine recipients be advised about possible symptoms, and given advice for reducing fever, including the use of paracetamol for fever in the period 5 to 12 days after vaccination. The use of aspirin after MMRV vaccination is not recommended for 6 weeks (see Chapter 3.24, *Varicella*).
- It had been hypothesised that the measles component of the MMR vaccine may be causally linked with autism, autistic spectrum disorder and inflammatory bowel disease.³⁶ There has been no credible scientific evidence to support this claim. Most proponents of the hypothesis have retracted this claim³⁷ and there is now good evidence to refute it³⁸ (see Appendix 5, *Commonly asked questions about vaccination*).

Transmissibility of MMR vaccine viruses

Measles, mumps and rubella vaccine viruses are not transmissible to contacts.²³ It is, therefore, safe to vaccinate the healthy siblings of children with impaired immunity and safe for children with impaired immunity to go to school with children recently vaccinated with the MMR vaccine. If using MMRV, see Chapter 3.24, *Varicella* for information about varicella vaccine virus transmission.

The public health management of measles

(i) Definition of a person who is considered **not** susceptible to measles

A person is considered not susceptible to measles if he/she meets 1 of the following criteria:

- born during or since 1966 with documented evidence of receiving 2 doses of a measles-containing vaccine, with both doses of vaccine having been given at ≥ 12 months of age and at least 4 weeks apart. This applies unless serological evidence indicates otherwise,
- born before 1966 (unless serological evidence indicates otherwise),
- documented evidence of immunity,
- documented evidence of laboratory confirmed measles infection.

NB. These criteria have been revised since publication of the *Guidelines for the control of measles outbreaks in Australia* in 2000.³⁹

(ii) Vaccination of measles contacts

As vaccine-induced measles antibody develops more rapidly than that after natural infection, MMR vaccine can be used to protect susceptible contacts.²³ The incubation period of the vaccine strain (4 to 6 days) is shorter than the incubation period of wild measles virus (10 to 14 days). To be effective, the vaccine must be administered within 72 hours of exposure. If there is doubt about a person's immunity, vaccine should be given, since there are no ill effects from vaccinating individuals who are already immune. It must be noted that antibody responses

to the rubella and mumps components are too slow for effective use of vaccine as prophylaxis after exposure to these infections. Alternatively, MMRV vaccine, when available, could also be used in this setting if varicella vaccination is indicated. However, there are no data on the use of MMRV vaccines in individuals >12 years of age.

Immunoglobulin is available for contacts for whom measles-containing vaccine is contraindicated (see 'Use of immunoglobulin to prevent measles' below), for infants aged 6–9 months, and for susceptible individuals who did not receive a measles-containing vaccine within 72 hours of contact (see Table 3.11.1 below).

Isolation of susceptible close contacts by exclusion from school or the workplace should occur until 14 days after their last exposure³⁹ *unless* they receive either the MMR vaccine within 72 hours or immunoglobulin within 7 days of their first exposure. If they do not receive MMR vaccine or immunoglobulin within these specified timeframes, they should be excluded.

(iii) Vaccination during an outbreak

During a confirmed measles outbreak, MMR vaccine may be given (on the direction of public health authorities) to infants between 9 and 12 months of age, and even to those between 6 and 9 months of age.³⁹ In these cases, another dose of MMR (or MMRV when available) should be given at 12 months of age or 4 weeks after the first dose, whichever is later. This should be followed by the routine administration of the next dose of measles-containing vaccine at 18 months of age. This is because maternal antibodies to measles are known to persist in many infants until 11 months of age and may interfere with active immunisation before 12 months of age.¹

Children between 12 and 18 months of age who have received 1 dose of measles-containing vaccine can be offered their second dose early (ie. at least 4 weeks after the first dose) if they are considered at risk of coming in contact with measles³⁹ (see 'Recommendations (i)' above). If a child receives the second dose early, he/she is considered to have completed the vaccination schedule and, therefore, does not require another dose at 18 months of age or beyond, provided 2 doses were given at ≥ 12 months of age and at least 4 weeks apart.

Any older children, adolescents or adults who are considered susceptible to measles (see (i) above) during an outbreak should receive MMR (or MMRV if appropriate).

(iv) Use of immunoglobulin to prevent measles

Normal human immunoglobulin (NHIG) should be considered for contacts of patients with confirmed or suspected measles³⁹ (see Table 3.11.1). If NHIG is administered by IM injection within 7 days of exposure, it can prevent or modify measles in non-immune individuals.

The dose of NHIG is 0.2 mL/kg by deep IM injection for healthy children, adolescents and adults (including pregnant women), and 0.5 mL/kg by deep IM injection for people with impaired immunity. The maximum dose is 15 mL.

NHIG should be given to exposed individuals if contact was within the previous 7 days in the following instances:

- infants <6 months of age where the infant's mother is the measles case, or the infant was born before 28 weeks' gestation,
- infants 6–9 months of age (see 'Vaccination during an outbreak' above),
- all those ≥9 months of age in whom administration of MMR vaccine would be contraindicated,
- non-immune pregnant women,
- those exposed to measles who have impaired immunity,
- those who have never received a measles-containing vaccine, and who did not receive a MMR or MMRV vaccine within 72 hours of contact.

Children with impaired immunity, where MMR is contraindicated, should be given NHIG as soon as possible (within 7 days) after exposure. Testing for measles antibody does not assist with the decision to use immunoglobulin, since neither previous vaccination nor demonstrated low-level serum antibody guarantees immunity to measles in individuals with significantly impaired immunity.^{23,39} Testing for measles antibody may delay the appropriate use of NHIG. However, testing may be of value in making a definitive diagnosis of measles.

Infants 6–9 months of age who have direct contact with a person with measles are at risk of developing complications from the disease, and should be offered NHIG within 7 days of contact.³⁹ MMR vaccine should then be given as close as possible to 12 months of age, after an interval of at least 5 months following the administration of immunoglobulin (see Chapter 2.3, *Groups with special vaccination requirements*, Table 2.3.5 *Recommended intervals between either immunoglobulins or blood products and MMR, MMRV or varicella vaccination*). NHIG is not usually given to babies <6 months of age, who are protected by passive maternal antibodies. However, if the mother of an infant <6 months of age does not have documented evidence of having received 2 doses of MMR, or is the measles case, the infant should be given NHIG. Similarly, premature infants (<28 weeks' gestation) have little or no acquisition of transplacental maternal antibody, irrespective of the number of doses of MMR the mother has received, and should also be offered NHIG (see Table 3.11.1).

Table 3.11.1: Management of significant measles exposure using vaccination or normal human immunoglobulin (NHIG)

Age	Action
<6 months	NHIG 0.2 mL/kg* IM injection <i>if</i> mother has not received 2 documented doses of MMR, or the mother is the measles case, or the infant was premature (<28 weeks' gestation)
≥6–<9 months	NHIG 0.2 mL/kg IM injection*
≥10 months	MMR or MMRV vaccine within 72 hours of exposure <u>OR</u> NHIG 0.2 mL/kg IM injection* if 3–7 days after exposure†

* The dose of NHIG is 0.2 mL/kg in immunocompetent individuals and 0.5 mL/kg in those with impaired immunity.

† Immunoglobulin is not required if the person has received at least 1 measles-containing vaccine at ≥12 months of age or is assessed as being not susceptible (see (i) 'Definition of a person who is considered *not* susceptible to measles' above), unless the person has impaired immunity.

Use in pregnancy

MMR vaccine is not recommended in pregnancy due to the theoretical risk of transmission of the rubella component of the vaccine to a susceptible fetus.

Pregnancy should be avoided for 28 days after vaccination³⁰ (see Chapter 3.19, *Rubella* and Chapter 2.3, *Groups with special vaccination requirements*, Table 2.3.1 *Vaccinations in pregnancy*).

Variations from product information

The product information recommends that women of child-bearing age should be advised not to become pregnant for 3 months after vaccination with MMR or MMRV vaccines, whereas the NHMRC recommends 28 days.³⁰

The product information for Priorix states that people with a history of anaphylactic or anaphylactoid reactions should not be vaccinated with Priorix, but it is established that MMR vaccine can be given in this situation.²³

References

Full reference list available on the electronic *Handbook* or website <http://immunise.health.gov.au>.