

Measles (Rubeola)

Summary

Measles is an acute viral disease characterized by fever (as high as 105°F), cough, coryza, conjunctivitis and followed by a maculopapular rash. The rash begins in the face and spreads down to the rest of the body. The diagnosis should be confirmed by laboratory testing using serology and reverse transcriptase polymerase chain reaction assay (RT-PCR) or culture.

See here for [Surveillance Worksheet](#).

Agent

Measles virus is a single stranded RNA virus (*Morbillivirus*) that belongs to the family Paramyxoviridae.

Transmission

Reservoir:

Humans are the natural hosts and there are no known animal reservoirs.

Mode of transmission:

- Airborne by droplet spread and direct contact with nasal or throat secretions of infected people. Measles is one of the most highly communicable infectious diseases, infecting >90% of susceptible contacts.

Period of communicability:

- From 4 days before the onset of rash through four days after rash onset.

Clinical Disease

Incubation period:

Range of 8-12 days (mean: 10 days) from exposure to onset of prodromal symptoms. The average interval between the appearance of rash in the index case and subsequent cases is 14 days with a range of 7-21 days.

Illness:

Measles is an acute disease with prodromal fever, conjunctivitis, coryza, and cough. A characteristic rash usually appears around the fourteenth day after exposure. The rash typically begins behind the ears and on the forehead, and then spreads centrifugally from the head to the feet; however, atypical rash presentations occur as well. The rash is initially erythematous and maculopapular but becomes confluent as the rash spreads. Koplik spots, which are small spots with white or bluish-white centers on the buccal mucosa, can be present. Leukopenia is common. The disease is more severe among infants and adults. Complications include otitis media, pneumonia, croup, and encephalitis.

Laboratory Diagnosis

Diagnostic testing for measles should include serologic, molecular and virologic testing.

The detection of viral presence in a nasopharyngeal swab by RT-PCR, measles-specific IgM antibodies, or a significant rise in measles-specific IgG antibody concentration between acute

and convalescent sera establishes the diagnosis. False positive IgM results are possible, and vaccinated cases should be confirmed by RT-PCR or viral culture.

Virus can be isolated in cell culture from serum or a throat or nasopharyngeal swab collected ideally within 1-3 days of rash onset, but up to 10 days (14 days for PCR) after rash onset. Urine may optionally be collected within 8 days of rash onset, but is not preferred; priority should be placed on collecting a throat or nasopharyngeal swab and serum.

Because measles is rare in the US, the diagnosis should be confirmed by laboratory testing.

Treatment

No specific antiviral therapy is available for measles. Ribavirin has been used to treat severely ill and immunosuppressed children by intravenous and aerosol routes, but is not currently approved by FDA for the treatment of measles.

Vitamin A administration is recommended for children diagnosed with measles where vitamin A deficiency is a recognized problem, as vitamin A deficiency is associated with higher severity of measles.

Surveillance

Case Definition (2013):

Clinical case definition

An acute illness characterized by:

- Generalized, maculopapular rash lasting ≥ 3 days, and
- 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 clinical criteria 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 (PCR); or
- IgG seroconversion[‡] or a significant rise in measles IgG antibody[‡] using any evaluated and validated method; or
- A positive serologic test for measles IgM^{†§}; 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 measles testing in a public health laboratory.

Epidemiologic Classification of Internationally-Imported and US-Acquired Cases

Internationally-Imported Case:

An internationally imported case is defined as a case in which measles results from exposure to measles virus outside the United States (US) as evidenced by at least some of the exposure period (7–21 days before rash onset) occurring outside the US and rash onset occurring within 21 days of entering the US and there is no known exposure to measles in the US during that time. All other cases are considered US-acquired.

US-Acquired Case:

A US-acquired case is defined as a case in which the patient had not been outside the US during the 21 days before rash onset or was known to have been exposed to measles within the US.

Reporting:

Report all suspected or confirmed cases of measles immediately (24/7/365) to the Epidemiology and Response Division (ERD) at 505-827-0006. Information needed includes: patient's name, age, sex, race, ethnicity, home address, home phone number, occupation, and health care provider.

Case Investigation:

Complete the CDC Measles Surveillance Worksheet and mail to the Epidemiology and Response Division, P.O. Box 26110, Santa Fe, New Mexico 87502-6110, or (preferably) fax to 505-827-0013. Investigation information should also be entered in NM-EDSS per established procedures.

Control Measures

1. Case management

1.1. Isolation: Persons with measles should be excluded from work, school, childcare, and all other public settings (aside from medical visits) through four days after rash develops. (In other words, may return to usual activities on day 5 after rash onset.)

1.1.a In hospitals and institutions, patients should be placed in airborne precautions from onset of catarrhal stage of the prodromal period through the fourth day of rash. Immunocompromised patients should be presumed infectious throughout the course of illness.

2. Contact management

2.1. Evidence of measles immunity: Persons can be considered immune to measles if they meet at least one of the following criteria:

2.1.a 1) Have written documentation of adequate measles vaccination: receipt of one or more doses of measles-containing vaccine administered on or after the first birthday for preschool-age children and adults not at high risk, and two doses of measles-

containing vaccine for school-age children (grades K-12) and adults at high risk for exposure transmission (i.e., health care personnel, international travelers, and students at post-high school educational institutions); or

2.1.b 2) Have laboratory evidence of immunity to measles (i.e., IgG+ titer); or

2.1.c 3) Were born before 1957; or

2.1.d 4) Have documentation of laboratory-diagnosed measles

2.1.e Some adults may have received a killed measles vaccine during 1963 to 1968. People vaccinated during those years are not considered to have adequate immunization and the recommendation is for them to be re-vaccinated.

2.1.f During an outbreak, a second dose of MMR should be considered for children aged 1 through 4 years or adults who have only received 1 dose. If the outbreak involves infants aged <12 months with ongoing risk of exposure, infants aged ≥6 months can be vaccinated.

2.2. Isolation: If exposed susceptible persons (those who cannot demonstrate adequate immunity as listed above) do not receive post-exposure prophylaxis as listed below within the appropriate timeframes after exposure (72 hours for vaccine or 6 days for IG), they should be excluded from work, school, childcare, or any other group activities until at least 21 days after their last exposure to an infectious measles case.

2.3. Post-Exposure Prophylaxis:

2.3.a Live-attenuated virus measles vaccine (MMR or MMRV), if given within 72 hours of measles exposure, may prevent disease in susceptible persons. If the exposure does not result in infection, the vaccine should induce protection against subsequent measles exposures. Vaccine is the intervention of choice for control of measles outbreaks in schools and childcare centers. It is also preferred for infants aged 6-11 months, although it does not count towards their recommended two-dose series.

2.3.b Immune globulin (IG) for post-exposure prophylaxis can be used within six days of exposure for susceptible household or other contacts, particularly in whom the risk of complications is very high (such as pregnant women without evidence of immunity, immunocompromised persons, and those under one year of age).

2.3.b.1 The recommended dose of intramuscular (IGIM) is 0.50 mL/kg with a maximum dose of 15mL. Pregnant women without evidence of immunity and immunocompromised persons of any vaccination status should receive intravenous (IVIG) at a dose of 400 mg/kg. If a person with a history of one vaccine dose is not able to get a second dose, IG is not indicated, unless they are immunocompromised. Do not give vaccine and IG at the same time.

3. Prevention

3.1. Immunization:

3.1.a A single dose of live, attenuated measles virus vaccine is 93% effective against measles, while two doses are 97% effective. Measles vaccine is to be administered as a component of the MMR or measles/mumps/rubella/varicella (MMRV) vaccine when a child is 12-15 months of age and at school entry at 4-6 years. The second dose may be received earlier, as long as it occurs at least 28 days after the first dose.

3.1.a.1 The first dose should preferably be MMR rather than MMRV, to lessen the risk for fever and side effects.

Management of Measles in Child Care Centers

- Contact the Epidemiology and Response Division (ERD) **immediately** for any suspected or confirmed case of measles in a school or childcare center.
- Children with measles should be kept out of school or childcare for four days after rash develops.
- Immunization records of all childcare attendees and staff should be reviewed. Refer to section 2.1 above for definition of immunity to measles. Exposed susceptible persons, including those who have been exempted from measles vaccination, who do not receive post-exposure prophylaxis within the specified timeframes after exposure should be excluded from the childcare facility through at least 21 days after their last exposure to an infectious case of measles.

References

American Academy of Pediatrics. "Measles." In: Kimberlin, DW, et al eds. Red Book: 2018 Report of the Committee on Infectious Diseases. 31st ed. Itasca, IL: American Academy of Pediatrics; 2018.

Heymann D, ed. Control of Communicable Diseases Manual. 19th ed. Washington, DC: American Public Health Association; 2008.

Centers for Disease Control and Prevention. "Measles." In: Hall E, Wodi AP, Hamborsky J, et al., eds. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. 14th ed. Washington, D.C. Public Health Foundation; 2021:193-206.

Centers for Disease Control and Prevention. "Measles." In: Gastanaduy PA, Redd SB, Clemmons NS, Lee AD, Hickman CJ, Rota PA, Patel M, eds. *Manual for the Surveillance of Vaccine-Preventable Diseases*. 13 May 2019. <https://www.cdc.gov/vaccines/pubs/surv-manual/chpt07-measles.html>

See Measles Fact Sheets ([English](#)) ([Spanish](#)).