Measles

Goal/Objective:
The Public Health goal in the management of measles disease is to maintain the elimination of indigenous measles in NS and prevent transmission from imported cases.

Measles is one of the most highly communicable of all infectious diseases. The attack rate in a susceptible individual exposed to measles is 90%. Measles can result in multiple severe complications and case fatality rates are increased in children less than 5 years of age, pregnant women, and immunocompromised children. Acute encephalitis can occur which often results in permanent brain damage, in approximately 1 of every 1000 cases.

Due to the highly infectious nature of this illness and the potential for severe complications, immediate public health investigation must be initiated.

INFORMATION

Case definition

CONFIRMED CASE
Laboratory confirmation of infection in the absence of recent (previous 28 days) immunization with measles-containing vaccine:

- isolation of measles virus from an appropriate clinical specimen
  OR
- detection of measles virus RNA
  OR
- seroconversion or a significant [e.g., fourfold or greater] rise in measles IgG titre, by any standard serologic assay, between acute and convalescent sera
  OR
- positive serologic test for measles 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
  OR
- clinical illness* in a person with an epidemiologic link to a laboratory-confirmed case
PROBABLE CASE
Clinical illness*

• in the absence of appropriate laboratory tests
  OR

• in the absence of an epidemiologic link to a laboratory-confirmed case
  OR

• in a person who has recently travelled to an area of known measles activity

*Clinical illness is characterized by all of the following features:

• fever of 38.3°C or greater
• cough, coryza or conjunctivitis
• generalized maculopapular rash for at least 3 days

SUSPECT CASE (Outbreak only)
Regardless of recent [previous 28 days] immunization, clinical illness in a person with a maculopapular rash of any duration, who does not meet the confirmed or probable case definition, and where the clinician has a high index of suspicion of measles.

Causative agent
Measles virus

Source
Humans

Incubation
8-12 days from exposure to onset of symptoms with an average of 14 days, with a range of 7-21 days.

Note: The incubation period may be extended in an exposed individual if Immune globulin [IG] is given for passive protection early in the incubation period.

Transmission
Measles is one of the most highly communicable infectious diseases.

Transmitted by direct contact with infectious droplets or, less commonly, by airborne spread.
Communicability
From four days before the rash onset to 4 days after the appearance of the rash, with the day of the rash being day 0. Minimal after 2nd day of rash. Immunocompromised individuals who may have prolonged excretion of the virus in respiratory tract secretions, can be contagious for the duration of the illness.

Symptoms
Prodromal fever, conjunctivitis, coryza, cough, Koplik spots [https://phil.cdc.gov/Default.aspx]; then red maculopapular confluent rash on 3rd to 7th day beginning on face and becoming generalized. Multiple complications can occur following infection with measles virus. Individuals with 1 or 2 doses of measles vaccine can have an atypical presentation.

Diagnostic testing
1. Nasopharyngeal swab using a viral swab (same swab used for influenza testing; additional swabs can be obtained from the local laboratory)
   AND
2. 50 ml of urine in a sterile container

If there is a high clinical suspicion of measles (ie. contact of a lab-confirmed case) please also order acute serology: IgM and IgG. It is NOT recommended that IgM serology be ordered as the only test for measles diagnosis – viral swab and urine should be prioritized.

Treatment
None

Prevention
Immunization with a measles containing vaccine is an effective strategy in the prevention of measles disease and high rates of complications. Refer to the Nova Scotia Publicly Funded Vaccine/Immunoglobulin Eligibility policy found here: https://novascotia.ca/DHW/CDPC/info-for-professionals.asp
PUBLIC HEALTH MANAGEMENT & CONTROL

Case management
Case investigation is a priority and requires immediate action to prevent spread and subsequent secondary cases.

Case follow up
All cases must meet the case definition, and laboratory confirmation through NP swab or urine culture is the diagnostic testing required.

A detailed case history outlining the following is a critical and necessary component of the assessment to inform further public health action:

• Immunization history
• Potential exposure
  ◦ Ill family or household contact
  ◦ Ill friends, coworkers, roommates
  ◦ Attendance/work; school/daycare
  ◦ Attendance/work; medical facilities
  ◦ Travel to endemic areas
  ◦ Use of public transportation, conveyances
  ◦ Attendance at social events/group functions
  ◦ Visitation from out of province/country
  ◦ Knowledge of other people with similar symptoms

If Public Health directs any possible cases for further testing or assessment by a health care provider, then the facility must ensure proper infection control measures are in place to accommodate these cases and prevent further spread.

Exclusion: Persons infected with measles
Individuals diagnosed with measles should be excluded from: child care settings, schools, post-secondary educational institutions, work places, healthcare and other group settings; and away from non-household contacts until the end of the fourth day after the appearance of the rash [with the day of the rash being day 0]. This should apply whether the case had been previously vaccinated or not. Self-isolation will help to prevent transmission of the virus.
Education of case
All cases must be educated about the period of communicability, the important
of ensuring immunizations are up to date [NS Publicly Funded Vaccine/
Immunoglobulin Eligibility Policy] and basic hygienic practices (washing hands
often/using hand sanitizer, not sharing drinking glasses or eating utensils, covering
coughs and sneezes with a tissue or elbow, staying home when sick).

Cases employed in a health care setting should be advised to immediately notify
their Occupational Health or Infection Control Department at their place of
employment.

Contact tracing
Contact tracing is the primary means of controlling the spread of measles.
Identifying individuals who had contact with the case during the communicability
period is critical. Immediate reporting, investigation and vaccination of susceptible
contacts can stop secondary cases.

Definition of contacts
Contacts are individuals who have spent any length of time in a room or enclosed
space while the infectious measles case was present or for up to 2 hours after the
case left the room/space.

Susceptibility
Within 24 hours of reporting a confirmed or probable case of measles, all possible
efforts should be made to identify contacts and classify them as susceptible*, high
risk**, or non-susceptible. The immunization status of all contacts of cases should
be ascertained to determine susceptibility to measles.

*Susceptible:
Any contact ≥ 6 months of age or born in 1970 or later is considered susceptible to
measles if they meet one or more of the following criteria:
  ◦ lack of documented evidence of two valid doses of measles-containing vaccine
  ◦ lack of laboratory evidence of prior measles infection; and
  ◦ lack of laboratory evidence of immunity

**High Risk:
The following susceptible contacts are at high risk of measles complications:
  ◦ Pregnant women who have never had measles disease or 2 doses of MMR
    vaccine
  ◦ Infants under 12 months of age
  ◦ Immunocompromised individuals
**Prophylaxis**

Recommendations for post exposure prophylaxis (PEP) for susceptible contacts are based on the October 2018 *National Advisory Committee on Immunization* updates.

**MMR Vaccine**

Susceptible immunocompetent individuals six months of age and older who are exposed to measles and who have no contraindications, should be given MMR vaccine within 72 hours of the exposure.

**Immunoglobulin (Ig)**

Susceptible infants < six months of age, if injection volume is not a major concern, should be provided IMIg at a concentration of 0.5 ml/kg, to a maximum dose of 15 mls administered over multiple injection sites.

Susceptible infants six to 12 months of age who are identified after 72 hours and within six days of a measles exposure should receive IMIg (0.5 mL/kg) if injection volume is not a major concern (to a maximum of 15 mls administered over multiple injection sites).

For susceptible contacts who are pregnant or immunocompromised, if injection volume is not a concern, IMIg can be provided at a concentration of 0.5 mL/kg, understanding that recipients weighing 30 kg or more will not receive the measles antibody concentrations that are considered to be fully protective.

Where injection volume is a major concern or for recipients weighing 30 kg or more, IVIg can be provided alternatively at a dose of 400 mg/kg. Although IVIg products are not indicated for use as measles PEP in Canada, NACI now recommends them as an alternative to IMIg because there are no comparable appropriate prophylaxis strategies in some situations.

NACI does not recommend that susceptible immunocompetent individuals older than 12 months of age, who are not pregnant, receive Ig PEP for measles exposures due to the low risk of disease complications and the practical challenges of administration for cases and contact management.

See *Table 1* for a summary of recommended measles PEP strategies.
Table 1: Summary of updated measles post-exposure prophylaxis recommendations for susceptible contacts

<table>
<thead>
<tr>
<th>Population</th>
<th>Time since exposure to measles&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤ 72 hours</td>
</tr>
<tr>
<td></td>
<td>73 hours–six days</td>
</tr>
<tr>
<td>Susceptible infants 0–6 months of age&lt;sup&gt;b&lt;/sup&gt;</td>
<td>IMIg (0.5 mL/kg)&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Susceptible immunocompetent infants 6–12 months of age</td>
<td>MMR vaccine&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Susceptible immunocompetent individuals 12 months of age and older</td>
<td>MMR vaccine series&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Susceptible pregnant individuals&lt;sup&gt;f&lt;/sup&gt;</td>
<td>IVIg (400 mg/kg)</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>IMIg (0.5 mL/kg), limited protection&lt;sup&gt;g&lt;/sup&gt;</td>
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<td>Immunocompromised individuals six months of age and older</td>
<td>IVIg (400 mg/kg)</td>
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<td></td>
<td>IMIg (0.5 mL/kg), limited protection if 30 kg or more&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>Individuals with confirmed measles immunity</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Abbreviations: IMIg, intramuscular immunoglobulin; IVIg, intravenous immunoglobulin; MMR, measles-mumps-rubella

<sup>a</sup>: Ig should only be provided within six days of measles exposure. Individuals already receiving replacement IVIg (400 mg/kg of body weight or higher) are considered protected against measles and do not require Ig if the last dose of IVIg was received within three weeks prior to measles exposure

<sup>b</sup>: Two doses of measles-containing vaccine are still required after the first birthday for long-term protection

<sup>c</sup>: If injection volume is a major concern, IVIg can be provided at a concentration of 400 mg/kg

<sup>d</sup>: Two additional doses of MMR vaccine provided after 12 months of age are required for long term protection

<sup>e</sup>: MMR vaccine will not provide PEP protection after 72 hours of exposure, however, starting and completing a two dose series should not be delayed to provide long term protection

<sup>f</sup>: Provide two doses of MMR vaccine postpartum for long-term protection

<sup>g</sup>: For individuals weighing 30 kg or more, IMIg will not provide complete protection but may provide partial protection


**Immunization of contacts**

In contacts that are given a dose of Ig for prevention of measles, measles-containing vaccine should be provided if the contact does not develop clinical measles and the vaccine is not contraindicated. Measles-containing vaccine can be given once the measles antibodies administered from the Ig have degraded [Please see the Canadian Immunization Guide to determine guidelines for the interval between administration of Ig and MMR].
Exclusion of Contacts:
At the discretion of the Medical Officer of Health, susceptible contacts [See Susceptible; Contact Tracing section] may be excluded from child care settings, schools, and post-secondary educational institutions and may be required to self-isolate from workplaces, or other group settings, including travel. As part of the risk assessment, consideration should be given to the following: the number of susceptible individuals in that setting; the presence of high-risk individuals, susceptible infants, or immunocompromised individuals; and the reliability of the incubating individual to comply with early recognition and self-isolation.

If exclusion is warranted, the period of exclusion should extend from 5 days after the first exposure and up to 21 days after the last exposure until the individual meets any of the following criteria:

- Has had at least one recent measles-containing vaccine within 72 hours of the first measles exposure [except Health care workers*] OR
- Demonstrates serological confirmation of immunity OR
- Has received immunoglobulin [Ig], if eligible [except Health care workers*]

NOTE:
*Health care workers who have received MMR vaccine or Ig as part of measles post exposure prophylaxis, should have serology to determine immunity and only return to work prior to 21 days post exposure, if serology indicates measles immunity. For further information on managing measles in a health care setting refer to the Guidelines for the Prevention and Control of Measles Outbreaks in Canada.

Health care workers born in or after 1970 would be eligible for MMR vaccine, as per the general population. Health care workers born before this date are currently not eligible for publicly funded MMR vaccine.

School/Childcare settings:
Consider reaching absent school/childcare attendees in order to determine if they are cases.

PH will inform school/childcare setting when it is permissible for the contact to return.

Air Travel Contacts:
The Guidelines for the Prevention and Control of Measles Outbreaks in Canada recommend conducting contact tracing for passengers seated two rows ahead and two rows behind the infectious individuals based on aircraft airflow models.

However, in an interim document developed by the Public Health Agency of Canada, there is evidence to 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 is related to duration of the flight. When contact tracing for measles when there has been a case on a plane during the communicable period, consider following up on the whole plane giving priority to children less than 2 year of age given their greater infection risk.

Please see Appendix A for the interim PHAC document “Measles on a Flight – Contact tracing Algorithm [June 2019]”.

The Public Health Agency of Canada can assist in obtaining a flight manifest and personal name record [PNR] or requesting the manifest or PNR be placed on hold until further laboratory confirmation or risk assessment is complete. For assistance:

- During regular business hours [8am to 4pm Eastern time on Monday to Friday except federal holidays], please email phac.vpd-mev.aspx@canada.ca

- Outside of regular business hours, please email phac-aspc.hpoc-cops@Canada.ca or call: 1-613-952-7940

Please note that the flight manifest does not include flight crew. This must be asked for specifically when connecting with the Public Health Agency of Canada or may require follow up with the airline directly. The management of flight crews on affected aircraft is under review at the national level.

If a flight manifest and PNR is considered being requested, the following information may be helpful to inform that request:

- flight manifests and PNRs may lack relevant contact information

- flight manifests and PNRs are 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 can be lengthy

- follow up with individual contacts can be time and resource intensive while public/healthcare provider alerts/announcements may be alternate strategies

Further consideration may be given to contacts who have travel plans and the need to quarantine versus allowing air travel. Considerations should include conversation with the province/territory of flight to ensure they agree with no quarantine based on circumstances.

Education of contacts
Educate contacts about the signs and symptoms of measles, how it is transmitted, and what to do if they develop symptoms [isolate themselves, notify Public Health and their health care provider].
Advise them to call ahead before going to any health care facility, including blood or specimen collection sites, to inform the staff of measles symptoms so that they can be isolated on arrival to avoid exposing any susceptible persons.

Students at school who are suspect measles cases should be sent home but not on public transportation or the school bus.

Ensure the contact keeps a record of activities for the timeframe after exposure until they are cleared by Public Health.

**Following up contacts**
Follow up with contacts within 1 week to confirm that they received appropriate vaccination and to determine if they have or have not become cases. In outbreaks or where large numbers of contacts are identified, resources may need to be assessed to determine feasibility of follow up.

**Follow up in a Health Care Facility**

**Surveillance Guidelines**

**General Information Sheet**

**References**


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**Nova Scotia Communicable Diseases Manual**
Section: Measles (January 2020)
Appendix A: Measles on a Flight - Contact tracing algorithm (Public Health Agency of Canada, June 2019)

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. 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\(^1\). 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\(^2,3\). Recent reviews also suggest that there is no evidence that measles transmission risk on a flight is related to the duration of the flight\(^3\). 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.

**Table 1. Summary of updated measles post-exposure prophylaxis recommendations for susceptible contacts.**


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<sup>a</sup> IMlg should only be provided within six days of measles exposure. Individuals already receiving replacement IVlg [400 mg/kg of body weight or higher] are considered protected against measles and do not require IG if the last dose of IVlg was received within three weeks prior to measles exposure.

<sup>b</sup> Two doses of measles-containing vaccine are still required after the first birthday for long-term protection.

<sup>c</sup> If injection volume is a major concern, IVlg can be provided at a concentration of 400 mg/kg.

<sup>d</sup> Two additional doses of MMR vaccine provided after 12 months of age are required for long-term protection.

<sup>e</sup> MMR vaccine will not provide PEP protection after 72 hours of exposure, however, starting and completing a two dose series should not be delayed to provide long term protection.

<sup>f</sup> Provide two doses of MMR vaccine postpartum for long-term protection

<sup>g</sup> For individuals weighing 30 kg or more, IMlg will not provide complete protection but may provide partial protection.

**REFERENCES:**

Measles on a Flight - Contact tracing algorithm
(Public Health Agency of Canada, 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.
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.

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.

The flight arrival time was between 48 hours ago and 5 days ago.
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.

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.

The flight arrival time was 6 days ago or more (up to 1 month).
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 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