Local Health Department Guidelines for the Epidemiological Investigation and Control of Measles

Maryland Department of Health
Prevention and Health Promotion Administration
Infectious Disease Epidemiology and Outbreak Response Bureau
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Introduction and Background

Measles is a highly contagious rash illness caused by the measles virus. It is considered one of the most highly communicable infectious diseases, with an attack rate of 90% in susceptible, exposed individuals in a close contact setting. Measles is rare in the United States; however, it is still common in many areas of the world, and sporadic cases and outbreaks of measles in the U.S. often involve individuals who recently traveled to measles-endemic regions or who were exposed to imported cases of measles. Most measles cases in the United States occur in people who are not vaccinated against measles.

This document consolidates measles guidance from different CDC resources for use by health department staff and other partners involved in measles case investigations and outbreak response. The recommendations in this document are intended to provide general guidance. Measles cases and outbreaks should be evaluated individually to determine the appropriate steps for measles prevention and control.

Questions regarding this document can be directed to:

Maryland Department of Health
Infectious Disease Epidemiology and Outbreak Response Bureau
201 W. Preston St. Baltimore, MD 21201
Ph (410) 767-6700

I. Measles Overview

Disease Description

Measles is typically characterized by a prodrome of high fever, malaise, cough, coryza, and conjunctivitis. Tiny white spots (Koplik spots) may appear inside the mouth 2-3 days after symptoms begin, followed by a maculopapular rash that appears 3-5 days after first symptoms. The rash usually starts at the hairline and spreads downward to the trunk and lower extremities. Fever often progresses through the early stages of the illness and is typically highest when the rash appears. The rash persists for 5-6 days and then fades in order of appearance.

While measles is usually a mild or moderately severe illness, it can result in complications such as pneumonia, encephalitis, and death. Certain individuals are at greater risk of experiencing complications from measles infections, including:

- Children younger than 5 years of age
- Adults older than 20 years of age
- Pregnant people
- People with weakened immune systems

INCUBATION PERIOD

- 11 to 12 days from exposure to onset of prodromal symptoms
    - Exposure to rash onset averages 14 days with a range of 7 to 21 days

MODE OF TRANSMISSION

- Person-to-person via large respiratory droplets
- Airborne in closed areas for up to 2 hours

INFECTIOUS PERIOD

- 4 days before rash onset through 4 days after

Measles Infection Timeline:

DAY 0: Rash Onset

↓

	EXPOSURE WINDOW		INFECTIOUS PERIOD	RESOLUTION
Day	-21 -7		-4 0 4	5+
Illness	The average incubation period for measles is 11-12 days (from exposure to onset of prodrome). The rash typically appears ~14 days after exposure, with a range of 7-21 days.		The prodrome typically begins 3-5 days before the appearance of the rash. The infectious period starts 4 days prior to rash onset and ends 4 days after.	Symptoms typically start resolving 5-6 days after the rash onset. The rash fades in order of appearance.
Health Dept. Actions	Identify potential exposures that the case had during this time to determine the likely source of infection. Gather information on ill contacts, including a description of illness, testing results or diagnoses, and the nature of contact. Ask about travel history, including travel locations, travel dates, and mode of transportation.		Ensure isolation of the case. Identify contacts of the case during the infectious period. Determine the immune status of contacts and recommend PEP, exclusion of nonimmune contacts, and/or symptom monitoring, as appropriate.	Ensure the exclusion of nonimmune contacts, as indicated. Symptomatic contacts should be evaluated for measles infection.

Prevention

VACCINATION

Vaccination is the most effective way to prevent measles infection.

- Children should routinely get two doses of MMR vaccine: one at age 12-15 months and a second at 4-6 years
    - This can be administered as MMR or MMRV vaccine
- Children can receive the second dose of MMR vaccine earlier than 4-6 years of age if it is at least 28 days after the first dose
- A second dose of MMRV vaccine can be given 3 months after the first dose, up to 12 years of age
- CDC recommends that separate MMR and varicella vaccines be given for the first dose in children aged 12-47 months; however, MMRV may be used if parents or caregivers express a preference
- Adults and teens should be up to date on MMR vaccinations with either one or two doses (depending on risk factors) unless they have other presumptive evidence of immunity (see below)
    - MMR vaccination (or other evidence of immunity) is especially important for healthcare professionals, international travelers, college students, close contacts of immunocompromised people, people with HIV infection, adults who got inactivated measles vaccine, and groups at increased risk during measles outbreaks
- Any clinically significant events, unexpected events following vaccination, and/or events

listed on the vaccine manufacturer's package insert should be reported to the Vaccine Adverse Event Reporting System (VAERS).

- For more information on measles vaccination, go to CDC Measles Vaccine Recommendations

Laboratory Tests and Specimen Collection

- Individuals for whom measles is suspected due to clinical presentation and exposure history should be tested for measles.
    - PCR and serology are the preferred testing methods for measles diagnosis.
- A nasopharyngeal (NP) or throat (OP) swab should be collected for PCR testing. A sample for serologic testing should also be collected.
- Ideally, upper respiratory specimens should be collected within 3 days of rash onset, but specimens collected after that time may still be tested. IgM is most sensitive 3+ days after rash onset and may not be detected in specimens collected earlier in the illness.
- **MDH epidemiologists must approve measles testing before specimens are submitted to the MDH Laboratory.** To obtain approval, call 410-767-6700 during business hours. For urgent matters after hours, call 410-795-7365.
- See Table 1 below for more information on specimen collection and submission to the MDH Lab.
- Testing asymptomatic persons, including those identified as close contacts of a case, should be avoided as it increases the likelihood of obtaining false positive results.

Table 1: MDH Laboratory Testing for Measles - PCR and Serology

	PCR	Serology (IgM with IgG)
Time of specimen collection	Ideally, within 3 days of rash onset, but up to 10 days after onset of rash is acceptable.	IgM is most sensitive 3+ days after rash onset and may remain positive for 6-8 weeks; specimens collected <3 days after rash onset may be negative.
Site of specimen collection	Posterior nasopharynx (NP swab) or throat (OP swab)	Serum
Method of collection	NP/OP specimen on Dacron™ swab in viral transport media	5 mL of whole blood or 4 mL of serum in red-top or gold-top vacutainer
Comments	N/A	IgG can be detected 2+ weeks after vaccination or infection; an IgG-only test may provide evidence of immunity but should not be used (alone) for diagnosing acute measles infection.
Specimen Identification	Specimens should be labeled with the patient's first and last name, address, and DOB, as well as specimen type/source and the date and time of collection. The specimen/sample must be properly labeled and match the test requisition or electronic test order.	
Turnaround time	2-5 business days	2-5 business days
Requisition	**MDH Form 4676**	**MDH Form 4677**

<table>
<tr><td rowspan="2">Package/Shipping/Transport</td><td>Transport at 2-8°C on cold packs for overnight shipping. For delayed shipping, transport -20°C or colder on dry ice.</td><td>Whole blood or separated serum transported at 2-8°C on cold packs up to 2 days after collection. Separated Serum only: For >2 days after collection, transport -20°C or colder on dry ice. WHOLE BLOOD CANNOT BE FROZEN.</td></tr>
<tr><td colspan="2">All specimens:

Specimens must be packaged in a triple packaging system to ensure that under normal conditions of transport, they cannot break, be punctured, or leak their contents (Refer to pages 9 & 10 for triple packing guidance).
*Refer to current federal regulations for specific shipping requirements.

Specimens should be shipped to:
MD Department of Health Laboratories Administration, Central Laboratory
1770 Ashland Avenue
Baltimore, Maryland 21205</td></tr>
</table>

*MDH Guide to Public Health Laboratory Services, starting on page 98 (IgM only)

Treatment

There is no specific antiviral treatment for measles infection. Treatment and management are supportive.

Reporting

The Code of Maryland Regulations (COMAR) 10.06.01 Communicable Diseases requires healthcare providers, hospitals, laboratories, and school and childcare facility personnel to immediately report cases of measles to the health department.

When reporting a case of measles, information should include:

- Identifying information (name, DOB, address, telephone number)
- Demographic information (age, sex, race, etc.)
- Clinical details, such as the date of illness onset and symptoms
- Laboratory results (if available)
- Vaccination status
- Risk factors
- Occupation
- Contacts for investigation and prophylaxis

II. Measles Case and Outbreak Investigations

Note: Measles case and outbreak investigations are often complex and require immediate follow-up. **Local health departments are encouraged to coordinate response actions, including testing, post-exposure prophylaxis, and exclusion recommendations, with MDH.** To speak with an MDH epidemiologist during normal business hours, call 410-767-6700. Outside of normal business hours, call 410-795-7365 and ask to speak with the epidemiologist on call.

Case Definition

CLINICAL CRITERIA

An acute illness characterized by:

- Generalized, maculopapular rash lasting ≥3 days; AND
- Temperature ≥101°F or 38.3°C; AND
- Cough, coryza (runny nose), or conjunctivitis (red, watery eyes).

CASE CLASSIFICATION

- **Probable**
  - In the absence of a more likely diagnosis, an illness that meets the clinical description with:
    - No epidemiologic linkage to a laboratory-confirmed measles case; AND
    - Noncontributory or no measles laboratory testing.
- **Confirmed**
  - An acute febrile rash illness† with:
    - Isolation of measles virus‡ from a clinical specimen; OR
    - Detection of measles virus-specific nucleic acid‡ from a clinical specimen using polymerase chain reaction; OR
    - IgG seroconversion‡ or a significant (at least 4 fold) rise in measles immunoglobulin G antibody‡ using any evaluated and validated method; OR
    - A positive serologic test for measles immunoglobulin M antibody‡§; OR
    - Direct epidemiologic linkage to a case confirmed by one of the methods above.

† Temperature does not need to reach ≥101°F/38.3°C and the rash does not need to last ≥3 days.
‡ Not explained by MMR vaccination during the previous 6–45 days.
§ Not otherwise ruled out by other confirmatory testing or more specific measles testing in a public health laboratory.

EPIDEMIOLOGIC CLASSIFICATION

Please see the CDC website for more information.

Complete a Measles Case Report Form for all probable and confirmed cases.

Control Measures and Post-Exposure Prophylaxis (PEP)

ISOLATION OF CASES

- Confirmed measles cases should be isolated during their infectious period, from four days before rash onset through four days after rash onset (the day of rash onset is considered day 0). Cases must be excluded from school, daycare, healthcare facilities, and workplaces. Cases should remain at home and limit exposure to others.
- Suspect measles cases should be isolated until measles has been ruled out or until their presumed infectious period is over.
- Suspect or confirmed cases requiring medical attention should notify the healthcare facility prior to arrival so that appropriate precautions can be taken.
- Cases in healthcare settings must be placed in airborne and standard precautions.
  - Airborne precautions include isolation in a negative air pressure isolation room, also

known as airborne infection isolation (AII) or airborne infection isolation room (AIIR). In clinic settings where a negative air pressure isolation room may not be available, a single room with the door closed and away from susceptible contacts may be used when evaluating persons for whom measles is suspected.
    - Suspect or confirmed measles patients should be asked to wear a medical mask.

IDENTIFICATION OF EXPOSED SUSCEPTIBLE CONTACTS

- Individuals potentially exposed to the case-patient during the infectious period (from four days before rash onset through four days after) should be quickly identified. Note that in a closed setting, the measles virus has been reported to have been transmitted by airborne or droplet exposure up to two hours after the measles case occupied the area.
- All contacts should be assessed for presumptive evidence of immunity. If the criteria for presumptive evidence of immunity is not met, these individuals should be considered susceptible.

PRESUMPTIVE EVIDENCE OF IMMUNITY

Presumptive evidence of immunity can be established in any of the following ways:

- Written documentation of one or more doses of a measles-containing vaccine administered on or after the first birthday for preschool-age children and adults not considered high-risk
- Written documentation of two doses of measles-containing vaccine for school-age children and adults at high risk, including students at post-high school secondary educational institutions, healthcare personnel (HCP), and international travelers
- Laboratory evidence of immunity
- Laboratory confirmation of disease
- Birth before 1957

NOTE: Verbal reports of measles vaccination or measles infection without written documentation should not be accepted as presumptive evidence of immunity.

NOTE: Although birth before 1957 is considered acceptable evidence of immunity for HCP in routine circumstances, healthcare facilities should consider vaccinating HCP born before 1957 who lack laboratory evidence of immunity or laboratory confirmation of disease. During a measles outbreak, two doses of measles virus-containing vaccine are recommended for all HCP, regardless of year of birth.

POST-EXPOSURE PROPHYLAXIS (PEP) RECOMMENDATIONS

- Prophylaxis of susceptible household contacts should occur immediately and should not be delayed because of pending laboratory results.
- Waiting for laboratory confirmation of measles infection prior to prophylaxis of non-household contacts (e.g., schoolmates) may be reasonable in some situations; however, this should be evaluated on a case-by-case basis.
- **Use of MMR Vaccine as PEP**
    - Measles vaccine should be provided to exposed susceptible persons who do not have a contraindication to MMR vaccine.
    - Measles vaccine should be given as soon as possible after the first exposure, and

mightbe effective as prophylaxis if given up to 72 hours of the last exposure to measles.
    - However, vaccine should be administered to susceptible individuals regardless of time since exposure in order to provide protection against subsequent measles exposures.
- **Use of Immune Globulin (IG) as PEP**
    - If the vaccine cannot be given, IG might be effective as a prophylaxis if administered to susceptible persons within 6 days of their last exposure.

EXCLUSION OF CONTACTS

Asymptomatic contacts who demonstrate presumptive evidence of immunity do not need to be excluded. For all others:

- Contacts lacking presumptive evidence of immunity who do not receive appropriate postexposure prophylaxis within the appropriate time must be excluded from school, childcare, healthcare facilities, and workplaces until at least 21 days after the last exposure to a case during the infectious period:
    - From schools and childcare until at least 21 days after the onset of rash in the last case identified
    - From medical settings from the 5th day after first exposure through the 21st day after last exposure
- For contacts who are HCP and lack presumptive evidence of immunity:
    - HCP with no prior documented doses of MMR should be offered the first dose of MMR vaccine and should be excluded from work from day 5 after their first measles exposure through day 21 following their last exposure.
    - HCP who received a single dose of MMR vaccine prior to exposure may remain at work and should receive the second dose of MMR vaccine at least 28 days after the first dose.
    - HCP who receive IG as PEP should be excluded from work from the 5th day after their first exposure through the 21st day after their last exposure
- Contacts who lack presumptive evidence of immunity and who receive <u>vaccine PEP</u> within 72 hours of exposure can be immediately readmitted to childcare, school, or non-healthcare work.
- Contacts who lack presumptive evidence of immunity and receive <u>IG PEP</u> should be excluded from settings where transmission risk is high (e.g., settings with a large number of susceptible persons or infant care settings). Exclusion should last at least 21 days, and ideally 28 days, following the last exposure to a case during the infectious period.
- Contacts who develop signs or symptoms of measles, regardless of evidence of immunity or receipt of PEP, should be excluded from school, childcare, healthcare facilities, and workplaces, until evaluated further.

SYMPTOM MONITORING

- <u>All</u> contacts (regardless of evidence of immunity or receipt of PEP) should monitor for measles signs and symptoms for at least 21 days after the last measles exposure.
    - Individuals who receive IG PEP should monitor for 28 days after last measles exposure (because receipt of IG PEP may prolong the duration of the incubation period of measles)
- Note that previously vaccinated individuals may have a modified disease presentation.

- If signs or symptoms develop, contacts should be instructed to contact their local health department by phone. If the individual requires an in-person medical evaluation, the local health department should call ahead to alert the healthcare facility.

Outbreaks

A measles outbreak is defined as two or more epidemiologically linked cases occurring within a 42-day period, AND at least one case is laboratory-confirmed. During a measles outbreak, follow the investigation steps and control measures for each identified case. Further response measures (e.g., facility-wide or public communications, additional vaccination, and exclusion recommendations) will be considered on a case-by-case basis.

Active surveillance should be maintained for at least two incubation periods (42 days) after the last reported confirmed case to ensure that all cases are identified before the outbreak investigation closes.

References

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2. Centers for Disease Control and Prevention. Epidemiology and Prevention of Vaccine Preventable Diseases. 14th Edition. 2021. Chapter 13: Measles. Available at https://www.cdc.gov/pinkbook/hcp/table-of-contents/chapter-13-measles.html.
3. Centers for Disease Control and Prevention. Manual for the Surveillance of Vaccine Preventable Diseases. 2019. Chapter 7: Measles. Available at https://www.cdc.gov/surv-manual/php/table-of-contents/chapter-7-measles.html.
4. Centers for Disease Control and Prevention. Pink Book. 2024. Rubeola/Measles. Available at https://www.cdc.gov/pinkbook/hcp/table-of-contents/chapter-13-measles.html.
5. Centers for Disease Control and Prevention. National Notifiable Diseases Surveillance System. 2021. Measles/Rubeola 2013 Case Definition. Available at https://ndc.services.cdc.gov/case-definitions/measles-2013/.
6. Centers for Disease Control and Prevention. Interim Infection Prevention and Control Recommendations for Measles in Healthcare Settings. 2024. Available at https://www.cdc.gov/infection-control/hcp/measles/index.html

Appendix 1- Sample Measles Notification Letter of Potential Exposure

Letterhead of LHD or Facility

Date

Dear Parent/Guardian/Staff,

We are writing to inform you that a case of measles has been reported in our community.

Measles is a highly contagious disease that often begins with a high fever (≥101°F) and cold-like symptoms such as cough, runny nose, and conjunctivitis (red, watery eyes). This is followed by a red rash that may look like small bumps and last for 5-6 days. The rash usually begins on the head and then spreads to the neck, torso, arms, and legs. The rash usually appears 14 days after a person is exposed.

Measles is spread through the air and can even be spread in a closed area (e.g., a classroom) up to two hours after the person with measles has left the area. A person with measles can spread the disease from four days before a rash appears until four days after the rash appears. There is no specific treatment for measles.

Persons suspected of having measles must stay home from school/daycare/work for 4 days after the rash appears. Exposed, unvaccinated students and staff should receive a dose of vaccine as soon as possible. Those unvaccinated students and staff who receive a measles-containing vaccine will be allowed back to school immediately. Unvaccinated students and staff who do not receive a measles-containing vaccine due to medical or religious reasons will be excluded from school/work until 21 days after the onset of rash in the last case of measles.

Measles can be prevented with appropriate vaccination. Please check with your healthcare provider to make sure your/your child's shots are up to date.

Attached is a Measles Fact Sheet. If you/your child experience(s) measles symptoms during the next several weeks, please contact your healthcare provider and let them know about a possible exposure to measles before going into the office to be evaluated. If you/your child has been seen by a healthcare provider and been diagnosed with measles, please notify us and stay home.
If you or your healthcare provider has any questions, please contact (POC at facility/school/daycare) at (###-###-####) or the (local health department) at (###-###- ####).

Sincerely,
Name of Facility/School/Childcare and LHD