

Ontario Public Health Standards:
Requirements for Programs, Services and Accountability

Infectious Disease Protocol

Appendix 1:

Case Definitions and Disease-Specific Information

Disease: Measles

Effective: May 2022

Measles

- Communicable
- Virulent

[Health Protection and Promotion Act \(HPPA\):](#)

[Ontario Regulation \(O. Reg.\) 135/18 \(Designation of Diseases\)](#)

Provincial Reporting Requirements

- Confirmed case
- Probable case

There are enhanced surveillance activities undertaken for measles to support the continued monitoring and documenting of the elimination status of Canada and the Americas. Any case of measles identified by the board of health should be reported via telephone to Public Health Ontario (PHO) within one business day of receipt of initial notification.

As part of elimination documentation, it is essential to document travel history and other exposure history to assess source of infection, as well as immunization status, on every measles case.

As per Requirement #3 of the "Reporting of Infectious Diseases" section of the *Infectious Diseases Protocol, 2018* (or as current), the minimum data elements to be reported for each case are specified in the following:

- [O. Reg. 569](#) (Reports) under the HPPA;⁵
- The iPHIS User Guides published by PHO;
- For certain vaccines, information to be entered into the applicable provincial inventory system (i.e. Panorama or COVaxON); and
- Bulletins and directives issued by PHO.

Type of Surveillance

Case-by-case

Case Definition

Confirmed Case

Laboratory confirmation of infection with clinically compatible signs and symptoms (see Clinical Evidence section) in the absence of recent immunization with measles-containing vaccine[†]:

- Isolation of measles virus from an appropriate clinical specimen (e.g., nasopharyngeal swab/aspirate/wash and urine);

OR

- Detection of measles virus ribonucleic acid (RNA) from an appropriate clinical specimen;

OR

- Seroconversion or a significant (i.e., fourfold or greater) rise in measles Immunoglobulin G (IgG) titre by any standard serologic assay between acute and convalescent sera;

OR

- Positive serologic test for measles Immunoglobulin M (IgM) antibody using a recommended assay in a person who is either epidemiologically linked to a laboratory-confirmed case OR has recently travelled[†] to an area of known measles activity;

[†] Individuals with suspect measles who have been immunized with measles-containing vaccine in the last 5-42 days require specimen collection for viral detection (e.g. nucleic acid amplification testing) and subsequent genotyping. If wild-type measles virus is detected, the case would be classified as confirmed. Those with evidence of vaccine-derived measles virus on genotyping should be classified as adverse events following immunization (AEFI).

[†] Recent travel is defined as travel within 21 days of rash onset

OR

Clinically compatible signs and symptoms in a person with a known epidemiologic link to a laboratory-confirmed case of measles.

Probable Case

Clinical evidence of infection (see Clinical Evidence section) in the absence of immunization with measles-containing vaccine in the last 5 – 42 days;

AND

- A positive serologic test for measles IgM antibody using a recommended assay;

OR

- In a person who has recently travelled to an area of known measles activity.

Outbreak Case Definition

The outbreak case definition varies with the outbreak under investigation. Please refer to the *Infectious Diseases Protocol, 2018* (or as current) for guidance in developing an outbreak case definition as needed.

The outbreak case definitions are established to reflect the disease and circumstances of the outbreak under investigation. The outbreak case definitions should be developed for each individual outbreak based on its characteristics, reviewed during the course of the outbreak, and modified, if necessary, to ensure that the majority of cases are captured by the definition. The case definitions should be created in consideration of the outbreak definitions.

Outbreak cases may be classified by levels of probability (i.e. confirmed and/or probable).

Clinical Information

Clinical Evidence

Clinically compatible signs and symptoms are characterized by all of the following:

- Fever \geq 38.3 degrees Celsius (oral);
- Cough, runny nose (coryza) or red eyes (conjunctivitis);

- Generalized maculopapular rash for at least three days.

Clinical Presentation

Symptoms of measles begin 7 – 21 days after exposure to a case of measles and include fever, coryza, cough, drowsiness, irritability and conjunctivitis. Small white spots (known as "Koplik's spots") can appear on the inside of the mouth and throat but are not always present. Then, 3 – 7 days after the start of symptoms, a red blotchy (maculopapular) rash appears on the face and then progresses down the body.¹

Complications include diarrhea, pneumonia, blindness and encephalitis.¹

Complications such as otitis media and bronchopneumonia occur in about 10% of reported cases.

Measles encephalitis occurs in approximately 1 of every 1,000 reported cases and may result in permanent brain damage. Measles infection can cause subacute sclerosing panencephalitis (SSPE), a rare but fatal disease.²

Measles complications disproportionately affect persons suffering from malnutrition, those with immunodeficiency and in pregnancy.^{1,2}

Laboratory Evidence

Laboratory Confirmation

Any of the following will constitute a confirmed case of measles:

- Positive measles virus culture;
- Positive for wild type measles virus RNA by direct nucleic acid amplification test (NAAT);
- Seroconversion or a significant (i.e., fourfold or greater) rise in measles IgG titre between acute and convalescent sera. The first acute sample should be collected no later than 7 days from rash onset and the second convalescent sample 10 – 30 days after the first;
- Positive for measles IgM antibody AND an epidemiologic link or positive travel history (as above).

Note: A person recently vaccinated with measles-containing vaccine requires

measles virus genotyping to differentiate wild-type versus vaccine-derived measles. Genotyping requires the collection of specimens for NAAT.

Approved/Validated Tests

- Commercial tests for measles IgM and IgG by enzyme immunoassay (EIA).
- NAAT for measles virus RNA.
- Consult with laboratory with regards to testing and appropriate specimens.

Indications and Limitations

- Measles IgM and IgG serology may be negative if blood is collected very early in infection; if measles is still suspected, the test can be repeated no less than 3 days after the acute sample.
- IgM serology has the potential for false positive findings. Further confirmation (IgG serology – paired sera – or measles virus isolation or detection of measles virus RNA) is required in cases especially where there is no established epidemiological link or travel exposure. Negative IgM results in a true measles case may occur if specimen is taken earlier than 3 days or later than 28 days after rash onset.
- Isolates should be obtained on all persons suspected of having measles for molecular epidemiological analysis.
- Specimens for isolation or RNA detection include nasopharyngeal or throat swab collected no later than 7 days after onset of rash or urine collected within 14 days of rash onset. Consult with [Public Health Ontario Laboratories](#) with regards to testing and appropriate specimens.

For further information about human diagnostic testing, contact the [Public Health Ontario Laboratories](#).

Case Management

Confirm the diagnosis, ensuring that appropriate specimens have been collected according to the case definition, including specimens for viral detection. This is particularly important for accurate diagnosis, as well as genotyping, which may provide information on the geographic region of imported and import-associated cases. Genotyping can only be conducted if specimens for viral detection (i.e., PCR

testing) are collected.

In addition to the requirements set out in the Requirement #2 of the "Management of Infectious Diseases – Sporadic Cases" and "Investigation and Management of Infectious Diseases Outbreaks" sections of the *Infectious Diseases Protocol, 2018* (or as current), the board of health shall investigate cases to determine the source of infection. Refer to Provincial Reporting Requirements above for relevant data to be collected during case investigation.

The following disease-specific information should also be obtained during case management:

- Contact during their period of communicability with high risk individuals who are vulnerable to measles and measles complications (high risk individuals include immunocompromised persons, pregnant women and infants under 12 months of age); and
- Attendance or work during their period of communicability within a high risk setting (a high risk setting is a setting where individuals vulnerable to measles and measles complications are likely to be found, (i.e., child care settings, healthcare environments such as doctors waiting rooms or hospital emergency rooms);

There is no specific treatment for persons with measles infection; however severe complications can be avoided through supportive care that ensures good nutrition and adequate fluid intake.⁴

Individuals diagnosed with measles should be advised to stay home (self-isolate from: child care settings, schools, post-secondary educational institutions, work places, sporting events, healthcare and other group settings; and away from non-household contacts) for 4 days after the appearance of the rash. This should apply to all cases, regardless of their vaccination history. Self-isolation will help to prevent further transmission of the virus.³

Contact Management

Within 24 hours of reporting a suspect case of measles, all contacts should be identified and classified as susceptible or non-susceptible.³

- Contact identification and tracing:
 - Contact history during period of communicability;
 - Assessment of type of contact and probability of transmission;
 - Identification of contacts for follow-up and determine immunization status of contacts;
 - Occupation of contact; and
 - Residency/attendance at a facility or institution.

A measles contact is any susceptible (see Host Susceptibility and Resistance under Disease Characteristics section) person who shared the same air space for any length of time during the period of communicability, including two hours after the case left the air space (e.g. home, school, child care, school bus, doctor's office, emergency room, etc.).³

Post-exposure prophylaxis (PEP):

The timely administration of Measles, Mumps, and Rubella (MMR) vaccine or immune globulin (Ig) can be used to reduce the risk of infection in susceptible individuals exposed to measles. The effectiveness of Measles, Mumps, Rubella, Varicella (MMRV) vaccine for PEP has not been established.³ PEP is not 100% effective and contacts who receive PEP should be counseled on the signs and symptoms of measles. They should also be counseled to avoid contact with high risk individuals (pregnant women, infants < 12 months of age, and immunocompromised individuals) and to avoid high-risk exposure settings/gatherings where high risk individuals are likely to frequent.

Immunization with MMR vaccine of immunocompetent susceptible contacts over 12 months of age within 72 hours after exposure may prevent measles infection. MMR vaccine may be given to children between 6 months and 12 months of age however, two additional doses of measles-containing vaccine must be administered after the child is 12 months of age to ensure long lasting immunity to measles.³

Susceptible individuals with a contraindication to MMR vaccine, including infants under 6 months of age, pregnant women, and immunocompromised individuals, who are within 6 days of exposure should be offered Ig at the recommended dose.³ Further information regarding recommendations for use and dosing of Ig can be found in the Canadian Immunization Guide or the GamaSTAN®S/D product

monograph.¹⁰

Susceptible individuals without a contraindication to MMR vaccine, who present more than 3 days (72 hours) after exposure (when MMR vaccine no longer provides post-exposure protection) but less than 6 days after exposure (when Ig may still provide post-exposure protection) can also be considered for Ig.³

Some adults born after 1970 and who have only received one documented dose of MMR vaccine may still be susceptible to measles, as a single dose of MMR vaccine has a vaccine effectiveness of between 85-95%.² Therefore, in the context of contact management, consideration should be given to offering these adults a second dose of vaccine.

For infants under 12 months of age the following is recommended for PEP:

- Infants under 6 months of age: Ig within 6 days of exposure
- Infants 6-12 months of age:
 - If immunocompromised: Ig within 6 days of exposure
 - If immune competent but beyond 3 days and within 6 days of exposure: Ig
 - If immune competent and within 3 days of exposure: MMR vaccine

Exclusion of susceptible contacts

Individuals that refuse or cannot receive MMR vaccine or Ig may be excluded from licensed child care settings, 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:³

- Adequately immunized according to age (further description below); or
- Demonstrates laboratory confirmation of immunity; or
- Has received Ig.

Consideration should be given to: the number of susceptible individuals in the setting; the presence of high risk individuals (i.e. susceptible infants, or immunocompromised individuals); and the reliability of the incubating individual to

comply with early recognition and self-isolation.³

There is no requirement to exclude individuals for any length of time after their receipt of vaccine or Ig before their re-entry to childcare settings, schools, or other settings (with the exception of healthcare workers [see below]). This also is at the discretion of the medical officer of health.

Health care workers that have been exposed to a confirmed case of measles should have their immune status reviewed. If they have had two documented doses of measles-containing vaccine or documentation of antibodies to measles, they can be considered immune and can return to work. If they have had only one documented dose of measles-containing vaccine, without laboratory evidence of immunity or history of laboratory confirmed measles, it is recommended that they be tested for measles IgG antibody and one dose of MMR vaccine be administered immediately. While waiting for the serology results, health care workers should be excluded from work from the fifth day to the 21st day after the last exposure.³

Children identified as contacts who are under 6 years of age and who have only had one dose of measles-containing vaccine (i.e., have not yet reached age for the recommended booster dose according to the *Publicly Funded Immunization Schedules for Ontario* [four to six years]), should be excluded from school or licensed child care settings until they receive a second dose of measles-containing vaccine. Children could return to school/child care setting immediately following immunization.

Chain of Transmission

Assessing the immunization status of the contacts of an individual exposed to measles can assist in reducing the possibility of subsequent transmission, especially in settings with children who have received only 1 dose of MMR vaccine. The board of health should consider:

- Assessing the immunization status of persons in high risk settings if a susceptible contact of measles attends the setting (e.g. in child care settings); and
- Vaccinating susceptible contacts of the exposed individual, by providing the 2nd dose MMR vaccine in children who have only received 1 dose of

measles-containing vaccine (at least 4 weeks apart for measles-containing vaccine) and offering MMR vaccine for children who are unvaccinated.

Outbreak Management

Please see the *Infectious Diseases Protocol, 2018* (or as current) for the public health management of outbreaks or clusters in order to identify the source of illness, manage the outbreak and limit secondary spread.

Outbreaks provide the opportunity to update the immunization status of contacts if required and to recommend immunization to all those who are not up to date in their measles immunization.

Prevention and Control Measures

In the event that publicly funded vaccine doses are needed for case and contact management, the board of health should contact the Ministry of Health's immunization program at vaccine.program@ontario.ca as soon as possible.

Personal Prevention Measures

Immunize as per the current *Publicly Funded Immunization Schedules for Ontario*.⁶

In Ontario, the [Immunization of School Pupils Act](#) (ISPA) is the legislation that governs the immunization of school pupils for the designated diseases that are included in the Act. All students without a valid exemption must have documented receipt of two doses of measles-containing vaccine according to the specified schedule.⁷

In Ontario, the [Child Care and Early Years Act, 2014](#) (CCEYA) is the legislation that governs licensed child care settings. Pursuant to [O. Reg. 137/15](#) under the CCEYA, children who are not in school and who are attending licensed child care settings must be immunized as recommended by the local medical officer of health prior to being admitted. Under the CCEYA parents can provide a medical reason as to why the child should not be immunized or object to immunization on religious/conscience grounds.⁸

Infection Prevention and Control Strategies

- For hospitalized cases, in addition to routine practices, airborne transmission

precautions are indicated for 4 days after onset of rash in otherwise healthy persons and for the duration of illness in immunocompromised persons.⁹ The conservative approach is to maintain patients on precautions until all their measles symptoms have resolved.³

- All cases of measles will be investigated immediately in order to confirm the diagnosis, identify the source of infection, identify other cases and protect susceptible contacts in the community.
- Public health advice to probable and confirmed cases, as well as for persons suspected of having measles, includes the following: to self-isolate, to practice good hand hygiene, avoid sharing drinking glasses or utensils and cover coughs and sneezes with a tissue or forearm.³

Refer to [PHO's website](#) to search for the most up-to-date information on Infection Prevention and Control.

Disease Characteristics

Aetiologic Agent - Measles is caused by the measles virus, a member of the genus *Morbillivirus* of the family *Paramyxoviridae*.¹

Modes of Transmission - The virus is highly contagious and is spread by airborne droplet nuclei, close personal contact or direct contact with the respiratory secretions of a case.¹ Transmission can occur as a result of the persistence of the virus in the air or on environmental surfaces.³ Measles virus can remain active and contagious in the air or on infected surfaces for at least two hours. Measles is one of the most highly communicable infectious diseases.¹

Incubation Period - About 10 days, but may be 7-21 days from exposure to onset of fever, usually 14 days until rash appears.¹

Period of Communicability - One day before the start of prodromal period, which is usually about 4 days before rash onset, to 4 days after the onset of rash.¹

Immunocompromised patients may have prolonged excretion of the virus from their respiratory tract and be contagious for the duration of their illness.³

Reservoir - Humans.¹

Host Susceptibility and Resistance - After infection, immunity is generally lifelong.¹

The following individuals should be considered susceptible:^{2,3}

- Lack of documented evidence of vaccination with measles-containing vaccine:
 - One dose for adults 18 years of age and older and born in 1970 or later who are not health care workers, students in post-secondary educational setting or military personnel
 - Two doses for health care workers, military personnel or students in post-secondary educational settings regardless of age and year of birth
 - Two doses for children 12 months to 17 years of age (given on or after the first birthday and given at least 4 weeks apart for MMR vaccine, or 6 weeks apart for MMRV vaccine)
 - Infants under age 12 months, regardless of immunization history

OR

- Lack of laboratory evidence of prior measles infection or documentation of prior confirmed measles disease in iPHIS.

OR

- Lack of laboratory evidence of immunity (i.e. "reactive" or "positive" anti-measles IgG antibody or a previous measles antibody level of > 200 mIU per ml).

Note: It is important to note that the susceptibility criteria outlined above apply on a population basis and it is possible that small numbers of individuals within these groups may not be immune to measles. For this reason, contacts should be advised of any relevant exposure and counselled to monitor for signs and symptoms, even if they are not recommended to receive PEP or other public-health management (self-isolation or exclusion).

Please refer to [PHO's Reportable Disease Trends in Ontario reporting tool](#) and other reports for the most up-to-date information on infectious disease trends in Ontario.

For additional national and international epidemiological information, please refer to the Public Health Agency of Canada and the World Health Organization.

Comments

Provinces provide active, weekly case-by-case notification (including zero-notification) to the Canadian Measles/ Rubella Surveillance System (CMRSS) and weekly reporting to the Pan-American Health Organization, in accordance with the goal of eliminating measles in the Western Hemisphere.

Note about testing for Subacute Sclerosing Panencephalitis (SSPE):

Subacute sclerosing panencephalitis (SSPE) is a rare complication caused by persistent measles virus infection in the central nervous system. In the presence of the characteristic clinical, neurological and pathology signs, the diagnosis can be confirmed by detecting an increase of measles IgG titre in the cerebrospinal fluid (CSF) relative to the titre in serum. Further consultation with the laboratory and a medical microbiologist is advised.

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Document History

Revision Date	Document Section	Description of Revisions
April 2022	Entire Document	New template. Appendix A and B merged. No material content changes.
April 2022	Epidemiology: Occurrence section	Removed.
April 2022	ICD Codes	Removed.