MMR vaccination remains a priority

Measles, mumps and rubella are vaccine-preventable causes of significant morbidity and mortality (particularly for measles), that can affect people of any age. Historical gaps in vaccination coverage in New Zealand have left many people under-immunised. Furthermore, with the challenges of the COVID-19 pandemic, many countries have had disrupted immunisation programmes so New Zealand needs to be prepared for the potential for increasing international rates of measles over the next few years. There has also been a recent drop-off in the uptake of childhood immunisations in New Zealand, creating further potential immunity gaps in our younger population, particularly tamariki Māori.

KEY PRACTICE POINTS:

- Immunisation against measles, mumps and rubella requires two doses of the combined MMR vaccine, and is the best protection against all three diseases
- Historical gaps in vaccination coverage have left many New Zealand adolescents and young adults, aged between 15 and 30 years, under-immunised and at increased risk of infection, making this population group a priority for catch-up vaccination
- Catch-up doses of MMR are fully funded for people born from 1 January, 1969, without documented history of two doses of MMR
- The timing of MMR vaccination was amended in the National Immunisation Schedule in October, 2020, to include a first dose of MMR at age 12 months and a second dose at age 15 months
- Maintaining the infant immunisation programme and ensuring all infants receive two MMR vaccinations by 15 months remains vital to reduce the risk of developing further immunity gaps
- Practices should actively check for and recall all patients with uncertain or undocumented MMR vaccination history, particularly focusing on infants who have missed their dose at age 12 and/or 15 months and people aged between 15 and 30 years; there is no evidence to suggest receiving an extra dose causes any harm

Measles, mumps and rubella in New Zealand

Following the introduction of the combined measles, mumps and rubella (MMR) vaccine in 1990, the number of cases of all three diseases has significantly and progressively declined.[1] Since then, there have been very few large outbreaks and in 2017, the World Health Organization (WHO) verified New Zealand as free of both endemic measles and rubella (see: "Epidemiology definitions").[1] Historical issues in vaccination coverage, however, have left many adolescents and young adults in New Zealand more likely to have missed full MMR vaccination and at greatest risk of infection (see: "Adolescents and young adults in New Zealand are under-immunised").[1, 2] For this reason, the Ministry of Health now recommends that this population group is prioritised for recall for catch-up MMR vaccination to help to close the immunity gap, reducing the risk of future outbreaks.[1]

N.B. While adolescents and young adults are currently the priority for catch-up MMR vaccination, anyone born on, or after 1 January, 1969, without documented evidence of immunity to all three diseases may also receive funded catch-up MMR vaccination (see: "Encourage immunisation of susceptible individuals").[1]

Criteria for determining immunity

Evidence of immunity against measles, mumps and rubella requires documented history of two doses of MMR, or serologic evidence of immunity against all three diseases.[1] Clinical history of disease alone does not reliably indicate immunity.[1] Serologic evidence of protection against one disease (if tested), or documented history of measles-only vaccination, cannot be used as a proxy for immunity against the other two diseases; complete MMR vaccination is still required.[1]

N.B. In New Zealand, serological testing for immunity against rubella is typically only performed as part of the "antenatal screen" and serological testing is not funded or recommended for routine use;[1] if there is doubt about vaccination status, it is safe and effective to offer further vaccination rather than a serological test.

Adolescents and young adults in New Zealand are under-immunised

Since the early 1990s, several gaps in MMR coverage have resulted in certain cohorts in New Zealand being under-immunised, particularly adolescents and young adults aged between 15 and 30 years.[1] This gap in immunity is due to a combination of historical issues in vaccination coverage directly affecting this population group, including:[1]

Historically low national immunisation rates, with less than 60% of children being fully vaccinated by age two years in the 1991/92 National Childhood Immunisation Survey.[5, 6] Coverage increased to 63.1% in 1996 (with lower rates for those of Māori [44.6%] and Pacific [53.1%] ethnicity) and further increased to 77.4% in 2005.[5, 6] N.B. National immunisation coverage dropped again in the 2010s but increased to 88% (for children aged five years) between 2020 – 2021.[7]

Unfounded, but widespread vaccine safety concerns regarding a since discredited association between MMR vaccine and the development of autism in children in the late 1990s and early 2000s* (see: "Vaccination hesitancy" for further information on immunisation concerns)[8, 9]

Changes to the timing of the second dose in the MMR vaccination schedule in 2001; from age 11 years to age four years

Potentially compromised vaccine quality, resulting from inadequate cold chain processes, which have now been rectified

Vaccine supply shortages, particularly during the 2019 measles outbreak[10, 11]

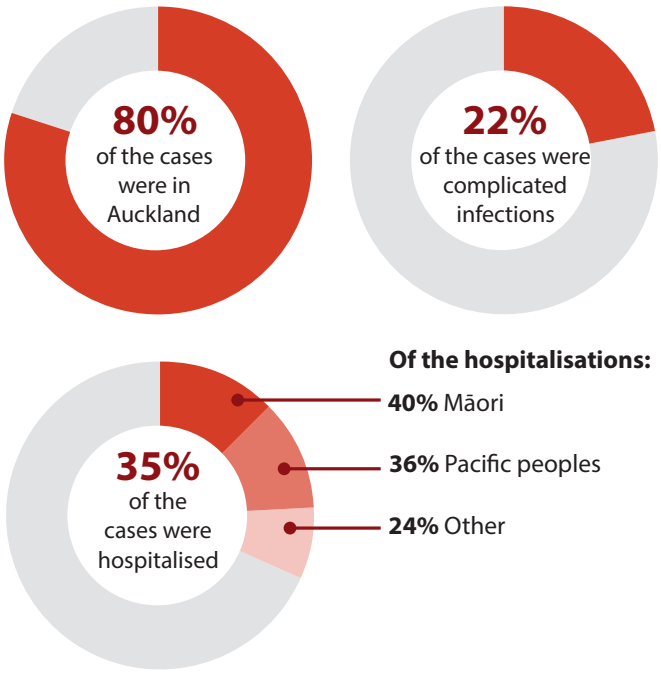
* These claims have been discredited, with over 30 years of epidemiological research confirming there is no evidence of a link between MMR and autism.[8, 9] The original study (1998) was retracted in 2004 due to dishonest and irresponsible methods, where it was later disclosed to have used incorrect laboratory reports and falsified patient data. For further information, see: **www.thelancet.com/journals/lancet/article/PIIS0140-6736(10)60175-4/fulltext**.[1]

Recent mumps and measles outbreaks highlight immunity gap

The most recent mumps and measles epidemics in New Zealand occurred in 2016/2017 and 2018/2019, with most cases located in the wider Auckland region (see: "Measles, mumps and rubella: an overview").[1, 12] Adolescents and young adults aged between 12 – 29 years* were the population group most affected by the outbreaks (Figure 1).[1, 12]

During the 2018/2019 measles epidemic, **nine outbreaks** occurred throughout New Zealand, resulting in **2,213 notified cases**, of which:[1, 13]

Six outbreak clusters were linked to imported cases; deriving from Australia, Thailand, Japan, Singapore and the Philippines



The highest burden of disease was among under-immunised young children, adolescents and young adults; particularly infants aged under two years and adolescents/young adults aged between ten and 30 years* (see: "Adolescents and young adults in New Zealand are under-immunised")

* The age range has been inconsistently reported, i.e. 10 – 15 and 20 – 30 years, and varies depending on data age groupings[1, 13, 14]

Rubella infection is still rare in New Zealand

The most recent rubella outbreak occurred between 1995 – 1996, mostly involving young adult males, and likely due to the earlier under-immunisation of young males (see: "Vaccination history of measles, mumps and rubella in New Zealand").[1] Since 1998, no incidences of congenital rubella syndrome (CRS), and very few cases of rubella, have been reported.[1] In 2017, New Zealand was verified by the WHO as rubella-free, and since then only three imported cases of rubella have been reported (Figure 1).[1]

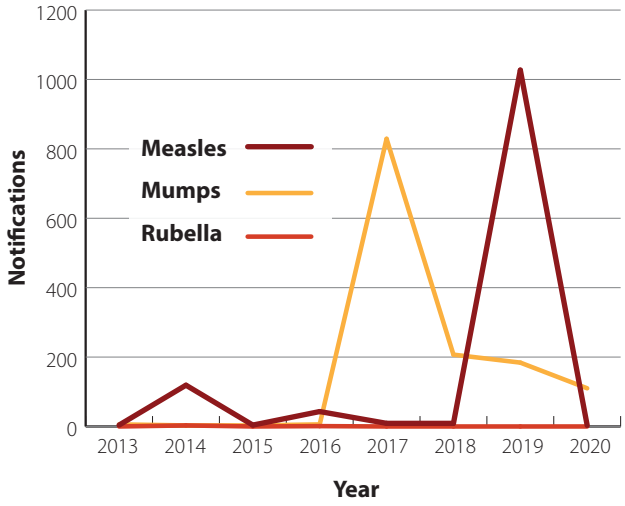


Figure 1. Measles, mumps and rubella notifications for adolescents and young adults aged 15 – 29 years in New Zealand from 2013 – 2020.[12]

Epidemiology definitions

Cluster: a greater than expected accumulation of cases of a health condition (e.g. disease or injury) which are grouped together in place and time.[3] N.B. The expected number of cases is not always known.[3]

Endemic: the constant presence of a disease, infectious organism or health condition within a given population and in a given geographic area.[3]

Epidemic: an increase in the number of cases of a disease, illness, health-related event or health-related behaviour that far exceeds the expected number within a community, region, or any other group of people at a particular period.[3, 4]

Outbreak: technically synonymous to epidemic, outbreak, however, is typically used to describe a more localised increase in the number of cases of a health condition (e.g. disease or injury), such as within a community, town or institution.[3, 4]

Pandemic: an epidemic on a much larger scale, spreading to many countries or continents and therefore usually affecting a larger number of people around the world.[3]

Table 1. History of measles, mumps and rubella vaccination in New Zealand.[1]

Date	Measles	Rubella
1969	**Single dose measles-only vaccine:** introduced for children aged between ten months and five years, and those at high risk aged under ten years N.B. People born prior to 1 January, 1969, are considered immune due to wild-type virus exposure.	
1970		**Single dose rubella-only vaccine:** introduced for all children aged four years (to reduce wild-type virus transmission in children aged five to nine years) N.B. The Department of Health* also initiated a school-based immunisation programme resulting in the vaccination of 95% of children aged five to nine years during 1970.
1974	**Recommended age change:** single dose measles-only vaccination changed to age 12 months	
1979		**Recommended age change for girls:** single dose rubella schedule changed to age 11 years for girls only, due to a low uptake of rubella vaccination at age four years (especially in boys)
1981	**Recommended age change:** single dose measles vaccination changed to age 12 – 15 months	
1990	**Single dose combined MMR vaccine:** introduced to the National Immunisation Schedule for all infants aged 12 – 15 months, replacing the separate measles and rubella vaccines N.B. Vaccination against mumps was not included in the National Immunisation Schedule before the combined MMR vaccine in 1990.	
1992	**Double dose combined MMR:** a second dose was added to the National Immunisation Schedule for boys and girls aged 11 years	
1996	**Measles, mumps and rubella became notifiable diseases**	
2001	**Recommended MMR age change:** the timing of the second dose of MMR was changed from age 11 years to age four years and a school-based, catch-up vaccination programme was offered to all children aged five to ten years	
2014	**Vaccination available following immunosuppression:** MMR became available for (re)vaccination following immunosuppression. Two-dose schedule remained at ages 15 months and four years.	
2020	**Recommended MMR age change:** following the 2019 measles outbreak, the recommended age for vaccination changed in October, 2020, to age 12 months (for dose one) and age 15 months (for dose two)	

* In 1993, the Department of Health became the Ministry of Health[20]

N.B. Measles, mumps and rubella are all notifiable diseases and all suspected and confirmed cases must be immediately reported to the local Medical Officer of Health.[1]

Vaccination history of measles, mumps and rubella in New Zealand

The history of measles, mumps and rubella vaccination in New Zealand can provide information to help identify people who are likely to be under-immunised (Table 1).[1]

N.B. People vaccinated in other countries may have received monovalent measles or measles-rubella only vaccines, and if applicable, still require immunisation with MMR for full protection.

Immunisation is the best protection

In cases of highly infectious vaccine-preventable diseases such as measles, mumps and rubella, a high percentage of the population needs to be fully immunised to prevent wide-spread community transmission (Table 2).[1] With a basic reproduction number (R0) of 12 – 18, measles is one of the most contagious and communicable of all infectious diseases.[1, 15] Influenza and coronavirus disease 2019 (COVID-19) have comparatively lower basic reproduction numbers (Table 1).[1, 21]

Table 2. Disease transmissibility ratings and herd immunity thresholds required to prevent wide-spread community transmission.[1]

Disease	Basic reproduction number (R0)*	Herd immunity threshold
Measles	12 – 18	92 – 94%
Mumps	4 – 7	75 – 86%
Rubella	6 – 7	83 – 85%
Coronavirus (COVID-19)	4.08†	Unknown
Influenza	1.4 – 4	30 – 75%

* R0 values are estimated values, often deriving from global averages, such is the case with COVID-19.[21] R0 values represent the estimated spreading potential of an infection by calculating the number of secondary cases that can be infected by one infectious case, within a given, and susceptible population.[1] Ranges can therefore vary greatly between populations depending on the means of calculation and the specific population.[21]

† The mean R0 number of the delta variant of COVID-19 is estimated to be 5.08 (range 3 – 8)[22]

First MMR dose now recommended at age 12 months

Following the 2019 measles outbreak, the National Immunisation Schedule was revised on 1 October, 2020, recommending that children now receive the first MMR dose at age 12 months, and a second dose at age 15 months (previously recommended at age 15 months and age four years).[1] MMR vaccination is fully funded for New Zealand citizens and residents, and contacts of confirmed cases, including catch-up vaccinations (see Table 3 for recommended MMR vaccination schedule).[1]

Encourage immunisation of susceptible individuals

Any person born on or after 1 January, 1969, who has not received two documented doses of the combined MMR vaccine, is considered susceptible to one or more of measles, mumps and rubella, and includes those who have:[1, 16]

- **Received partial vaccination** with one or two doses of a measles-only vaccine (or measles-rubella vaccine for people vaccinated overseas)
- **Clinical history of infection** of one or more of the diseases without further documentation of immunity (see: "Criteria for determining immunity")

All susceptible individuals should receive one or two doses of MMR vaccine (see Table 3 for dosing recommendations).[1] If vaccination history is not available or is uncertain (i.e. number of doses and/or type of vaccine), advise patients that there is no safety concern in re-vaccinating with MMR and this is recommended.[1] However, as a live attenuated vaccine, there are certain people for whom MMR is contraindicated (see: "Contraindications and cautions").[1]

New Zealand population groups at higher risk of infection

In New Zealand, people most at risk of measles exposure and infection include those:[1]

Who are not fully vaccinated with MMR, particularly children aged under two years, and adolescents and young adults, aged between 15 and 30 years (see: "Adolescents and young adults in New Zealand are under-immunised")[13]

Returning from recent travel overseas with uncertain immunisation history, due to higher risk of exposure in measles-endemic countries

Born in countries where complete vaccination with all three antigens is less likely or access is difficult

Working in certain occupations including health care, early childhood education services and other high-contact occupations*, who are at increased risk of both contracting and transmitting infections

* High-contact occupations include those working in emergency and essential services such as armed forces, immigration/refugee centres, long-term care facilities, correctional facilities and border workers[1]

Table 3. Recommended MMR immunisation schedule. Adapted from the "Immunisation Handbook" (2020).[1]

Patient group	Recommended vaccination (all doses of MMR must be given at least four weeks apart)
Childhood immunisation schedule for children born in New Zealand	**Two doses of MMR***; dose one at age 12 months and dose two at age 15 months
Early vaccination for infants during an outbreak	**A single dose of MMR0 [zero]** can be given to infants aged between six and 11 months for early protection N.B. Any infants receiving the MMR0 vaccine still require two further doses of MMR, as per the usual childhood schedule.
Catch-up schedule for those born from 1 January, 1969, without documented history having received two doses of MMR or evidence of serologic immunity against all three diseases	**Two doses of MMR;** recommended catch-up doses for patients with vaccination histories of: ■ **No prior MMR** – two doses ■ **One MMR** – one dose ■ **Any number of measles, mumps or rubella vaccines** (alone or combined, e.g. measles-rubella) **and no MMR** – two doses N.B. Pregnancy should be avoided for at least four weeks following final vaccination.
Women who are pregnant	**MMR is contraindicated during pregnancy** (due to the possibility of fetal harm) N.B. MMR can be given to women who are breastfeeding.
Immunocompromised individuals	**MMR is contraindicated;** close contacts should be vaccinated (see below)
People born in New Zealand before 1 January, 1969	**MMR is not required** as they are considered immune to measles (due to presumed exposure to wild-type measles before the introduction of MMR) N.B. Those born before 1980 are considered immune to mumps.

For further information on occupation-related vaccination, see: **www.health.govt.nz/our-work/immunisation-handbook-2020/4-immunisation-special-groups#4-8**

MMR immunity gap increases the risk of fetal rubella infection

Although rubella cases have remained low, a large number of women falling within this immunity gap are now of childbearing age and susceptible to rubella infection, increasing the risk of fetal infection and serious complications such as CRS (see: "Measles, mumps and rubella: an overview").[1] Women of childbearing age, especially those who are planning pregnancy, should be asked if they are fully immunised against rubella with MMR (see Table 2 for recommended vaccination schedule if catch-up is required).[1]

N.B. In New Zealand, serological testing for immunity against rubella is typically only performed as part of antenatal care and is not funded as a precautionary measure for women planning pregnancy.[1] If serology results indicate a lack of immunity during pregnancy, MMR vaccination should be given following delivery.[1]

Further information on MMR immunisation catch-ups is available from: **www.health.govt.nz/our-work/immunisation-handbook-2020/appendix-2-planning-immunisation-catch-ups**

Further information on MMR immunisation for special groups is available from: **www.health.govt.nz/our-work/immunisation-handbook-2020/4-immunisation-special-groups**

Scheduling MMR with COVID-19 vaccination

The requirements for spacing between administration of mRNA COVID-19 vaccine with other vaccines, with the exception of the vaccine for herpes zoster, have been removed. Previously, it was recommended that a gap of two weeks be observed between COVID-19 vaccination and any non-live vaccine, or four weeks with a live vaccine, such as MMR.[1] If a person therefore requires MMR vaccine and also COIVD-19 vaccine, the advice is that they can now be administered concurrently, and that MMR can be given either immediately before or after COVID-19 vaccine.[1]

Measles, mumps and rubella: an overview

Measles

Measles is a highly infectious viral disease caused by a paramyxovirus.[1] It can be transmitted through both airborne spread (coughing, sneezing, breathing) and direct person-to-person contact (via transfer of infectious droplets).[1, 15, 16] Measles is characterised by clinical features of fever and a distinctive maculopapular rash, and causes an acute immune suppression that leads to widespread infection.[1, 15] After exposure, the virus has an incubation period of approximately ten days before symptoms appear, typically in three characteristic stages.[1, 16]

Measles infection increases the risk of further complications such as pneumonia, encephalitis and myocarditis and in rare cases, sub-acute sclerosing panencephalitis*.[1]

* Sub-acute sclerosing panencephalitis is a rare but serious and fatal degenerative nervous system disease, that arises from persistent, wild-type measles infection and typically appears 7 – 11 years following initial infection[17]

Mumps

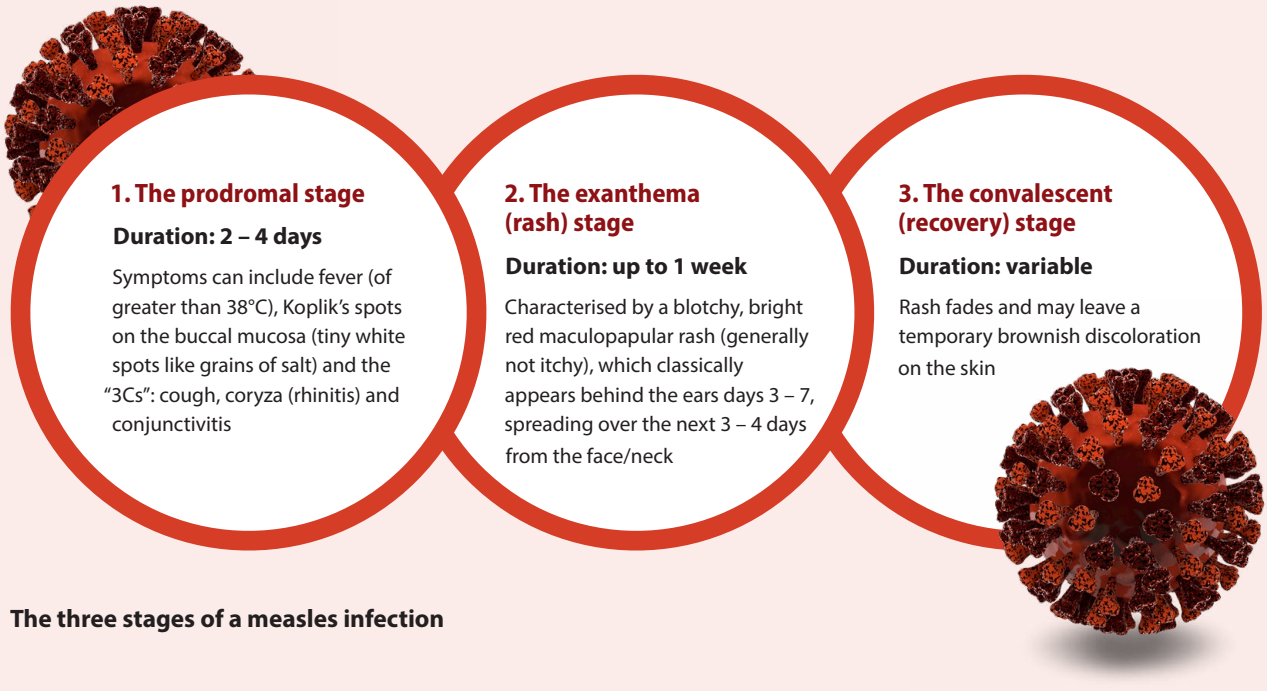
Mumps is an acute viral infection also caused by a paramyxovirus, and characterised by clinical features of headache, fever and parotitis (parotid salivary gland swelling and tenderness).[1] It is transmitted both indirectly (through airborne droplets) and directly (through contact with urine or saliva), and is most infectious for the period of two days before and five days after onset of parotitis.[1] Widespread mumps infection can lead to further complications such as meningitis, encephalitis, hearing loss, mastitis and oophoritis in females and orchitis in males that can decrease fertility or lead to temporary sterility; it is unknown whether mumps can result in permanent sterility.[1, 18]

N.B. Parotid gland swelling is most common, but swelling can also occur in other salivary glands and other structures, e.g. the brain and testes.[1]

Rubella

Rubella is an infectious disease caused by a togavirus that affects both adults and children.[1] The virus is comparatively less infectious than measles (Table 1), however, maternal infection can lead to serious consequences for the unborn child, particularly if contracted during the first trimester of pregnancy.[1]

Congenital rubella syndrome (CRS) is the most severe complication following rubella and results from maternal infection during pregnancy.[1, 19] CRS is characterised by a number of serious consequences including miscarriage, fetal death and severe congenital defects including hearing impairment, congenital heart disease, cataracts and developmental delay.[1, 19] Fetal damage can occur in up to 80% of infants if rubella is contracted within the first 12 weeks of pregnancy, decreasing to 50% after 16 weeks and 25% after the end of the second trimester; multiple defects are common.[1, 19]



The three stages of a measles infection

Further information about COVID-19 vaccination is available from the Immunisation Handbook (see Section 5.4.5 for information on co-administration with other vaccines): **www.health.govt.nz/our-work/immunisation-handbook-2020/5-coronavirus-disease-covid-19**

Contraindications and cautions

As MMR is a live vaccine, people with contraindications include those:[1]

Who are pregnant

Who are immunocompromised

With proven anaphylaxis to either the vaccine itself or a component within it, e.g. gelatin or neomycin. N.B. People with egg allergies (including anaphylaxis) can safely receive the vaccine.

Who have been immunised with another live vaccine* within the previous four weeks; All vaccines can be given concurrently with MMR vaccine (with separate syringes and different injection sites), however, a four week gap is required for administration of any other live vaccine if not administered concurrently. There is no longer a requirement for spacing with inactivated vaccines, e.g. the COVID-19 vaccine.

* Additional live attenuated vaccines include varicella, rotavirus, tuberculosis (BCG) and zoster[1]

Further information about co-administration of MMR with other vaccines is available from the Immunisation Handbook (see Section 12.4.4) **www.health.govt.nz/our-work/immunisation-handbook-2020/12-measles#11-6**

Vaccination hesitancy

Vaccine hesitancy is a complex barrier to immunisation and refers to a patient or caregiver's refusal, or delayed acceptance of vaccination, even when the services are fully funded and available.[1, 24] According to a recently published longitudinal study, over time approximately 30% of the New Zealand population is showing decreasing levels of confidence in the safety of childhood vaccination.[25] Between 1 April, 2020, and 31 March, 2021, the National Immunisation Register (NIR) reported:[7]

- **3,290 parents or caregivers (5.2%) had declined/opted out of any one vaccination for their child** (i.e. children turning the milestone age five years during that 12-month period)
- **366 had opted to move their child off the NIR (0.6%)**

Vaccine hesitancy is complex and can involve varying factors, including:[1, 24]

- **Vaccine and vaccination-specific concerns;** general concern about vaccine safety (i.e. risks/benefits), associated costs
- **Individual and/or social group influences;** knowledge, beliefs and attitudes about health and prevention, perceptions of risks/benefits, personal or anecdotal experience with vaccination, philosophical or conspiratorial beliefs, complacency
- **Contextual issues;** culture, religion, socio-economic status, gender, policies and politics, influential leaders, geographical barriers, historical influences, distrust in health professionals or pharmaceutical industry, media environment (i.e. ease of access to and abundance of anti-vaccine sentiment)
- **Access barriers;** physical or geographical access, costs and affordability, ability to understand vaccine information (i.e. language and/or health literacy)[26]

Understanding and addressing concerns through effective communication

Clinicians should respectfully correct any misconceptions patients and/or caregivers may have, addressing poor sources of information with clear, evidence-based research and at the appropriate level of health literacy for the individual.[1, 24, 25] Information should include the benefits, risks and possible adverse effects of vaccination, the risks of disease without vaccination and advice on what they should do if adverse effects occur.[1, 25]

For further guidance on addressing vaccination concerns, visit: **www.health.govt.nz/our-work/immunisation-handbook-2020/3-vaccination-questions-and-addressing-concerns#3-2**

Two doses are needed for full immunity

Following the second dose of MMR the serologic evidence of immunity increases to 99% against measles, 83 – 88% against mumps, and is likely higher than 90 – 97% against rubella.[1] Almost all people who do not develop protective immunity following the first MMR dose, do so after the second. Rarely, fully immune people can still contract measles following two doses, however, it is usually less severe and hospitalisation is less likely.[1]

Inform patients about potential adverse reactions

Following vaccination, some patients may experience common, mild adverse reactions such as rash, fever, submaxillary gland swelling or joint pain.[1, 23] Mild reactions typically resolve within a few days without treatment. Patients can manage symptoms by resting, drinking plenty of fluids and relieving fever or discomfort with mild analgesia if required (e.g. paracetamol or ibuprofen).[1, 23] Advise patients to contact a health professional if they are concerned about troublesome and/or unexpected symptoms.[1]

N.B. Adverse events following immunisation should be reported to the Centre for Adverse Reactions Monitoring (CARM).[1]

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