MEASLES

Based on the Ministry of Health Communicable Disease Manual 2012[1]

Associated Documents

- Case report form: Y:\CFS\ProtectionTeam\FinalDocs\NotifiableConditions\Measles\FormsStdLetters Quest MMR_CRF_June2015.pdf
- Fact sheet: https://www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/measleses
- CPH Border Health Protocols for a Public Health Response to Public Health Risks at ChCh International Airport Limited: http://cdhbintranet/communitypublichealth/cphpoliciesandprocedures/Protection%20Team/Home.aspx
- MoH Environmental Circular – ref: Sharing information about ill travellers with airlines: (K:\CFS\ProtectionTeam\Library\MoHEnvHealthCirculars.

The Illness[1-4]

Measles is the most common vaccine-preventable cause of death among children throughout the world.

In 2017, New Zealand was verified by the World Health Organization as having eliminated endemic measles. This means that no cases of measles have originated in New Zealand in the past three years. However, measles is often imported into New Zealand following international travel. New Zealand has continued to experience outbreaks of measles in recent decades. This is due to historically low immunisation rates and therefore insufficient levels of immunity across the population to prevent community transmission.

The disease is transmitted by direct contact with infectious droplets or, less commonly, by airborne spread. Measles is one of the most highly communicable of all infectious diseases, with an approximate basic reproductive number of 12–18 in developed countries. There is a prodromal phase of two to four days with fever, conjunctivitis, coryza and Koplik's spots on the buccal mucosa. The characteristic maculopapular rash appears first behind the ears on the third to seventh day, spreads over three to four days from the head and face, over the trunk to the extremities. It lasts for up to one week. The patient is most unwell during the first day or two after the appearance of the rash.

Complications are common, occurring in 10 percent of cases and include otitis media, pneumonia, croup and diarrhoea. Encephalitis has been reported in 1 in every 1000 cases, of whom some 15 percent die and a further 25–35 percent are left with permanent neurological damage. Other complications of measles include bronchiolitis, sinusitis, myocarditis, corneal ulceration, mesenteric adenitis, hepatitis and immune thrombocytopenic purpura (ITP or thrombocytopenia). Sub-acute sclerosing panencephalitis (SSPE), a rare degenerative central nervous system disease resulting from persistent measles virus infection, is fatal. SSPE typically occurs 7 to 10 years after wild-type measles virus infection.[3] This complication has virtually disappeared where there is widespread measles immunisation.

The case fatality rate for reported cases of measles in the US is 1–3 per 1000. Measles is particularly severe in the malnourished and in patients with defective cell-mediated immunity, who may develop giant cell pneumonia or encephalitis without evidence of rash, and have a much higher case fatality rate. Measles during pregnancy can cause miscarriage, stillbirth and preterm delivery.

Measles is also serious in healthy children: over half of all the children who died from measles in the UK between 1970 and 1983 were previously healthy.[4] No other conditions were reported as contributing to the death of seven people who died from measles in the 1991 New Zealand epidemic.[2]

Clinical description
An illness characterised by **all** of the following:
1. generalised maculopapular rash, starting on the head and neck
2. fever (at least 38ºC if measured) present at the time of rash onset
3. cough or coryza or conjunctivitis or Koplik's spots present at the time of rash onset.

Prodrome: 2-4 days with fever, conjunctivitis, coryza and Koplik spots.

Incubation: About 10 days, but may be 7–18 days from exposure to onset of fever, and about 14 days, but may be 7–21 days, from exposure to the onset of rash . The incubation period may be longer in the immune suppressed or those given immunoglobulin after exposure.

Transmission: Airborne spread or by direct contact with nasal or throat secretions of cases. The measles virus has a short survival time (less than 2 hours) and is rapidly inactivated by heat, sunlight and pH extremes.

Infectivity: From 5 days before to 5 days after onset of rash.

Prevention: Prevention in the community is achieved by 'herd' immunity when a ≥95% immunisation coverage of the population is achieved. Disease in contacts can be prevented by vaccination of susceptible contacts with MMR within 72 hours of exposure or passive immunisation with immunoglobulin if 3-6 days after exposure. Other public health preventive measures include Isolation of cases and exclusion of susceptible contacts from high-risk settings.

Notification Procedure

- On suspicion, immediately.
- Laboratory notifications should be discussed with the patient's doctor to obtain the clinical history and to ensure that the patient has been informed of their diagnosis.
- If there is a significant situation inform ESR and the Ministry of Health.

Status

- **Under investigation**: A case which has been notified but information is not yet available to classify it as probable or confirmed.
- **Probable***:* A clinically compatible illness consisting of all three of the following criteria:
  1. fever 38^{0}C or higher
  2. generalised maculopapular rash lasting three or more days
  3. cough or coryza or conjunctivitis or Koplik spots.
- **Confirmed:** A clinically compatible illness that is laboratory confirmed or epidemiologically linked to a confirmed case.
- **Not a case**: A case that has been investigated and subsequently has been shown not to meet the case definition.

Laboratory Testing

- If the case **received a vaccine** containing the measles virus in the 6 weeks prior to symptom onset then **laboratory confirmation requires**:
  - evidence of infection with a wild-type virus strain obtained through genetic characterisation.
- If the case **did not receive a vaccine** containing the measles virus in the 6 weeks prior to symptom onset, then **laboratory confirmation requires** at least one of the following:
  - detection of IgM antibody specific to the virus (IgM may last from 3- 6 months)
  - IgG seroconversion or a significant rise (four-fold or greater) in antibody level for the virus between paired sera tested in parallel where the convalescent serum was collected 10 to 14 days after the acute serum
  - isolation of measles virus by culture

- detection of measles virus nucleic acid (PCR) from a clinical specimen e.g., urine, nasopharyngeal swab or throat swab. It is strongly recommended that, for any sporadic cases of suspected measles, two or more samples be taken: preferably blood for serology, and nasopharyngeal swab or urine sample for nucleic acid testing (NAT).
- the use of laboratory tests may change in an established outbreak.
- genetic characterisation should be carried out in accordance with advice from the national measles laboratory, in particular for imported cases, for sporadic cases unrelated to a known outbreak, and during the course of a prolonged outbreak for cases without clear epidemiological links to previously confirmed cases.

HealthPathways testing advice

For sporadic cases of suspected measles take 2 samples:

- a naso-pharyngeal swab placed in viral transport media (preferred sample) from onset of rash up until 5 days after the rash appearance. This detects both wild and vaccine virus types.

  AND
- a whole blood sample for measles serology. Measles IgM antibody can be detected in 40% of cases on day 1 of the rash, increasing to 90% on day 7 and disappearing 30 to 60 days post illness.

- Samples are to be taken in general practice because of the risk of infection to other (especially vulnerable) patients in laboratory waiting rooms.
- If both samples are not able to be done (e.g., GP unable to locate a naso-pharyngeal swab with viral transport media, or the venepuncture is difficult), the GP is advised to contact C&PH to discuss further testing options. Discuss with MOH. Options include:
  - delivering a nasopharyngeal swab if the medical centre has none
  - doing a throat swab (use viral transport media) for a PCR instead of a nasopharyngeal swab
  - obtaining a urine sample for a PCR.
- Samples are taken by courier from medical centre to the local laboratory or taken by HPO/Com Dis nurse.
- For further information on sample collection or laboratory testing, contact CHL Virology / Serology, phone (03) 364-0416 or (03) 364-0356 or the Grey Hospital laboratory on (03) 768-2797 .

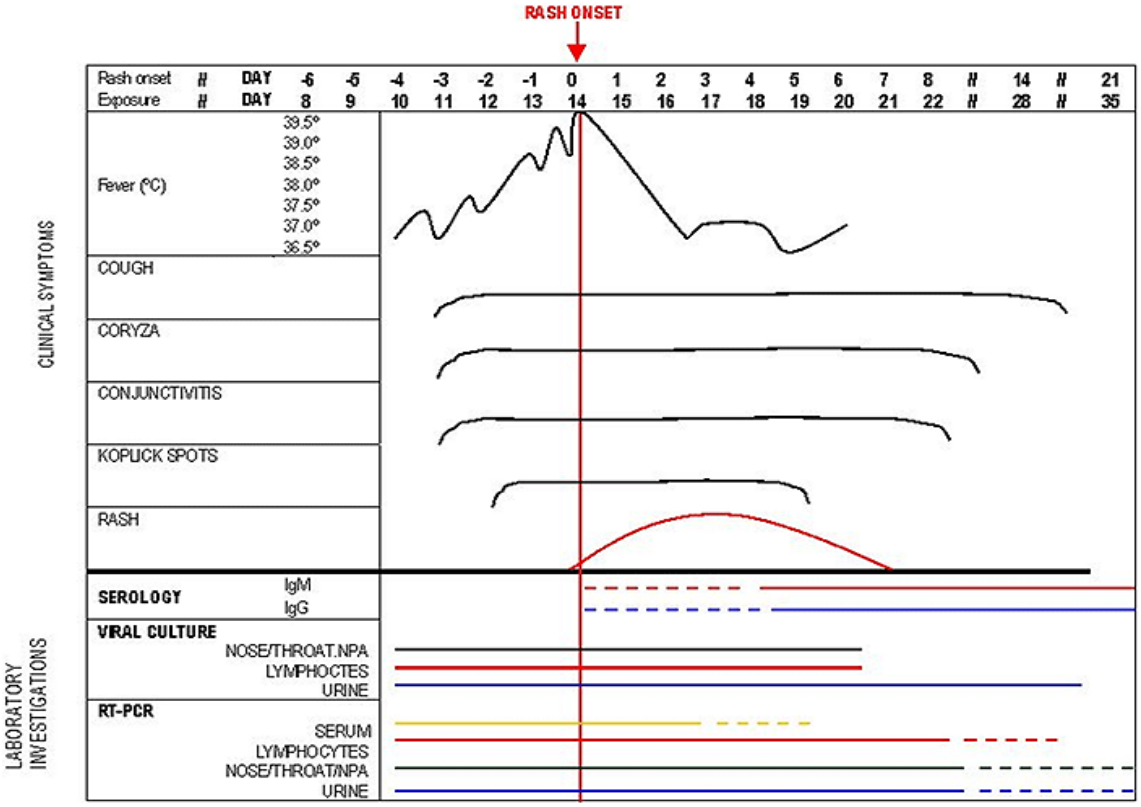
Interpreting serology

- Measles IgG detected within 1–2 days of a rash and no measles IgM strongly suggests prior immunity and that the rash is more likely due to causes other than measles.
- After measles vaccination, measles IgM is produced as part of the seroconversion and can be detected for 1–2 months. Serologically diagnosed cases who have received a measles-containing vaccine 8 days to 6 weeks before testing should not be classified as confirmed measles cases unless they are also linked epidemiologically to another confirmed case before vaccination. Measles virus genetic characterisation can distinguish between vaccine and wild-type strains.
- *[When] there are few or no true measles cases in a region, the positive predictive value of diagnostic tests [is] decreased. False-positive results of IgM tests can also occur as a result of testing suspected measles cases with exanthemata caused by Parvovirus B19, rubella and Human herpesvirus 6, among others. In addition, as countries maintain high levels of vaccination activity and increased surveillance of rash and fever, the notification of febrile rash illness in recently vaccinated people can be anticipated.* ***Thus, managers in the measles elimination programme must be prepared to address the interpretation of a positive result of a laboratory test for measles IgM when clinical and epidemiological data may indicate that the case is not measles.*** [3]

	Refer to the next page for Figure 1. Key aspects to consider in case interviews and laboratory test.

Figure 1 (provided by CHL, May 2017)

Key Aspects To Consider In Case Interviews and Laboratory Tests



Source: www.vidrl.org.au/labsandunits/measles

Management of Case

In **South Canterbury** and **West Coast**, the Public Health Nurses follow up these notifications.

Investigation

- Discuss notification with the MOH.
- Request notifying doctor to obtain laboratory confirmation (serology and/or nasopharyngeal swab) if possible for sporadic cases. Refer to Figure 1 above for the timing of tests.
- Action on the day of notification and ensure that cases details are obtained as soon as possible.
- Check that the following information is obtained:
  - the date of onset (important to establish duration of communicability)
  - any immune suppression (may be no rash)
  - contact with a probable or confirmed case
  - history of prior MMR vaccination (the vaccine may cause a fever and non-infectious rash around 6-12 days after immunisation)
  - history of travel
- Speak with the case/parent for further details including possible contacts, on the same day as notification.
- Testing may not be necessary or appropriate for cases with an epidemiological link to a confirmed case, or in outbreak situations.
- Contact the laboratory (Virology: ext. 80356, Serology: ext. 80416) for urgent tests or results. The MOH can contact on call microbiology registrar to arrange weekend testing if required.

- Serology and/or nasopharyngeal swab are recommended (see Figure 1 above for timing of tests) especially if no current outbreak but still treat as a case if not done. [IgM = acute antibodies and indicate recent infection. IgG = long term antibodies and usually indicate immunity however, a rise in IgG on paired sera may indicate recent infection.]
- Measles is a potentially serious, vaccine preventable disease and is highly contagious. One case in a preschool/school is considered an outbreak and attempts should be made to prevent spread (see Management of Contacts).
- Initiate active case finding (see below).
- Vitamin A is recommended for all cases admitted to hospital and may be recommended for those with immune deficiency or who may be vitamin A deficient (discuss with paediatrician).

Restriction

- Exclude from early childhood service, school or work and close contact with unexposed people for at least 5 days after the appearance of the rash.
- In health care facilities, airborne precautions should be taken until 5 days after the appearance of the rash.

Treatment (supportive)

- Vitamin A treatment in hospital at the time of measles infection can reduce the risk of fatality and eye complications and should be considered particularly in cases with severe or complicated measles, immunodeficiency, malabsorption, malnutrition or documented vitamin A deficiency.

Management Of An Infectious Outward Bound Passenger

For managing the privacy and medico-legal situation of an infectious passenger intending to travel refer to:

- C&PH protocol 'Border Health Protocols for a Public Health Response to Public Health Risks at Christchurch International Airport Limited', Part Two: p.15, Notes for Response to Communicable Disease K:\CFS\Quality\ApprovedDocuments\ProtectionTeam\Environment\BorderHealthProtocolAirport161109.pdf.
- and in more detail in the MoH Environmental Circular (K:\CFS\ProtectionTeam\Library\MoHEnvHealth Circulars\2012\Nov\Sharing Information About Ill Travellers with Airlines (page 28).

Counselling

The case or parents/caregivers should be advised of the nature of the infection and its mode of transmission. A pamphlet on measles is available from the Community Health Information Centre as well as a fact sheet: https://www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/measleses.

- If other vaccinations are incomplete, recommend the case catches up once they are through the acute illness.

Active case finding

- Public health units should alert doctors and laboratories in areas where the case may have acquired the infection or was infectious and should ask these doctors and laboratories to notify all cases to the public health unit promptly. Part of the reason for this is that early prophylaxis given to susceptible contacts (see below) can reduce the risk of developing disease.
- Consider a media alert to assist in finding cases.

Management of Contacts/Outbreak Control

Definitions
Contact:

- Any person who has been in a confined space with the case during the period of communicability. Confined settings may include an early childhood service, classroom, household, transportation, indoor occupational or social setting. Some judgement may be required by the local medical officer of health, but noting that measles is highly infectious and this should be taken into account when determining contacts and public health action.
- Any person who has been in a waiting or consultation room with an infectious case, or has spent time in that room up to and including one hour after it has been vacated by the case must be treated as a contact.
- Contacts are considered to be **susceptible** to measles if ***none*** of the following apply:
- born before 1969 (Measles vaccine was introduced into New Zealand in 1969)
- confirmed measles infection in the past.
- documented vaccination with two doses of MMR vaccine.
- documented immunity to measles.

If in doubt, vaccinate as there are no undue effects from vaccinating an individual who is immune.

- An **outbreak** has occurred if one case is identified and confirmed in an institution (an early childhood centre, school, university hostel etc.).
- **Epidemic:** Likely if more than one outbreak in more than one institution or neighbourhood in an area.

Investigate

- Consider using CCAT from the outset to assist with managing contacts, especially if there are a significant number of them.
- Testing contacts for immunity to measles (IgG) is not recommended because of the cost and the time taken for the result to be known.
- Efforts should be made to prevent spread from an index case by recommending vaccination of contacts by their GP within 72 hours of exposure. Vaccination within this time can prevent disease (see Prophylaxis below).
- Commence active case finding in the community and institutions, e.g. school, to try and prevent further spread. Identify if there are other cases and contacts who need appropriate management including prophylaxis. Request members of the community to present early if signs/symptoms develop.
- Discuss with MOH about informing local GPs, hospitals and schools in the locality to alert them that other cases are likely. If there are no other confirmed cases in the area it is sufficient to warn institutions and caregivers to immunise susceptible children. If cases are confirmed consideration should be given to immunising those at-risk.
- Inform:
    - the institution attended (by the case) that they are to inform others attending the institution eg. by newsletter. Recommend that immunisations be brought up to date.
    - the Public Health Nurse of the area.

Prophylaxis (sporadic case or outbreak)

There is some evidence that a single dose of measles– mumps–rubella (MMR) vaccine, when given to an unvaccinated person within 72 hours of first contact with an infectious person, may reduce the risk of developing disease.

For susceptible contacts, consider the use of MMR vaccine, human normal immunoglobulin (HNIG) or intravenous immunoglobulin (IVIG) as described in the *Immunisation Handbook 2014, 3rd ed. p.320. (http://www.health.govt.nz/system/files/documents/publications/imm-handbk-2014-3rd-edn-dec16.pdf)*.

HNIG is available from the New Zealand Blood Service and can be obtained by contacting the local hospital blood bank.

- Refer to the flow diagram Figure 2 and accompanying footnotes (page 9) for which contacts are to receive MMR or immunoglobulin.
- If MMR is advised, fax the MMR request form to the Moorhouse Medical Centre, see Moorhouse medical Flowchart: http://cdhbintranet/communitypublichealth/cphpoliciesandprocedures/Documents/Forms/M.aspx

or the patient's GP., see General Practice Flowchart: http://cdhbintranet/communitypublichealth/cphpoliciesandprocedures/Documents/Forms/G.aspx

- If immunoglobulin (IG) is advised the MOH or GP is to discuss the referral with an infectious disease physician or a paediatrician. Those persons who are advised to receive IG are to be referred to either an infectious disease physician or paediatrician. For dosages refer to p. 320-321, *Immunisation Handbook 2014,* (see link in paragraph above).
- MMR vaccine is recommended. Single antigen measles vaccine is not available.

Follow Up Of Passengers After In-Flight Exposure

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If a case of disease is identified prior to the arrival of an international flight, the ill traveller protocol (ie flow diagram 1.1 of the Border Health Airport Protocol: http://cdhbintranet/communitypublichealth/cphpoliciesandprocedures/Documents/Forms/B.aspx should be implemented. If the MOH has a high index of suspicion that the case is likely to be measles, then contact tracing (see details below) should be carried out on arrival and passengers and crew not considered as contacts should be provided with the following information (**contact tracing does not need to be carried out for measles cases on domestic flights**.[Ψ])

- the need to check whether they are fully immunised or immune against measles, and to arrange MMR catch-up if they are not, and
- the Healthline number (0800 611 116) if they have questions or start developing symptoms.

[Ψ] No secondary case occurred on all 17 domestic flights that carried infectious cases of measles in an Australian study [6]

If a suspected case of measles has travelled on an [international] flight during the infectious period and is detected after the arrival of the flight, a series of actions need to be considered as quickly as possible, i.e. as soon as the Medical Officer of Health has a high index of suspicion that the suspected case is likely to be measles, or on confirmation of the case:

- Issue a general media alert
- Direct email and/or SMS messaging to all flight passengers and the flight crew
- Contact tracing

- **General media alert**

It is recommended that a media alert be always issued if the case is identified after flight arrival. The purpose is to let passengers and crew know as soon as possible about the possibility that they may have been infected on the identified flight and what they need to do. The media alert may also help to raise awareness within the health sector.
The media alert should be done as quickly as possible, and must include the following information as a minimum:

- Affected flight number, date/time, origin and destination.
- A statement about the contagious measles case on the flight, and the possibility that susceptible passengers and crew members may have been infected.
- The need for all passengers and crew to check whether they are fully immunised or immune against measles, and to arrange MMR catch-up if they are not.
- Healthline number (0800 611 116) if they have questions or start developing symptoms.

- **Direct email and/or SMS messaging to all flight passengers and the flight crew**

Direct email and/or SMS messaging to flight passengers and the flight crew should be done to complement the media alert as soon as their contact information is available, or the channel that can be used has been identified. The information to include is similar to the one in the media alert. If contact tracing is carried out, then this should be also mentioned in the message.

- **Contact tracing**

Given that New Zealand has experienced sustained measles outbreaks linked to measles importations in recent years, contact tracing is still recommended on international flights, as soon as possible up to 14 days after the flight. Contact tracing does not need to be carried out for measles cases on domestic flights. [Ψ]

The purpose of the contact tracing is:

- to prevent further transmission by recommending 'quarantine' and isolation as appropriate,
- to facilitate post-exposure prophylaxis if still indicated, in particular for those at higher risk for becoming sick or having complications, and
- to recommend MMR immunisation to susceptible contacts (see first paragraph of this section above for definition of 'susceptible' contacts).

- Upon identification of a suspected measles case on a flight, the passenger arrival cards of the passengers identified for contact tracing (see below) must be

[Ψ] No secondary case occurred on all 17 domestic flights that carried infectious cases of measles in an Australian study [6]

requested from NZ Customs and/or Statistics NZ as soon as possible, as per agreed protocol with these agencies. See 'Attachment-EmergencyContactNumbers–ArrivalCards'.
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- One public health unit (PHU) only should be seeking the cards (e.g. the PHU where the plane landed or where case was notified). If the PHU identifies a contact located outside its area, it should then communicate the individual contact information to enable contact tracing to the PHU where the contact is located.
- Contact tracing must be carried out at least for all passengers sitting within **eight**θ rows fore and aft of the index case and in the same cabin section.
- If there are multiple cases of measles on the plane, contact tracing must be carried for all passengers regardless of where they were seated.

Restriction

- Advise susceptible contacts to avoid attending school, early childhood services or community gatherings, and to avoid contact with other susceptible individuals, from 7 days after first exposure until 14 days after last exposure to the infectious case.
- Consider excluding susceptible persons in an affected institution until 14 days after the first day of appearance of the rash in the last case or until the contact receives vaccination (if within 72 hours of contact) or immunoglobulin (if within 7 days of contact), whichever occurs first.
- The MOH should consider whether it is necessary to use exclusion provisions in the Health (Protection) Amendment Act 2016, and the Education (Early Childhood Centres) Regulations 1998 for exclusion from early childhood services.
- However, if they receive either immunisation (MMR or IG within the recommended time frames) they may return immediately.

Counselling

- Advise all contacts to seek early medical attention if symptoms develop and take precautions so as not to infect others. It is important they telephone and alert the health provider before attending their medical centre to prevent the risk of spreading the virus in health care settings.

Provide information to the institution/family on the disease risk and ensure all caregivers are aware of the disease and receive advice to ensure all unimmunised children receive MMR. A pamphlet on measles is available from the Community Health Information Centre as well as a Fact Sheet: https://www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/measleses.

θ About 90% of secondary cases (17 out of 19) among passengers were seated within 8 rows of the case in the same Australian study [6]

Other Control Measures

Health Education

- Stress the importance of two doses of measles vaccination for all children and encourage early childhood services to keep up-to-date immunisation records of attending children.
- Two doses of MMR vaccine are recommended for all children (without contraindications): the first at 15 months of age and the second at 4 years of age.
- Where dose/s have been delayed or missed, catch-up vaccination is recommended. This applies to anyone born from 1 January 1969.
- All children and unimmunised adults are eligible for a free primary course (two doses of MMR vaccine).

Epidemic Control

- If there is a significant increase in the number of epi-linked and sporadic cases, our response may need to move from full public health follow-up of all notified cases to targeted follow-up plus public health support of community-wide measures. Any transition will require time and preparation. The following strategies should be discussed promptly with the local Outbreak Committee, other DHB stakeholders, primary care representatives, ESR, and the Ministry of Health:
  - Reducing the extent of public health case and contact follow-up (eg limiting follow-up to household/family and high-risk contacts and settings, in conjunction with increased care and follow-up through primary care)
  - Change of surveillance, encouraging notification based on clinical criteria and reduced emphasis on laboratory confirmation and laboratory surveillance.
  - Providing information and advice to health professionals on the situation and on public health measures including infection control
  - Improving population immunity through:
    - Active recall of children eligible for MMR1 through primary care.
    - Increasing outreach immunisation for children who have missed MMR1 and are not able to be reached through existing primary care services.
    - Bringing the scheduled 15 month immunisations (MMR1 and Hib) forward to 12 months (discussion with Ministry of Health needed).
    - Additional MMR dose for infants aged 9-12 months (MMR0), delivered through primary care (discussion with Ministry of Health needed). MMR1 will need to be given at least 4 weeks after MMR0.
    - Bringing MMR2 forward, as far forward as 4 weeks after MMR1 (discussion with Ministry of Health needed).
    - MMR catch-up programmes in primary schools and ECECs.
    - MMR catch-up for adolescents and adults who have had only 1 dose of measles vaccine – encouraged through primary care (vaccine is free).
  - Communication with the public on the measles situation, and promoting immunisation

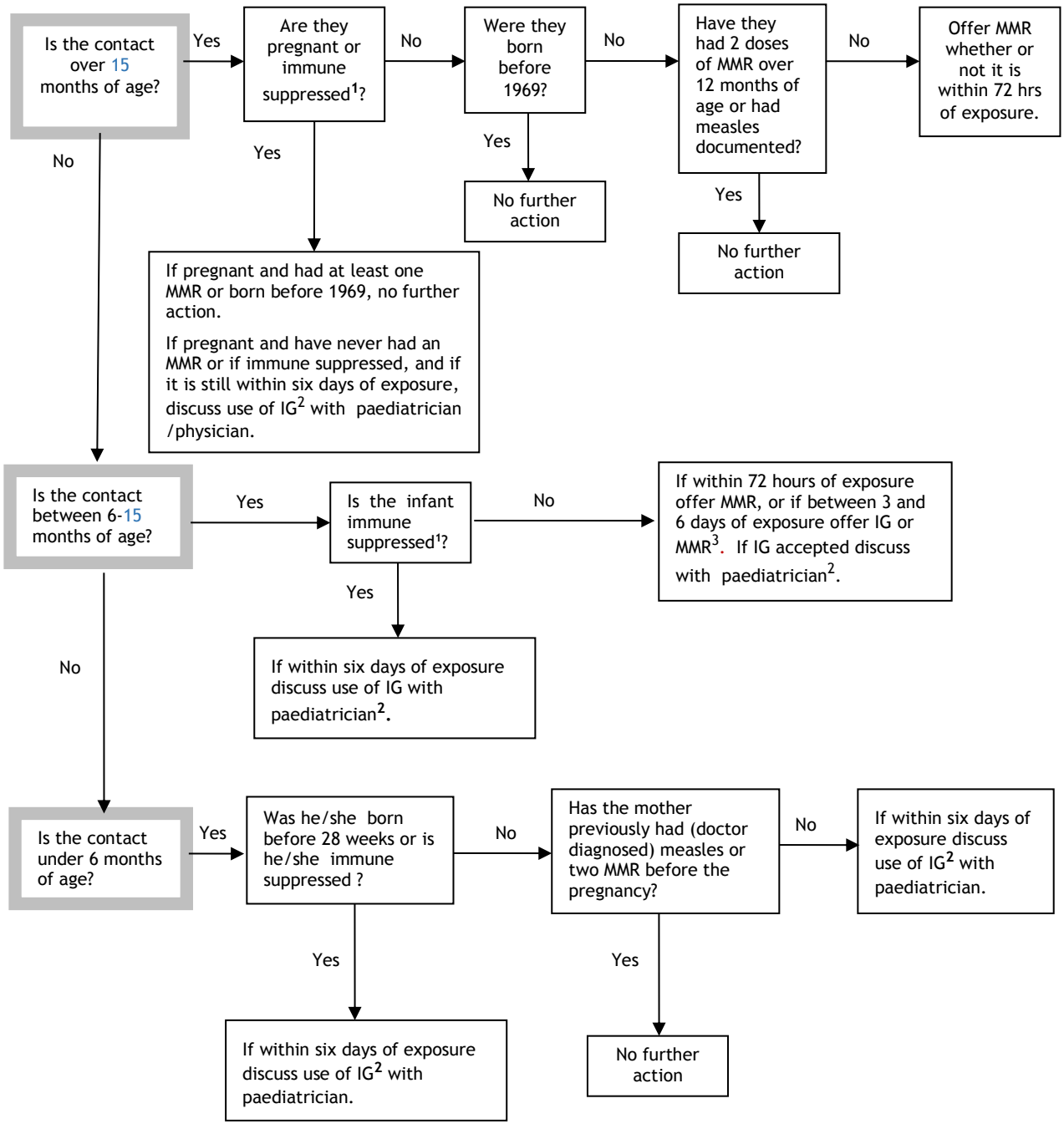
Infection control

- Ensure that the attending medical practitioner and laboratory collection rooms understand the importance of prompt isolation of a suspected case within their health care facility and the need to leave the consultation/examination room vacant for one hour after the suspected case has left.
- Visits of cases and contacts (who may be entering the infectious period) to laboratory collection rooms should be planned ahead by telephone.

Reporting

- Enter case details on EpiSurv
- File the laboratory results with the case notes.
- If a cluster, report as an outbreak in EpiSurv.
- If an outbreak, write report for Outbreak Report File [….Com Diseases\Com Disease Control\Outbreaks\...Reports].
- File.

Figure 2. **Public Health Guidelines For The Management Of Measles Contacts**



Notes:

MMR= measles, mumps and rubella vaccination. IG = immunoglobulin.

- IG is a blood derived product and parental consent is required for it to be given. Consent forms are available from the Ministry of Health and Transfusion Medicine (Blood Bank).
- IG should **not** be given sooner than 3 weeks after MMR.
- MMR should **not** be given sooner than 5 months after IG.

1. If a contact is immune suppressed, give immunoglobulin (IG) regardless of vaccination status
2. Subsequently requires follow up to review when it may be appropriate to give MMR for long term measles immunity.
3. To be fully vaccinated a person requires two MMR over 12 months of age, at least 1 month apart.

References and further information

1. Ministry of Health, Communicable Disease Control Manual 2012. URL: http://www.health.govt. nz/publication/communicable-disease-control-manual-2012
2. Ministry of Health, Immunisation handbook 2014, http://www.health.govt.nz/publication/immunisation-handbook-2014-3rd-edn
3. Bulletin of the World Health Organization 2004;82:852-857. The laboratory confirmation of suspected measles cases in settings of low measles transmission: conclusions from the experience in the Americas. http://www.who.int/bulletin/volumes/82/11/en/852.pdf accessed 11/09/2015
4. CDC. 2009. *Measles (Rubeola) 2009 Case Definition*: *CSTE Position Statement Number: 09-ID-48*. Atlanta: National Notifiable Diseases Surveillance System, Centers for Disease Control and Prevention, United States Department of Health and Human Services.

   www.cdc.gov/ncphi/od/ai/casedef/measles _current.htm
5. Health [Immunisation] Regulations 1995, New Zealand Legislation,

   http://www.legislation.govt.nz/regulation/public/1995/0304/latest/DLM207705.html?src=qs
6. Hoad V, O'Connor B, Langley A, et al. Risk of measles transmission on aeroplanes: Australian experience 2007-2011, MJA 2013; 198: 320-323

   https://www.mja.com.au/journal/2013/198/6/risk-measles-transmission-aeroplanes-australian-experience-2007-2011

– Communicable Diseases Prevention and Control Unit. 2008. Measles. In *The Blue Book: Guidelines for the control of infectious diseases* (pp 127–130). Victoria: Public Health Branch, Department of Human Services, State Government of Victoria.. https://www2.health.vic.gov.au/public-health/infectious-diseases/disease-information-advice/measles
– Dayan GH, Rota J, Bellini W, et al. 2008. Chapter 7: Measles. *VPD Surveillance Manual* (4th edition). 7-1–7-15.
– Department of Health and Ageing, Australia. 2009. *Measles National Guidelines for Public Health Units*. Version 1.0, 19 February.
– Health Protection Agency, UK. 2010. *National Measles Guidelines. Local & regional services*. Version 1.2, 28 October.
– Heymann D (ed). 2008. *Control of Communicable Diseases Manual* (19th edition). Washington: American Public Health Association.
– NSW Health. 2008. *Measles Control Guideline.* New South Wales: New South Wales Government. URL: www.health.nsw.gov.au/factsheets/guideline/measles.html
– Public Health Laboratory Network. 2006. *Pathology Laboratory Diagnosis of Measles*. Communicable Diseases Network Australia: Department of Health and Ageing, Australian Government. URL: www.health.gov.au/internet/main/publishing.nsf/Content/cda-phlnpubs-measles.htm
– Queensland Health. 2005. Measles. *Communicable Diseases Control Manual.* Queensland: Queensland Government. URL: www.health.qld.gov.au/ph/Documents/cdb/19682.pdf
– WHO. 2004. Measles vaccines. *Weekly Epidemiological Record* 79(14): 129–144. URL: www.who.int/wer
– WHO. 2004. *Field guidelines for measles elimination*. WHO Regional Office for the Western Pacific.