



MEASLES (Rubeola)

(Red measles, hard measles, 10-day measles, morbilli)

1. **Agent:** Measles (rubeola) virus.
2. **Identification:**
 - a. **Symptoms:** Acute, highly communicable febrile illness with cough, high fever, conjunctivitis, coryza, and Koplik's spots on buccal mucosa. Erythematous, maculopapular rash first appears on face (commonly around ears and hairline) about 2-4 days following onset of prodrome. Rash usually spreads to other parts of body and becomes confluent in about 4-7 days. Complications include otitis media, pneumonia, dehydration, convulsions (with or without fever), and acute encephalitis. Subacute sclerosing panencephalitis (SSPE) is extremely rare.
 - b. **Differential Diagnosis:** Distinguish from Kawasaki disease, rubella, scarlet fever, and other childhood exanthems. See **EXANTHEMS—DIFFERENTIAL DIAGNOSIS** (Appendix A).
 - c. **Diagnosis:** A presumptive diagnosis is based on clinical and epidemiological grounds. The presence of measles IgM antibody in a person with a febrile rash illness usually confirms the diagnosis of measles and is preferred. (IgM antibodies can also be detected in individuals recently vaccinated against measles for up to 6 weeks after vaccination.) A four-fold or greater increase in specific hemagglutination-inhibition (HI) or complement fixation (CF) IgG antibody titers between acute and convalescent specimens also confirms the diagnosis.
3. **Incubation:** About 10 days, varying from 8-13 days from exposure to onset of fever; average 14 days until rash appears; rarely as long as 21 days. Encephalitis can occur 2-6 days after rash.
4. **Reservoir:** Human.
5. **Source:** Respiratory tract secretions and fomites.
6. **Transmission:** Direct contact with infectious droplets or less commonly, by airborne spread. Measles is one of the most readily transmitted communicable diseases.
7. **Communicability:** From 4 days before beginning of rash to 4 days after its appearance. Patients with SSPE are not contagious.
8. **Specific Treatment:** Supportive care; no antiviral agent available.
9. **Immunity:** Lifelong. Persons can be considered immune to measles only if they have had a documented history of physician-diagnosed measles, have laboratory evidence of immunity, or have documented 2 doses of a measles-containing vaccine on or after the first birthday. Birth before 1957 is not a reliable indicator of immunity, particularly in healthcare personnel.

REPORTING PROCEDURES

1. **Reportable.** Section 2500, *California Code of Regulations*. Report by telephone immediately at time of identification of case or suspected case by calling 888-397-3993 (for Los Angeles County). **Do not wait for laboratory confirmation before reporting a suspected measles case to the local health department.**
2. **Report Form:** [MEASLES \(RUBEOLA\) CASE REPORT \(CDPH-8345\)](#).
[MEASLES EXPOSURE INTERVIEW FORM](#)
3. **Epidemiologic Data:**
 - a. History of immunization. Number of doses of measles vaccine and dates administered.
 - b. History of exposure(s), 8-21 days prior to rash onset.
 - c. Travel history, with dates of exit from and re-entry into the United States. Include



travel history with dates of travel to other counties or states.

- d. **Case finding:** Identify rash illnesses among household members, neighbors, schoolmates, and other household visitors, especially “out-of-country” visitors, etc.
- e. Immune status of household and other close contacts.
- f. List of primary and secondary group contacts.

CONTROL OF CASE, CONTACTS & CARRIERS

Public Health Nursing Protocol:

Home visit is required – a face to face interview is required.

Refer to “Public Health Nursing Home Visit REQUIRED Algorithm” (B-73 Part IV [Public Health Nursing Home Visit Protocol](#)). For contact investigation, use [Measles Exposure Interview Form](#).

Investigation of measles cases will be a collaborative effort between the Immunization Program and the public health district wherein the case resides. A district public health nurse home visit will be made on all measles cases. The initial interview of the measles case (or guardian) will be conducted by Immunization Program staff, or jointly by Immunization Program staff and the district public health nurse in the event that the case (or guardian), cannot be contacted prior to the scheduled home visit. Investigate case, primary contacts, and secondary contacts within 24 hours so effective prophylactic measures can be taken for contacts. Prompt reporting of cases provides opportunity for better outbreak control.

CASE:

Precautions:

1. Respiratory precautions during prodrome and for 4 days after appearance of rash.
2. Keep out of school or work and avoid social contacts.

3. Disinfect fomites soiled with nose and throat secretions and urine.
4. With hospitalized patients, prompt airborne isolation is required for 4 days after onset of rash. In immunocompromised patients, isolation should be maintained for the duration of the illness.

CONTACTS:

1. **PRIMARY CONTACTS:** Identify all individuals exposed to patient from 4 days before to 4 days after rash onset. A measles exposure is defined as sharing the same air space with a communicable measles case, e.g., same classroom, home, clinic waiting room, airplane, etc., or having been present in these areas within two hours of a communicable measles case. Susceptible contacts are those who in addition to being born in 1957 or after and having contact with the case during the infectious period, lack a written record showing dates of receipt of at least two doses of measles-containing vaccine (i.e., MMR or MR) received on or after the first-birthday, or a written record of measles seropositivity.

Immunize susceptible contacts to limit the spread of disease as follows: for persons ≥ 6 months of age with one **or no** documented doses of MMR, give MMR if < 72 hours of exposure (if vaccine not contraindicated). No harm has been noted if vaccine is given later in incubation period; however, vaccination at a time when it will not prevent measles, can complicate the diagnosis of measles if adverse events to the vaccination occur (i.e., rash, fever). Also, recently vaccinated persons will have a positive IgM for measles. Unvaccinated persons who cannot be vaccinated < 72 hours after exposure, should be scheduled for vaccination after the 21 day surveillance period has ended, unless they develop measles in which case they will be immune. (Advise women of childbearing age to avoid becoming pregnant for one month if MMR or MR vaccine is administered.)

If MMR vaccine is contraindicated, immune globulin (IG) given in the first 3 days after exposure will usually prevent disease; given within 6 days of exposure, it may prevent or modify disease. IG should be used as post-exposure prophylaxis to protect susceptible



persons who are at risk for severe complications if they develop measles (examples, infants less than 12 months of age, pregnant women, and persons immunocompromised as a result of a medical condition or medication regardless of prior measles vaccination). It can, also, be used in other susceptible persons with an intense measles exposure who cannot be vaccinated with MMR within three days of exposure such as non-immune health care workers. It should not be used in an attempt to control measles outbreaks.

In post-exposure prophylaxis, IG should be administered to infants less than 12 months of age as follows: 0.5 mL/kg of body weight of IG given intramuscularly (IGIM), maximum dose of 15mL. Susceptible pregnant women should receive 400 mg/kg of IG given intravenously (IGIV). Severely immunocompromised individuals (see note below), irrespective of evidence of measles immunity, should receive 400 mg/kg of IG given intravenously (IGIV). For persons already receiving IGIV therapy, >400 mg/kg <3 weeks before the measles exposure should be sufficient to prevent infection. IGIM (0.5 mL/kg of body weight, max dose=15 mL can be given to other persons who do not have evidence of measles immunity but priority should be given to persons exposed in settings with intense, prolonged, close contact.

Because post-exposure immunization or administration of IG is not completely effective, the recipient should be considered infectious from 5 to 21 days after exposure. Measles vaccine should not be given for at least 5 months after the administration of IG.

Note: Severely immunocompromised patients include patients with severe primary immunodeficiency; patients who have received a bone marrow or stem cell transplant until at least 12 months after finishing all immunosuppressive treatment, or longer where the patient has developed graft-versus-host disease; patients on treatment for ALL within and until at least six months after completion of immunosuppressive chemotherapy; and patients with a diagnosis of AIDS or HIV-infected persons with CD4 percent <15% (all ages) or CD4 <200 lymphocytes /mm³ (age

>5 years) and those who have not received MMR vaccine since receiving effective ART; some experts would include HIV-infected persons who lack recent confirmation of immunologic status or measles immunity.

- 2. SECONDARY CONTACTS:** Defined as contacts to susceptible household or other close, susceptible primary contact. Identify all secondary contacts during follow-up of primary contacts. Contact and arrange immunization if susceptible. Do not offer IG to eligible secondary contacts unless primary contact has developed signs of disease. Ask susceptible individual contacts (primary contacts who may be incubating measles) about groups with which they had or may have contact within 8-21 days after case's rash onset to identify secondary contacts. If the primary contact develops measles, this information can be used by Immunization Program to assist in subsequent investigations and to link future cases epidemiologically. Establish a liaison (team coach, clinic manager, church secretary, etc.) for each group to assist in determining persons exposed, number of susceptibles exposed, and to help monitor for illness among group contacts.

If a primary contact becomes ill with measles, include the secondary contact information with a telephone report of spread case(s) to the Immunization Program. This will then be forwarded to other health district(s) for investigation of the spread case(s).

- 3. SURVEILLANCE OF CONTACTS:** All contacts, both primary and secondary, should be followed for signs and symptoms of measles for 21 days after exposure. Any contacts (primary or secondary) that develop measles should be reported to the Immunization Program and investigated using a separate investigation form and investigation number.

CARRIERS: Not applicable.

INSTITUTIONS: If exposure occurs in an institution, all occupants of same quarters, ward, or classroom are considered primary contacts. Carry out investigation and preventive measures as above. Report all institutional exposures immediately to Immunization Program.



School Exclusion of Un-Immunized

Contacts: If a case is reported at a school, the Immunization Program will exclude from school any children on medical or personal beliefs waiver. These children will be excluded until 21 days after last case was at school while infectious, unless child is immunized or shows proof of immunization within 2 days.

PREVENTION-EDUCATION

1. **Immunization (General):** In Los Angeles County public clinics, the first dose of live-attenuated MMR (measles, mumps, and rubella) vaccine is given at 12 months; the second dose of MMR is given to children 4-6 years old or at kindergarten entry. Children through 18 years of age who have not previously received the second dose of MMR should be immunized. The interval between doses should be at least one month. Students entering college or university within 6 months should be immunized with second dose of MMR (if not previously received). A person whose most recent dose of measles vaccine was given before the first birthday should be considered un-immunized and given another dose of MMR. Approximately 95% or more of susceptible individuals develop serum antibody after initial dose; this increases to more than 99% after second dose.

a. Indications for Immunization: MMR vaccine is indicated for all individuals susceptible to measles, unless otherwise contraindicated (see item "b" below). Two doses of live MMR vaccine are recommended for all persons born after 1956. All health care workers, especially, require documentation that they are immune to measles or that they have received two doses of MMR vaccine. All foreign travelers who are not immune to measles should be vaccinated, ideally 2 weeks prior to travel. Unvaccinated Infants 6 months of age and older should be vaccinated if they are traveling out of the country.

b. Contraindications to Use of Live Vaccines: If a woman is pregnant or intends to become pregnant in the next one month, MMR vaccine is contraindicated. As a general rule, live

vaccines should not be given to pregnant women.

c. Other Contraindications for MMR Vaccine:

- Anaphylaxis due to gelatin, neomycin, or severe reaction to prior MMR.
- Patients with immune deficiency diseases (except HIV; see "d" below) or suppressed immune responses from leukemia, lymphoma, or generalized malignancy, or from therapy with corticosteroids, irradiation, alkylating drugs, or antimetabolites should not receive live vaccine of any kind.
- Patients with a high fever or severe illness should be deferred immunization with MMR until recovery.

d. Other Considerations: Measles disease can be severe in HIV-infected persons. MMR vaccine is recommended for all measles-susceptible, asymptomatic HIV-infected persons and should be considered for susceptible symptomatic persons who are not severely immunosuppressed. Data indicate that vaccination with MMR has not been associated with severe or unusual adverse events in such individuals.

Tuberculosis patients may be immunized after therapy has begun.

Vaccine should be given 14 days before or deferred for 3 to 11 months after immune globulin or blood transfusion depending on the product received. Contact Immunization Program for specific intervals.

e. Education: Public education by health departments and private physicians should encourage measles vaccine for all susceptible infants, children, adolescents, and adults. IG should be used to protect susceptible individuals for whom vaccine is not appropriate or is contraindicated and who are exposed to measles. IG should not be given with measles vaccine.

2. **Immunization Requirement for School Attendance:** Measles immunization



requirement for school attendance (from day-care center through college) is an important and effective means of measles control in the USA. In California, all children attending day-care centers and public/private schools (K-12) are required by state law to show proof of receiving a measles immunization on or after the first birthday or else have on file a formal parental waiver before being allowed entry into school. Children entering kindergarten and 7th grade are required to show proof of having received 2 doses of a measles-containing vaccine, one of which is MMR.

DIAGNOSTIC PROCEDURES

1. **Serology:** Clinical and epidemiological histories are required to aid the laboratory in test selections. There are two serologic tests available, IgM and IgG. If possible, both tests should be performed on the acute sample. Although IgM antibody is generally detectable from 2-3 days to 2-3 weeks after rash onset, the currently recommended IgM EIA is often positive at the time the patient first presents for medical evaluation. With some test kits that still might be in use, serum collected earlier than 3 days after rash onset can be falsely negative; in such instances when measles is suspected, the test should be repeated.

Paired sera, an acute specimen taken within 7 days after the onset of the rash and a convalescent specimen taken 14-28 days later, are examined for IgG. A four-fold or greater rise in measles IgG titer is indicative of recent infection. Presence of IgG in the acute specimen indicates prior exposure to measles, either naturally or by immunization.

Container: Serum separator tube (SST, red-gray rubber stopper or gold plastic stopper).

Laboratory Form: Test Requisition and Report Form H-3021

Procedure: Collect the acute specimen as early as possible, preferably within 7 days of onset of rash. Collect second (convalescent) specimen approximately 14-28 days after first blood is drawn. (If the IgM is positive in the acute specimen, a second specimen is not routinely necessary.)

Amount: For venous blood, ideally 8-10 ml in serum separator tube (SST, red-gray rubber stopper or gold plastic stopper). (With prior notification and consent of the testing laboratory, three 0.5ml capillary tubes for serum collection can be used for finger-stick specimens).

Material: Whole clotted blood.

Storage: Send to Public Health Laboratory as soon as possible at 4°C and ship cold with ice packs; if not able to send on same day, refrigerate. Sera should be stored for no longer than 7 days before testing.

Note: In instances where serological testing has already been performed by a private laboratory, Immunization Program staff will request that the original specimen be sent to the Public Health Laboratory for confirmation.

2. **Virus Isolation:** Within 6 days of rash onset obtain a throat swab and place in tube of viral transport medium and collect urine specimen in sterile container. If after 6 days, but within 10 days of rash onset, collect only urine specimen. Keep specimens on wet (water) ice and send to Public Health Lab as soon as possible. Viral isolation permits epidemiological comparison with other isolates.

Container: Viral culturette for NP or throat specimens; sterile specimen container for urine.

Laboratory Form: Test Requisition and Report Form H-3021

Examination Requested: Measles culture and PCR.

Material: Nasopharyngeal or throat swab, urine.

Storage: Store at 4°C and ship cold with ice packs as soon as possible. If unable to ship within 48 hours, freeze specimen immediately at -70°C (except for urine which should not be frozen). Avoid repeat freeze-thaw cycles, and transport on dry ice.