

Georgia Department of Public Health Epidemiology Branch

Measles (Rubeola) Protocol

Prior to the introduction of vaccine in 1963 measles was a common childhood illness in the U.S., and most people developed natural immunity before adulthood. As a result, persons born in the U.S. prior to 1957 are considered to have presumptive immunity to measles. Following the adoption of a two dose immunization schedule with MMR vaccine in 1989, measles incidence declined to record low levels, and in 2000 measles was declared no longer endemic in the U.S. Cases of measles continue to occur in the U.S. as a result of importation of the virus from other countries, with occasional secondary spread most often among unvaccinated or partially vaccinated persons. Immunity must remain high in a population if an absence of endemic transmission of measles is to be sustained. However, in addition to maintaining high vaccination rates, prompt recognition, reporting, and investigation of cases and contacts is essential to halt the spread of imported disease.

Infectious Agent: Measles virus (paramyxovirus)

Incubation: Average of 14 days (range 7 - 21 days) from exposure to onset of symptoms.

Infectious Period: Measles is highly infectious, with greater than 90% secondary attack rates among persons who are susceptible. Measles can be transmitted from 4 days before to 4 days after the appearance of the rash.

Signs and Symptoms: Measles begins with a prodrome which lasts 2-4 days and is characterized by fever, malaise, cough, coryza (runny nose and watery eyes), and conjunctivitis (eye inflammation and redness). Small spots with white or bluish white centers on an erythematous (red) base in the mouth (buccal mucosa or soft palate) called Koplik spots are specific for measles and may be seen on oral exam between day 2 and 6. A characteristic red, blotchy, palpable (maculopapular) rash appears on the third to the seventh day and typically begins on the face (at the hairline) and spreads over the body (may include the palms and soles), becoming generalized, and may coalesce in areas. The rash lasts 4 to 7 days and is typically not itchy. Complications that may result include diarrhea, otitis media (middle ear infection), pneumonia, and encephalitis (inflammation of the brain and/or spinal cord).

Transmission: Measles is transmitted person to person by respiratory droplets and through direct contact with nasal and throat secretions or items freshly soiled with these secretions. Airborne transmission via aerosolized droplet nuclei can also occur in enclosed areas up to two hours after an infected person has occupied the area. Measles is one of the most communicable infectious diseases.

Susceptibility and Immunity: Persons who have no history of measles and who have not been immunized are susceptible. Infants, pregnant women without evidence of immunity, and immunocompromised persons are particularly susceptible to disease. Measles infection confers lifelong immunity. Primary vaccine failure can occur in up to 5% of persons after one dose.

However more than 99% of persons who receive two doses of measles vaccine develop serologic evidence of immunity.

Prophylaxis of Contacts: Live virus vaccine (MMR), if given within 72 hours of measles exposure, may prevent disease among susceptible persons. Household or other contacts for whom risk of complications is very high and for whom measles vaccine may be contraindicated, (ie contacts under 1 year of age, pregnant women without evidence of immunity, and immunocompromised persons), should receive immunoglobulin (IG) within 6 days of exposure. (*See Appendix for post-exposure prophylaxis recommendations*).

Quarantine and Isolation: Hospitalized patients with measles should be maintained under both standard precautions and airborne transmission precautions from onset of symptoms through 4th day of the rash if otherwise healthy and for the duration of illness if immunocompromised. Infants and n with measles should be kept out of childcare or school for 4 days after appearance of rash; ; adults should remain home from work and avoid public places during this time. Case-patients should avoid contact with anyone without documented measles immunity during their infectious period.

Measles Case Investigation Guidelines for Public Health Practitioners:

All suspect measles cases should be reported to the GA DPH Acute Disease Epidemiology Unit (404 657-2588) immediately if measles is suspected. If after hours please call 1-866-PUB-HLTH (24 hours/7 days a week). The following steps should be followed in the investigation of a suspect measles case:

- 1) If suspect – ISOLATE THE PATIENT promptly (in a negative pressure room if available). Suspect measles patients should be managed in a manner that prevents disease spread in the healthcare setting, i.e. using general and aerosol precautions (<http://www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf>)
- 2) Obtain a detailed description and timeline of the suspect case-patient’s clinical presentation to determine if consistent with measles:
 - History of cough, coryza and/or conjunctivitis including onset dates
 - Rash characteristics (characteristics of appearance, onset date, progression, distribution)
 - Documentation of Koplik's spots (this is difficult but specific for measles if present)
 - Fever, including onset date, pattern, and maximum documented temperature in relation to symptoms above
- 3) Obtain an accurate immunization history (documentation of MMR - # of doses and dates), or history of measles, date of birth (considered immune if born before 1957)
 - Only written or electronic records of vaccination are acceptable documentation
 - Consider “unknown status” if not documented
- 4) Identify possible sources for infection – review activities during the 21 days prior to rash onset
 - Was the patient exposed to a confirmed or suspect measles case during that time?

- Did the patient travel (airline, especially any international travel) or visit an international airport in the past 21 days?
 - Was the patient around foreign visitors (in the home, at a tourist attraction, international conference, healthcare setting, etc).
- 5) Collect the appropriate laboratory specimens to confirm the diagnosis. Contact the GA DPH Acute Disease Epidemiology Unit (404- 657-2588) promptly if measles is suspected and collaborate to collect the appropriate specimens. Specimens should be submitted to the GA Public Health Laboratory as soon as possible. Refer to *Measles: Specimen Collection and Shipping Instructions* included. These should include:
- Blood for serology (measles IgG and IgM antibodies)
 - Throat swabs for virus isolation and PCR
 - Urine specimen for virus isolation and PCR
- 6) Continue to complete the epidemiologic investigation in collaboration with the GA DPH. Note that several of these steps should be conducted simultaneously.
- Ensure isolation of case and quarantine of immediate contacts until susceptibility is assessed.
 - Determine the dates for the period of communicability (4 days before and 4 days after rash).
 - Interview case to obtain a detailed history of activities during the period of communicability, identify possible contacts (i.e. household, school, childcare, work, healthcare facilities, airplane) and venues, and obtain phone numbers when possible (*see Period of Communicability Timeline below*).
 - If exposure to others in a hospital ER waiting room or healthcare facility has occurred, work with facility personnel to identify persons in attendance at the time the case-patient arrived and up through 2 hours following appropriate isolation of the suspect patient.
 - Interview contacts to determine susceptibility (obtain age, determine if contact has been immunized with 2 doses of measles vaccine, or has had the disease as diagnosed by a physician, determine if pregnant/immunocompromised). Refer to *Measles – Assessment of Potential Exposure – Contact Tracing* to document information.
 - Stratify by time of exposure to determine the appropriateness and type of prophylaxis (refer to *Algorithm for Determining Measles Prophylaxis for Exposed Persons* included); be aware of contraindications; IG must be given within 6 days of exposure and MMR within 72 hours.
 - If period of prophylaxis has passed, counsel susceptible contacts to call their health practitioner if they develop respiratory symptoms and/or a rash, and report their exposure.
 - Work with GA DPH and State Pharmacy (district pharmacies in certain districts) to ensure availability of adequate IG.
 - Follow-up with individuals to ensure they received prophylaxis (IG or vaccine).
- 7) Notify other districts of measles contacts in their areas.
- 8) Conduct surveillance for secondary cases and contacts.

Period of Communicability Timeline

DAY - 4	DAY -3	DAY -2	DAY -1	DAY 0 RASH 1 ST APPEARS	DAY 1	DAY 2	DAY 3	DAY 4
AM	AM	AM	AM	AM	AM	AM	AM	AM
NOON	NOON	NOON	NOON	NOON	NOON	NOON	NOON	NOON
PM	PM	PM	PM	PM	PM	PM	PM	PM
Date _____	Date _____	Date _____	Date _____	Date _____	Date _____	Date _____	Date _____	Date _____

* Ask about the following (not inclusive – use as a guide): work activities, leisure, faith activities, shopping, errands, travel, dining out, childcare, school, household visitors and appointments



Acute Disease Epidemiology
 2 Peachtree St., NW
 Atlanta, GA 30303
 404-658-2588 or 1-866-PUB-HLTH
<http://dph.georgia.gov/vaccine-preventable-diseases>

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Algorithm for Determining Measles Prophylaxis for Exposed Persons

Use the table as a guide to determine appropriate post-exposure prophylaxis for exposed individuals based on their current age and/or health status.

Current age and/or health status	Vaccination History	
	Yes*	No
Pregnant		
W/ documented evidence of measles immunity	No action is needed	No action is needed
W/o documented evidence of measles immunity	—	Administer intravenous IG (IGIV) within 6 days of exposure [§] (under physician guidance)
Immunocompromised	Administer intravenous IG (IGIV) within 6 days of exposure [§] (under physician guidance)	Administer intravenous IG (IGIV) within 6 days of exposure [§] (under physician guidance)
< 12 months of age[†]	—	Administer intramuscular IG (IGIM) within 6 days of exposure ^{†‡}
≥ 12 months of age*	No action needed*	MMR vaccine should be given within 72 hours of exposure; or IGIM should be given within 6 days of exposure [†]
Born before 1957	Assume immunity. No action needed.	Assume immunity. No action needed.
Healthcare worker (regardless of age and year of birth)		
W/ documented evidence of measles immunity	No action needed	No action needed
W/o documented evidence of measles immunity	—	MMR vaccine should be given within 72 hours of exposure; or IG ^{‡§} should be given within 6 days of exposure

*The algorithm assumes **2 doses of MMR vaccine**. Exposed persons with history of only 1 dose of MMR vaccine should receive a second dose of MMR within 72 hours of exposure if 28 days have passed since their first MMR.

† For infants aged 6 -11 months, MMR vaccine can be given in place of IGIM, if administered within 72 hours of exposure. This dose does not count toward the two-dose series.

‡ Recommended dosage for intramuscular Immunoglobulin (IGIM) is 0.5 mL/kg of body weight up to a maximum of 15 mL .

§ Recommended dosage for intravenous Immunoglobulin (IGIV) is 400 mg/kg. This decision should be made in consultation with the patient's physician.

|| Healthcare workers are excluded. See "Healthcare worker" field for recommendations.

Measles: Specimen Collection and Shipping Instructions

A case of measles is a **public health emergency**. Contact public health **immediately** when the diagnosis of measles is suspected. A clinical diagnosis of measles is unreliable; suspect cases of measles must be laboratory confirmed. Confirmation of acute infection can be determined by the presence of serum immunoglobulin M (IgM), a four-fold rise in serum immunoglobulin G (IgG) titer between acute and convalescent phase specimens, a positive PCR, and/or the isolation of measles virus from a throat or urine specimen.

The Georgia Division of Public Health strongly recommends the **collection of serum for measles IgM/IgG AND collection of a throat swab and urine specimen to confirm a measles case**. To coordinate specimen collection and laboratory submission, call your District or County Health Department. **Please do not send specimens directly to the Georgia Public Health Laboratory (GPHL) or the Centers for Disease Control and Prevention (CDC).**

Specimen Collection Instructions

Serologic Testing: Collect as soon as possible when measles infection is suspected, preferably at the onset of rash.

- Collect 7-10 ml of blood in a red top or serum separator tube (SST)
Acute serum (IgM and first IgG)
Convalescent serum (second IgG)
- SST tubes must be centrifuged and the serum transferred into a transport tube for shipment.
- Keep specimens cold (4° C or 39° F) and ship overnight service. **Do not freeze serum samples.**

Viral Testing: Collect a urine and throat swab at the same time as serology. Virus is most frequently recovered within the first 3 days following rash onset, but up to 7 days after rash onset is acceptable. If a few days have passed since resolution of the rash collect only a urine specimen.

Throat Swabs

- Use a **viral transport kit** if possible (such as that used to isolate influenza or herpes simplex virus)
- Collect a throat swab by rubbing the posterior oropharynx with a dry sterile cotton swab
- Place swab in a tube containing 2-3 mls of viral transport medium or other sterile isotonic solution (phosphate buffered saline or cell culture medium).
- Keep samples cold (4° C or 39° F)
- Ship the viral specimens using ice packs or dry ice*. Avoid freeze-thaw cycles.

Urine Specimens

- Collect 10-15 ml of urine in a screw top sterile container
- Keep samples cold (4° C or 39° F)
- Ship the viral specimens using ice packs or dry ice*. Avoid freeze-thaw cycles.

*If shipment contains both serum and viral specimens, ship together by overnight service on cold packs (do not freeze serum)

Laboratory Submission Instructions

1. Notify your District Public Health Office or the Vaccine Preventable Disease Epidemiology Unit **immediately**.
2. Label the specimen containers (transport media, urine, and/or blood) with the patient's name, date of birth, and date of specimen collection (**UNAPPROVED OR UNLABELED SPECIMENS WILL NOT BE TESTED**)



3. Complete the Georgia Public Health Laboratory Submission Form found at: http://dph.georgia.gov/sites/dph.georgia.gov/files/related_files/site_page/GPHL%20FINAL%20Lab%20Submission%20Form_Non-Fillable%204-1-2014.pdf with the following information:
 - a. Submitter code (if known), address, phone and fax number, and contact name
 - b. Patient name, address, phone number, date of birth, sex, race, and ethnicity (if available)
 - c. Date of specimen collection, source, type of specimen, clinical history and information
 - d. If requesting IgM and/or IgG, under “Immunology” check **ALL** of the following boxes: 1510 Rubella IgG; 1515 Rubella IgM; 1520 Rubella IgG; and 1525 Rubella IgM
 - e. If requesting a culture, under “Virology” check the box labeled 62040 Measles Culture/IFA
 - f. If requesting a PCR, under “Molecular Biology” check the box labeled 416000 Measles (RT-PCR)

NOTE: A separate submission form needs to be completed for **EACH** specimen submitted (i.e. if two specimens are collected – one for culture and one for PCR , two GPHL submission forms need to be completed).
4. Ship specimens overnight by courier or Federal Express on ice packs. If the shipment is delayed, refrigerate specimens at 2-8 °C (or 36-46 °F) and transport the next day on ice packs by first class mail, common carrier, or courier.
5. Ship specimens to the following address:

Georgia Public Health Laboratory
1749 Clairmont Road
Decatur, GA 30033-4050
ATTN: Bacteriology Laboratory

Contact Information

- For specimen outfit requests call the Georgia Public Health Laboratory at 404-327-7921
- For questions related to specimen collection and transport: contact local or district public health or the State VPD Epidemiology Unit, 404-657-2588

Interpretation of Measles Laboratory Test Results

- Serology
 - IgM: Measles infection is confirmed using measles IgM antibody testing of serum samples collected as soon as possible after symptom onset. A positive IgM test result indicates current/very recent infection or reinfection. As with any lab test, there can be false positive test results.
 - IgG: IgG alone is not diagnostic unless you obtain both an acute (can be done as soon after onset as the patient is seen, but ideally four to five days after onset of symptoms) and convalescent (from two to four weeks after onset) blood specimen for serologic tests to determine if a four-fold rise in IgG antibody titer has occurred (e.g., from 1:40 to 1:320). In vaccinated persons it may not be possible to detect a four-fold rise in measles IgG antibody titer in paired serum samples (acute and convalescent). In such persons, the existing IgG will begin to rise soon after exposure and infection. At the time of onset of symptoms and collection of the acute serum, the IgG may already be quite elevated, and obviate the 4fold rise observed in the convalescent serum specimen.



- PCR
 - Sequence analysis of an RT-PCR product derived from a virus isolate or from clinical material confirms a presumptive positive PCR result and provides epidemiologically important information
- Viral Culture
 - Isolation of measles virus from any clinical specimen constitutes laboratory confirmation of measles