

## MEASLES (Rubeola)

### REPORTING INFORMATION

- **Class A:** Report immediately via telephone the case or suspected case and/or a positive laboratory result to the local public health department where the patient resides. If patient residence is unknown, report immediately via telephone to the local public health department in which the reporting health care provider or laboratory is located. Local health departments should report immediately via telephone the case or suspected case and/or a positive laboratory result to the Ohio Department of Health (ODH).
- Reporting Form(s) and/or Mechanism:
  - Immediately via telephone.
  - The local health department should enter the case into the Ohio Disease Reporting System (ODRS) within 24 hours after the telephone report.
- [CDC Measles Surveillance Worksheet](#) is available for use to assist in local health department disease investigation and contact tracing activities. Information collected from the form should be entered into ODRS and not sent to ODH, unless otherwise requested.

### AGENT

Measles virus, an RNA virus with one antigenic type. It is a paramyxovirus of the genus *Morbillivirus*.

### CASE DEFINITION

#### Clinical Case Definition

An illness characterized by **all** of the following:

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

#### Laboratory Criteria for Diagnosis

- Positive serologic test for measles immunoglobulin M (IgM) antibody *or*
- Significant rise in measles antibody level by any standard serologic assay *or*
- Isolation of measles virus from a clinical specimen *or*
- Detection of measles-virus specific nucleic acid by polymerase chain reaction

#### Case Classification

Probable: a case that meets the clinical case definition, has non-contributory or no serologic or virologic testing, *and* is not epidemiologically linked to a laboratory confirmed case of measles.

Confirmed: an acute febrile rash illness with laboratory confirmation or epidemiologic linkage to a laboratory confirmed case of measles. In outbreak situations or if there is PCR laboratory confirmation, a confirmed case may not need to meet all clinical symptoms.

Not a Case: This status will not generally be used when reporting a case, but may be used to reclassify a report if the investigation revealed that it was not a case.

#### Comments:

In Ohio, two probable cases that are epidemiologically linked but not serologically confirmed would be considered to be confirmed. However, an attempt should be

made to confirm at least one case by culture in each documented chain of transmission.

An outbreak is defined as more than 3 cases (with at least one laboratory confirmed case) clustered in space and time. Active surveillance should be maintained for at least two incubation periods (42 days) after the last confirmed case is reported.

### **Epidemiologic Classification for Measles of Internationally-Imported and U.S.-Acquired**

*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 as evidenced by at least some of the exposure period (7-21 days before rash onset) occurring outside the United States and rash onset occurring within 21 days of entering the United States and there is no known exposure to measles in the U.S. during that time. All other cases are considered U.S.-acquired.

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

U.S.-acquired cases are sub-classified into four mutually exclusive groups:

- **Import-linked case:** Any case in a chain of transmission that is epidemiologically linked to an internationally imported case.
- **Imported-virus case:** a case for which an epidemiologic link to an internationally imported case was not identified, but for which viral genetic evidence indicates an imported measles genotype (i.e. a genotype that is not occurring within the United States in a pattern indicative of endemic transmission). An endemic genotype is the genotype of any measles virus that occurs in an endemic chain of transmission (i.e. lasting  $\geq 12$  months). Any genotype that is found repeatedly in U.S.-acquired cases should be thoroughly investigated as a potential endemic genotype, especially if the cases are closely related in time or location.
- **Endemic case:** a case for which epidemiological or virological evidence indicates an endemic chain of transmission. Endemic transmission is defined as a chain of measles virus transmission that is continuous for  $\geq 12$  months within the United States.
- **Unknown source case:** a case for which an epidemiological or virological link to importation or to endemic transmission within the U.S. cannot be established after a thorough investigation. These cases must be carefully assessed epidemiologically to assure that they do not represent a sustained U.S.-acquired chain of transmission or an endemic chain of transmission within the U.S.

**Note 1:** Internationally imported, import-linked, and imported-virus cases are considered collectively to be import-associated cases.

**Note 2:** States may also choose to classify cases as "out-of-state-imported" when imported from another state in the United States. For national reporting, however, cases will be classified as either internationally imported or U.S.-acquired.

### **SIGNS AND SYMPTOMS**

Measles infections classically are described as having a prodromal period with a fever of 103-105°F, coryza, conjunctivitis, cough and photophobia for 2-4 days. Then a maculopapular rash appears on the face which spreads to the trunk and finally to the

extremities. The rash and other symptoms normally subside in 7-9 days. Koplik spots may be observed on the buccal mucosa just prior to and on the first day of the rash. Complications of measles include otitis media, pneumonia, cardiac manifestations, encephalitis and occasionally death. A slow virus disease associated with the measles virus is subacute sclerosing panencephalitis (SSPE).

Atypical measles syndrome (AMS) occurs in individuals who have received two or more doses of inactivated measles vaccine and is characterized by a rash on the extremities, high fever and frequently pneumonia.

Modified measles occurs in infants who still have maternal antibodies and in those who received measles vaccine or immune globulin soon after exposure.

## **DIAGNOSIS**

The most common methods for confirmatory measles testing are IgM antibody and RNA by real-time PCR (RT-PCR). Clinical specimens for RT-PCR and virus isolation should be collected at the same time as samples for serologic testing. Specimens for virus isolation and RNA detection should be collected within three days of rash onset. The preferred specimens for virus isolation or RT-PCR are throat and nasopharyngeal swabs.

IgM tests are often positive on the day of rash onset. However, up to 20% of tests for IgM may give false-negative results in the first 72 hours of rash onset. Therefore, IgM tests that are negative in the first 72 hours after rash onset should be repeated. IgM obtained four days after the onset of rash is the preferred laboratory diagnostic procedure. IgM is detectable for at least 28 days after rash onset. If the titer is negative at that time, it can be repeated at seven days, or paired acute and convalescent sera can be tested for an increase in IgG antibody. The acute specimen should be taken as close to rash onset as possible and the convalescent specimen drawn two weeks after the acute. The latter method is less desirable because of the delay in definitive diagnosis.

When laboratory specimens need tested or verified, they may be sent to a public health laboratory. For serum specimens, complete the [Ohio Department of Health Laboratory Microbiology Specimen Submission Form](#) and the [CDC Specimen Submission Form](#). For swab specimens, complete the [Ohio Department of Health Laboratory Microbiology Specimen Submission Form](#) and the [Wisconsin \(WI\) VPD Submission Form](#).

Please notify the ODH VPD Epidemiology Program at (614) 995-5599 before shipping a specimen to the Ohio Department of Health Laboratory.

**Note 1:** Negative culture or negative RT-PCR results do not rule out measles because both methods are affected by the timing of specimen collection and the quality and handling of clinical specimens.

## **EPIDEMIOLOGY**

### **Source**

Humans are the only natural host of the measles virus.

### **Occurrence**

Prior to the licensure of measles vaccine, the disease was widespread and common in childhood with over 90% of individuals having the disease by 20 years of age. Recently measles has been seen most frequently in preschool children and in young adults attending high schools or colleges. Measles occurs primarily in late winter and early spring.

**Mode of Transmission**

By droplet spread or direct contact with nasal or throat secretions of infected persons. Tiny droplets can be suspended in the air for up to two hours or more. Measles virus is highly communicable.

**Period of Communicability**

Communicability is greatest from four days before the onset of rash until four days after the onset of rash.

**Incubation Period**

The average incubation period for measles is 14 days, with a range of 7-21 days.

**PUBLIC HEALTH MANAGEMENT****Case**Investigation

Local health agencies should report suspect cases immediately and complete the [CDC Measles Surveillance Worksheet](#). Prompt recognition, reporting, and investigation of measles is important because the spread of the disease can be limited with early case identification and public health response including vaccination and quarantine of susceptible contacts without presumptive evidence of immunity.

Isolation

The Ohio Administrative Code (3701-3-13, (M)) states that "a person with measles shall be isolated, including exclusion from school or child care center, for four days following the onset of rash. Contagiousness may be prolonged in patients with altered immunity."

**Isolation of the Hospitalized Patient**

Airborne isolation precautions are indicated for four days after the onset of rash in otherwise healthy individuals and for the duration of the entire illness in immunocompromised patients.

**Minimizing transmission in healthcare settings**

To minimize the risk of measles transmission in healthcare settings, healthcare personnel should do the following:

1. Query patients with a febrile rash illness about a history of international travel, contact with foreign visitors, transit through an international airport, or possible exposure to a measles patient in the 3 weeks prior to symptom onset. Suspect measles in patients with such a history.
2. Mask suspect measles patients immediately. If a surgical mask cannot be tolerated, other practical means of source containment should be implemented (e.g. place a blanket loosely over the heads of infants and young children suspected to have measles when they are in the waiting room or other common areas).
3. Do not allow suspect measles patients to remain in the waiting room or other common areas; isolate them immediately in an airborne infection isolation room if one is available. If such a room is not available, place patient in a private room with the door closed. For additional infection control information, please see the [CDC Control Measures](#).
4. If possible, allow only healthcare personnel with documentation of 2 doses of MMR vaccine or laboratory evidence of immunity to measles (i.e. measles IgG positive) to enter the patient's room.
5. Healthcare personnel who do not have documentation of 2 doses of live measles vaccine or lab-evidence of immunity must wear an N95 respirator. (The N95 respirator must be fit-checked each time it is donned.)

6. If possible, do not allow susceptible visitors in the patient room.
7. Do not use the examination room for at least two hours after the possibly infectious patient leaves.
8. If possible, schedule suspect measles patients at the end of the day.
9. Notify the local health department whose jurisdiction the patient resides immediately by telephone about any suspect measles patients.
10. Notify any location where the patient is being referred for additional clinical evaluation or laboratory testing about the patient's suspect measles status and do not refer suspect measles patients to other locations unless appropriate infection control measures can be implemented at those locations. The patient must wear a mask, if feasible, or loosely cover the heads of infants or young children with a blanket during transport to another clinical area.
11. Instruct suspect measles patients and exposed persons to inform all healthcare providers of the possibility of measles prior to entering a healthcare facility so that appropriate infection control precautions can be implemented.
12. Make note of the staff and other patients who were in the area during the time the suspect measles patient was in the facility and for two hours after they left. If measles is confirmed in the suspect case, exposed people will need to be assessed for measles immunity.

### **Contacts**

All contacts should provide proof of a live measles immunization on or after their first birthday or previously physician diagnosed measles disease. In an outbreak situation involving child care or schools, demonstration of two doses of MMR will be required. Generally those born prior to 1957 are considered immune. Contacts who might be susceptible should be immunized with measles vaccine as soon after exposure as possible. Measles vaccine given within 72 hours after exposure may prevent or modify the disease. Immune globulin (IG) can prevent or modify measles in a susceptible person if given within six days of exposure. IG may be especially indicated for susceptible household contacts <1 year of age, pregnant women or immunocompromised persons, for whom the risk of complications is increased. Subsequent immunization should then be delayed for five to six months (depending on the dose to allow passive antibody to disappear) and until the individual is at least 12 months old.

### **Prevention and Control**

Susceptible persons who refuse immunization should be excluded from contact in schools and child care centers until 21 days after the last case has occurred.

IG should not be used in an attempt to control measles outbreaks.

Ohio School Requirement: All children entering school must have received two doses of MMR (measles, mumps, rubella) vaccine. All three vaccine components (i.e. measles, mumps, and rubella) must have been received to meet this vaccination requirement. MMR vaccine is the only way that measles vaccine is supplied in the U.S. but other countries still use a one-component vaccine.

For specific vaccine information, please view the ODH Vaccine Protocol Manual or the current [Advisory Committee for Immunization Practices \(ACIP\) vaccine recommendations](#).

**What is measles?**

Measles is an acute, highly contagious respiratory disease caused by a virus. The virus normally grows in the back of the throat and in the cells that line the lungs. Since the introduction of the measles vaccination in 1963, the number of measles cases has decreased to about 100 cases reported annually in the United States.

**Who gets measles?**

Most people in the United States are protected against measles through vaccination, so measles cases in the U.S. are uncommon compared to the number of cases before a vaccine was available. However, measles is still brought into the United States by unvaccinated travelers who get measles while they are in other countries. They can spread measles to other people who are not protected against measles, which sometimes leads to outbreaks. This can occur in communities with unvaccinated people; for example, in 2014 there was a measles outbreak in an unvaccinated community in Ohio.

**How is measles spread?**

The virus resides in the mucus in the nose and throat of the infected person. When that person sneezes or coughs, droplets with virus spray into the air. The virus can land in other people's noses or throats when they breathe or put their fingers in their mouth or nose after handling an infected surface. The virus remains active and contagious on infected surfaces for up to 2 hours. Measles spreads so easily that anyone who is not immunized will probably eventually get it.

The disease is highly contagious, and can be transmitted from 4 days prior to the onset of the rash to 4 days after the onset. If one person has it, 90% of their susceptible close contacts will also become infected with the measles virus.

**What are the symptoms of measles?**

An individual's symptoms usually begin to appear about 10 to 12 days after exposure to the virus. The infected person first experiences a fever greater than or equal to 101°F that lasts about 2 to 4 days. The fever can peak as high as 105°F. This is followed by the onset of cough, runny nose, and/or conjunctivitis (pink eye). A red blotchy rash usually appears about 14 days after exposure and lasts 5 to 6 days. It begins at the hairline, then involves the face and upper neck. Over the next 3 days, the rash gradually proceeds downward and outward, reaching the hands and feet. Koplik spots (little white spots) may also appear on the gums and inside of the cheeks.

**How soon do symptoms appear?**

Symptoms usually appear within 14 days after exposure, although they may occur as early as 7 or as late as 21 days after exposure.

**When and for how long is a person able to spread measles?**

An individual is able to transmit measles from four days prior to and four days after rash onset.

**Does past infection make a person immune?**

Yes. Permanent immunity is acquired after contracting the disease.

**What is the treatment for measles?**

There is no specific treatment for measles.

**What are the complications associated with measles?**

Approximately 20% of reported measles cases experience one or more complications. These complications are more common among children under 5 years of age and adults over 20 years old. One out of ten children will develop ear aches. As many as one out of 20 children with measles gets pneumonia, and about one child in every 1,000 who gets measles develops encephalitis (an acute inflammation of the brain). For every 1,000 children who get measles, one or two will die from it. In developing countries, where malnutrition and vitamin A deficiency are prevalent, measles has been known to kill as many as one out of four people. It is the leading cause of blindness among African children. Measles kills almost 1 million children in the world each year.

**How can measles be prevented?**

Adults born in 1957 or later who do not have a medical contraindication should receive at least one dose of MMR vaccine unless they have documentation of vaccination with at least one dose of measles-containing vaccine or a history of physician-diagnosed measles or laboratory confirmation of measles immunity. With the exception of women who might become pregnant and persons who work in medical facilities, birth before 1957 generally can be considered acceptable evidence of immunity to measles, mumps, and rubella. Children should receive two doses of MMR vaccine: the first dose should be given at 12 to 15 months of age and the second dose at four to six years of age (school entry). MMR vaccine is recommended for all measles vaccine doses to provide increased protection against all three vaccine-preventable diseases: measles, mumps and rubella. Measles immunization is required of all children enrolled in daycares and schools in Ohio. Persons traveling out of the country need to make sure that they and their travel mates (including family members) are vaccinated against measles.