Measles (Rubeola) Table of Contents

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Case Definition – Measles / Rubeola - 2013 Case Definition

Overview

- ***Agent*** – Measles virus (also called rubeola).
- ***Reservoir*** – Humans.
- ***Occurrence*** – Measles occurs throughout the world. In endemic, temperate areas, measles disease occurs primarily in late winter and spring.
- ***Risk Factors –*** Traveling outside the United States or to areas where measles is present; being unvaccinated or incompletely vaccinated. Young children, adults older than 20 years of age, pregnant persons, and people with compromised immune systems are at highest risk of severe measles complications.
- ***Mode of Transmission –*** Measles is transmitted person-to-person among close contacts by direct contact with infectious droplets (when a person with measles coughs, sneezes, or breathes out tiny droplets with measles virus into the air and another person breathes them in), or by airborne spread (sometimes the virus can float in the air and infect others for approximately two hours after a person with measles leaves a room). Transmission may also occur by handling or touching contaminated objects and then touching your eyes, nose, and/or mouth. Measles is highly contagious and if an individual has it, as 90% of their susceptible close contacts who are not immune will also become infected with the measles virus.
- ***Period of Communicability –*** Measles may be transmitted from 4 days before to 4 days after rash onset. Maximum communicability occurs from onset of prodrome (or first symptoms) through the first 3-4 days of rash.
- ***Incubation Period*** – The average incubation period for measles from exposure to prodrome is 10-12 days, or from exposure to onset of rash averages 14 days with a range of 7-21 days.
- ***Clinical Illness*** – Measles is characterized by a prodrome that last 2-4 days (range 1-7 days) which appears like the beginning of a cold with a high fever, feeling run down, achy, watery eyes, and runny nose. Two or three days after symptoms begin, tiny white spots with bluish-white centers (Koplik spots) may appear inside the mouth and are considered pathognomonic for measles. A red blotchy rash appears 3-5 days after the prodrome, usually beginning on the face (hairline), spreading down the trunk and down the arms and legs. When the rash appears, a person's fever may spike to more than 104 degrees Fahrenheit. The rash usually lasts 4-7 days. The illness is usually mild or moderately severe. However, approximately 30% of reported measles cases have one or more complications. The most severe complications include diarrhea (8%), middle ear infection (7%), and pneumonia (6%), which is the most common cause of death (60%).
- ***Laboratory Testing*** – Measles virus infection can be confirmed by: (1) detection of measles viral RNA by reverse transcriptase-polymerase chain reaction (RT-PCR); (2) detection of measles virus-specific immunoglobulin (Ig) M; (3) a fourfold increase in measles IgG

antibody concentration in paired acute and convalescent serum specimens (collected at least 10 days apart); or (4) isolation of measles virus in cell culture. Detection of measles-specific IgM antibody in serum and measles RNA by RT-PCR in a respiratory specimen are the most common methods for confirming measles infection. Healthcare providers should obtain both a serum sample and a throat swab (or nasopharyngeal swab) from patients suspected to have measles at first contact with them. Urine samples may also contain virus, and when feasible to do so, collecting both respiratory and urine samples can increase the likelihood of detecting measles virus.

- ***Treatment*** – There is no specific antiviral therapy for measles. The World Health Organization (WHO) currently recommends vitamin A for all children with measles, regardless of their country of residence. See the American Academy of Pediatrics, *Red Book: 2021 Report of the Committee on Infectious Diseases* for dosing information.
- ***Priority*** - Immediate investigation and implementation of control measures is required.

Quick References / Factsheets

- Measles Clinical Diagnosis Fact Sheet (CDC)
- Measles: Questions and Answers (IAC)
- Clinical Overview of Measles (CDC)

Forms

- Disease Case Report (CD-1) PDF format
  - Measles Surveillance Worksheet (CDC)
  - Measles Investigation Form (CDC)
  - Measles Case Line List (CDC)
  - Missouri Outbreak Report Form (MORF)

Notifications

- If measles is suspected, the local public health agency (LPHA) should immediately contact the District Epidemiologists or the Missouri Department of Health and Senior Services (MDHSS) Bureau of Communicable Disease Control and Prevention (BCDCP), phone (573) 751-6113, Fax (573) 526-0235, or for after-hours notification contact the MDHSS Emergency Response Center (ERC) at (800) 392-0272 (24/7).
- If a case(s) is associated with a childcare center, BCDCP or the LPHA will contact the Bureau of Environmental Health Services, phone (573) 751-6095, Fax (573) 526-7377 and the Section for Child Care Regulation, phone (573) 751-2450, Fax (573) 526-5345.
- If a case(s) is associated with a long-term care facility, BCDCP or the LPHA will contact the Section for Long Term Care Regulation, phone (573) 526-8524, Fax (573) 751-8493.
- If a case is associated with a hospital, hospital-based long-term care facility, or ambulatory surgical center BCDCP or the LPHA will contact the Bureau of Health Services Regulation phone (573) 751-6303, Fax (573) 526-3621.

Reporting Requirements

- Measles is a Category 2 (A) disease and shall be reported to the local health authority or MDHSS within one (1) calendar day of first knowledge or suspicion; for after-hours notification, contact the MDHSS ERC at (800)-392-0272 (24/7). All suspect cases of measles should be reported immediately, regardless of waiting for laboratory confirmation.
- Measles is a nationally notifiable condition and measles cases require notification within 24 hours to the Centers for Disease Control and Prevention (CDC), followed by submission of an electronic case notification in the next regularly scheduled electronic transmission. Measles reporting includes the following:
  - For all cases, complete a Disease Case Report and a "Measles Investigation Form" (CDC).
  - All outbreaks or suspected outbreaks must be reported as soon as possible (by phone, fax, or e-mail) to the District Epidemiologists.
  - Within 90 days of the conclusion of an outbreak, submit the final outbreak report to the District Epidemiologists.

Laboratory Testing and Diagnosis

Laboratory confirmation is essential for all outbreaks and all sporadic measles cases. Measles testing is available through commercial clinical laboratories and the Missouri State Public Health Laboratory (MSPHL). The most common tests for confirmation of measles infection include:

- ***Polymerase chain reaction (PCR):*** Detection of measles RNA is most successful when specimens are collected on the first day of rash through the 3 days following onset of rash. Detection of measles RNA by PCR may be successful as late as 10-14 days after rash onset. Collect throat or nasopharyngeal swab specimens as soon as measles disease is suspected. Urine may also contain virus.
- ***IgM:*** Serum should be collected as soon as possible upon suspicion of measles disease. Measles IgM tests that are negative and were collected less than 72 hours after the rash onset should be repeated using sera collected 3-10 days after rash onset.

Because measles is a rare disease in the U.S., even with the excellent laboratory tests available, false positive results for measles IgM will occur. To minimize the problem of false positive laboratory results, it is important to restrict case investigation and laboratory tests to persons most likely to have measles (i.e., those who meet the clinical case definition, especially if they have risk factors for measles, such as being unvaccinated, recent history of travel abroad, without an alternate explanation for symptoms, for example epi-linked to known parvovirus case) or those with fever and generalized maculopapular rash with strong suspicion of measles.

Measles testing performed by the MSPHL must be pre-approved by a District Epidemiologist. After approval, testing should be coordinated through the Virology and Molecular Units by calling (573) 751-3334. Information on the collection and shipment of specimens for measles serology testing by the MSPHL may be viewed at https://health.mo.gov/lab/measlesrubella.php and information on PCR testing is available at https://health.mo.gov/lab/pdf/lab-measles-pcr-guidance.pdf.

Clinical specimens or isolates positive for measles performed by commercial clinical laboratories are to be submitted to the MSPHL for epidemiological or confirmational purposes.

Conducting the Investigation

1. **Verify the diagnosis.** Investigate reports of possible measles cases immediately. Contact the provider, hospital and/or laboratory as needed to obtain the demographic, clinical and laboratory information needed to verify the diagnosis and confirm the current case definition is met.
2. **Obtain accurate and complete immunization history of the case.** Measles case investigations should include complete immunization histories documenting any doses of measles-containing vaccine. Acceptable proof of vaccination is documented administration of live measles vaccine virus. Vaccination histories may be obtained from schools, medical providers, immunization records provided by the case, or immunization registries. Written or electronic records with dates of vaccine administration are the only acceptable evidence of vaccination; self-reported doses and history of vaccination is not valid.
3. **Identify the source of infection.** Efforts should be made to identify the source of infection for every case of measles. Cases or their caregivers should be asked about contact with other known cases within 7–21 days prior to onset of rash. When no history of contact with a known case can be found, opportunities for exposure to unknown cases should be sought. Such exposures may occur in schools (especially high schools with foreign exchange students), during air travel, through other contact with foreign visitors, while visiting tourist locations (casinos, resorts, theme parks), or in health-care settings.
4. **Assess potential for transmission and identify contacts.** Identify everywhere the case went during their infectious period. Identify contacts at those locations and evaluate their evidence of immunity to measles. Evidence of immunity to measles includes any of the following:
    a. Documentation of age-appropriate vaccination with a live measles virus-containing vaccine:
        i. Preschool-aged children: 1 dose administered after the first birthday;
        ii. School-aged children (grades K-12): 2 doses; the first dose administered after the first birthday and the second dose administered at least 28 days after the first dose;
    b. Laboratory evidence of immunity;
    c. Laboratory confirmation of disease; or
    d. Birth before 1957.

High priority groups for contact investigations include household members, close contacts other than household (e.g., persons who shared the same room or airspace in various settings),

health care settings, and schools/child care centers, colleges or other close settings where a defined number of persons have congregated (e.g., churches) because of high contact rates and transmission potential. All contacts should be notified of the possible exposure and educated on what symptoms to watch for and what to do if they become sick.

5. Implement control measures. Isolate the case for four days post rash onset and exclude contacts without presumptive evidence of immunity. Exposed persons who cannot readily document presumptive evidence of measles immunity should be offered postexposure prophylaxis (PEP), if warranted. See additional guidance in the **Control Measures** section below.

6. Continue enhanced surveillance. Continue enhanced surveillance until at least two incubation periods after the last case is reported to assure cases are not missed and that implemented control measures have been effective.

Control Measures

Pre-exposure vaccination: Two doses of measles, mumps, and rubella (MMR) vaccine are recommended routinely for children, with the first dose at age 12 through 15 months and the second dose at ages four through six years (school entry). For prevention of measles among adults, two doses of MMR vaccine are also recommended for adults at high risk, including international travelers, college and other post-high school students, and health care personnel born during or after 1957. All other adults born during or after 1957, without other presumptive evidence of measles immunity, should be vaccinated with one dose of MMR vaccine.

Post-exposure prophylaxis (PEP): The MMR vaccine, if administered within 72 hours of initial measles exposure, and immunoglobulin (IG), if administered within six days of exposure, may provide some protection or modify the clinical course of disease among susceptible persons. There is limited data regarding the effectiveness of MMR vaccine and IG PEP against disease prevention. Thus, individuals who receive MMR vaccine or IG as PEP should be monitored for signs and symptoms consistent with measles for at least one incubation period (21 days). IG may prolong the incubation period, so extending the monitoring period for individuals who received IG as PEP may be considered.

Individuals who are at risk for severe disease and complications from measles (e.g., infants <12 months of age, pregnant women without evidence of measles immunity, and severely immunocompromised persons regardless of vaccination status because they might not be protected by the vaccine) should receive IG. IG should not be used to control measles outbreaks, but rather to reduce the risk for infection and complications in the person receiving it.

Potentially exposed, susceptible contacts should be excluded from group settings (e.g. schools, child care centers, workplaces, camps) until 21 days after their last exposure if they were not properly vaccinated, refused or were unable be vaccinated, or were not vaccinated within 72 hours of first exposure to the case. Generally, persons who are vaccinated for the first

time or received a required second dose may be re-admitted immediately to the group setting; however, such a re-admittance policy may be modified depending upon the circumstances involved.

Except in health care settings, unvaccinated persons who receive their first dose of MMR vaccine within 72 hours postexposure may return to child care, school, or work.

After receipt of IG, individuals cannot return to health care settings. In other settings, such as childcare, school, or work, factors such as immune status, intense or prolonged contact, and the presence of populations at risk should be taken into consideration before allowing these individuals to return. These factors may decrease the effectiveness of IG or increase the risk of disease and complications depending on the setting to which they are returning.

Infectious or potentially infectious persons requiring medical attention (e.g., a case or a susceptible contact in quarantine who develops measles-like symptoms) should be advised to call ahead before visiting a clinic or emergency department to ensure appropriate precautions are in place prior to the medical encounter.

For more information on measles pre- and post-exposure recommendations, visit https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm. For additional guidance on how to handle potentially exposed contacts, see Table 3.31 and Table 3.32 in the Measles chapter of the American Academy of Pediatrics, *Red Book: 2021-2024 Report of the Committee on Infectious Diseases*. For additional guidance for special settings such as schools, child care centers, and health care settings, visit https://www.cdc.gov/measles/hcp/vaccine-considerations/specific-groups.html.

Resources

1. American Public Health Association. *Measles (Rubeola, Hard Measles, Red Measles, Morbilli).* In: Heymann D Ed. *Control of Communicable Diseases Manual*. 21st ed. Washington, D.C. American Public Health Association, 2022: pp 405-413.
2. American Academy of Pediatrics. *Measles*. In: Kimberlin DW, Barnett ED, Lynfield R, Sawyer MH, eds. *Red Book: 2021 Report of the Committee on Infectious Diseases*. 32nd ed. Itasca, IL: American Academy of Pediatrics 2018: 503-519.
3. Centers for Disease Control and Prevention. Epidemiology and Prevention of Vaccine-Preventable Diseases. Hall E., Wodi A.P., Hamborsky J., et al., eds. 14th ed. Washington, D.C. Public Health Foundation, 2021. Pinkbook: Measles | CDC (3/25)
4. CDC's National Notifiable Diseases Surveillance System (NNDSS) and Case Definitions. https://ndc.services.cdc.gov/case-definitions/measles-2013/ (3/25)
5. Centers for Disease Control and Prevention, Vaccine (Shot) for Measles: https://www.cdc.gov/vaccines-children/index.html (3/25)
6. Centers for Disease Control and Prevention, Clinical Overview of Measles: https://www.cdc.gov/measles/hcp/clinical-overview/index.html (3/25)

7. Centers for Disease Control and Prevention, Travelers' Health – Yellow Book: Rubeola / Measles | CDC Yellow Book 2024 (3/25)
8. Centers for Disease Control and Prevention, Measles (Rubeola), Laboratory Testing for Measles: https://www.cdc.gov/measles/php/laboratories/?CDC_AAref_Val=https://www.cdc.gov/measles/lab-tools/index.html. (3/25)
9. Centers for Disease Control and Prevention, *Chapter 7: Measles, Manual for the Surveillance of Vaccine-Preventable Diseases* (last reviewed May 13, 2019) https://www.cdc.gov/surv-manual/php/table-of-contents/chapter-7-measles.html (3/25)
10. Morbidity and Mortality Weekly Report (*MMWR*), *Prevention of Measles, Rubella, Congenital Rubella Syndrome, and Mumps, 2013: Summary Recommendations of the Advisory Committee on Immunization Practices (ACIP), Recommendations and Reports,* June 14, 2013 / 62(RR04);1-34 http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm (3/25)