

Measles Report Immediately

August 2016 | Page 1 of 17

Section 1

ABOUT THE DISEASE

A. Etiologic Agent

Measles is caused by the measles virus (genus *Morbillivirus*, family *Paramyxoviridae*).

B. Clinical Description

Measles is an acute disease characterized by fever, cough, runny nose, conjunctivitis, erythematous maculopapular (both raised and flat lesions) rash, and characteristic mouth lesions (Koplik spots). The prodrome, which lasts 2–4 days (range 1–7 days), is characterized by a fever that increases in stepwise fashion, peaking as high as 103 - 105°F. This is followed by the onset of cough, runny nose (coryza), and/or conjunctivitis. Koplik spots, white spots (enanthem) present on the buccal mucosa (inside of cheeks), is considered to be definitive for measles in the presence of other signs and symptoms. It occurs 1–2 days before the rash to 1–2 days after the rash, and appears as small blue-white spots on the bright red background of the buccal mucosa (inside of cheeks).

The measles rash is a maculopapular eruption that usually lasts 5–6 days. Classically, it begins at the hairline, then involves the face and upper neck. During the next three days, the rash gradually proceeds downward, reaching the hands and feet. The maculopapular lesions are generally discrete, but may become confluent, particularly on the upper body. Initially, lesions blanch with pressure. Fine, scaly desquamation may occur over more severely involved areas. The rash fades in the same order that it appears, from head to the extremities. Other symptoms of measles include loss of appetite, diarrhea (especially in infants), and generalized lymphadenopathy.

Complications of measles include otitis media, pneumonia, laryngotracheobronchitis (croup), encephalitis (approximately 5–10 per 10,000 reported cases), seizures with or without fever (6–7 per 1000 reported cases), and death (approximately 2–3 per 1,000 reported cases, mostly from pneumonia and occasionally from encephalitis (1/1,000)). The risk of death from complications of measles is higher in younger children, older adults, and individuals with immunosuppression. Pneumonia complicates 6% of measles cases in the U.S., and 19% of measles cases are hospitalized. Measles in an immunocompromised person may be severe, with a prolonged course, particularly in those with T-cell deficiencies (certain leukemias, lymphomas, and HIV/AIDS). This type of measles may occur without the typical rash, and the patient may shed the virus for several weeks after the acute illness.

One rare long-term sequela of measles virus infection is subacute sclerosing panencephalitis (SSPE), a fatal disease of the central nervous system that generally develops 7–10 years after infection. Among persons who contracted measles during the resurgence in the United States (U.S.) in 1989–1991, the risk of SSPE was estimated to be 4–11 cases/100,000 cases of measles. The risk of developing SSPE may be higher when measles occurs prior to the second year of life.

Measles during pregnancy results in a higher risk of premature labor, spontaneous abortion, and low-birth-weight infants. Birth defects (with no definable pattern of malformation) have been reported rarely, without confirmation that measles was the cause.

C. Vectors and Reservoirs

Humans are the only host for measles.

D. Modes of Transmission

Measles is transmitted from person to person by droplet or direct contact with nasopharyngeal secretions of an infected person, and by the airborne route. According to the Pink Book (2015), “airborne transmission via droplet nuclei has been documented in closed areas (e.g., office exam room) for up to two hours after a person with measles occupied the area.”

E. Incubation Period

The incubation period of measles, from exposure to prodrome, averages 10–12 days. From exposure to rash onset, it averages 14 days (range is 7–18 days).

F. Period of Communicability or Infectious Period

The infectious period is from the four days before to the four days after the day of rash onset (i.e., counting the day of rash onset as day zero). Immunocompromised patients may have prolonged excretion of virus in their secretions and can be infectious for the duration of their illness. Measles is highly infectious, with up to 5,000 infectious particles excreted per hour. Infectious particles may remain suspended in air for hours, depending on ventilation, sunlight exposure, and relative humidity. Asymptomatic carriage has not been documented.

G. Epidemiology

Measles occurs worldwide. In the temperate zones, peak incidence is in late winter and early spring. Measles is the leading vaccine-preventable killer of children worldwide. In developing countries, case-fatality rates average 3–5%, but can range as high as 10–30% in some localities. Since 1997, incidence of measles in the U.S. has been very low, with fewer than 200 cases reported most years. However, in 2014, the United States experienced a record number of measles cases, with 667 cases from 27 states reported to CDC's National Center for Immunization and Respiratory Diseases (NCIRD); this is the greatest number of cases since measles elimination was documented in the U.S. in 2000. Indigenous transmission has been interrupted and an increasing proportion of U.S. cases are imported, often from Europe and Asia, and they occur among U.S. citizens traveling abroad, persons visiting the U.S., and adoptees from other countries. (Cases are considered imported from another country if the rash occurs within 18 days of entering the U.S. and the illness cannot be linked to local transmission.) Due to an aggressive measles vaccination program supported by the Pan American Health Organization, measles incidence is now very low in Latin America and the Caribbean. Measles elimination from the Americas appears to be an achievable goal.

All individuals may be at risk for measles, but those most at risk are generally limited to five groups:

1. Children <12 months of age (those who are too young to be immunized);
2. Unimmunized individuals;
3. Adults who may have received an earlier ineffective measles vaccine prior to 1968 or who are unimmunized because they graduated from school prior to mandatory measles vaccination;
4. Children and adults with only one dose of measles-containing vaccine; and
5. Those who are foreign born and have never been vaccinated or did not have measles as a child in their country of origin.

H. Vaccine Effectiveness

One dose of measles, mumps, rubella (MMR) vaccine induces measles immunity in about 95% of vaccinees; however, due to measles' extreme infectiousness, 2 doses are necessary to prevent outbreaks in the 5% that remain susceptible after 1 dose of vaccine. Vaccine failure after 2 doses administered at ≥ 12 months of age is uncommon. Two doses of MMR vaccine are highly effective in preventing measles.

I. Bioterrorist Potential

This pathogen is not considered to be of risk for use in bioterrorism.

Section 2

REPORTING CRITERIA AND LABORATORY TESTING

A. What to Report to the Massachusetts Department of Public Health (MDPH)

Report any of the following:

- A suspect case of measles as diagnosed by a health care provider
- Positive serologic test for measles immunoglobulin M (IgM)
- IgG seroconversion or a significant rise in measles immunoglobulin G antibody using any evaluated and validated method
- Detection of measles-virus specific nucleic acid from a clinical specimen using polymerase chain reaction (PCR)
- Isolation of measles virus from a clinical specimen

Note: See Section 3C for information on how to report a case.

B. Laboratory Testing Services Available

Before sending sera and clinical specimens to the Massachusetts State Public Health Laboratory (MA SPHL) for virus isolation, **please call an MDPH epidemiologist (24 hours a day/7 days a week) at (617) 983-6800**. See *Attachment A: Measles Testing – Specimen Collection* (at the end of this chapter) for instructions on collecting and submitting specimens to MA SPHL.

PCR and Culture Testing

Virus Isolation/Molecular Characterization of Measles (Measles PCR and Culture)

Virus isolation from, and detection by real time polymerase chain reaction (RT-PCR) in, clinical specimens is very useful for disease control purposes as well as confirming measles. PCR results can be available within 24 to 48 hours after receipt of specimen during regular business hours. Molecular characterization of measles virus can help determine the source of the infection and identify linked cases and outbreaks. Molecular epidemiologic surveillance helps: 1) determine the origin of the virus; 2) determine which viral strains are circulating in the U.S. and whether these viral strains have become endemic; and 3) in cases where serology is not useful or possible (for example, when a suspect case has been recently vaccinated with MMR), can confirm the case and distinguish between wild-type virus and vaccine virus.

The MA SPHL Virus Isolation Laboratory will forward all measles isolates and any original specimens collected from IgM-positive patients to the U.S. Centers for Disease Control and Prevention (CDC) for further genotyping.

Serologic Testing

Measles IgM Antibody Test

It is important to obtain laboratory confirmation of cases of measles and suspect cases of measles. There are issues relating to the sensitivity and specificity of commercially available IgM antibody tests. The MDPH strongly recommends submission of specimens to the MA SPHL. A specimen drawn at least three days after onset of rash allows sufficient time for the development of measurable antibody. However, a serum collected at any time prior to 3 days after onset of rash is acceptable and will be tested. Please note that if a serum is collected prior to the third day, and is negative, a follow-up specimen will be requested. The amount of serum required is at least 2 mL.

Measles IgG Antibody Paired-titer Test

In rare circumstances, paired testing for IgG antibody can be helpful when measles IgM antibody results are not interpretable. An acute serum should be collected as soon as possible after onset of rash; convalescent serum should be collected approximately 14 days later. The suspect case can be confirmed if there is a 4 fold or higher rise in measles IgG from the acute to convalescent specimen.

Measles IgG antibody testing is performed at the MA SPHL under special circumstances and after consultation with a MDPH epidemiologist. The amount of serum required is at least 2 mL.

Shipment of Sera

Sera should be sent on a cold pack with a completed MA SPHL *Specimen Submission Form* found on the MDPH website at: <http://www.mass.gov/eohhs/docs/dph/laboratory-sciences/general-submission-form.pdf>.

MA State Public Health Laboratory
305 South Street
Jamaica Plain, MA 02130

Antibody Avidity Testing

Antibody avidity testing can be performed at the CDC when testing at MA SPHL is difficult to interpret. The serum is sent to CDC for avidity testing which determines if it is a true positive based on if the result shows high or low avidity. High avidity indicates infection with measles occurred more than 3 months before collection of the specimen; low avidity indicates infection with measles within the past 3 months or that an individual was recently vaccinated.

The table below and *Attachment A: Measles Testing – Specimen Collection* (at the end of this chapter) provide more detail with regard to specimen collection for measles testing.

Measles Testing Summary

Test	Specimen	Timing (1 st specimen)	Timing (2 nd specimen)	Turnaround Time
Measles IgM	Serum (SST or red top)	Acute, at time of diagnosis; also send a serum to hospital or commercial lab for measles IgG testing	After day four of rash	1-2 days
PCR	NP or OS in VTM/UTM	ASAP, ideally \leq day 5 or < 14 days post rash	N/A	1-2 days
Culture	NP or OS in VTM/UTM; urine	ASAP, ideally \leq day 5 of rash	N/A	Up to 2 weeks

When submitting clinical specimens to the MA SPHL, you must use the MA SPHL Specimen Submission Form, which can be found on the MDPH website at <http://www.mass.gov/eohhs/docs/dph/laboratory-sciences/general-submission-form.pdf>. Use one form for each specimen.

Section 3

REPORTING RESPONSIBILITIES AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify all cases and susceptible exposed individuals rapidly to prevent further spread of this highly contagious infection.
- To identify the source of infection. Genotyping of viral isolates allows for determination of patterns of importation and transmission.
- To help in the international effort to eradicate measles.

B. Laboratory and Health Care Provider Reporting Requirements

Measles is reportable to the local board of health (LBOH). The MDPH requests that health care providers immediately report by telephone to the LBOH in the community where the case is diagnosed, all confirmed or suspect cases of measles, as defined by the reporting criteria in Section 2A.

Report immediately: Due to the potential significance of a measles case, the MDPH requests that information about any case also be immediately reported by telephone (24 hours per day, 7 days per week) to an MDPH epidemiologist at the MDPH Division of Epidemiology and Immunization by calling (617) 983-6800.

Laboratories performing examinations on any specimens derived from Massachusetts residents that yield evidence of measles infection, including measles virus IgM+, measles IgG seroconversion or a significant rise in IgG, detection of measles virus using PCR, or isolation of measles virus, shall immediately report such evidence of infection, directly by phone, to the MDPH Division of Epidemiology and Immunization at (617) 983-6800. Additionally, all laboratories performing examinations on any specimens derived from Massachusetts residents are required to submit all specimens with indication or suspicion of measles virus presence directly to the MA SPHL for further examination.

C. Local Board of Health (LBOH) Reporting and Follow-Up Responsibilities

Reporting Requirements

MDPH regulations (*105 CMR 300.000*) stipulate that measles is reportable to the LBOH and that each LBOH must report any case of measles or suspect case of measles, as defined by the reporting criteria in Section 2A. Cases should be reported immediately (24 hours a day, 7 days a week) to an MDPH epidemiologist at the MDPH Division of Epidemiology and Immunization by calling (617) 983-6800.

Case Investigation

Depending on local public health capacity, the MDPH may take the lead on measles case investigation and control recommendations in partnership with the LBOH. When this is necessary, the MDPH will keep the LBOH informed of all significant developments through MAVEN and will request the assistance of the LBOH as needed. Rapid implementation of disease control measures is an integral part of case investigation. It is the responsibility of the LBOH to understand, and if necessary, institute the control guidelines listed in Section 4.

Essential components of case investigation include establishing a diagnosis of measles, obtaining immunization history for confirmed cases, identifying sources of infection, assessing potential for transmission, identifying susceptible contacts and obtaining specimens for viral isolation. In order to assess the likelihood that a suspect case is a true case prior to laboratory testing, the MDPH and/or other public health staff helping in the investigation should ask about:

- Clinical presentation – people with measles are usually very ill;
- Measles immunization history (two doses of MMR are very protective);
- Country of origin and length of residence in U.S. (those in the U.S. for a short time are more likely to be susceptible);
- Recent history of travel (to where and dates);
- Whether there were any recent out-of-town and out-of-country visitors (from where and dates);
- Whether there was any recent contact with anyone with similar symptoms;
- Risk factors for severe disease (e.g., <12 months of age, pregnancy, immunosuppression);
- Exposure and transmission settings (e.g., health care, childcare, school, institutional/residential settings [e.g., correctional, shelter, group home, military, and college—any setting where large numbers of foreign-born individuals are employed or live]); and
- Laboratory information, including viral isolation and serologic test results.

Using MAVEN

As indicated above, depending on local capacity, the MDPH epidemiologist may enter most, if not all, measles case investigation information into MAVEN. In other circumstances the LBOH will enter most if not all the information. MDPH staff and local health staff should work in partnership to ensure that all variables are assessed and entered.

Administrative Question Package

Monitor your “Online LBOH Notification for Immediate Disease” workflow in MAVEN for any new cases of measles. An MDPH Epi-of-the-Day (EOD) will review all new cases and initiate immediate follow-up for measles events. Depending on local capacity, EODs may take the lead for case investigation and will coordinate follow-up with the LBOH as needed. Once a new event appears in this workflow, open the Administrative Question Package (QP) and under the “Local Health and Investigation” section, answer the first question “**Step 1** – LBOH acknowledged” by selecting “Yes.” The “LBOH acknowledged date” will auto-populate to the current day. Completing this first step will move the event out of this workflow and into your “Online LBOH notified but Case Report Forms (CRF) are pending” workflow. The EOD leading the case investigation will document when the investigation was initiated by answering “**Step 2** – Investigation started” as “Yes” and then noting the date where shown. The epidemiologist leading the investigation will record his or her name and phone number where shown in “**Step 3** – LBOH/Agency Investigator.” If you are actively involved with the investigation, you should add a new line for **Step 3** and enter your name, agency, and phone number as well.

Demographic Question Package

Record all demographic and employment information. It is particularly important to complete the Race/Ethnicity, Place of Birth (country), and Occupation questions.

Clinical Question Package

Complete the “Diagnosis/Clinical Information” section, providing symptom and other medical information. For case classification purposes, it is particularly important that Rash/Rash Onset Date, Fever, Cough, Coryza, and Conjunctivitis symptom questions are answered, as well as information about the duration and distribution of the rash.

Vaccine and IG Information Question Package

Enter at least vaccine type and date for any documented doses of measles-containing vaccine. If the case has no documentation of measles-containing vaccines or does not know his or her history, “Vaccination history unknown” should be selected. If the case is known to be unvaccinated, “No vaccine administered” should be selected and an answer to the question “If not vaccinated, why not received?” should be entered.

Risk/Exposure/Control & Prevention Question Package

Accurately record all risk questions about travel, exposures, and where the case acquired measles. Please note that measles is not currently endemic in the United States, and cases of measles typically will have traveled themselves or been in contact with an international traveler. It is important to identify the source of infection and whether the case can be tied to an international importation.

Epi-linked and Outbreak Information Question Package

The EOD leading the case investigation will complete questions about links to other cases or outbreaks.

Completing Your Investigation

The EOD leading the case investigation will mark “Step 4 – Case Report Form Completed” as “Yes” and then choose “MDPH Epidemiologist” for the Completed by variable. This will move the event out of your “Online LBOH notified but Case Report Forms (CRF) are pending” workflow and into your “Online LBOH needs final review” workflow. Answer “Step 5 – LBOH final review” as “Yes” to move the case out of this workflow and complete the investigation.

Section 4

CONTROLLING FURTHER SPREAD

This section provides detailed control guidelines that are an integral part of case investigation and follow-up. LBOHs should familiarize themselves with the information. However, depending on local capacity, the MDPH may take the lead on implementing control measures for measles in collaboration with the LBOH.

A. Isolation and Quarantine Requirements (105 CMR 300.200)

Minimum Period of Isolation of Patient

Through four days after onset of rash (counting the day of rash onset as day zero). Patients suspected of having measles should be isolated immediately, and should refrain from all public activities for four days after day of rash onset, or until it is determined that the patient does not have measles.

Minimum Period of Quarantine of Contacts

Susceptible contacts born in or after 1957, who are not appropriately immunized or do not have laboratory evidence of immunity, will be excluded from work, classes or other public activities from the fifth through the 21st day after their exposure even if they receive immune globulin. If exposure was continuous and/or if multiple cases occur, susceptibles will be excluded through the 21st day after rash onset in the last case. Health care workers and inpatients, regardless of year of birth, who are not appropriately immunized or do not have laboratory evidence of immunity, will be excluded from work (health care workers) or isolated with airborne precautions (inpatients) from the fifth day after their first exposure through the 21st day after their last exposure. These restrictions for health care workers and inpatients remain even if they received IG or were vaccinated post-exposure.

B. Protection of Exposed Contacts of a Case

Note: In cases of high suspicion of measles, implementing control measures before laboratory confirmation may be necessary.

1. **Isolate the case** during his/her infectious period, as defined in Section 4A.
2. **Verify rash onset date** to determine infectious period (four days before day of rash onset – four days after day of rash onset).
3. **Identify all exposed** contacts of the case while the case was infectious. Consider individuals in the following areas/groups, if they were in contact with the case during the case’s infectious period (4 days before through 4 days after rash onset; rash onset = Day 0; total 9 days): household; the medical facility where the case was seen (other patients and staff, including staff with and without direct patient contact); school/daycare (students and staff); the case’s workplace (especially daycare centers, schools,

and medical settings); any religious/social groups exposed to the case; case's sports teams/extracurricular activity groups; bus or carpool; close friends; and social events, travel sites, etc. This information about possible exposures needs to be as accurate and detailed as possible. *Note: This list is not exhaustive and other exposed contacts may be defined. Measles is so contagious that everyone at an entire institution is often considered exposed. Individuals present in a room at the same time as a case, as well as for 2 hours after the case has left the room are considered exposed.*

4. Of those exposed to the case during their infectious period, **identify high-risk susceptibles for referral to their health care providers** (those without evidence of immunity who are at high risk of complications if they develop measles). **Pregnant women, immunocompromised individuals, such as with leukemia and HIV infection, and infants <12 months of age should be referred to their health care providers.** They may benefit from treatment with immune globulin. See 4a below.

Presumptive Evidence of Immunity to Measles

If someone has evidence of immunity listed below, they are presumed to be immune to measles; if they do not, they are presumed to be susceptible to measles.

a. Born in the U.S. before January 1, 1957

- i. Year of birth does NOT constitute acceptable evidence of immunity for health care workers. See Section 4C for further guidance.
- ii. Year of birth may not constitute acceptable evidence of immunity in foreign-born individuals (see below for explanation).

OR

- b. Two doses of measles-containing vaccine**, given at least 4 weeks apart and beginning at ≥ 12 months of age, and the 2nd dose given prior to or within 72 hours of exposure. (In most low-risk situations, individuals receiving their first dose within 72 hours of exposure will also be considered immune.);

OR

- c. Serologic immunity (a "positive antibody titer"), or laboratory evidence of past infection.**

Additionally, please note that:

- a. Physician-diagnosed disease alone is NOT acceptable evidence of immunity.
- b. Susceptibles include those with medical and religious exemptions to immunization.

Year of Birth as Evidence of Immunity

Epidemiological data indicate that most individuals born in the U.S. before January 1, 1957 are immune to measles. This has not been found to apply uniformly to those born prior to 1957 in other countries, where the epidemiology of measles was not the same and where measles immunization may not have been routine. However, many people born in other parts of the world prior to 1957 had measles; therefore, it may make sense to prioritize younger susceptibles for measles follow-up.

4a. **Post-exposure Prophylaxis with Immune Globulin (IG):** IG can prevent or modify measles in persons who are nonimmune, if given within 6 days of exposure. There are three groups of patients at increased risk of severe disease from measles: infants <12 months; pregnant women without evidence of measles immunity; and severely immunocompromised individuals. The recommended dose of IG administered intramuscularly (IGIM) is 0.5 mL/kg of body weight (maximum dose = 15 mL) and the recommended dose of IG given intravenously (IGIV) is 400 mg/kg.

- **Recommended use of IGIM in infants <12 months:** IGIM should be administered to all infants aged <12 months who have been exposed to measles. For infants aged 6 through 11 months, MMR vaccine can be administered in place of IG if administered within 72 hours of exposure. Note that children vaccinated before their first birthday should be revaccinated when they are 12-15 months old, and again at 4-6 years of age.
- **IGIV use in pregnant women without evidence of immunity:** IGIV should be administered to pregnant women without evidence of measles immunity who have been exposed to measles. IGIV is recommended at doses high enough to achieve estimated protective levels of measles antibody titers.
- **IGIV use in immunocompromised patients:** Severely immunocompromised patients (such as from leukemia and HIV infection) who are exposed to measles should receive IGIV prophylaxis regardless of immunologic or vaccination status because they may not be protected by the vaccine.

Please refer to the June 2013 ACIP statement regarding measles, mumps and rubella for additional information concerning IG and management of immunocompromised people: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm>

4b. **Exclude** from all public activities for days 5-21 after exposure. Exposure date is day zero. Those excluded should be asked to contact state and local public health immediately if they develop symptoms of measles, and to call their healthcare provider before going in for an evaluation, in order to avoid exposing others.

5. **Identify all other susceptibles, for possible vaccination.** Susceptibles are those individuals without presumptive evidence of immunity, as defined above.

5a. Immunize all other susceptibles ASAP (except for those for whom vaccination is contraindicated). Please review *Current MMR Vaccine Recommendations*: <http://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/mmr.html> and *Current MMR Vaccine Information Statement*: <http://www.cdc.gov/vaccines/hcp/vis/vis-statements/mmr.html>. Keep in mind the following:

- **Measles vaccine given within 72 hours of exposure can prevent disease.**
- Vaccinate susceptibles **even if it is >72 hours** post-exposure. It will protect against exposure to the next potential generation of cases. In addition, the situation should be viewed as an opportunity to vaccinate.
- Vaccinating an individual who may be incubating measles is NOT harmful.

Note: after an exposure, some exposed people may decide to get a blood test to demonstrate evidence of immunity to measles. It is recommended that these individuals get vaccinated after their blood is drawn for the titer, in order to ensure timely vaccination if the titer result is negative.

5b. Exclude those susceptibles unable to be vaccinated, or not vaccinated quickly enough (usually 3 days after exposure, occasionally five days), from all public activities for days 5-21 after exposure. Date of exposure is considered day zero. Those excluded should be asked to contact state and local public health immediately if they develop symptoms of measles, and to call their healthcare provider before going in for an evaluation, in order to avoid exposing others.

6. Conduct surveillance for 2 incubation periods (42 days) after rash onset in the last case or the last exposure in the setting, whichever is later.

Summary of Measles Exclusion Requirements: Low-risk, Non-health care settings
(For healthcare settings see Section 4C.)

Case and Symptomatic Contacts

Exclude through the 4th day after rash onset (count day of rash onset as day zero). They may return to normal activities on the 5th day. Criteria for isolation/exclusion of case are more rigorous for immunocompromised individuals and for those in health care settings, as outlined in Section 4C.

Asymptomatic Contacts

Discrete exposure to one case: Exclude susceptibles for 5–21 days postexposure. They may return to normal activities on the 22nd day.

Continuous exposure to one case/multiple cases: Exclude susceptibles for 21 days from date of rash onset in last case. They may return to normal activities on the 22nd day.

Exclusion of asymptomatic contacts is enforced even if the individual received post – exposure prophylaxis with IG.

See Section 4A (above) for Isolation and Quarantine requirements.

C. Managing Special Situations

Schools

Determine if there are any:

- Pregnant teachers, pregnant staff (including those without direct contact with students), or pregnant students, anywhere in the school. Refer as per 4 and 4a above.
- Immunocompromised individuals among the students, teachers, and staff anywhere in the school. Refer as per 4 and 4a above.
- Medical/religious exemptions anywhere in the school, among both students and staff. It is particularly important to identify these individuals in the classroom and grade of cases. Remember,

these susceptible individuals (who do not get vaccinated) must also be excluded for the appropriate time period.

- Extracurricular or sporting events that occurred during the infectious period of the case. If so, a large notification, and/or public notification, may be necessary. Please consult with MDPH if a large notification may be necessary.

Exclusion Criteria

Susceptible contacts, including those in classrooms, at extracurricular activities, and in other settings, who have already received one dose of MMR and received a second dose of measles-containing vaccine within 72 hours of exposure can be readmitted; otherwise, they should be excluded, as above. In some settings, individuals who have received their first or second dose >72 hours post-exposure, but within a specified time period (as determined by the MDPH with the LBOH), may be allowed to continue to attend classes. In some rare settings where very high-risk susceptibles are present, the MDPH may recommend that susceptible students and staff be excluded, even if they have been immunized within 72 hours.

If multiple cases occur, recommendations may be revised to include other classrooms and teachers.

Notification

- Notify groups or schools exposed during the infectious period.
- Surveillance and control measures will need to be instituted in these groups or schools.

Health Care Settings

Recommendations for health care facilities are more rigorous.

Evidence of Immunity

Ill health care personnel have contributed to the spread of measles in medical settings. Documentation of presumptive evidence of immunity is extremely important. Acceptable presumptive evidence of immunity in healthcare personnel includes:

Written documentation of vaccination with two doses of MMR vaccine administered at least 28 days apart; serologic evidence of measles immunity; or laboratory confirmation of disease.

Surveillance: All exposed to measles in a healthcare setting, even those with two doses of MMR, should monitor themselves for measles symptoms for 21 days following an exposure.

D. Preventive Measures

Personal Preventive Measures/Education

Vaccination, including routine childhood vaccination, catch-up vaccination of adolescents, and targeted vaccination of high-risk adult groups (including international travelers), is the best preventive measure against measles. It is particularly important to vaccinate susceptible household contacts of high-risk susceptibles who cannot themselves be vaccinated, such as immunocompromised individuals, pregnant

women, and infants. Good personal hygiene (which consists of proper hand washing, disposal of used tissues, not sharing eating utensils, etc.) is also important in preventing measles. Please refer to the *References* section, the most current versions of MDPH's Immunization Guidelines, MDPH's Model Standing Orders for MMR Vaccine, and *Massachusetts Immunization Program State-Supplied Vaccines and Patient Eligibility Criteria*, for recommended schedules, groups recommended, and groups eligible to receive state-supplied vaccine. These, as well as other relevant resources, are available through the MDPH Division of Epidemiology and Immunization at (617) 983-6800 and on the MDPH website at www.mass.gov/dph/imm.

ADDITIONAL INFORMATION

The following is the formal CDC surveillance case description for measles. It is provided for your information only and should not affect the investigation and reporting of a case that fulfills the criteria in Section 2A of this chapter. (The CDC and the MDPH use the CDC case definitions to maintain uniform standards for national reporting on a national basis.) For reporting to the MDPH, always use the criteria outlined in Section 2A.

Note: CDC case definitions are available on the CDC website at <http://www.cdc.gov/vaccines/pubs/surv-manual/index.html>

Clinical Description:

An acute illness characterized by all the following:

- Generalized maculopapular rash lasting ≥ 3 days;
- Temperature $\geq 101^\circ\text{F}$ (38.3°C); and
- Cough, coryza, or conjunctivitis.

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 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 (PCR); or
- IgG seroconversion or a significant 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 $\geq 101^\circ\text{F}/38.3^\circ\text{C}$ and 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 testing in a public health laboratory.

RESOURCES

Attachment A: Measles Testing – Specimen Collection

Attachment B: Measles Control in Medical Settings – Initial Steps

Current MMR Vaccine Recommendations: <http://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/mmr.html>

Current MMR Vaccine Information Statement: <http://www.cdc.gov/vaccines/hcp/vis/vis-statements/mmr.html>

Prevention of Measles, Rubella, Congenital Rubella Syndrome, and Mumps, 2013: Summary Recommendations of the Advisory Committee on Immunization Practices (ACIP)
<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm>

REFERENCES

American Academy of Pediatrics. [Measles.] In: Kimberlin, D.W., ed. *Red Book: 2015 Report of the Committee on Infectious Diseases, 30th Edition*. Elk Grove Village, IL, American Academy of Pediatrics; 2015: 535–547.

American College of Obstetricians and Gynecologists (ACOG). *Immunization During Pregnancy*. ACOG Committee Opinion No. 282, January 2003.

CDC. *Epidemiology & Prevention of Vaccine-Preventable Diseases: The Pink Book, 13th Edition*. CDC, 2015.

CDC. Immunization of Health Care Personnel: Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR*. 2011, 60(RR07);1-45.

CDC. *Manual for the Surveillance of Vaccine-Preventable Diseases*. CDC, 2013.

CDC. Measles, Mumps, and Rubella—Vaccine Use and Strategies for Elimination of Measles, Rubella, and Congenital Rubella Syndrome and Control of Mumps. Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR*. 1998; 47(RR-8).

Heymann, D.L. ed. *Control of Communicable Diseases Manual, 20th Edition*. Washington, DC, American Public Health Association, 2015.

MDPH. *The Comprehensive School Health Manual*. MDPH, 2007.

MDPH. *Recommended Childhood Immunization Schedule*. MDPH, 2015.

MDPH. *Regulation 105 CMR 300.000: Reportable Diseases, Surveillance, and Isolation and Quarantine Requirements*. MDPH, effective December 2013.

Ray P., Black S., Shinefield H., et al. Risk of Chronic Arthropathy among Women after Rubella Vaccination. Vaccine Safety Datalink Team. *JAMA*. 1997; 278: 551–556.

Measles Testing – Specimen Collection

August 2016 | Page 15 of 17

Attachment A

Report suspect cases immediately

Measles is immediately reportable in Massachusetts, whether suspected or confirmed. Call your local board of health and MDPH at 617/983-6800. Providers in Boston should contact the Boston Public Health Commission at 617/534-5611.

When to test for measles:

A clinical diagnosis of measles must be confirmed by laboratory testing. Consider lab testing for patients with symptoms consistent with measles:

- Fever of 101°F or higher
- Cough, coryza, or conjunctivitis and
- A generalized, descending maculopapular rash

Patients with fever, rash and contact to a known measles case should be given high priority for testing. Asymptomatic patients should **not** be tested for measles. Consider testing for other causes of febrile rash illness, like enterovirus, parvovirus B19, rubella, and human herpesvirus-6 virus (roseola). Note: two doses of MMR vaccine are considered to be about 97% effective in preventing measles.

Isolate the patient: Mask and isolate the suspect patient as much as possible and consolidate care; use a negative air pressure room if available. Clinicians should wear N95 or higher level of protection respirators. Do not use the exam room for two hours after the patient has left.

What specimens should be collected?

In general, when measles is suspected, MDPH recommends the collection of **serum** for measles immunoglobulin M (IgM) testing and an **oropharyngeal swab (OS, throat swab)** or **nasopharyngeal swab (NPS)** for measles PCR testing. The serum and NPS/OS specimens should be sent to the Massachusetts State Public Health Laboratory (MA SPHL) in Jamaica Plain for testing. A measles IgG test (for evidence of immunity to measles) should be performed at a hospital or commercial laboratory. A urine sample may also be helpful as a back-up specimen for virus isolation. The NPS can be tested for other causes of illness if PCR negative for measles. **Collect these specimens before the patient leaves your office.**

Timing of specimen collection

- Collect the OS or NPS as soon after onset of rash as possible, ideally within five days of rash onset but acceptable up to 14 days post rash onset.
- Collect an acute serum at the same time.
- Collect urine as a back up specimen (up to 45 mL in a sterile leak-proof container, kept cold)
- A second serum may be requested five days after rash onset.

Collecting a throat swab or NP swab (for measles PCR)

- Use a sterile synthetic swab with a polyester or Dacron tip (flocked swabs are ideal). Do NOT use wooden sticks, cotton swabs, swabs with calcium alginate tips, charcoal swabs, gel swabs or dry swabs.
- Firmly rub nasopharyngeal passage (NPS) or tonsillar region/posterior nasopharynx (OS) with the sterile synthetic swab.
- The swab must be placed and sent wet in viral transport medium (VTM) or universal transport medium (UTM). Agitate the swab for at least 30 seconds in a tube containing 2 mL VTM. The swab should be left in the tube. Break/cut the end if necessary.
- **Dry swabs are not suitable for testing, and will not be tested.**

Collecting serum

- At least 2 mL of serum should be collected in a serum-separator tube. A red-top tube is an acceptable alternative if a serum separator tube is not available.
- The serum specimen must be spun before submitting it.
- If the initial specimen is negative, a second specimen may be requested at five days after rash onset.

Storing, labeling and shipping the specimens

Keep specimens refrigerated at 4°C and send on cold packs as soon as possible. Ensure that specimen containers are firmly closed and clearly labeled with two unique identifiers, such as patient name and date of birth. If your specimens will not be sent to the MA SPHL within 48 hours, specimens may be stored and shipped at -70°C or colder. Do not freeze at -20°C because storage at this temperature will harm the measles virus. Avoid freeze-thaw cycles. Cracked and leaking containers will be rejected.

Complete the Specimen Submission Form

Use one form for each specimen submitted. Include provider contact information and all important details (patient demographics, symptoms, rash onset date, recent travel history and possible exposure to measles). Failure to fully complete this form will delay testing. The Specimen Submission Form is on the MDPH website at <http://www.mass.gov/eohhs/docs/dph/laboratory-sciences/general-submission-form.pdf>

How do I get the specimen to the MA SPHL?

Using your own courier is usually the best way to get a specimen to MA SPHL in a timely manner. In high-suspect situations and outbreaks, MDPH may be able to provide a courier to pick up the specimen and deliver to the MA SPHL. Call 617/983-6800.

Measles Testing Summary

Test	Specimen	Timing (1 st specimen)	Timing (2 nd specimen)	Turnaround Time
Measles IgM	Serum (SST or red top)	Acute, at time of diagnosis; also send a serum to hospital or commercial lab for measles IgG testing	After day four of rash	1-2 days
PCR	NP or OS in VTM/UTM	ASAP, ideally ≤ day 5 or < 14 days post rash	N/A	1-2 days
Culture	NP or OS in VTM/UTM; urine	ASAP, ideally ≤ day 5 of rash	N/A	Up to 2 weeks

Where can I get more information?

Call MDPH at 617-983-6800 or your local board of health.

CDC has measles information for healthcare professionals at <http://www.cdc.gov/measles/hcp/>.

Attachment B

Measles Control in Medical Settings – Initial Steps

Patients with fever, rash and respiratory illness may have measles. Measles usually starts with a prodrome consisting of mild to moderate fever, cough, conjunctivitis and/or coryza. This is followed by fever spikes, often as high as 104-105° F, and a red maculopapular rash that typically starts at the hairline, then affects the face, spreading rapidly down the body. Patients who have recently (within three weeks) been in contact with other people with measles, have been in locations with recent cases of measles, have travelled internationally, or who have visited sites popular with international visitors (tourist attractions, airports) may be at increased risk.



1. **Assess, screen and mask all patients with febrile rash illness immediately on arrival.** Only staff with evidence of immunity to measles should attend suspect measles patients and should wear N95 or higher level of protection respirators to filter airborne particles when caring for suspect measles patients, if possible.
2. **Isolate and consolidate care:** Escort masked patients with febrile rash illness or suspect measles to a separate waiting area or private room, preferably an airborne infection isolation (“negative pressure”) room.
3. **Ask:** Ask patient about risk factors for measles, such as international travel, known exposure to a measles case, vaccine history, and progression of rash.
4. **Report:** Immediately report the suspect case to your local board of health and to the DPH Division of Epidemiology and Immunization at 617/983-6800. Cases diagnosed in Boston should be reported to Boston Public Health Commission (BPHC) at 617/534-5611.
5. **Test:** Obtain specimens including serum, and NP swab or throat swab, and urine, for testing at the MA State Public Health Laboratory in Jamaica Plain (call 617/983-6800).
6. **Restrict:** Do not use the room which has been occupied by a suspect case for two hours following the case’s exit.
7. **Identify:** Identify all exposed patients and staff. This includes patients and families in the waiting and examination rooms up to two hours after suspect case was present; all staff both with and without direct patient contact (e.g., maintenance, administrative support); and due to airborne route of transmission, those in areas of shared air space beyond that occupied by the patient may be considered exposed, potentially encompassing an entire facility.
8. **Document:** Acceptable evidence of immunity for healthcare workers: two doses of MMR or serologic evidence of measles immunity.

Depending on test results and index of suspicion, next steps may include:

Notify exposed potentially susceptible patients and staff quickly, and offer MMR or immune globulin: MMR within 72 hours of exposure may prevent illness. Beyond 72 hours it is usually still recommended, to provide protection against exposure to future cases of measles. For high-risk susceptibles and those ineligible for vaccination, IG ≤6 days after exposure may modify or prevent illness.

Exclusions: MDPH, BPHC (in Boston), or your local health department will provide assistance with quarantine requirements if exclusions are necessary. In general, susceptible individuals exposed to measles who are not appropriately vaccinated within 72 hours of the exposure may need to be excluded from all public activities from day 5 through day 21 after the exposure. In high-risk healthcare settings exclusion criteria may be more rigorous.