

# Appendix A: Disease-Specific Chapters

**Chapter: Measles**

Effective: February 2019

# Measles

Communicable

Virulent

**Health Protection and Promotion Act:  
O. Reg. 135/18 (Designation of Diseases)**

## 1.0 Aetiologic Agent

Measles is caused by the measles virus, a member of the genus *Morbillivirus* of the family *Paramyxoviridae*.<sup>1</sup>

## 2.0 Case Definition

### 2.1 Surveillance Case Definition

Refer to [Appendix B](#) for Case Definitions.

### 2.2 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.

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).

## 3.0 Identification

### 3.1 Clinical Presentation

Symptoms of measles begin 7 – 21 days after exposure to a case of measles and include fever, runny nose (coryza), cough, drowsiness, irritability and red eyes (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.<sup>1</sup>

Complications include diarrhea, pneumonia, blindness and encephalitis.<sup>1</sup> 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.<sup>2</sup>

Measles complications disproportionately affect persons suffering from malnutrition, those with immunodeficiency and in pregnancy.<sup>1,2</sup>

## 3.2 Diagnosis

See [Appendix B](#) for diagnostic criteria relevant to the Case Definitions.

For further information about human diagnostic testing, contact the Public Health Ontario Laboratories or refer to the Public Health Ontario Laboratory Services webpage: <http://www.publichealthontario.ca/en/ServicesAndTools/LaboratoryServices/Pages/default.aspx>

# 4.0 Epidemiology

## 4.1 Occurrence

Measles has been eliminated in the Americas. Endemic transmission of measles in Canada has been interrupted by high two-dose vaccine coverage as a part of routine infant and childhood immunization programs. Canada has been free of endemic measles since 1998.<sup>3</sup>

Endemic measles transmission continues to occur outside of the region of the Americas and remains a serious and common disease in developing countries. According to the World Health Organization, measles is a leading cause of vaccine preventable deaths in children worldwide.<sup>4</sup>

Importation and travel-related cases continue to occur in Ontario. Between 2013 and 2017, an average of 14 confirmed cases were reported annually in Ontario.\*

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

<http://www.publichealthontario.ca/en/DataAndAnalytics/Pages/DataReports.aspx>

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

## 4.2 Reservoir

Humans.<sup>1</sup>

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\* Data included in the epidemiological summary are from January 1, 2013 to December 31, 2017. Data were extracted from Query on February 7, 2018 and therefore are considered preliminary.

### 4.3 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.<sup>1</sup> Transmission can occur as a result of the persistence of the virus in the air or on environmental surfaces.<sup>3</sup> 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.<sup>1</sup>

### 4.4 Incubation Period

About 10 days, but may be 7-21 days from exposure to onset of fever, usually 14 days until rash appears.<sup>1</sup>

### 4.5 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.<sup>1</sup>

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

### 4.6 Host Susceptibility and Resistance

After infection, immunity is generally lifelong.<sup>1</sup>

The following individuals should be considered susceptible:<sup>2,3</sup>

- 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 post-exposure prophylaxis or other public-health management (self-isolation or exclusion).

## 5.0 Reporting Requirements

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 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:

- *Ontario Regulation 569* (Reports) under the *Health Protection and Promotion Act* (HPPA);<sup>5</sup>
- The iPHIS User Guides published by PHO; and
- Bulletins and directives issued by PHO.

## 6.0 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’s immunization program at [vaccine.program@ontario.ca](mailto:vaccine.program@ontario.ca) as soon as possible.

### 6.1 Personal Prevention Measures

Immunize as per the current *Publicly Funded Immunization Schedules for Ontario*.<sup>6</sup>

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.<sup>7</sup>

In Ontario, the *Child Care and Early Years Act, 2014* (CCEYA) is the legislation that governs licensed child care settings. Pursuant to *Ontario Regulation 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.<sup>8</sup>

### 6.2 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.<sup>9</sup> The conservative approach is to maintain patients on precautions until all their measles symptoms have resolved.<sup>3</sup>

- 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.<sup>3</sup>

Refer to PHO's website at [www.publichealthontario.ca](http://www.publichealthontario.ca) to search for the most up-to-date information on Infection Prevention and Control.

### 6.3 Management of Cases

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 Section 5: 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.<sup>4</sup>

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.<sup>3</sup>

## 6.4 Management of Contacts

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

- 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 section 4.6 for susceptibility criteria) 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.).<sup>3</sup>

### **Post-exposure prophylaxis (PEP):**

The timely administration of MMR vaccine or immune globulin (Ig) can be used to reduce the risk of infection in susceptible individuals exposed to measles. The effectiveness of MMRV vaccine for PEP has not been established.<sup>3</sup> 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.<sup>3</sup>

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.<sup>3</sup> 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.<sup>10</sup>

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.<sup>3</sup>

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%.<sup>2</sup> 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:<sup>3</sup>

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

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.<sup>3</sup>

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.<sup>3</sup>

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.

## **6.5 Management of Outbreaks**

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.

## **7.0 References**

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10. National Advisory Committee on Immunization, Public Health Agency of Canada. Part 5 - Passive Immunization. 2013. In: Canadian Immunization Guide [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada, [cited March 14, 2018]. Available from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-5-passive-immunization.html#p5a2>

## 8.0 Document History

**Table 1: History of Revisions**

<b>Revision Date</b>	<b>Document Section</b>	<b>Description of Revisions</b>
April 2014	2.1 Surveillance Case Definition	Addition of “Measles is eliminated in Canada; therefore, one case is unexpected.”  Addition of last paragraph: “Public health units should notify PHO....”
April 2014	2.2 Outbreak Case Definition	Section 2.2 is deleted.
April 2014	3.2 Diagnosis	Addition of “for diagnostic criteria relevant to the Case Definitions” and “For further information...”
April 2014	4.1 Occurrence	Entire section revised.
April 2014	4.6 Host Susceptibility and Resistance	Entire section revised.
April 2014	5.1 To local Board of Health	First paragraph, replaced “Confirmed and suspected cases” with “Individuals who have or may have measles”...

Revision Date	Document Section	Description of Revisions
April 2014	5.2 To the Ministry of Health and Long-Term Care (the ministry) or Public Health Ontario (PHO), as specified by the ministry	First paragraph, second sentence: “Any confirmed or probable case of measles identified” replaced with “Any case of measles identified by the public health unit”...
April 2014	6.1 Personal Prevention Measures	<p>First paragraph, second sentence changed from “According to the <i>Immunization of School Pupils Act</i>, all students must have documented receipt of two doses of measles containing vaccine” to “According to the <i>Immunization of School Pupils Act</i>, all students over 6 years of age must have documented receipt of two doses of measles containing vaccine and students under this age must have documented receipt of a single dose of measles containing vaccine”.</p> <p>Second paragraph, first sentence changed from “...days after MMR immunization” to “...days after MMR immunization, although the range can be longer.”</p> <p>Second paragraph, last sentence, addition of “(i.e., occurring between 5 and 42 days after immunization).”</p> <p>Third paragraph, first sentence changed from “Healthcare workers should have documentation of two doses of live measles vaccine given after the first birthday, or laboratory evidence of immunity prior to or upon employment...” to “Healthcare workers should have documentation of two doses of measles-containing vaccine given after the first birthday, or laboratory evidence of immunity prior to or upon employment, regardless of their year of birth...”</p>

<b>Revision Date</b>	<b>Document Section</b>	<b>Description of Revisions</b>
April 2014	6.2 Infection Prevention and Control Strategies	First bullet point, last sentence changed from “The conservative approach is maintaining patients...” to “The conservative approach is to maintain patients...”  April 2014 Third bullet point updated.
April 2014	6.3 Management of Cases	First paragraph, addition of “including specimens of 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.”  Second paragraph, bullet points updated.  Last paragraph, addition of “sporting events” to first sentence.  Second last sentence in last paragraph changed from “This should apply whether the case had been previously vaccinated or not” to “This should apply to all cases, regardless of their vaccination history.”  Addition of “further” in last sentence.
April 2014	6.4 Management of Contacts	Entire section updated.
April 2014	7.0 References	Updated.
February 2019	General	Minor revisions were made to support the regulation change to Diseases of Public Health Significance. Common text included in all Disease Specific chapters: Surveillance Case Definition, Diagnosis, Reporting Requirements and Management of Cases. The epidemiology section and references were updated and Section 8.0 Additional Resources was deleted.
February 2019	2.2 Outbreak Case Definition	Section added.

<b>Revision Date</b>	<b>Document Section</b>	<b>Description of Revisions</b>
February 2019	6.0 Prevention and Control Measures	Updates regarding the ordering of publicly funded vaccines for case and contact management.
February 2019	6.1 Personal Prevention Measures	Updates to information on Immunization of School Pupils Act and Child Care and Early Years Act.
February 2019	6.4 Management of Contacts	Section updated.
February 2019	6.5 Management of Outbreaks	Section added.

