

Measles

CDNA National Guidelines for Public Health Units

Revision history			
Version	Date	Revised by	Changes
1.0	February 2009		Original
2.0	February 2015		
2.1	February 2019	HPNSW	Addition of how to access normal human immunoglobulin (NHlg) to Section 11 Contact management
2.1	16 April 2019	CDNA	Updated SoNG to align with the Immunisation Handbook (12 April 2019): <ul style="list-style-type: none"> • Recommended age at which infants can receive the MMR vaccine is 6 months • For post-exposure prophylaxis, infants from 6 months can be offered MMR vaccine in place of normal human immunoglobulin.

The Series of National Guidelines ('the Guidelines') have been developed by the Communicable Diseases Network Australia (CDNA) and noted by the Australian Health Protection Principal Committee (AHPPC). Their purpose is to provide nationally consistent guidance to public health units (PHUs) in responding to a notifiable disease event.

These guidelines capture the knowledge of experienced professionals, and provide guidance on best practice based upon the best available evidence at the time of completion.

Readers should not rely solely on the information contained within these guidelines. Guideline information is not intended to be a substitute for advice from other relevant sources including, but not limited to, the advice from a health professional. Clinical judgement and discretion may be required in the interpretation and application of these guidelines.

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Measles

CDNA National Guidelines for Public Health Units

1. Summary

Public health priority

Urgent

Case management

- Laboratory confirmation should be sought in all suspected cases. Appropriate specimens for genotyping should be collected from at least one case in each chain of measles transmission and all sporadic cases where possible.
- Cases, including suspected cases under investigation, should stay home (unless isolated in hospital) and should not attend school, early childhood education and care services or work from onset of symptoms to 4 days after onset of rash. Cases should avoid contact with susceptible persons, especially children <1 year old and immunocompromised persons.
- The source of each confirmed measles case should be determined as: imported, import-related or unknown.(1) A thorough epidemiological investigation should be conducted to limit the number of cases with unknown source.

Contact management

- Individuals who are not immunocompromised with 2 documented doses of MMR OR documented evidence of measles infection OR born prior to 1966 are considered immune.
- Individuals born during or after 1966 with <2 doses of MMR and who have no documented history of measles infection or serological markers of immunity are considered non-immune, i.e. susceptible.
- Recommend either immunisation or normal human immunoglobulin (NHIG) to defined contacts where indicated.
- Exclude susceptible contacts from school, early childhood education and care services, healthcare settings, and other settings with high risk contacts.
- Ask contacts to be alert for signs and symptoms of measles and advise those who develop symptoms to telephone ahead before seeking medical review so as to avoid infecting others.
- Ask hospital Emergency Departments (EDs), medical practitioners, school principals and early childhood education and care services directors to report new suspected cases promptly to the local public health unit.

2. The disease

Infectious agent

The measles virus, a member of the genus Morbillivirus (a paramyxovirus).

Reservoir

Humans

Mode of transmission

Measles is transmitted by airborne droplets and direct contact with discharges from respiratory mucous membranes of infected persons and less commonly by articles freshly soiled with nose and throat secretions.(2) It is one of the most highly communicable infectious diseases. Measles virus has a short survival time (less than 2 hours) in the air or on objects and surfaces and is inactivated rapidly in the presence of sunlight, heat and extremes of pH.(3)

Incubation period

The incubation period is variable, averaging about 10 days (range from 7 to 18 days, occasionally longer) to the onset of fever and about 14 days to the onset of the rash. This period can be longer if immunoglobulin is given early in the incubation period.(2)

Infectious period

Cases are considered to be infectious from 24 hours prior to onset of prodromal symptoms until 4 days after the onset of rash. Where the prodrome is undefined, the onset of the infectious period should be considered to be 4 days before the onset of the rash.

Clinical presentation and outcome

The disease is characterised by a prodrome that usually lasts 2 to 4 days and includes fever, followed by conjunctivitis, coryza and cough. Koplik spots may be present briefly on the buccal mucosa. A characteristic maculopapular (non-itchy) rash appears about 2 to 7 days after the onset of the prodrome, begins on the face or upper neck, spreads to become generalised, and typically lasts 4 to 7 days. Cases are usually very unwell and miserable; other symptoms can include anorexia, diarrhoea (especially in infants) and generalised lymphadenopathy.(3) People who have received one or two doses of measles vaccine may develop attenuated infection with mild symptoms.

Common complications of measles include middle ear infection and viral or bacterial bronchopneumonia. Acute encephalitis occurs rarely and subacute sclerosing panencephalitis is a very rare delayed complication, occurring in about 1 per 100,000 cases.(5)

Persons at increased risk of disease

Unvaccinated or under-vaccinated people (i.e. those who have not had two doses of measles containing vaccine) are at increased risk of measles.

Those at risk of more severe disease include(3):

- Immunocompromised people, especially those with T-cell deficiencies such as certain leukaemias, lymphomas and acquired immunodeficiency syndrome (AIDS), in whom measles can be severe, atypical (e.g. without rash) and prolonged, with virus shedding for several weeks after the acute illness
- Malnourished children, particularly those with vitamin A deficiency
- Children younger than 5 years and adults 20 years of age and older, in whom complications of measles are more common
- Pregnant women in whom infection is associated with increased risk of premature labour, spontaneous abortion and low birth weight infants. Birth defects have not conclusively been associated with measles virus infection.

Disease occurrence and public health significance

Endemic transmission of measles ceased in Australia by the late 1990s as a result of the introduction of a two-dose vaccination schedule and by improved vaccination coverage. In 2014 the WHO verified that Australia had achieved 'measles elimination' status, defined as the absence of endemic transmission in a defined geographical area for ≥ 12 months.(1) Although measles is no longer endemic here, Australia continues to have imported cases in overseas visitors and returning residents, with the potential for limited transmission and small to moderate-sized outbreaks. Geographic areas and population sub-groups with low vaccination coverage are more susceptible to prolonged outbreaks and every attempt should be made to provide all children with two doses of measles-containing vaccine. Other than unvaccinated children, adults born during or after 1966 are at most risk due to less frequent exposure to wild-type virus and lower vaccination coverage.(4)

3. Routine prevention activities

Vaccination

Maintaining high rates of immunity to measles throughout the population is the mainstay of measles elimination in Australia. Measles vaccine, as MMR and MMRV, is currently recommended for all children at ages 12 and 18 months of age, respectively, as part of the National Immunisation Program schedule.(5)

For persons born during or after 1966 who do not have documented immunity, two doses of measles-containing vaccine, given at least 4 weeks apart, are recommended. For those known to have received only one dose previously, a second dose is recommended.

Health facilities should ensure that healthcare workers and administrative staff are fully vaccinated or immune to measles, particularly those working with high risk persons such as children <1 year; pregnant and immunocompromised persons; and in high exposure risk areas such as emergency departments.

Immunisation recommendations for early childhood education and care service workers and overseas travellers should be promoted.

Outbreak control

Control of measles relies on early diagnosis and notification of cases, prompt isolation of infectious cases, and timely and effective identification of contacts, with provision of advice and post-exposure prophylaxis and/or quarantine, as appropriate. In defined groups of susceptible people, where exposure has occurred but it is too late or not feasible to identify individuals for whom post-exposure prophylaxis may prevent infection, widespread vaccination is sometimes indicated to minimise ongoing transmission within the group.

4. Surveillance objectives

- To rapidly identify cases and their contacts in order to prevent further spread
- To determine the source of each confirmed measles case
- To monitor the epidemiology of measles in Australia in order to inform public health strategies and assess interventions
- To maintain a surveillance system that is sufficiently sensitive to detect sporadic cases
- To confirm measles elimination is sustained in Australia and to contribute to regional measles elimination goals
- To assist in identifying at risk groups and areas of under-immunisation.

5. Data management

- Probable and confirmed cases (see case definitions) should be entered onto the notifiable diseases database within 1 working day following notification.
- Enter viral genotype (where determined) on notifiable diseases database within 3 working days of receipt of results.
- In order to verify elimination status, information on suspected cases subsequently shown not to have measles (discarded cases) should be retained for national monitoring purposes, in accordance with jurisdictional protocols and data systems.
- If overseas acquired, enter place of acquisition (where determined) on notifiable diseases database in accordance with jurisdictional protocols and data systems.
- Assign each case in a chain of transmission of two or more epidemiologically linked cases a unique outbreak reference identification number that links all cases in the cluster and enter

this on the notifiable diseases database in accordance with jurisdictional protocols and data systems.

6. Communications

As soon as is practicable and ideally within 1 working day following notification:

- For new cases, notify the State/Territory Communicable Diseases Branch (CDB) of the case's age, sex, date of onset, vaccination history, laboratory result status, occupation, travel history, likely source of infection, high risk settings where people were exposed and public health action taken.
- Notify each new case in an ongoing outbreak to the CDB, to provide regular updates on progress to identify when further escalation is warranted, and to confirm when any outbreak is deemed to be over.
- The State/Territory CDB should report summary details of cases and outbreaks to CDNA during regular teleconferences. For outbreaks or cases with the potential to involve multiple jurisdictions, the State/Territory CDB should notify the relevant jurisdictional members either directly or via the CDNA secretariat, as appropriate.
- Where there are cases or contacts who are overseas, the State/Territory CDB should notify the Commonwealth Department of Health's National Incident Room (via 'Health Ops'), to inform the relevant Health Departments as appropriate.

7. Case definition

The case definition (2004) is under review. The case definition is primarily intended to inform surveillance activities. This intention should be considered when it is used for operational matters.

Case definitions can be found on the Department of Health's website.

The current measles case definition is:

Reporting

Both **confirmed cases** and **probable cases** should be notified.

Confirmed case

A confirmed case requires either:

1. **laboratory definitive evidence**
- OR
2. **clinical evidence AND epidemiological evidence.**

Laboratory definitive evidence

At least one of the following:

1. Isolation of measles virus
- OR
2. Detection of measles virus by nucleic acid testing
- OR
3. Detection of measles virus antigen
- OR
4. IgG seroconversion or a significant increase in antibody level or a fourfold or greater rise in titre to measles virus EXCEPT if the case has received a measles-containing vaccine eight days to eight weeks before testing. (NOTE: paired sera must be tested in parallel).
- OR

5. Detection of measles virus-specific IgM antibody confirmed in an approved reference laboratory EXCEPT if the case has received a measles-containing vaccine eight days to eight weeks before testing.

Clinical evidence

An illness characterised by all of the following:

1. A generalised maculopapular rash lasting three or more days
AND
2. Fever (at least 38°C if measured) at the time of rash onset
AND
3. Cough OR coryza OR conjunctivitis OR Koplik spots.

Epidemiological evidence

An epidemiological link is established when there is:

1. Contact between two people involving a plausible mode of transmission at a time when:
 - a. one of them is likely to be infectious (approximately five days before to four days after rash onset)
AND
 - b. the other has an illness that starts within seven to 18 (usually 10) days after this contact
AND
2. At least one case in the chain of epidemiologically linked cases (which may involve many cases) is laboratory confirmed.

Probable case

A probable case requires **Laboratory suggestive evidence AND clinical evidence.**

Laboratory suggestive evidence

Detection of measles specific IgM antibody other than by an approved reference laboratory EXCEPT if the case has received a measles-containing vaccine eight days to eight weeks before testing.

Clinical evidence

As with confirmed case.

8. Laboratory testing

Definitive laboratory evidence should be sought for all suspected measles cases. The results should be interpreted in the context of the clinical and epidemiological findings, and vaccination history. Depending on the context, tests for other clinically plausible infectious causes of fever/rash illnesses (such as rubella, roseola, dengue fever and other arboviral infections, scarlet fever, human parvovirus (B19) infection, enterovirus, adenovirus, HIV, Kawasaki disease) should usually be undertaken at the same time as measles tests when investigating suspected cases. If measles is the working diagnosis, make arrangements wherever possible for diagnostic specimens to be collected from suspected cases isolated at home, rather than having them visit a clinic or specimen collection centre where there is a risk of transmission to others.

Testing guidelines

The Public Health Laboratory Network (PHLN) provides information on the laboratory diagnoses of measles. This is available at:

<http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-phln-cd-measles.htm>

The recommended laboratory tests for measles diagnosis and their timelines are outlined in Table 1

Table 1. Recommended laboratory tests for measles diagnosis based on symptom onset

Time from onset of rash	Recommended specimen collection	Recommended laboratory test
<1 week	Nasopharyngeal aspirate or throat swab, and first catch urine	NAT, culture
	5 ml tube of clotted blood	measles serology
1-3 weeks	Nasopharyngeal or throat aspirate or swab, and first catch urine	NAT
	5 ml tube of clotted blood	measles serology
>3 weeks	5 ml tube of clotted blood	measles serology

Laboratory confirmation is not necessary for cases which meet the clinical case definition and have a clear epidemiological link to a laboratory-confirmed case, but may still be sought.

Routine serology for asymptomatic contacts is not usually recommended. However, there are limited circumstances where it may be appropriate to test exposed contacts to determine if they are immune, such as healthcare workers for whom it is too late for post-exposure prophylaxis to be effective, and who need to be excluded from patient-care duties unless they have demonstrable immunity to measles, and pregnant women for whom normal human immunoglobulin (NHIG) may be recommended if susceptible.

Measles Nucleic Acid Testing

- Laboratory confirmation by nucleic acid testing (NAT) or virus isolation is preferred for all sporadic cases and at least one case in each chain of measles transmission.
- Respiratory specimens, first catch urine (collected up to 3 weeks after onset of the rash) or EDTA blood or sera collected early in the illness, should be referred to an approved reference laboratory for measles NAT on an urgent basis in sporadic suspected cases, and in at least one case in every chain of transmission.
- The PHU should facilitate communication with and between the clinicians and laboratories involved concerning collection of suitable specimens and referral and transport arrangements. Where appropriate, and in consultation with the patient's doctor, arrange for a home visiting pathology service to expedite specimen collection for suspected cases.
- Nasopharyngeal aspirates or nasopharyngeal swabs are the preferred samples for NAT. Throat swabs or nasal washes are also suitable. A dry sterile swab of the nasal passage combined with a similar swab from the back of the throat is the recommended specimen for detection of viral nucleic acid by NAT testing. Swabs should be flocked, cotton, rayon or dacron-tipped, plastic-coated or aluminium shafted swabs. They should preferably be placed into viral transport medium, and stored and transported at 4°C.
- First catch urine samples should be stored and transported at 4°C.
- EDTA blood for NAT should be stored and transported at room temperature.

Measles serology

- A 5 mL tube of clotted blood is the preferred specimen for serological testing.
- An IgM response will be present in approximately 75% of measles cases 3 days after rash onset, rising to approach 100% after 7 days. A measles IgG antibody test should be performed together with the IgM assay to aid interpretation.
- Measles-specific IgM is a sensitive and specific marker of recent measles infection, but can also be detected for 1 to 2 months following immunisation.
- There is poor negative predictive value of an IgM result early in the illness. A negative result does not rule out a diagnosis of measles if the sample was taken earlier than 72 hours after onset of the rash. When no measles IgM or IgG antibody is detected in a sample collected

from a suspected case of measles within 3 days of rash onset, repeat testing is recommended after 7 days.

- Where there is a suspected false negative or false positive IgM result, NAT testing is recommended. Repeating the IgM and/or testing for measles-specific IgG seroconversion by EIA on paired sera collected 10-14 days apart may also be helpful.
- Note that persons with waning or partial immunity—for instance, those who may have received only one dose of measles-containing vaccine in the past—may experience an attenuated measles infection with a milder clinical course than is normally seen, and serology may be misleading, with false negative IgM and positive IgG. It is important that public health management of such cases is based on the likelihood of infection, and that they have nasopharyngeal swabs, EDTA blood specimens and/or urine specimens submitted for NAT testing.

Measles culture

- Measles virus may be identified by cell culture from blood, throat swab, nasopharyngeal aspirate, or conjunctival swab, if taken within 5 days of the onset of the rash, and from urine for up to 10 days after the onset of rash.
- Nasopharyngeal aspirates or swabs are the preferred sample for antigen detection by culture. Throat swabs are also suitable for culture. The swabs should be placed immediately after collection into viral transport medium, and all these samples should be transported at 4°C.

Measles immunofluorescence

- Antigen testing by immunofluorescence may also be performed on respiratory or urine samples collected during the prodrome or in the first few days after rash onset, however sensitivity and specificity are poor compared to other diagnostic methods.
- Nasopharyngeal aspirates or swabs are the preferred sample for antigen detection by immunofluorescence.
- Throat swabs may not be sufficiently sensitive for immunofluorescence.

Measles genotyping

- It is important that NAT or immunofluorescence positive material or a viral isolate from all sporadic cases (including those that cannot be clearly linked to another case during an outbreak) and at least one case from any documented chain of transmission should be sent for measles virus genotyping. This assists in confirming the source of measles importation and confirms that endemic transmission has not been re-established in Australia.
- Where a state/territory does not have the facility for WHO-accredited measles virus genotyping, samples may be sent to Victorian Infectious Diseases Reference Laboratory (VIDRL).
- Genotyping data from VIDRL, FSS (Qld) and SA Path are loaded directly onto the Measles Nucleotide Surveillance (MeaNS) database for the WHO Measles Laboratory Network. MeaNS is web accessible and searchable. Genotyping data are used in the ongoing verification of measles elimination within Australia.

The effect of recent vaccination

- Vaccine-induced “measles” is a modified form of measles that may occur 5-12 days after measles vaccination. It is not transmissible and should NOT be classified as measles.
- In contacts who are given post-exposure MMR vaccination, a fever/rash illness could represent a real infection following from the initial exposure, or a post-vaccination infection. NAT/culture testing and virus genotyping should be carried out to resolve the cause of the apparent infection, as the genotype for the vaccine strain is distinct from wild virus strain. NAT detection may be possible for some time after the rash disappears.

- Where measles vaccination has been given in the 3 weeks prior to illness onset and wild-type virus was not detected, or unable to be detected, a case may be considered confirmed based on a considered review of clinical features and epidemiological and laboratory evidence.
- Serology is of no use in diagnosis of suspected measles in persons who received a measles-containing vaccine 8 days to 8 weeks before testing.

9. Case management

Response times

On the same day of notification of a suspected, probable or confirmed case, begin follow-up investigation using the Measles Investigation Form.

Response procedure

Case investigation

The response to a notification will normally be carried out in collaboration with the treating doctor. If possible, inform the treating doctor that you will be contacting the patient or their carer(s). However, where this cannot happen in a timely fashion, follow-up should proceed.

Regardless of who does the follow-up, PHU staff should ensure that action has been taken to:

- Interview the case or relevant caregiver, wherever possible. Suspected cases should usually be managed as though they are confirmed cases while awaiting laboratory results. Confirm the onset date and symptoms of the illness.
- Where the case is a resident of another jurisdiction in Australia, cross-border notification procedures should be followed, and coordination of public health follow-up, including interviewing the case, made between the involved jurisdictions.
- Review vaccination status of the case, including the dates of vaccination.
- Confirm results of relevant pathology tests, or that appropriate tests have been ordered and specimen referral and testing is proceeding as a matter of priority. Where results are required urgently to determine the public health response, arrange for the laboratory to phone the appropriate public health officer, and/or follow-up actively with the laboratory.
- Identify the likely exposure window and infectious period.
- Identify the likely source—for instance, check travel history (overseas or interstate) or contact with a confirmed case during the case's infectious period or recent contact with persons with fever/rash illness consistent with measles.
- Determine carefully a chronological history of potentially exposed contact persons to the extent possible, as well as places visited while the case was likely to have been infectious. This may include a wide range of locations, such as child-care centres, schools, work-places, public transport, shops, cinemas, medical clinics, hospital EDs and pathology collection centres.
- Review case management, including appropriate isolation and infection control if admitted to a hospital.

Exposure Investigation

PHUs should thoroughly investigate possible exposures while interviewing the case to determine whether infection was acquired overseas, or linked in some way to a known imported or locally acquired case.

Case treatment

Supportive only

Education

The case or relevant caregiver should be informed and given written advice about the nature of the infection including the mode of transmission and the infectious period, with dates specific to the patient. A fact sheet is useful for this purpose (see Appendix 3).

Isolation and restriction

- Exclude suspected, probable and confirmed cases from work, school, early childhood education and care services.
- Advise them to stay in isolation, and specifically advise against interaction with susceptible people, until 4 days after the onset of the rash. When a case is isolated at home, visitors should be discouraged while the case is infectious.
- Consider making a daily phone call to monitor compliance with isolation, and to encourage seeking medical attention, at home, if clinically indicated.
- Suspected cases seen in general practice or hospital emergency departments should be identified at the reception or triage desk, be fitted with a mask and immediately diverted away from waiting areas to a separate room (when in a hospital setting preferably with negative pressure ventilation) where they can be assessed by staff using airborne precautions.(6)
- Hospitalised measles cases should be kept in respiratory isolation (and preferably in a negative pressure room) until 4 days after the onset of the rash. If a negative pressure room is not available, the case should be in single room with the door closed. Only healthcare workers who have documented immunity should care for these patients. Airborne precautions should be maintained within the patient's room(6) and the patient should use a mask when being transported.
- Suspected cases should be managed as though they are probable or confirmed cases whilst awaiting laboratory results.

Active case-finding

The occurrence of a measles case may require the following response:

- Alert local doctors, emergency departments and laboratories in the area(s) where the measles case may have acquired or spread the infection, to the possibility of further cases. Encourage doctors, hospitals and laboratories to notify suspected and confirmed cases to the PHU promptly.
- Consider the need for a media alert to assist in case-finding. This decision will depend on factors such as the travel history of a single case and any evidence of spread, and should be decided in consultation with the State/Territory CDB.

10. Environmental evaluation

None routinely required

11. Contact management

Identification of contacts

The objective of contact tracing is to identify all potential contacts and then to target those at particular risk of disease for intervention. Identifying contacts of measles cases is required to determine who has been potentially exposed to an infectious case, to assess their susceptibility to infection and to provide advice and implement post-exposure prophylaxis, where appropriate.

Contact definition

Since measles is primarily transmitted by air-borne means, a contact is defined as anyone who has or may have shared the same air-space (enclosed area) for any length of time with an

infectious case. Contact tracing should aim to identify those most susceptible to measles or at greater risk from infection, including infants, immunocompromised people and pregnant women.

In general, contacts may be prioritised in the following order, recognising that it may not be feasible for the PHU to identify and arrange post-exposure prophylaxis for all susceptible contacts, given the constraints of time, resources and logistics:

- The household, and other settings where people share communal facilities (for example, in a hospital, boarding school or military barracks)
- Early childhood education and care services, school or other educational settings where people share a classroom with the case
- People who shared a waiting area at the same time as the case (for example, patients in a healthcare facility's waiting room and any people accompanying these patients) and people who used the waiting area or who were seen in the same consulting room for up to 30 minutes after the case left. The latter period is based on the recognition that normal room ventilation systems ensure that levels of airborne viruses and virus survival diminish rapidly.
- Work settings where work colleagues have shared the same work area or communal facilities at the same time as a case.

The following settings will generally not require individual contact tracing, and group level communication or a media release may be sufficient:

- Others who attend or work in the same educational institution as the case, and may have spent time in the vicinity of the case, but do not share a classroom (for example, use of common facilities such as a lecture theatre block at a high school or college)
- Passengers on an aeroplane (see Section 12, Special Situations)
- Others who may have been present in the general area where the case was known to be (for example, cinemas, shopping centres, airport transit lounges, trains and restaurants)

Contacts are considered susceptible to measles if they cannot provide evidence of immunity to measles. A person can be considered to have acceptable evidence of immunity to measles if they meet one of the following criteria, noting that more stringent levels of evidence should be obtained for contacts at higher risk of disease or severity:

- Persons born before 1966 (unless serological evidence is already available and indicates otherwise)
- Persons born during or since 1966 who have documented evidence (including GP confirmation, ACIR or personal record) of receiving 2 doses of a measles-containing vaccine, with both doses given at ≥ 12 months of age and at least 4 weeks apart (unless serological evidence indicates otherwise)
- Documented evidence of immunity (i.e. a detectable measles-specific IgG)
- Documented laboratory definitive evidence of prior measles.

Post-exposure prophylaxis

Refer to tables 2 and 3 for detailed guidelines for measles post-exposure prophylaxis.

Consideration should be given to providing susceptible contacts with either MMR vaccine or in some circumstances normal human globulin (NHIG), according to the following criteria and using Tables 2 and 3:

- Time elapsed since exposure to an infectious case - where there has been ongoing exposure (such as with household contacts) the time since exposure should be calculated from the first contact during the infectious period
- Age
- Previous MMR vaccination history

- For infants from birth to 5 months, their mother’s history of measles infection or MMR vaccination before current pregnancy
- Immune competence.

In general it is not feasible to perform timely serology in contacts to determine immunity, as resulting delays in providing post-exposure prophylaxis increase the likelihood of treatment failure. It is safe to give MMR (or NHIG, as indicated) to individuals who are already immune. For infants <6 months of age (and exposed pregnant women) it may be possible to check maternal IgG levels in stored serum from recent antenatal testing, or collect a further specimen if time allows.

In settings with large numbers of individuals with uncertain vaccination histories and immunity (e.g. in high schools, adult workplaces) it is reasonable to recommend prompt MMR vaccination, even if it is >72 hours after the exposure. In these circumstances, further cases of measles may occur (as someone may already be incubating the disease), but the liberal use of MMR should reduce the likelihood of ongoing transmission of the measles virus within these groups.

MMR is recommended as the first dose of measles-containing vaccine in children under 4 years of age, due to an increased risk of fever and related adverse events when MMRV is given as the first dose.(5)

MMRV can be used for the second dose of measles-containing vaccine in children aged between 12 months and under 4 years of age, and as the first or second dose in children aged between 4 years and under 14 years of age. MMR—and not MMRV—should be used in persons aged 14 years or above.(5)

Broad use of NHIG, such as in large numbers of healthy adults who have had casual contact (e.g. in a medical waiting room or normal workplace) between 72 hours and 6 days previously, and who are not able to provide evidence of documented past vaccination or immunity, is likely to be impractical and unnecessarily wasteful of NHIG and of staff resources.

NHIG should usually be reserved for contacts at higher risk of disease or severity of disease such as:

- Susceptible household contacts
- Immunocompromised individuals
- Pregnant women who cannot provide evidence of either immunisation or immunity
- Infants too young to be vaccinated and who are not likely to be protected by maternal antibodies (i.e. infants born to susceptible mothers; those aged 6–11 months if not timely for MMR).

NHIG may also be considered for use in school children exposed to a confirmed case, and may be used sparingly in exposed susceptible healthcare workers in situations where their exclusion from the workplace would affect service delivery significantly.

Note: People who receive NHIG for measles post-exposure prophylaxis will not be able to receive an MMR (or varicella)-containing vaccine for at least 5 months (dependent on dose)(5). This may affect immunisation scheduling of children participating in the National Immunisation Program.

People who receive NHIG should be advised that they may still develop measles infection, however, signs, symptoms and time course of illness may be atypical.

Immunocompromised contacts

The assessment of the severity of immunocompromise is often best determined by consulting with the treating clinician, with guidance from an appropriate senior PHU staff member or director.

MMR is a live vaccine and is contraindicated in 'severely immunocompromised' people as defined in the 10th edition of the *Australian Immunisation Handbook*. See 'Vaccination for Special Risk Groups' section 3.3.3 'Use of live viral or live bacterial vaccines in immunocompromised persons'. Section 3.3.3 also includes advice on immunocompromised contacts who are unable to maintain previously acquired antibody levels.

Most contacts who are immunocompromised should be able to maintain adequate antibody from prior measles vaccination or infection. However, because immunocompromised people may have severe disease if they are infected with measles virus, urgent IgG antibody testing should be performed where possible to correctly determine the person's immune status, especially if there is an uncertain history of past immunisation or measles infection. If IgG is detected, they should be regarded as immune. If IgG serology is negative, they should be offered NHIG if they are within 6 days (144 hours) of exposure to the case.

Education

- Advise susceptible contacts (or parents/guardians) of the risk of infection and counsel them to watch for signs or symptoms beginning 7 to 18 days after the first contact with an infectious case (or longer if the contact received NHIG). They should avoid contact with young children (under 12 months or unvaccinated), hospitals, pregnant women and immunocompromised people during this period.
- Advise that if symptoms consistent with measles develop, they should self-isolate and telephone the PHU; and that if they need medical attention they should arrange for a home visit or call ahead before visiting doctors' rooms, hospital EDs or pathology services so as to avoid mixing with other people in waiting rooms.
- A sample script and 'Measles: information for contacts' fact sheet can be found in Appendix 3. Information should be provided to individuals in their own language where available.

Isolation and restriction

- Susceptible contacts in early childhood education and care services and primary schools¹ should be excluded until 14² days after the onset of the rash in the last case occurring at the facility or 18 days after the last contact with an infectious case to whom they were exposed outside the facility. However they may return if vaccinated within 3 days (72 hours) of first exposure to an infectious case or if they receive NHIG within 6 days (144 hours) following exposure.
 - If a child or staff member receives MMR more than 72 hours after exposure and hence requires exclusion, if the outbreak is ongoing they may return to the facility if they remain well and more than 18 days have elapsed since their last contact with a case.
 - Immunocompromised children or staff should be excluded (regardless of their measles vaccination status) until 14 days after the onset of the rash in the last case occurring at the facility. Exclusion is advised for their own safety, even if they receive NHIG.
- Adults in normal work situations or tertiary education facilities who are susceptible contacts do not always need to be excluded from work, education or social settings, depending on an

¹ Consider exclusion from secondary schools in accordance with local practices.

² In a facility with numerous people the exposure opportunities for each individual may be difficult to identify. Using 14 days takes into account the infectious period (at least 4 days of the potential exposure period for a contact) before the rash—a readily identifiable event—is apparent in a case within the facility.

assessment of their likelihood of developing measles and the likely consequences of infecting others. However, in these instances, they should be advised to isolate themselves from the time of onset of any prodromal symptoms consistent with measles, and to advise the PHU and seek medical assessment, as described under the Education section above. Exceptions may be necessary, and should be considered on merit in relation to the degree of exposure and the implications should the contact develop measles. For instance, it would be reasonable to exclude an exposed susceptible contact from returning to work in a remote mining community or on an oil rig or a ship for 18 days after last contact with a case of measles.

- Consider making a daily phone call to monitor compliance with quarantine, and to encourage seeking medical attention, at home, if clinically indicated.

Table 2: Post-exposure guidelines – *within 3 days (72 hours)* of first exposure to infectious case

Age	MMR vaccination history		
	0 doses MMR or unknown	1 dose MMR	2 doses MMR
birth to 5 months	Normal Human Immunoglobulin 0.2 mL/kg only if mother has had <2 doses MMR and no history of past measles infection or negative maternal IgG (otherwise, no NHIG)	Not applicable	Not applicable
6 to 11 months	MMR now, then repeat dose at 12 months of age or 4 weeks later (whichever is later) and the usual dose at 18 months of age.	Not applicable	Not applicable
12 months to <18 months	MMR	MMR or MMRV (at least 4 weeks after initial dose of MMR)	Nil necessary
≥18 months and born after 1965	MMR if not pregnant. If pregnant: consult with obstetrician or GP; check IgG if time; offer NHIG (0.2 mL/kg to a maximum of 15 mL)	MMR or MMRV (see page 12, based on age) if not pregnant. If pregnant: consult with obstetrician or GP; check IgG if time; offer NHIG (0.2 mL/kg to a maximum of 15 mL)	Nil necessary
Immunocompromised* (any age)	Normal Human Immunoglobulin 0.5 mL/kg to max of 15 mL	Normal Human Immunoglobulin 0.5 mL/kg to max of 15 mL	Normal Human Immunoglobulin 0.5 mL/kg to max of 15 mL

*See discussion about immunocompromised contacts in section 11. Consult with treating clinician about interpretation of IgG results and use of NHIG.

Table 3: Post-exposure guidelines – from 3 days (73 hours) to within 6 days (144 hours) of first exposure to infectious case

Age	MMR vaccination history		
	0 doses MMR or unknown	1 dose MMR	2 doses MMR
birth to 5 months	Normal Human Immunoglobulin 0.2 mL/kg only if mother has had <2 doses MMR and no history of past measles infection or negative maternal IgG (otherwise, no NHIG)	Not applicable	Not applicable
6 to 11 months	Normal Human Immunoglobulin 0.2 mL/kg	Not applicable	Not applicable
12 months to <18 months	Normal Human Immunoglobulin 0.2 mL/kg	Nil necessary	Nil necessary
≥18 months and born after 1965	Normal Human Immunoglobulin 0.2 mL/kg to max of 15 mL Prioritise for immunocompromised people, pregnant women, healthcare workers and close personal (e.g. household) contacts. Wider use is not routinely recommended, but should be judged in relation to the relative risks and benefits.	Nil necessary – consider MMR or MMRV (depending on age) if not pregnant If pregnant, check IgG if time allows and offer NHIG if IgG is not detected (0.2 mL/kg to a maximum of 15 mL) and inform obstetrician or GP	Nil necessary
Immunocompromised* (any age)	Normal Human Immunoglobulin 0.5 mL/kg to max of 15 mL	Normal Human Immunoglobulin 0.5 mL/kg to max of 15 mL	Normal Human Immunoglobulin 0.5 mL/kg to max of 15 mL

*See discussion about immunocompromised contacts in section 11. Consult with treating clinician about interpretation of IgG results and use of NHIG.

Access to normal human immunoglobulin (NHIG) under the national blood arrangements

- NHIG may be supplied under the national blood arrangements for public health disease control activities, to treat susceptible contacts of an indicated infectious disease (hepatitis A, measles, poliomyelitis or rubella), where directed by the public health units in each state and territory.
- To order NHIG for public health disease post-exposure prophylaxis, follow the instructions at the [National Blood Authority NHIG Website](#), including completing and lodging a Normal human immunoglobulin (NHIG) order form.

- In addition, NSW Health has authorised the pre-positioning of NHIg in certain rural areas (including John Hunter, Bathurst, Orange, Dubbo, Port Macquarie, Coffs Harbour, Lismore, Tamworth, Armidale, Wagga Wagga, Goulburn, Bega, Griffith, and Broken Hill) to facilitate urgent access. The ARCBS is still charged with authorising access to that stock – this is because it may be more efficient to deliver short-expiry stock from elsewhere (generally the stock pre-positioned will be long-expiry stock).

12. Special situations

Cases among children or staff at schools or in early childhood education and care services

- In addition to routine case and contact management, for sporadic cases with an unknown source ask about possible cases occurring among attendees or employees within the 3 weeks prior to onset in the known case. Parents and staff should be provided with information about the disease and its prevention. Written information such as a fact sheet is recommended, but an information meeting for parents may also be useful (see Appendices for sample letters to parents).
- Consider holding an immunisation clinic at the facility. Vaccination of all susceptible contacts aged 6 months of age or over should be recommended, even if it may be too late for vaccine to be protective in relation to the exposure and the child/worker requires exclusion.
- Monitor for occurrence of further cases for 18 days after the last attendance by an infectious case. All suspected cases should be investigated and measures taken to minimise or eliminate secondary transmission from these cases.
- If no further cases have occurred by 18 days after the last attendance by an infectious case then it is generally reasonable to conclude that there has been no further transmission in the facility and the outbreak is over.

Cases among staff or patients in a healthcare facility

For suspected, probable or confirmed cases among staff or patients in a healthcare facility, practice management, infection control and/or occupational health staff from the facility should consult immediately with the local PHU to institute a management plan appropriate to that facility. PHUs should liaise with and assist general practices and similar facilities (e.g. private allied health clinics) in follow-up of patients exposed in waiting areas and consultation rooms in these settings.

Whilst the PHUs coordinate the overall contact management strategy, PHUs should liaise with staff health or infection control teams (where they exist). Hospitals should take primary responsibility for implementing prevention and control measures for their facility, including identification and follow-up of potentially exposed inpatients, staff and discharged patients. The latter includes inpatients, outpatients and those who attended the emergency department, and those who accompanied them, as appropriate. Depending on respective work-loads and resources, PHUs may be able to assist hospitals with follow-up of patients discharged to the community.

See Appendix 4 for procedures and principles to include in management plans for healthcare facilities.

Cases among travellers on aeroplanes

Previous guidelines on the follow-up of measles cases on aeroplanes recommended contact tracing of passengers seated within 2 rows of the case. However, experience shows that most secondary cases resulting from transmission during aeroplane travel are seated outside this

range of seats.(7–10) A recent review found that secondary infections occurred in 14% of flights that carried infectious measles cases notified in Australia over a 4.5 year period. Given delays in diagnosis and notification of the index case and the further time it can take to obtain passenger manifests and determine telephone/email contact information for people seated within a range of adjacent seating rows, it may not be feasible to locate potentially susceptible exposed passengers in sufficient time for post-exposure prophylaxis to be protective.(10) Such individual level contact tracing of airline passenger contacts is also resource intensive.

Based on current evidence, direct contact tracing of passengers based on seating proximity should not be undertaken routinely.(10) Rather, PHUs should consider less resource-intensive and possibly more timely strategies that reach more passengers, including, in collaboration with the airline:

- General media alerts
- Email or SMS messaging, if airlines can provide details or undertake messaging on behalf of the PHU, using a provided script.

Circumstances in which individual contact tracing for aeroplane flights might be justified include those where:

- Diagnosis and notification have been early
- Flight manifests are readily available and passenger contact information can be provided promptly
- There have been multiple infectious cases, especially children, on a flight.(10)

PHUs/CDBs should continue to promote and encourage pre-departure measles vaccination to travellers who do not have a documented history of measles vaccination and raise awareness among medical practitioners of the need to consider the diagnosis of measles in overseas visitors and returning travellers who have clinically compatible illnesses with fever and rash.

Local transmission of measles

Where transmission of measles is identified within Australia, use of epidemiological data will be important to inform awareness raising in the relevant area to alert local doctors, hospitals, laboratories and the general public. This may encompass use of local print and electronic media, and fax or email distribution lists for medical practitioners, hospitals and pathology laboratories. In addition, identification of population groups at greater risk will be important for targeting prevention and control strategies.

PHUs should liaise with GPs and hospital EDs to promote early identification, isolation and appropriate testing of suspected cases, and their notification to PHUs.

13. References

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14. Appendices

Appendix 1. Measles investigation form

Appendix 2. Measles fact sheet

Appendix 3. Measles information for contacts fact sheet

Appendix 4. Management plan for healthcare facilities

Appendix 5. PHU Checklist

15. Jurisdiction specific issues

Links to State and Territory Public Health Legislation, the Quarantine Act and the National Health Security Act 2007.

<http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-state-legislation-links.htm>

Appendix 1: Measles investigation form

..... **Public Health Unit** Outbreak ID:

Completed by: Date sent to CDB:/...../.....

Telephone: Fax:

NOTIFICATION:

Date PHU notified:/...../..... Date initial response:/...../.....

Notifier: Organisation:

Telephone: Fax: Email:

Treating Dr:

Telephone: Fax: Email:

CASE DETAILS:

UR No:

Name:
First name Surname

Date of birth:/...../..... Age: Years Months Sex: Male Female

Name of parent/carer:

Aboriginal Torres Strait Islander Aboriginal & Torres Strait Islander Non-Indigenous Unknown

English preferred language: Yes No – *specify* COB: _____ Ethnicity – *specify*

Permanent address:

..... Postcode:

Home tel: Mob: Email:

Occupation: Work telephone:

Temporary address (if different from permanent address) :

..... Postcode:

Telephone: Mob: Email:

General Practitioner: Dr

Address: Postcode:

Telephone: Fax: Email:

CLINICAL DETAILS:

Onset first symptoms/...../..... Unknown Date of rash onset/...../.....
Site of onset of rash Head Trunk Extremities Unknown
Number order of rash appearance: Head Trunk Extremities Other..... Unknown
Fever: Yes No Unknown At rash onset? Yes No Unknown
Measured temperature °C
Cough: Yes No Unknown Conjunctivitis: Yes No Unknown
Coryza: Yes No Unknown Koplik spots: Yes No Unknown
Hospitalised: Yes No Unknown Hospital: Date:/...../..... to

Complications: Yes – *specify* No Unknown
Outcome: Survived Died Date of death:/...../..... Died of condition Unknown

LABORATORY:

Laboratory: First collection date:
Measles NAT positive: Urine: Yes No Not done Result pending
Throat/nasopharyngeal swab: Yes No Not done Result pending
Measles IgM positive: Yes No Not done Result pending
Measles IgG seroconversion: Yes No Not done Result pending
Measles IF: Yes No Not done Result pending

MEASLES VACCINATION DETAILS:

Dose	Date	Type		
1/...../.....		
2/...../.....		

Vaccination status: Age-appropriate Incomplete Not vaccinated Unknown
Source of vaccination history: ACIR Health record Self-reported Not applicable

EXPOSURE PERIOD:

Date:/...../..... to Date:/...../.....
(Onset of symptoms – 18 days) (Onset of symptoms – 7 days)
Was there contact with another case of measles? Yes No Unknown
Name / NID: Telephone: Contact type:
Name / NID: Telephone: Contact type:

Did case attend any of the following during their exposure period?

Childcare – *specify* Telephone: Dates attended:

Preschool/school – *specify* Telephone: Dates attended:

- Educational/residential facility – *specify* Telephone: Dates attended:
- Hosp/healthcare facility – *specify* Telephone: Dates attended:
- Other risk setting(s) – *specify*
- Has the case travelled prior to onset? Yes – *specify*: No Unknown

Notes:

PLACE ACQUIRED:

- Hospital/healthcare facility
- Australian state/territory – *specify*
- Unknown Other country – *specify*

- Case advised about reducing spread to others? Yes No Unknown
- | | |
|--|--|
| Name of facility | Name of facility |
| Date presented/...../..... | Date presented/...../..... |
| Time presented (24:00) | Time presented (24:00) |
| Date departed/...../..... | Date departed/...../..... |
| Time departed (24:00) | Time departed (24:00) |
| Isolated on arrival: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown | Isolated on arrival: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown |
| Verification: <input type="checkbox"/> HCW <input type="checkbox"/> Patient <input type="checkbox"/> Other | Verification: <input type="checkbox"/> HCW <input type="checkbox"/> Patient <input type="checkbox"/> Other |

INFECTIOUS PERIOD:

Date:/...../..... to Date:/...../.....
 (1 day prior to onset of prodrome symptoms or 4 days prior to rash onset) (Onset of symptoms + 4 days)

Did case attend any of the following during their infectious period?

- Childcare – *specify* Telephone: Dates attended:
- Preschool/school – *specify* Telephone: Dates attended:
- Educational/residential facility – *specify* Telephone: Dates attended:
- Hospital/healthcare facility – *specify* Telephone: Dates attended:
- Other risk setting(s) – *specify*

Case excluded from childcare/school/other high risk setting: Yes No Unknown Dates:

Notes:

NOTIFICATION DECISION: Confirmed – Measles case Probable – Measles case

CONTACT MANAGEMENT:

Type of contact	Number of contacts	Intervention recommended		
		Vaccine	NHIG	No intervention
Household (including all people sleeping overnight in same room as case)	Children: Adults: .....	.....	.....	.....
Shared a classroom (e.g. child care, family day care, preschool or school)	Children: Adults: .....	.....	.....	.....
Waiting rooms (e.g. GP, ED, Pathology, X-ray room)	Children: Adults: .....	.....	.....	.....
Workplace	Children: Adults: .....	.....	.....	.....
Travel				
Other	Children: Adults: .....	.....	.....	.....

Appendix 2: Measles factsheet

What is measles?

Measles is an acute viral disease that may have serious complications. In the past, measles infection was very common in childhood. Now, due to immunisation, measles is rare in Australia.

What are the symptoms?

- The first symptoms of infection with measles are fever, tiredness, runny nose, cough and sore red eyes. These symptoms usually last for a few days before a red blotchy rash appears. The rash starts on the face and spreads over 1–2 days down to the body. Sometimes the rash peels. The rash will last for 4–7 days.
- Up to a third of people infected with measles will experience a complication. Complications are more common in young children and in adults. Complications include ear infections, diarrhoea and pneumonia, and may require hospitalisation. About one in every 1000 people with measles develops encephalitis (swelling of the brain). Rarely, measles can be fatal.

How is it spread?

- Measles is usually spread when a person breathes in the measles virus that has been coughed or sneezed into the air by an infectious person. Measles is one of the most easily spread of all human infections. Just being in the same room as someone with measles can result in infection.
- People with measles are infectious from a day before the symptoms begin until four days after the rash appears. The time from exposure to becoming sick is usually about 10 days. The rash usually appears around 14 days after exposure.

Who is at risk?

- Anyone who comes in contact with measles during the infectious phase and has not been infected with measles in the past or has not received two doses of vaccine is at risk of measles infection.
- If it is less than three days since you came into contact with measles, immunisation with MMR (measles, mumps and rubella vaccine) can prevent infection.
- If it is more than three days and less than seven days since coming into contact with measles, an injection called immunoglobulin can protect you. Immunoglobulin contains antibodies against the measles virus and is especially recommended for young children and people with underlying illnesses who have a greater risk of developing complications if they catch measles. Subsequent immunisation with MMR and chickenpox vaccines should not be given until for at least five months (six months if the person has major compromise of the immune system) after immunoglobulin as the immunoglobulin antibodies can prevent the vaccine from working.

How is it prevented?

- While a person is infectious with measles (i.e. up to 4 days after the onset of the rash) it is important that they remain at home to reduce the possibility of spread to other people.
- The best protection against measles is immunisation with an MMR-containing vaccine. This vaccine provides protection against infection with measles, as well as against mumps and rubella. If it is MMRV vaccine it also protects against varicella (chickenpox).
- MMR vaccine is currently recommended for children at age 12 months and a second dose at age 18 months (as MMRV). These two doses of MMR provide protection against measles to over 98% of those immunised.
- MMR vaccine is a safe and effective vaccine that has been used worldwide for many years. It is safe to have the vaccine even in those who have had previous measles or vaccination.

- While many older adults are immune to measles because they were infected as children, young adults may not have had either measles infection or received measles immunisation.
- Anyone born during or after 1966 who is susceptible to measles should have 2 doses of MMR immunisation. This especially applies to healthcare workers, childcare workers or people who plan to travel overseas.
- Unimmunised children who have come into contact with measles and who do not receive MMR or immunoglobulin within the specified time periods should not attend school until 14 days after the rash appeared in the person with measles.

How is it diagnosed?

- Measles can be difficult to diagnose early in the illness because there are many other viruses that cause similar illnesses with fever and a rash. The timing of the fever and the rash, and the characteristics of the rash can help a doctor to make the diagnosis. The rare presence of white spots inside the mouth, called Koplik spots, can also aid diagnosis.
- Whenever measles is suspected, a blood test or samples from the nose, throat or urine can be collected to confirm the diagnosis in the laboratory. Confirming the diagnosis is important so that other people who may be at risk of measles can be identified.

How is it treated?

- There is no specific treatment for measles. The treatment includes rest, plenty of fluids, and paracetamol for fever.
- While a person is infectious with measles it is important that he or she remains at home to reduce the possibility of spreading it to other people.

What is the public health response?

- Doctors, hospitals and laboratories must notify cases of measles to the local Public Health Unit. Public Health Unit staff will interview the doctor or patient (or carers) to find out how the infection occurred, identify other people at risk of infection, implement control measures (such as immunisation and restrictions on attending school or work) and provide other advice.

Further information

- Your local Public Health Unit can advise further regarding the need for immunisation, immunoglobulin and exclusions from work and school in the case of exposure to measles.
- For information on MMR see the Immunise Australia website:
<http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/home>

Appendix 3

Measles: information for contacts

Note to healthcare professionals:

- Information on this factsheet should be completed by a healthcare professional for each patient (exposure date, indicate if given MMR or NHIG, and practice stamp).
- A measles factsheet should also be given to the contact:

[insert web address]

1. Date of first and last contact with the infectious person:/...../..... /...../.....
2. Watch out for symptoms of measles until (last contact date + 18 days):/...../.....
3. You have been given the following treatment to prevent measles:

Measles, mumps, rubella (MMR) vaccine after measles exposure

MMR vaccine can make the body produce antibodies against measles and will protect against the disease developing if it is given within 3 days (72 hours) after exposure to the virus. As a precaution, you should not have contact with anyone who may be at risk of measles until 18 days after your exposure/...../..... . MMR vaccine is not suitable for everyone. Pregnant women and immunosuppressed people should not get MMR. Please see the footnote³ regarding infants and young children.

Normal Human Immunoglobulin (NHIG) injection after measles exposure

Normal human immunoglobulin (NHIG) is antibodies purified from blood donors. NHIG can provide short-term protection against infection if given within 6 days (144 hours) of exposure. As a precaution, you should not have contact with anyone who may be at risk of measles until/...../..... (date in 2. above). NHIG does not provide long-term protection from measles and you should arrange to receive MMR vaccination at least 5 months² after receiving NHIG.

³**For infants aged 6 - 11 months who have been given MMR for the first time after exposure to measles:** This does not replace normal immunisation with MMR. Your baby should receive the usual first MMR immunisation dose after 4 weeks or when he or she reaches 12 months (whichever is later). A second dose should be given at 18 months as MMRV.

For infants aged 12 months: this replaces the normal first MMR dose. A second dose as MMRV should be given at 18 months.

For children aged 1 year to 18 months who have been given MMR for the second time after exposure to measles: Provided this was as MMRV (including varicella) this replaces the second dose normally provided at 18 months, provided there has been a gap of at least 4 weeks between doses. If the second dose was MMR without varicella antigen, then an additional dose of MMRV will be required to provide protection against chickenpox.

² Length of time following NHIG administration before MMR or MMVR can be safely administered is dependent whether the person is immunocompromised, and should be determined on a per patient basis by the treating physician: see the National Immunisation Handbook 10th edition Immunise - 3.3 Groups with special vaccination requirements

<http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/handbook10-3-3#table3.3.6>

□ No treatment after measles exposure

If exposure to measles occurred more than 6 days ago, the above treatments are not effective. You should be on the lookout for symptoms. As a precaution, you should not have contact with anyone who may be at risk of measles until/...../..... (date in #2 above).

General information for contacts

What is a measles contact?

'Contacts' are people who shared the same air as someone while they were infectious with measles (for example, being in the same room as someone with measles). If the infection is transferred and takes hold in contacts, these people go on to develop measles symptoms in 7 to 18 days after sharing the same air.

Many contacts will be immune to measles because of past measles infection or immunisation and will not get the disease. Other contacts who are susceptible may catch the virus and may then go on to spread the virus to others. It is sometimes possible to stop the infection in susceptible people – either by giving Measles, Mumps Rubella (MMR)-containing vaccine or by giving an injection of normal human immunoglobulin (NHIG).

Who is at risk of measles infection?

People are at risk of measles if they have been a contact of someone with measles and if they are susceptible to measles. People who are regarded as susceptible to measles include:

- People born during or since 1966 who have not had two doses of MMR-containing vaccine⁴
- Babies under the age of 12 months who have not received their first dose of MMR vaccine
- Children over 18 months who have not received their second dose of MMR (or MMRV) vaccine
- Any people who have a weakened immune system (for example, people who are receiving chemotherapy or radiotherapy for cancer or people who take high-dose steroid medications) even if they have been fully immunised or have had past measles infection.

What should contacts do?

- Make sure they are up-to-date with measles vaccination.
- Read the measles fact sheet and look out for the symptoms of measles until the date on the front of this sheet (calculated as date of contact plus 18 days). The first symptoms of measles are general lethargy and fatigue, fever, runny nose, sore runny eyes and cough. The rash starts later.
- As a precaution, it is a good idea not to have contact with anyone who may be at risk until 18 days after your exposure.

If you (or your child) develops symptoms of measles

- Do not attend public places (such as work, school, early childhood education and care services or shopping centres) or use public transport.
- See a doctor, preferably your general practitioner, as soon as possible so a diagnosis can be confirmed. Take this fact sheet along.
- Call the surgery ahead to alert them of your symptoms and to allow them to make arrangements to assess you safely and without infecting other people. Ask to be given a mask and to be isolated so you don't spread the infection.
- Call the local public health unit.

⁴ People born before 1966 are likely to have had measles infection and are usually immune.

Further information

For more information please contact your doctor, local public health unit or community health centre

Appendix 4

Management plan for healthcare facilities

When cases occur among staff or patients in healthcare facilities, the following procedures and principles should be included in management plans:

- Define and identify contacts potentially exposed in waiting areas, emergency department assessment areas, wards, radiology and other areas.
 - Contacts could include patients; visitors and those accompanying patients; and staff, including medical, nursing, allied health, paramedical (ambulance), clerical, and other support workers such as orderlies and cleaners.
 - Potential exposure includes those who shared a defined air-space (e.g. waiting area, assessment room, ward) at the same time as the case and people who entered or used that space for up to 30 minutes after the case left.
- Inform contacts and organise post-exposure prophylaxis where appropriate.
- Where large numbers of discharged patients and accompanying persons may have been exposed, such as in an emergency department waiting area, it may be necessary to attempt to prioritise the persons most likely to be susceptible and vulnerable to measles infection (e.g. on the basis of age and diagnosis/medical history) for attempts to make contact and provide information. In addition, it may be appropriate to issue a media alert in such circumstances, providing a general warning of the possibility of exposure for persons who were at the facility on a certain day.
- Consider using SMS, or social media alerts as an option for sending timely written advice.
- Keep infectious patients in respiratory isolation for 4 days after the appearance of the rash, and ensure that susceptible individuals do not enter any room for 30 minutes after an infectious case has used it. Susceptible people entering this room within the 30 minute period should be considered as contacts. Ensure that only staff who are immune provide direct care to infectious patients, and that cases are nursed with airborne precautions.(6) Vaccinate susceptible contacts (i.e. those who do not have documentation of having received 2 doses of a measles-containing vaccine) among patients and staff.
 - Susceptible patients who are not vaccinated within 72 hours or do not receive NHIG within 144 hours (6 days) of first exposure, should be isolated while they remain in hospital until 18 days after the last exposure to the infectious case.
 - Susceptible staff who are not vaccinated within 72 hours or receive NHIG within 144 hours (6 days) of first exposure should be excluded from the facility or redeployed to duties not requiring direct patient care (for 18 days after the last exposure to the infectious case)
- Carrying out active surveillance for measles, where practical, among exposed inpatients, inpatients discharged before the diagnosis of the first case, staff, students, volunteers and visitors.
- Investigating staff members presenting with prodromal symptoms and ensuring that any infected person stays away from work until 4 days have elapsed after the onset of the rash (or until a measles diagnosis is excluded).
- Reviewing staff health records to ensure that all have documented immunity in line with current recommendations.

Appendix 5

PHU Measles Checklist

Patient ID number: _____

Contact the patient's doctor to:

- Obtain patient's history
- Confirm results of relevant pathology tests
- Recommend that the tests be done if need be
- Determine if others were exposed in the clinic

Contact the patient (or care giver) to:

- Identify likely source of infection
- Review vaccination status, including dates of measles vaccinations
- Confirm onset date and symptoms of the illness
- Recommend exclusions and restrictions
- Identify contacts and obtain contact details
- Complete *Measles Investigation Form*
- Provide with *Measles Factsheet*

Contact laboratory to:

- Obtain any outstanding results
- Refer lab specimens for genotyping

Confirm case

- Assess information against case definition

Contact patient's contacts to:

- Assess risk of measles (susceptibility, exposure history)
- Determine current symptoms
- Recommend intervention (vaccine, NHIG, or no intervention)
- Explain symptoms and restrictions (waiting rooms, early childhood education and care services, school)
- Provide with *Measles Factsheet* and *Information for Contacts* factsheet

Other issues:

- Report details of case and action plan to state/territory CDB
- Assess and arrange best method for delivering intervention to contacts
- Initiate active case finding
- Where defined groups of people have been exposed (e.g. schools, childcare, workplaces), contact the person in charge to explain the situation and make arrangements to provide letters to exposed people
- Consider alerting local doctors and EDs
- Consider local media release
- Enter case data onto notifiable diseases database