Measles (Rubeola)

Manitoba
Public Health Branch

Summary of Updates

May 2024

- **Addition of Appendix 2:**
  - Exclusion guidance for susceptible contacts in a K-12 school or child care facility.

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1. Case Definition

1.1 Laboratory Confirmed Case:

Consistent clinical illness* with laboratory confirmation, in the absence of recent immunization (one to 14 days prior) with measles-containing vaccine. Laboratory confirmation includes at least one of:

- Isolation of measles virus from an appropriate clinical specimen
  OR
- Detection of measles virus RNA
  OR
- Seroconversion or a significant rise in measles IgG titre between acute and convalescent sera by any standard serologic assay
  OR
- Positive serologic test for measles specific IgM antibody using a recommended assay[#](1).

1.2 Non-laboratory Confirmed Case:

In the absence of laboratory confirmation, clinical illness* in a person who has had contact (refer to page 7 for definition of contact) with a laboratory confirmed case (1, 2).

1.3 Probable Case:

Clinical illness* in the absence of appropriate laboratory tests and in the absence of known contact with a laboratory-confirmed case, in a person who:

- Has travelled during the 21 days prior to onset of rash to a geographic area where measles is endemic or an outbreak of measles is occurring
  OR
- Belongs to a defined risk group during an outbreak (e.g., immunocompromised) (1, 2).

*Clinical illness is characterized by all of the following:

- Fever 38.3° C or greater;
- Cough, coryza (runny nose) or conjunctivitis; and
- Non-blanching maculopapular rash for at least three days.

Atypical cases in immunocompromised or partially immune persons may lack hallmark symptoms.

[#]IgM serology may be a false positive. If the clinical presentation is inconsistent with a diagnosis of measles or in the absence of recent travel/exposure history, IgM results must be confirmed by another listed confirmatory method. Most acute measles cases develop IgM three days or more after rash onset. Therefore, a suspected measles case where serum collected ≤ 3 days post rash onset initially tests IgM negative should have a second serum collected > 3 days post rash onset for retesting for IgM. A specimen collected for IgM serology more than 28 days after rash onset may also yield a false negative result (2).

2. Reporting and Other Requirements

Laboratory:

- All positive laboratory results for measles virus are reportable to the Public Health Surveillance Unit by secure fax (204-948-3044). A phone report must be made to a Medical Officer of Health at 204-788-8666 on the **same day** the result is obtained, **in addition to** the standard surveillance reporting by fax.

Health Professional:

- Probable (clinical) cases of measles are reportable to the Public Health Surveillance Unit by telephone (204-788-6736) during regular hours (8:30 a.m. to 4:30 p.m.) AND by secure fax (204-948-3044) on the **same day** that they are identified. The *Clinical Notification of Reportable Diseases and Conditions* form https://www.gov.mb.ca/health/publichealth/cdc/protocol/mhsu_0013.pdf should be used. After hours telephone

reporting is to the Medical Officer of Health on call at (204-788-8666).
- Adverse events following immunization should be reported by health professional by completing and returning the form available at: http://www.gov.mb.ca/health/publichealth/cdc/docs/aefi_form.pdf.
- **Outbreak Reporting:** Outbreaks of measles should be reported through the Canadian Network for Public Health Intelligence (CNPHI) Outbreak Summaries application. Non-registered users of CNPHI Outbreak Summaries should report measles outbreaks by completing the *Vaccine Preventable and Respiratory Infections Outbreak Summary Report* form https://www.gov.mb.ca/health/publichealth/cdc/protocol/mhsu_6287.pdf and emailing it to outbreak@gov.mb.ca or faxing to (204) 948-3044.

Regional Public Health or First Nations Inuit Health Branch (FNIHB):

- Once the case has been referred to Regional Public Health or FNIHB, the *Communicable Disease Control Investigation Form* https://www.gov.mb.ca/health/publichealth/cdc/protocol/mhsu_0002.pdf should be completed and returned to the Public Health Surveillance Unit by secure fax (204-948-3044).

3. Clinical Presentation/Natural History

On average the prodromal phase begins 8 – 12 days after exposure in a susceptible person (3) and may resemble a severe respiratory infection (4). This phase is characterized by malaise, fever, anorexia, conjunctivitis and respiratory symptoms such as cough and coryza (4). Other symptoms may include diarrhea, especially in infants, and generalized lymphadenopathy (5). Older children may complain of photophobia and occasionally of arthralgia (6). Prior to the onset of rash, bluish-white Koplik's spots, which are pathognomonic for measles, may be seen in the oral mucosa (7). The maculopapular rash of measles is usually identified approximately 14 days after exposure (3). It begins on the face, then progresses down the body to the extremities, may include the palms and soles (4, 5), and lasts approximately 5 days (4). Patients tend to be most ill on the first or second day of the rash (4). The rash fades in the same sequence as it appears, from head to extremities (5). The characteristic rash may not develop in immunocompromised patients. Uncomplicated illness from late prodrome to resolution of the fever and rash, lasts seven to 10 days (4).

Uncomplicated recovery from measles is the norm in resource-rich areas; but serious complications of the respiratory tract (pneumonia) and central nervous system (CNS) (acute encephalitis) may occur (4). Complications of measles disease occur in about 10% of cases (8). Other potential serious complications include myocarditis, pericarditis and hepatitis. Complications are more common in children younger than five years of age and adults 20 years of age and older (5). Measles may directly cause croup, bronchiolitis and pneumonia (4). Secondary viral (9) or bacterial superinfection may also occur, resulting in complications such as pneumonia and otitis media (4). Measles associated with Vitamin A deficiency is a common cause of blindness in developing countries (10). Measles occurring during

pregnancy has been associated with spontaneous abortion, premature delivery (4, 5) and low birth weight infants (5). Measles in an immunocompromised person may be severe (8).

A rare late complication of measles infection is subacute sclerosing panencephalitis (SSPE), a progressive and degenerative central nervous system disease characterized by behavioural and intellectual deterioration and seizures that occurs seven to 11 years after wild-type measles virus infection (3).

Modified forms of measles with generally mild symptoms may occur in infants who still have partial protection from maternal antibody and, occasionally, in persons with only partial protection from the vaccine or in those who received immune globulin as post-exposure prophylaxis (6).

Atypical measles may occur in persons who received inactivated (”killed”) measles vaccine (KMV) and are subsequently exposed to wild-type measles virus (5). This is prevented by revaccinating with live measles vaccine (5).

4. Etiology

Measles virus is an RNA virus with only one antigenic type, classified as a member of the genus *Morbillivirus* of the family Paromyxoviridae (3, 5). There are different genotypes of the virus (3). The primary site of infection is the respiratory epithelium of the nasopharynx (5).

5. Epidemiology

5.1 Reservoir and Source

Humans (8). There is no known animal reservoir, and an asymptomatic carrier state has not been documented (5).

5.2 Transmission

The measles virus is spread by the airborne route, respiratory droplets (sneezing or coughing), or direct contact with nasal or throat secretions of infected persons (8). Airborne transmission via aerosolized droplet nuclei has been documented in closed areas (e.g., office examination room) for up to two hours after a person with measles occupied the area (5). The virus is spread less commonly by articles freshly soiled with nose and throat secretions (11).

5.3 Occurrence

General: Measles occurs worldwide (8). Most of the burden of the disease globally is still among children < 5 years of age (12). In tropical zones, most cases of measles occur during the dry season, whereas in temperate zones, incidence peaks during late winter and early spring (7). During 2000 -2015, the global annual reported measles incidence declined by 75% from 146 to 35 cases per million population (7). In 2017, 173,330 cases were reported to the World Health Organization (13). In certain settings (low income countries or refugee camps) low population immunity, high birth rates and high population density, lead to increased transmission in younger age groups including infants and pre-school children (7). As vaccination coverage increases, the average age of measles infection can shift to adolescents and young adults (7). Refer to https://www.who.int/immunization/monitoring_surveillance/burden/vpd/surveillance_type/act

ive/measles_monthlydata/en/ for up to date information.

In 2019, large outbreaks of measles have been ongoing in developed countries that had previously eliminated or interrupted endemic transmission (14). There was a dramatic resurgence of measles in the European Region (12, 15) prompting the development of a Strategic Response Plan http://www.euro.who.int/__data/assets/pdf_file/0020/414182/WHO-Measles-Emergency-v8a_hires_pages.pdf?ua=1 . The vast number of measles outbreaks in the European Region are driven by a high rate of unvaccinated children, adolescents and adults (12). Other developed countries such as New Zealand and the United States of America have also reported a resurgence of measles cases (14, 16).

Canada: As the last endemic* case of measles was reported in 1997, measles elimination status was achieved in Canada in 1998 (17). However, imported[+] measles cases from countries where measles is still endemic, continues to occur in Canada (17). In 2016, the incidence of measles in Canada was 0.3 cases per 1,000,000 population, with 11 reported cases (17). Nine of the 11 cases were unvaccinated and the other two had unknown vaccination status (17). Seven of the reported cases were in children less than one year of age (17).

In 2017, the incidence of measles in Canada was 1.2 cases per 1,000,000 population, with 45 reported cases (18). Three outbreaks accounted for 38 of the cases and the remaining seven cases were sporadic without further spread (18). Seventeen cases had up to date vaccination status and three cases were presumed to have acquired natural immunity as they were born before 1970 (18). Nine cases were imported into Canada and three of them resulted in the three separate outbreaks (18).

*In Canada, endemic measles refers to when a chain of transmission continues uninterrupted for a period greater than 12 months (2).

[+]Definition of imported measles case: A confirmed case, which as supported by epidemiological and virological evidence was exposed to the measles virus outside of Canada during the seven to 21 days before onset of generalized rash (2).

Manitoba: Nine measles cases were reported in 2014, eight of which were part of an outbreak. Two cases were reported in 2015, no cases were reported in 2016 and 2017 and two cases were reported in 2018. As of September 10, 2019 one confirmed cases of measles was reported for 2019.

5.4 Incubation

The incubation period from exposure to rash averages 14 days, with a range of 7 to 21 days (11).

5.5 Host Susceptibility and Resistance

Persons who have not had measles disease or who have not been vaccinated with two doses of measles-containing vaccine are susceptible to infection (8). Acquired immunity after illness is lifelong (11). In Canada, adults born before 1970 are generally considered to have acquired natural immunity to measles (8). Infants born to mothers who have had measles are protected against disease for the first six to nine months or more after birth, depending on maternal measles antibody levels (11). Children born to mothers with vaccine-induced immunity receive less passive antibody and may become susceptible to measles at an earlier

age than children born to mothers with naturally acquired immunity (11).

5.6 Risk Factors

Persons at greatest risk of exposure to measles include travelers to destinations experiencing measles outbreaks, health care workers, military personnel and students in post-secondary educational settings (8).

5.7 Period of Communicability

Measles is one of the most highly communicable diseases in humans (11). Cases are contagious from four days before rash onset until four days after rash onset (3, 11). Patients with SSPE are not contagious (3). Person-to-person transmission of measles vaccine strains has not been documented (7).

6. Laboratory Diagnosis

Molecular detection of the virus is preferred to confirm the diagnosis of measles as cases of measles may occur in previously immunized individuals, for whom serology may provide contradictory results (2).

All lab specimens should include date of onset of both fever and rash.

Virus Detection:

Cadham Provincial Laboratory (CPL) virology section (204-945-6123) should be consulted PRIOR to sending specimens for virus detection. All specimens should be transported with a cold pack (to maintain a temperature of approximately 4°C) to CPL as soon as possible. When investigating a sporadic case, a nasopharyngeal swab is preferred for virus isolation (refer to https://www.gov.mb.ca/health/publichealth/cpl/docs/nasopharyngeal_collection.pdf).

Alternatively, a throat swab can be used for virus isolation. Nasopharyngeal and throat swabs should be collected within four days of rash onset. Since the virus is cell associated, the technique should be vigorous enough to capture some epithelial cells. Swabs should be placed in a tube containing 2-3 ml of viral transport medium (VTM). A 50 ml urine specimen should also be collected within seven days of rash onset. A urine specimen is particularly helpful in later stage diagnosis of measles. Further strain characterization may be indicated for epidemiological and public health control activities.

Serology:

Serological testing is preferred during established outbreaks. Generally, IgM is used for diagnostic testing and IgG for immune status testing. A blood specimen for the detection of measles specific IgM antibodies should ideally be taken within three to seven days after rash onset, but may be taken up to 28 days after rash onset. Both false positive and false negative measles IgM results can occur. If the clinical presentation is inconsistent with a diagnosis of measles or in the absence of recent travel/exposure history, a positive IgM result must be confirmed by one of the confirmatory methods listed in section 1, “Case Definition”. If a specimen taken ≤ 3 days after rash onset is negative for measles IgM, a second specimen should be obtained three days later. Consideration should also be given to investigation for other exanthem viruses, including parvovirus and rubella. For IgG serology, the first (acute) sample should be collected no later than 7 days from rash onset and a second (convalescent) sample 10 to 30 days after the first (2).

7. Key Investigations for Public Health Response

Case investigation should not be delayed pending the receipt of laboratory results. All cases of probable measles should be investigated as soon as possible.

- Confirm lab tests ordered for the diagnosis of measles.
- Obtain immunization history including date(s) and type of vaccine if known.
- Request recent exposure/travel history of cases (i.e., 7-21 days before rash onset).
- Identify and follow-up susceptible contacts.

8. Control

8.1 Management of Cases

Measles is an uncommon infection in Manitoba that may present with signs and symptoms suggesting a wide differential diagnosis and has a possibility for severe adverse outcomes if not managed appropriately. Consultation with an expert in infectious diseases is recommended for the management of all cases of probable or confirmed disease.

Treatment:

- There is no specific treatment but severe complications can be avoided through supportive care that ensures good nutrition and adequate fluid intake (2).

Exclusion:

- Confirmed cases of measles should be excluded from child care facilities, schools, post-secondary educational institutions, work places, health care and other group settings; and they should stay away from non-household contacts for four days after the appearance of the rash (2).
- Cases who are health care workers should be advised to notify Occupational Health and/or Infection Prevention and Control for the facility/regional program in which they work and in consultation with them determine when it is appropriate to return to work.

Infection Prevention and Control:

Cases should practice good hand hygiene, avoid sharing drinking glasses or utensils and cover coughs and sneezes with a tissue or forearm (2).

Airborne Precautions in addition to Routine Practices should be followed when individuals with probable measles present to a health care setting[+]. Refer to the Manitoba Health, Seniors and Active Living document *Routine Practices and Additional Precautions: Preventing the Transmission of Infection in Health Care* available at: http://www.gov.mb.ca/health/publichealth/cdc/docs/ipc/rpap.pdf .

[+]For this document, health care settings include any facility or location where health care is provided and includes emergency care, pre-hospital care, acute care, long-term care, chronic/complex care, home care, ambulatory care and other facilities or locations in the community where care is provided (e.g., infirmaries in schools and residential facilities, etc. (2).

8.2 Management of Contacts

Regional Public Health (of case area of residence) or First Nations Inuit Health (FNIH) (if applicable) will contact all reported cases to establish a list of exposed persons and

identify susceptible contacts that require post-exposure prophylaxis (refer to Table 1 below) with MMR (measles-mumps-rubella) vaccine or Ig (human immune globulin). Examples of exposure situations where contacts should be identified include:

- Persons residing in the same household/residence.
- In a daycare or educational facility: all employees, volunteers, students, bus drivers, members of a sports team or club.
- In a workplace: Individuals who share the same schedule and/or office location as the case.
- In a health care facility: Individuals who shared the same room, waiting room or exam room without appropriate protection, including both patients and health care workers (2). Refer to the Manitoba Health, Seniors and Active Living document *Routine Practices and Additional Precautions: Preventing the Transmission of Infection in Health Care* available at: http://www.gov.mb.ca/health/publichealth/cdc/docs/ipc/rpap.pdf.
- Refer to Appendix I for the management of airline passengers exposed to a confirmed measles case on the same flight.
- When a case of measles is identified on another conveyance such as a bus or train, it should be managed on a case-by-case basis using a risk-based approach to contact tracing.

Despite the use of MMR vaccine or Ig for post-exposure management, measles infection may occur (8). Contacts should be counselled regarding the signs and symptoms of measles and the need to report to their health care provider and avoid contact with others should symptoms occur. Symptomatic contacts should be instructed to call before presenting to a health care provider to reduce the potential impact on susceptible individuals. Contacts should be encouraged to practice good hand hygiene, avoid sharing drinking glasses or utensils and cover coughs and sneezes with a tissue or forearm.

Contacts who are health care workers should be advised to notify Occupational Health and/or Infection Prevention and Control for the facility/regional program in which they work and in consultation with them determine when it is appropriate to return to work.

Definitions:

Contact: A contact is defined as any individual who has:

- Spent any length of time in a room or enclosed space with a confirmed measles case during that case's infectious period (i.e., approximately 4 days before rash onset until 4 days after rash onset); or
- Spent time in a room previously occupied by a measles case, during that case's infectious period, within 2 hours after that individual left the room/space (2).

Higher Risk Susceptible Contact:
Higher risk susceptible contacts refer to those individuals who are at greater risk of measles complications if infected and for whom measles-containing vaccine is either contraindicated (2) or of unknown effectiveness. A higher risk susceptible contact is someone who does not meet the criteria for immunity (refer to *Criteria for Immunity* below), and meets one or more of the following criteria:

- Pregnant
- Infant < 6 months of age

- Immunocompromised
- Immunocompetent infants 6-11 months old who present between 72 hours and 6 days after exposure (8).

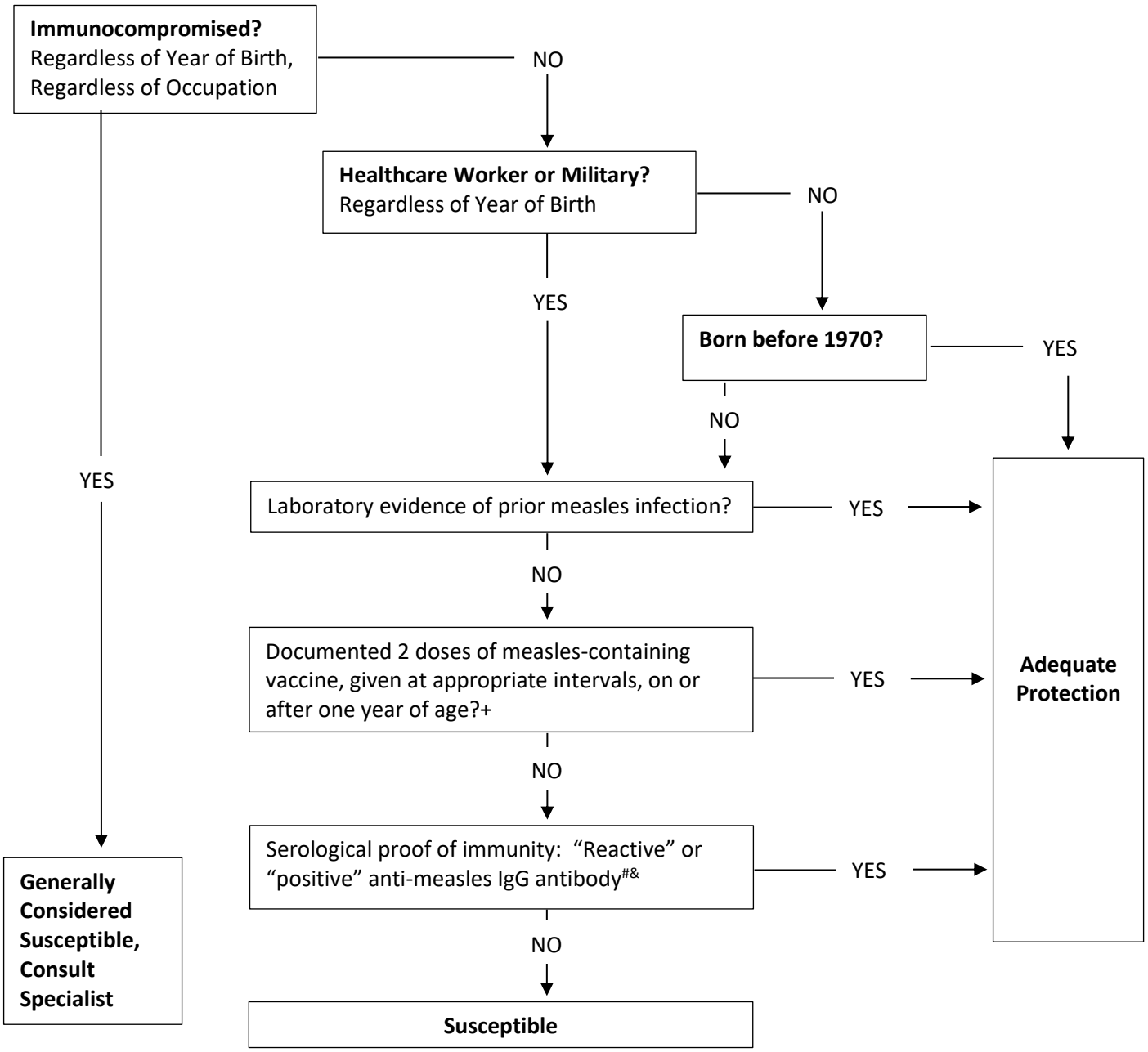
Susceptible Contact: A contact (defined above) who does not meet any of the following criteria for immunity:

Criteria for Immunity for the Purpose of Post-exposure Prophylaxis:

- **For the General Population (including students in post-secondary educational settings):**
  - Born before 1970;
  - Those born during or after 1970 who have 2 documented doses of MMR vaccine;
  - History of laboratory confirmed infection;
  - Laboratory evidence of immunity (8).
- **For Health Care Workers or Military Personnel:**
  - Two documented doses of MMR vaccine regardless of year of birth;
  - History of laboratory confirmed infection;
  - Laboratory evidence of immunity.

Refer to https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-3-vaccination-specific-populations/page-11-immunization-workers.html#p3c10a2 for additional information on vaccination of health care workers and military personnel. Refer to https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-3-vaccination-specific-populations/page-9-immunization-travellers.html#a2 for additional information on vaccination of travellers.

Measles Contact Susceptibility for Individuals ≥ 6 Months of Age* Based on *Alberta Public Health Disease Management Guidelines* (reference # 19)



*Individuals who recently received IMIg or IVIg may be protected. Consultation with a specialist is recommended.

+Children one year of age up to and including 3 years of age who have received one dose of vaccine are considered susceptible and should be managed accordingly.

#All individuals born in or after 1970, who are anti-measles IgG antibody positive following one dose of MMR vaccine, should receive a second dose to ensure protection against mumps.

&Serological proof of immunity should be considered for individuals one year of age or older. Serology may also be considered for previously immunized infants 6 – 11 months of age.

8.21 Post-exposure Prophylaxis (PEP) of Susceptible Contacts

An infectious diseases physician may need to be consulted for the contact management of higher risk contacts that are challenging to categorize for the purposes of measles PEP (e.g., immunocompromised).

Refer to Table 1 below for measles PEP recommendations. If disease does develop following measles post-exposure prophylaxis (PEP), symptoms are usually not severe and the duration of the illness is shortened (7).

Table 1: Summary of Measles PEP Recommendations for Susceptible Contacts (Based on the current *Canadian Immunization Guide* recommendations https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-12-measles-vaccine.html)

Populations	Time Since Exposure to Measles[a]	
	< 72 Hours After Exposure	**72 Hours – 6 days After Exposure**
All Infants < 6 months old[b]	IMIg (0.5 mL/kg)[c]	IMIg (0.5 mL/kg)[c]
Susceptible immunocompetent infants 6 – 12 months old	MMR vaccine[b]	IMIg (0.5 mL/kg)[bc]
Susceptible immunocompetent individuals 12 months and older	MMR vaccine series	Not applicable[bd]
Susceptible pregnant individuals[e]	IVIg (400 mg/kg) or IMIG (0.5 mL/kg), limited protection if 30 kg or more[f]	IVIg (400 mg/kg) or IMIg (0.5 mL/kg), limited protection if 30 kg or more[f]
Immunocompromised individuals 6 months and older	IVIg (400 mg/kg) or IMIg (0.5 mL/kg), limited protection if 30 kg or more[fg]	IVIg (400 mg/kg) or IMIg (0.5 mL/kg), limited protection if 30 kg or more[fg]
Individuals with confirmed measles immunity (i.e., does not meet susceptible contact definition)	No PEP required	No PEP required

[a]Ig should only be provided within 6 days of measles exposure; unless it is contraindicated. Individuals who receive Ig should receive measles-containing vaccine after a specified interval, once the measles antibodies administered passively have been degraded. For more information, refer to Blood Products, Human Immune Globulin and Timing of Immunization https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-1-key-immunization-information/page-11-blood-products-human-immune-globulin-timing-immunization.html .

[b]Two additional doses of MMR vaccine provided after 12 months of age are required for long-term protection.

[c]If injection volume is a major concern, IVIg can be provided at a dose of 400 mg/kg.

[d]Susceptible immunocompetent individuals 12 months of age and older are not a priority to receive Ig following measles exposure due to the low risk of disease complications and the practical challenges of administering contact management.

[e]Provide MMR vaccine series postpartum for future protection.

[f]For individuals 30 kg or more, IMIg will not provide complete protection but may prevent some symptoms.

[g]In HIV-infected individuals, measles antibody titre is known to decline more rapidly over time as compared to those who are not HIV-infected. A dose of Ig should be considered in HIV-infected individuals with severe immunosuppression after a known exposure to confirmed measles, even with documented previous MMR immunization. Regardless of vaccination status pre-transplant, Ig should be considered for hematopoietic stem cell transplantation (HSCT) recipients, unless vaccinated post-HSCT and known to have an adequate measles antibody titre.

8.22 Acquisition and Administration of MMR Vaccine and IMIg

During Regular Business Hours:

Sites authorized to stock formulations of MMR vaccines and IMIg include hospitals and some health centres outside Winnipeg. Specific formulations may or may not be stocked at these sites. If MMR vaccine and IMIg are not available at a particular site, an order can be placed using the Vaccine and Biologics Order Form available at: http://www.gov.mb.ca/health/publichealth/cdc/protocol/vaccinebiologics.pdf or through the Public Health Immunization Management System (PHIMS). Contact the Provincial Distribution Warehouse at 204-948-1333 or Toll-free 1-855-683-3306 and advise the customer service representative that the order is urgent. MMR vaccine and IMIg can be released to a hospital, Public Health Unit or physician. IMIg and MMR vaccine can also be released to a health professional who is registered or licensed to provide health care under an Act of the Legislature and who is authorized under that Act to administer vaccines. Assistance in determining the need for Ig and MMR vaccine can be obtained from the local Medical Officer of Health (MOH). Contact information is available at: http://www.gov.mb.ca/health/publichealth/contactlist.html .

After Hours:

For sites providing health care after regular warehouse hours, the on-call warehouse staff may be contacted at 204-805-4096. After regular hours, the Medical Officer of Health on call (204-788-8666) or Infectious Diseases on call (204-787-2071) may order IMIg and MMR vaccine.

Immunization providers should consult the respective product monograph prior to administering MMR vaccine and IMIg for information such as storage and handling requirements, administration schedule, injection site, dose specific to age and weight etc. to ensure appropriate use.

8.23 Acquisition and Administration of IVIg

IVIg must be administered by infusion in a setting with appropriate expertise. IVIg is supplied by Canadian Blood Services and can only be released to a health care provider after consultation with an Infectious Diseases specialist (204-787-2071). Refer to the Best Blood Manitoba website https://bestbloodmanitoba.ca/for-clinicians/ for immune globulin request forms and guidelines.

8.24 Exclusion of Susceptible Contacts

Susceptible contacts that refuse or cannot receive MMR vaccine or immune globulin may be excluded from childcare facilities, schools and post-secondary educational institutions at the discretion of the Medical Officer of Health; and may be required to self-isolate from work places or other group settings, including travel. If exclusions occur, the period of exclusion should extend from 5 days after the first exposure and up to 21 days after the last exposure, or until the individual is:

- Documented to be adequately immunized as per recommendations in the current *Canadian Immunization Guide*, or
- Demonstrates serological confirmation of immunity or
- Has received immune globulin (Ig) (2).

8.3 Management of Outbreaks

Outbreak Definition: As measles is eliminated in Canada, a single case would be unusual or unexpected. The following is a working definition of a measles outbreak:

- Two or more confirmed cases linked, either epidemiologically or virologically or both (2).

Refer to Sections 8.1 and 8.2 for case and contact management. Management of outbreaks may require mass immunization campaigns for selected age ranges. This will be determined by Public Health and/or Regional Health Authority, in consultation with an Outbreak Response Team.

Public notification should occur: the level of notification will be at the discretion of regional Public Health.

Conclusion of an Outbreak: The conclusion of an outbreak should be at least 32 days following the rash onset date of the last outbreak-associated case, in order to account for delays in case reporting, subclinical and/or undiagnosed cases (2), or as directed by the regional Medical Officer of Health.

8.4 Preventive Measures

- Prompt identification and management of cases and contacts.
- Immunization according to recommendations in the most current *Canadian Immunization Guide.* Refer to the Manitoba Health Seniors and Active Living website https://www.gov.mb.ca/health/publichealth/cdc/div/index.html for information on eligibility criteria for publicly-funded measles immunization.

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Appendix I: Measles on a Flight - Contact Tracing Algorithm

Adapted from *Risk assessment guidelines for diseases transmitted on aircraft. PART 2: Operational guidelines for assisting in the evaluation of risk for transmission by disease*. European Centre for Disease Prevention and Control, 2010.

Background:

Most measles cases in Canada are imported by people travelling to Canada from areas where measles is endemic. Travellers importing measles into Canada may travel during the infectious period (4 days before to 4 days after the onset of rash). Measles is highly communicable – there is risk of transmission to those who are susceptible to measles. However, due to immunization coverage and past infections, the majority of Canadian air travellers are not susceptible.

Contact tracing for measles is very time-sensitive due to the short timelines for offering post-exposure prophylaxis (PEP) - within 72 hours of exposure for MMR vaccine and within 6 days for immune globulin (Ig). The recommendations for PEP are summarized in Table 1 in Section 8.2. The Public Health Agency of Canada can assist provincial and territorial jurisdictions in requesting flight manifest and personal name record (PNR) information to help identify passengers exposed to measles. However, flight manifest and PNR information is often incomplete and may not include contact details. It can also take time to request and receive the information. In many circumstances, jurisdictions may opt to post a CNPHI Public Health Alert and/or a media release to notify passengers and public health partners of the measles exposure.

Contact tracing algorithm tool:

This contact tracing algorithm supports the decision making process for measles contact follow-up after exposure on a flight. This algorithm is intended to help jurisdictions assess the situation when they are informed of an individual with laboratory-confirmed measles who travelled by air during the infectious period. The tool helps determine whether PEP can be offered to susceptible travellers and what type of PEP susceptible travellers would be eligible for. This will help decide whether it is appropriate to request flight manifest and PNR information, which can take time but has potential to identify travellers at risk of exposure. Timeliness is considered in the algorithm, which assumes that 24 hours is needed to receive the information, identify at-risk contacts, and arrange for them to receive PEP. Other considerations for determining whether to request manifest information are listed in Box 1.

Considerations for the range of seats to request manifest information for:

The Guidelines for the Prevention and Control of Measles Outbreak in Canada currently recommend conducting contact tracing for passengers seated two rows ahead and two rows behind the infectious individual based on aircraft airflow models. However, analyses of reports of transmission on airplanes suggest that although transmission risk is higher for individuals sitting within two rows of the case, further analyses show that these recommendations may be inadequate as transmission beyond the two rows can occur. Recent reviews also suggest that there is no evidence that measles transmission risk on a flight is related to the duration of the flight. When contact tracing for measles, consider following up on the whole plane giving priority to children less than 2 years of age given their greater infection risk.

Measles on a Flight - Contact tracing algorithm (June 2019)

Notification of a lab confirmed* case of measles who travelled on an airplane while infectious (infectious time frame: between **four days before and four days after onset of rash**).

The flight arrival time was 48 hours ago or less	The flight arrival time was between 48 hours ago and 5 days ago	The flight arrival time was 6 days ago or more (up to 1 month)
Post-exposure prophylaxis (i.e. vaccination) is indicated for some contacts within 72 hours of exposure. For information, see Table 1 on the back of this document.	Post-exposure prophylaxis (i.e. Ig) is indicated for some contacts within 6 days of exposure. For information, see Table 1 on the back of this document.	No post-exposure prophylaxis is indicated at this time.
Public Health Actions: **For all cases of measles exposure on flights, consider taking public health actions which may include:** • Post a CNPHI Public Health Alert. • Post media release (and update website) asking susceptible contacts to self-identify for post-exposure prophylaxis. • Province or Territory request flight manifest and personal name record (PNR) information to identify contacts (see Box 1). Jurisdictions will directly reach out to passengers residing in their jurisdiction to identify susceptible contacts for post-exposure prophylaxis.	**Public Health Actions:** **For all cases of measles exposure on flights, consider taking public health actions which may include:** • Post a CNPHI Public Health Alert. • Post media release (and update website) asking susceptible contacts to self-identify for post-exposure prophylaxis. • Province or Territory request flight manifest and personal name record (PNR) information to identify contacts (see Box 1). Jurisdictions will directly reach out to passengers residing in their jurisdiction to identify susceptible contacts for post-exposure prophylaxis.	**Public Health Actions:** **For all cases of measles exposure on flights, consider taking public health actions which may include:** • Post a CNPHI Public Health Alert. • Post media release (and update jurisdiction website) to alert passengers of the potential exposure.

* If there is a highly suspicious case based on clinical presentation and a known epidemiological link awaiting lab confirmation, consider requesting the flight manifest and PNR information be put on hold until confirmatory lab results are received.

Box 1:
Considerations for requesting flight manifest information:

- Flight manifests and PNRs often lack relevant contact information (e.g., phone numbers).
- A flight manifest and PNR is most reliably available within 48 hours of the flight, after which time some airlines start to remove personal information.
- The turnaround time required to secure and receive the manifest and PNR can be lengthy.
- Follow-up with individual contacts can be time and resource intensive.

Based on their risk assessment, the provincial or territorial jurisdiction can ask the Public Health Agency of Canada to request the flight manifest and PNR information.

A provincial or territorial jurisdiction may ask the Public Health Agency of Canada to request that the airline put the manifest and PNR on hold while they are awaiting laboratory confirmation of a case or completing their risk assessment to decide if they will use the information to conduct contact tracing.

The Public Health Agency of Canada will **only** request a flight manifest and PNR if requested by a provincial or territorial jurisdiction.

To request assistance obtaining a manifest and PNR, a province or territory can reach out to the Public Health Agency of Canada:

- During regular business hours (8am to 4pm Eastern on Monday to Friday except federal holidays), please email phac.vpd-mev.aspc@canada.ca
- Outside of regular business hours, please email phac-aspc.hpoc-cops@canada.ca, or call 1-613-952-7940
- Quarantine services: Central Notification System, please email phac.cns-snc.aspc@canada.ca or call 1-833-615-2384

2

Adapted from *Risk assessment guidelines for diseases transmitted on aircraft. PART 2: Operational guidelines for assisting in the evaluation of risk for transmission by disease*. European Centre for Disease Prevention and Control, 2010.

Appendix 2: Measles Contact Exclusion Guidance for K-12 Schools and Child Care Facilities

This appendix is a supplemental guidance tool for public health to be used in conjunction with the *Manitoba Health Measles Protocol* when completing assessments for susceptible contacts in a school or child care facility.

***Definition of contacts**: contacts who attend or work in a school or child care facility; potentially anyone in the facility, including children, students, staff, volunteers, bus drivers, members of a sports team or club, etc.*

Immunity Criteria	▪ Born before 1970 regardless of immunization status (*except HCW's or Military who require 2 doses regardless of age)* ▪ Those born during or after 1970 who have 2 documented doses of measles containing vaccine (fully immunized), ▪ History of laboratory confirmed infection, ▪ Laboratory evidence of immunity	
Immunization/ Immunity status	**Post-exposure prophylaxis (PEP)* or immunization received after exposure**	**Exclusion Recommendations**
Meets one or more of the immunity criteria as above	None required	No exclusion required.
Partially immunized ** and does not meet immunity criteria (susceptible)	MMR or Ig received within recommended PEP* timeframes. *Note: 2nd dose should be given a minimum of 28 days from previous dose.*	No exclusion required: Those at high risk of complications may prefer to self-exclude or be excluded as per MOH discretion. *
	MMR received > 72 hrs from first exposure	No exclusion required: Advise to avoid contact with those that are a higher risk for disease or severe outcomes (e.g., infants, pregnant individuals and immunocompromised) for 21 days after last exposure to any case. Those at high risk of complications may prefer to self-exclude or be excluded as per MOH discretion*
	MMR or Ig not received or declined	
Unimmunized and does not meet immunity criteria (susceptible)	MMR or Ig received within recommended PEP* timeframes	No exclusion required: Advise to avoid contact with those that are a higher risk for disease or severe outcomes (e.g., infants, pregnant individuals and immunocompromised) for 21 days after last exposure to any case. Those at high risk of complications may prefer to self-exclude or be excluded as per MOH discretion. *
	MMR received > 72 hrs from first exposure	**Exclusion may be required:** General school/child care contacts who do not have known close exposure to the case can attend after immunized with the 1st dose of MMR vaccine. Advise to self-isolate/avoid contact with others, other than attending school, for 21 days from last exposure to any case. Contacts with known close exposures to case (e.g. classroom exposures, close contacts) who receive a dose of MMR > 72 hrs from first exposure to case may be excluded at the discretion of the MOH. *** Advise to self-isolate/avoid contact with others for 21 days from last exposure to any case.
	MMR or Ig not received or declined	**Exclude from school or child care and all public places:**

		Advise to self-isolate/avoid contact with others for 21 days from last exposure to any case. If tested for immunity, exclude until lab evidence of immunity to measles.

* Post-exposure Prophylaxis (PEP) of Susceptible Contacts – **see section 8.21 Table 1 of the measles protocol.** https://www.gov.mb.ca/health/publichealth/cdc/protocol/measles.pdf PEP can reduce the risk of infection in susceptible individuals exposed to measles or reduce clinical severity if measles infection occurs. PEP must be administered within specified timeframes to be considered as PEP. PEP is not 100% effective and those who receive it should continue to monitor for symptoms of measles. Susceptible contacts who received Ig < 6 days from first exposure to the case, may not require exclusion but remain at risk of exposure to secondary cases that may occur in the setting. Due to their underlying health conditions/risk factors, these individuals may prefer to self-exclude or be excluded as per MOH discretion.

**Adults and children that are considered "up to date" with one dose based on eligibility or routine schedule (i.e., a child under 4 who had the one dose at 12 months of age, or an adult born between 1970 and 1984) are still considered susceptible if exposed and should have a 2nd dose of MMR as soon as possible. These exposed individuals would typically be offered the 2nd dose immediately post exposure but not be excluded, as the likelihood of immunity after 1st dose is high (≥90%).

***Unimmunized susceptible contacts with known close exposures to case (e.g. classroom exposures, close contacts) who receive MMR vaccine > 72 hours from first exposure to the case may be excluded from 5 days after the first exposure and up to 21 days from last exposure to any case based on MOH discretion. Factors to consider include but are not limited to:

- details of the exposure
- the number of susceptible contacts in that setting;
- the presence of individuals at higher risk of severe disease,
- ability of the incubating individual to comply with early recognition and self-isolation.
- outbreak management if secondary cases occur (more intensive response to contain).

Staff born between 1970 and 1988 or who were not continuous residents of Manitoba may not have an immunization record. The majority of these individuals will be immune from previous immunization or measles infection. School or child care staff, or volunteers who believe they were immunized as children would be offered a dose of vaccine and would generally not be excluded from attending the school once the dose is administered. MOH discretion to exclude can be used in situations where there is a high risk of exposure. If known to be unimmunized, follow guidelines for unimmunized susceptible contacts. Alternatively, they could request laboratory proof of immunity from their health care provider, although not routinely recommended.

Notes:

- If vaccine records unknown/unavailable, recommend administration of MMR vaccine. If MMRV is provided, it can still be considered a valid dose for PEP, however MMR is the preferred vaccine due to limited data for PEP.
- Serology could be requested from a health care provider and accepted as proof of immunity but is not routinely recommended.
- Staff who work in a school or child care facility as a health care worker (e.g. nurse) require 2 doses of a measles containing vaccine regardless of age.
- Advise all contacts to monitor for signs and symptoms of measles disease and to self-report to public health, regardless of immunity status or administration of PEP. In addition, for contacts that received MMR >72 hrs after first exposure, advise that the dose most likely will not protect them from this exposure, but will help protect from future exposures.
- For unimmunized individuals in a school/child care setting who receive a dose of vaccine >72 hrs post-exposure and have not had known close contact with the case, the risk of further school exposures must be balanced by harms related to school exclusion. Not all susceptible contacts may have been directly exposed to the index case, and vaccination will help protect them in the event of a future exposure to a secondary case, as they will have received the vaccine pre-exposure.
- If exclusions are required, the period of exclusion should extend from 5 days after the first exposure and up to 21 days after the last exposure to any case.