Measles! ☎
(Rubeola)

PROTOCOL CHECKLIST

- ☐ Enter available information into Merlin upon receipt of initial report
- ☐ Review background on disease, case definition, and laboratory testing (see page 3)
- ☐ Contact provider
- ☐ Contact reporting laboratory and request that specimens be sent to the Bureau of Public Health Laboratories (BPHL) for testing
- ☐ Interview patient or guardian
  - ☐ Review disease facts
    - ☐ Modes of transmission
    - ☐ Incubation period
    - ☐ Symptoms
  - ☐ Ask about exposure to relevant risk factors (see page 8)
    - ☐ Immunization history
    - ☐ Travel
    - ☐ Contact with a known person with measles or symptomatic person(s)
    - ☐ Visit to or work in a health care setting
  - ☐ Identify settings where exposures may have occurred and all known contacts (see page 9)
    - ☐ Determine evidence of immunity to measles for contacts
    - ☐ Recommend and ensure access to post-exposure prophylaxis for contacts who do not have evidence of immunity to measles
    - ☐ Monitor contacts for the duration of the incubation period.
  - ☐ Determine whether patient, symptomatic contacts, or susceptible contacts have exposures in sensitive situation (i.e., daycare, schools, college dormitory, military, other congregate living settings, health care workers, etc.)
    - ☐ Ensure isolation of symptomatic contacts
    - ☐ Exclude susceptible contacts from sensitive situations
  - ☐ Provide education on prevention through vaccination
  - ☐ Address patient's questions or concerns
- ☐ Follow-up on special situations
- ☐ Enter additional data obtained from interview into Merlin

Measles

1. DISEASE REPORTING

A. Purpose of reporting and surveillance

1. To prevent the spread of measles
2. To identify persons who have been exposed to measles
3. To assess the risk of the person(s) with measles transmitting illness to others, and to prevent such transmission through immunization, isolation, and exclusion

B. Legal reporting requirements

Laboratories and physicians are required to report immediately upon initial suspicion or laboratory test order, 24/7 by phone to the county health department (CHD). Reports should not be delayed for final laboratory confirmation.

C. County health department investigation responsibilities

1. Begin investigation into suspected measles infections immediately.
2. Report all confirmed and probable measles infections to the Bureau of Epidemiology (BOE) by contacting your regional epidemiologist and laboratory liaison immediately, or by calling the BOE at 850-245-4401. See contact list: www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/_documents/investigation-unit-map.pdf.
3. Facilitate transport of specimens as soon as possible to Florida Department of Health BPHL to confirm the diagnosis.
4. Isolate the infected person until 4 days after the rash onset (unless the diagnosis is ruled out).
5. Identify all potential sites of transmission and known contacts of the person with measles during the period of communicability.
6. Make appropriate recommendations for post exposure prophylaxis, exclusion, and illness monitoring to susceptible contacts, or contacts that have exposures in high-risk settings (i.e., health care workers) and do not have evidence of immunity.
7. Enhance surveillance for additional measles infections.
8. Enter all patients under investigation for suspected measles (e.g., measles lab test ordered) and report all confirmed and probable cases of measles in Merlin. Complete the measles extended data section for all patients under investigation (PUI) and reported cases as detailed in the supplemental Merlin guidance. See Merlin Measles Guidance: www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/_documents/mg-measles.pdf.

2. THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic agent

The measles virus is a paramyxovirus consisting of a single-stranded, RNA-encoded core.

B. Description of illness

Measles is an acute viral illness characterized by a generalized maculopapular rash, fever, and one or more of the following: cough, coryza, or conjunctivitis.

Measles has a distinct prodrome lasting 2-4 days before the onset of rash, with a range of 1-7 days, that begins with fever and malaise followed by conjunctivitis, coryza (sneezing, nasal congestion, and nasal discharge), cough, photophobia, and/or Koplik's spots (which are pathognomonic but uncommonly observed). These spots are seen as bluish-white specks on a rose-red background appearing on the buccal mucosa.

Fever may exceed 40°C (104°F), and usually falls 2-3 days after rash onset. High fever persisting beyond the third day of the rash suggests that a complication (e.g., otitis media) may have occurred.

The rash usually begins on the head often along the hairline, followed by the upper neck, and spreads downward reaching the hands and feet over a 3-day span. The rash usually lasts 5-6 days and fades in the order it appeared.

Complications of measles include otitis media (7%), pneumonia (6%), and encephalitis (0.1%). Death occurred in 0.3% of cases in the United States with 19% requiring hospitalization. Children less than 5 years of age and adults over 20 years of age most commonly develop complications of measles. A rare long-term complication associated with measles is subacute sclerosing panencephalitis (SSPE), which may develop 7 to 11 years after a person has a wild-type measles infection and is always fatal.

C. Reservoirs

Humans are the only known reservoir.

D. Modes of transmission

Measles virus is spread directly from person to person by inhalation of respiratory droplets or when infectious nasopharyngeal secretions come into contact with the mucous membranes of a susceptible person. Measles virus is sensitive to light and heat, but remains infectious in the air or on surfaces for up to two hours. Measles is one of the most contagious of all infectious diseases with >90% attack rate among susceptible close contacts.

E. Incubation period

The incubation period ranges from 7-21 days with an average period of 14 days, with rash onset usually occurring within 2-4 days after the first symptoms appear and up to 21 days after the exposure. For investigation purposes, the exposure period is defined as 7-21 days prior to rash onset.

F. Period of communicability

Measles is **most** communicable from the onset of prodrome (symptoms) through the first 4 days of rash. For investigation purposes, the contagious period is defined as the time from the 4 days prior to the date of rash onset until 4 days after the date of rash onset.

G. Treatment

No specific treatment exists.

H. Postexposure prophylaxis

MMR vaccine, if administered within 72 hours of initial measles exposure, might provide some protection or modify the clinical course of measles. For vaccine-eligible persons aged ≥12 months exposed to measles, administration of MMR vaccine is preferable to using Immune globulin (IG), if administered within 72 hours of initial exposure.

IG given within 6 days of exposure can prevent or modify measles in persons who are nonimmune. The following groups are at risk for severe disease and complications from measles and should receive IG: infants aged <12 months, pregnant women without evidence of measles immunity, and severely immunocompromised persons. IG can be administered 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 (e.g., household, daycare, and classroom). For exposed persons without evidence of measles immunity, a rapid IgG antibody test can be used to inform immune status, provided that administration of IG is not delayed.

More detailed recommendations for measles post exposure prophylaxis can be found at: www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm.

I. Measles in Florida

From 2006-2015, twenty-seven confirmed measles infections, with patient's age ranging from 0 to 63 years, have been reported in Florida residents. Of those, 44% were classified as internationally imported cases, 22% were import-linked cases, and 7% were imported-virus cases. The rest of the cases were defined as endemic (15%) or had an unknown source (11%). Twenty-five out of the twenty-seven cases were determined to be outbreak associated.

3. CASE DEFINITION

A. Clinical description

Confirmatory:
A febrile rash illness (temperature does not need to reach ≥101°F [38.3°C] and rash does not need to last ≥3 days).

Presumptive:
An illness characterized by all the following:

- Generalized, maculopapular rash lasting ≥3 days,
- Temperature ≥101.0°F (38.3°C), and
- Cough, coryza, or conjunctivitis.

B. Laboratory criteria for diagnosis

- Isolation of measles virus[1] from a clinical specimen,
  Or
- Detection of measles virus-specific nucleic acid[1] from a clinical specimen using polymerase chain reaction (PCR),
  Or
- IgG seroconversion[1] or a significant rise in serum measles IgG antibody[1] level between acute- and convalescent-phase specimens using any evaluated and validated method,
  Or
- Positive serologic test for measles IgM antibody.[1,2]

[1] Not explained by MMR vaccination during the previous 6-45 days.
[2] Not otherwise ruled out by other confirmatory testing or more specific measles testing in a public health laboratory.

C. Case classification

Confirmed:
- A person with confirmatory clinical criteria and laboratory evidence
  Or
- A person with confirmatory clinical criteria who is epidemiologically linked to a laboratory confirmed case.

Probable:
A person with presumptive clinical criteria in the absence of a more likely diagnosis and noncontributory or no measles laboratory testing.

D. Comments

Epidemiologic classification 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 the measles virus outside the U.S. as evidenced by at least some of the exposure period (7-21 days before rash onset) occurring outside the U.S. and rash onset occurring within 21 days of entering the U.S. 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 U.S. during the 21 days before rash onset or was known to have been exposed to measles within the U.S.

U.S.-acquired cases are subclassified 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 U.S. 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 ≥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 ≥12 months within the U.S.

- **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.

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

Specimens from all cases must be sent to the Bureau of Public Health Laboratories for confirmation.

*Questions about measles follow-up should be directed to the Department of Health, Bureau of Epidemiology 850-245-4401***.**

4. LABORATORY DIAGNOSIS AND SERVICES

A. Criteria for diagnosis

Laboratory confirmation is essential for all outbreaks and all sporadic measles cases. Detection of measles-specific IgM antibody and measles RNA by real-time RT-PCR are the most common methods for confirmation of measles infection. Efforts should be made to obtain a serum specimen, throat swab (or nasopharyngeal swab), and urine specimens from suspected cases at first contact, as early as possible after rash onset. Measles virus IgM is best detected >72 hours 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 patients 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 alternative explanation for symptoms, for example epi-linked to known parvovirus B19 case) or those with fever and generalized maculopapular rash with strong suspicion of measles.

More information about laboratory testing for measles virus can be found at: http://www.cdc.gov/measles/lab-tools/index.html.

B. Services available at BPHL:

- Measles IgG and IgM on serum (Jacksonville laboratory)
- RT-PCR on throat, nasopharyngeal, and urine specimens (Jacksonville and Tampa laboratories)

Specimen collection:

Blood for serologic testing is collected by venipuncture. Use tubes without additives, either a plain, red-top tube or a serum separator tube.

Throat (oropharyngeal), nasal or nasopharyngeal (NP) swabs placed in viral transport media are the preferred samples for virus isolation or detection of measles RNA by RT-PCR. Measles virus is reliably detected by RT-PCR within 7 days of rash, and possibly up to 10 days in urine. Synthetic swabs are recommended. Urine samples may also contain virus and when feasible to do so, collection of both samples can increase the likelihood of detecting the virus. Urine specimens should be transferred to a urine transport tube to ensure the specimen does not leak.

All submissions should be accompanied by a completed Clinical Lab Submission Form: http://www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/surveillance-and-investigation-guidance/_documents/dh1847clinicallabsubmissionform.pdf.

C. Packaging and shipping

1. Contact BPHL for packaging and shipping training dates. BPHL conducts approximately 20, face-to-face trainings per year all over Florida, free of charge. DOH employees must register for the classes in the DOH online training system called, TRAIN. For shipping guidance, please contact BPHL.

2. Additional guidance regarding specimens sent for measles testing can be found at: http://www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/_documents/measles-laboratory-packaging-and-shiping-guidance.pdf.

3. Contact the virology department at BPHL-Jacksonville or BPHL-Tampa with questions: http://www.floridahealth.gov/programs-and-services/public-health-laboratories/locations/index.html.

D. Interpretation of Results

A positive IgM result obtained at any time during the illness is generally diagnostic for measles. Isolation of measles virus from a clinical specimen, detection of measles virus-specific nucleic acid by RT-PCR from a clinical specimen, or a rise in IgG antibody level can also be interpreted as a positive measles identification.

False positive IgM results can occur, particularly when testing is being performed in a low prevalence population (i.e., people who do not meet the clinical case definition or people

with no obvious risk factors for measles). In such instances, when a positive IgM result is obtained, the result should be interpreted with caution.

IgM testing is not useful for previously vaccinated or naturally infected persons, as little or no secondary IgM response has been observed after vaccine booster. A negative IgM result for a person who has received two MMRs given after 1980 is not a reliable result or of diagnostic value.

A positive IgG value usually indicates a past infection or antibody response to a prior vaccination. A positive IgG value could be indicative of a current infection if the person has not been infected with measles previously, has not received vaccination previously, and the serum was drawn at least 5 days post symptom onset.

Note: Since measles vaccine and natural measles infection can both stimulate an IgM response in the host, a surveillance dilemma occurs when a suspected measles case has a history of measles vaccination within 6 weeks of rash onset. *Measles vaccine can cause fever and rash in about 10% of vaccinees*, and most first time vaccinees are expected to have detectable measles IgM after vaccination. Moreover, other medical conditions, such as rubella, dengue, etc., may produce fever and rash in persons who have recently received measles vaccine. Therefore, a suspected measles case with a positive IgM result is not necessarily due to wild type measles virus infection.

5. CASE INVESTIGATION

Interview the patient and others who may be able to provide pertinent clinical or exposure information.

A. Evaluate the diagnosis

1. Review the clinical presentation, physical exam findings, travel history and other risk factors during the likely exposure period (7-21 days prior to the onset of rash), and immunization status of the patient to determine the likelihood of the diagnosis. Sources of immunization data might include medical records, parent immunization cards, school/child care records and the Florida State Health Online Tracking System (SHOTS), the statewide immunization registry. Names of vaccine products used outside the U.S. can be found in Appendix B of the *Pink Book* or online at: http://www.cdc.gov/vaccines/pubs/pinkbook/index.html.
2. Determine whether to test for measles.
    a. Testing should be performed at BPHL on all unimmunized persons who meet the clinical case definition and have a known measles exposure, international travel, or were in a high-risk setting during the likely exposure period (7-21 days prior to the rash onset).
    b. Testing is discouraged if a patient's clinical presentation is not consistent with measles **and** the patient has no known increased risk for exposure to measles. This is true regardless of immunization status. Testing in these situations will increase the likelihood of obtaining a false positive result. Commercial laboratories should be used by the medical providers for low-priority testing.

c. All other situations will require clinical judgment. Although the clinical case definition only includes a generalized rash, fever ≥101°F, and cough, coryza or conjunctivitis, there are aspects of the clinical presentation which can increase the suspicion for measles. A measles rash usually starts on the head or face and spreads downward and the fever is generally still present at the time the rash begins. In recent years, the source of acquisition for up to 10% of measles infections reported in the U.S. could not be determined; therefore persons with a clinical presentation suspicious for measles who lack a known risk factor for measles exposure should still be tested, particularly if they are known to be susceptible.

3. Collect serum, throat or NP swab, and urine at the first clinical encounter. All efforts should be made to ensure proper and timely specimen collection, including home visits as needed.
4. If a positive IgM result from a commercial laboratory is reported to public health and the person has symptoms consistent with measles, facilitate the transport of the positive serum specimen and additional specimens (serum, throat or NP swab, and urine) as appropriate based on timing to BPHL for confirmation of the diagnosis.

B. Identify potential sources of infection

Evaluate all of the patient's activities during the likely exposure period (7-21 days prior to the onset of rash). Identify situations where the case might have been at increased risk of exposure to measles. Collect the following information:

1. Contact information for any household member, playmate, or other contact who had a rash illness during the likely exposure period
2. Any travel inside or outside of the United States, or to an area of the United States where measles has recently been reported
3. Any contact with visitors from outside the United States or an area of the United States where measles has recently been reported
4. Any visit to a doctor's office, clinic, or hospital (find out exact time[s], date[s], name of the clinic[s], duration of visit[s], and areas of the facility visited)
5. Any indoor group activities attended (e.g., church, theaters, tourist locations, public or commercial travel, parties, athletic events, family gatherings) and contact information of the person who organized the group or event
6. Any work or volunteer activities in a health care setting, or attendance or work at a school, child care, college, prison, refugee center, etc.

C. Identify exposed, susceptible contacts and potential sites of transmission

1. If highly suspected and probable cases are investigated, postexposure prophylaxis of household contacts without presumptive evidence of immunity should not be delayed pending the return of laboratory results.
2. Other high priority groups for contact investigation are:
    a. Close contacts other than household (e.g., persons who shared the same room or airspace in various settings)
    b. Health care settings because of the risk of transmission to persons at high risk of serious complications

c. 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

In all these settings, exposures usually result in an identified number of susceptible contacts to follow up on individually. However, efforts to identify the likelihood of exposure in larger settings such as hospitals (e.g., patients and health care personnel in ER) may be helpful. In particular, one should identify individuals at high risk for severe disease including infants who are not vaccinated, immunocompromised individuals, and pregnant women.

3. Other exposure settings will more commonly be lower priority to investigate, though public health decisions should be guided by the epidemiologic investigation.
4. Evaluate the activities of the patient during the contagious period (4 days before through 4 days after the date the rash started). Measles virus lingers in the air, so anyone who enters a room within two hours after a person with confirmed measles should also be considered exposed.
5. Use a contact tracking form or database to record key variables for each contact identified to ensure linkage of future cases among contacts.
6. Determine measles immune status of exposed priority contacts. Persons are considered immune to measles if they have one or more of the following:
   a. Written documentation of adequate vaccination:
      i. One or more doses of a measles-containing vaccine administered on or after the first birthday for preschool-aged children and adults not at high risk.
      ii. Two doses of measles-containing vaccine for school-aged children and adults at high risk, including college students, health care personnel, and international travelers.
   b. Laboratory evidence of immunity to measles
   c. Laboratory confirmation of measles infection
   d. Born before 1957
7. Alert health care facilities visited by the patient during the contagious period and make recommendations regarding management of susceptible contacts. During an outbreak of measles, health care facilities should recommend two doses of MMR vaccine at the appropriate interval for unvaccinated health care personnel regardless of birth year who lack laboratory evidence of measles immunity or laboratory confirmation of disease.
8. Follow up of adults with unknown immunity or children with documented immunity, that are not household contacts, not immune compromised, not known to be pregnant, or not known to be present in high-risk settings can be conducted passively by letter notification.
9. If transmission may have occurred in a public place and potentially exposed individuals cannot be identified, a press release may be the best way to inform the public. Consultation with BOE and the Office of Communications is needed when developing public notifications.

D. Enhance surveillance for additional persons infected with measles

Alert health care providers, hospital emergency rooms, and student infirmaries have the potential for additional measles infections; encourage health care providers to consider measles in persons with a rash illness with known exposures, or lack of evidence of immunity, take appropriate infection control precautions when evaluating suspected cases and report every suspected cases to public health immediately. During an outbreak, consider putting a notice outside hospital emergency rooms and other clinic facilities advising patients with rash to remain outside and ask for medical evaluation.

E. Merlin data entry

Enter all PUI for measles (e.g., measles lab test ordered) and report all confirmed and probable cases of measles in Merlin. Complete the measles extended data section for all PUIs and reported cases as detailed in the supplemental Merlin guidance (http://www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/_documents/mg-measles.pdf).

Attach **ALL** labs received via electronic laboratory reporting (ELR) to the case.

6. CONTROLLING FURTHER SPREAD

A. Infection control recommendations/case management

1. In addition to standard precautions, hospitalized patients should be cared for using airborne precautions until 4 days have passed since the onset of the rash (or for the duration of illness if the patient is immunocompromised).
2. Airborne transmission via aerosolized droplet nuclei has been documented in closed areas for up to 2 hours after a person with measles occupied the area. If a person communicable with measles is examined in a health care facility, the examination room should be closed to use for 2 hours prior to cleaning.
3. Persons suspected to have measles should be advised to do the following during the contagious period (until 4 days have passed since the onset of the rash or for the duration of illness if the patient is immunocompromised):
    - stay home and not go to child care, school, work, public places or social activities;
    - prohibit contact with susceptible children (particularly infants), susceptible pregnant women, and immunosuppressed individuals;
    - avoid contact with susceptible family members and visitors; and
    - avoid exposing other people at health care facilities by calling ahead and making special arrangements to prevent contact with others.

B. Contact management

1. Symptomatic contacts

- Any contact with a rash illness compatible with measles should be referred to a health care provider for evaluation and laboratory testing.

- Susceptible contacts with respiratory symptoms or fever should stay home and call their county health department and health care provider.
- If a contact goes to a health care provider for evaluation of possible measles, the patient should call ahead to ensure that facility personnel are aware of the specific reason for referral so that special arrangements can be made to keep them out of areas used by other patients.
- Persons with possible measles should avoid contact with others until measles is ruled out.

2. Active immunization with measles vaccine (persons 12 months of age or older)

- Vaccinating susceptible contacts within 72 hours of exposure may prevent or modify disease. If 72 hours has passed since the exposure, vaccination is still recommended to prevent future infection. Susceptible, previously unimmunized persons should receive their first MMR and persons who have received one dose should receive a second dose, if indicated. See Section 8, Routine Prevention, for recommendations and contraindications for vaccination.
- Public health may need to arrange special clinics to vaccinate susceptible contacts and others from the community.

3. Passive immunization with IG

- IG can be administered either intramuscularly (IGIM) or intravenously (IGIV) within 6 days of exposure to prevent or modify infection with measles in people who do not have evidence of measles immunity.
- The following patient groups are at risk for severe disease and complications from measles and should receive IG:
  - infants aged <12 months,
  - pregnant women without evidence of measles immunity, and
  - severely immunocompromised persons.
- IGIM can be administered 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 (e.g., household, daycare, and classroom).
- IG is not recommended for close contacts who have received one dose of vaccine on or after the first birthday unless they are immunocompromised.
- For exposed persons without evidence of measles immunity, a rapid IgG antibody test can be used to inform immune status, provided that administration of IG is not delayed.
- Patients should be warned that IG may modify but not prevent measles infection and may also increase the incubation period to 21 days.
- See the current edition of the *Red Book* for additional details regarding IG dosage and administration of vaccines after receipt of IG (http://aapredbook.aappublications.org/).
- IG should not be used to control measles outbreaks, but rather to reduce the risk for infection and complications in the person receiving it.

- Any nonimmune person exposed to measles who received IG should subsequently receive MMR vaccine, which should be administered no earlier than 6 months after IGIM administration or 8 months after IGIV administration, provided the person is then aged ≥12 months and the vaccine is not otherwise contraindicated.

4. Exclusion

- Susceptible, previously unimmunized contacts should avoid all public settings from 7 days after the first date of exposure until 21 days after the last date of exposure.
- Contacts who received one dose of measles-containing vaccine prior to the exposure do not need to be excluded from public settings. However, they should be educated about symptoms of measles and instructed to isolate themselves if symptoms develop and call the CHD.
- Persons without documentation of immunity may have blood drawn and tested for measles IgG to demonstrate immunity. Exclusion from a public setting will not be necessary if the person is found to be immune.

5. Education

- All exposed persons regardless of immune status should be advised to watch for symptoms of measles until 21 days after the last exposure to the communicable person. If suggestive symptoms develop, they must isolate themselves and call the CHD as soon as possible.
- If exposure has occurred among a large group or in a public setting, consider educating potentially exposed persons and making recommendations via letters or press release.

C. Management of other exposed persons

Persons potentially exposed to the same source as the patient or present in the same high-risk setting during the likely exposure period should be told to watch for symptoms of measles, particularly during the 7-21 days following exposure regardless of immune status.

7. MANAGING SENSITIVE SITUATIONS

A. Cases among employees or attendees at school/child care facility

1. Exclude persons with suspected measles from school or child care until 4 days have passed since rash onset.
2. Identify all persons at the school who were potentially exposed to the index patient.
3. Exclude all exposed persons who are susceptible and unimmunized at the time of exposure.
4. Recommend a second MMR to persons who have only received one MMR, as long as 28 days have passed since the first dose.
5. Recommend that susceptible, unimmunized persons receive the MMR vaccine within 72 hours. If immunocompromised, pregnant or under one year of age, IG should be given within 6 days.
6. Persons receiving their second dose and previously unvaccinated persons receiving

their first dose as part of the outbreak control program may be immediately readmitted to school. However, these individuals should be monitored for signs and symptoms of measles.

7. Persons who continue to be exempted from or who refuse measles vaccination, should be excluded until 21 days after the onset of rash in the last associated case of measles.
8. Maintain daily active surveillance of all school or child care contacts to assess for prodromal signs and symptoms compatible with measles for 21 days from the last possible exposure in the school.

B. Case in a medical setting

1. To prevent measles outbreaks in health care settings, health care workers (volunteers, trainees, nurses, physicians, technicians, receptionists and other clinical support staff) should have documented immunity to measles *before* exposure, ideally as a condition of employment. Health care facilities should maintain readily available documentation of immunity for employees. Recommendations for Immunization of Health care Workers is published in the *MMWR* at: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6007a1.htm?s_cid=rr6007a1_e.

   Evidence of immunity to measles includes one or more of the following:

   - Documented administration of two doses of live measles virus vaccine given on or after the first birthday (inactivated measles vaccines were in use from 1963-1967);
   - Laboratory evidence of immunity;
   - Laboratory confirmation of disease; or
   - Born before 1957.
2. If a person with measles is treated in a health care setting during the contagious period, identify all potentially exposed health care workers, volunteers and other staff and assess status of their immunity to measles.
3. Staff without presumptive evidence of immunity who have been exposed to measles should be offered the first dose of MMR and relieved from patient contact and excluded from the facility from the fifth day after the first exposure through the twenty-first day after the last exposure, regardless of whether they received vaccine or intramuscular IG after the exposure.
4. Health care workers who develop measles must avoid patient contact until 4 days have passed since the rash onset.
5. Only health care workers with documented immunity to measles should enter the room of a suspected measles patient.
6. Exposed patients should likewise have their immune status assessed and be given vaccine or IG if they are not immune; school and work restrictions of unimmunized contacts apply.
7. County health officers, or their designee, should ensure that persons who are exposed to measles and are susceptible or have unknown immunity are restricted from working in health care settings or from visiting settings with persons known to be at risk of severe measles infection. Voluntary or mandatory quarantine may be tools to protect the public's health in these circumstances.

8. ROUTINE PREVENTION

A. Immunization recommendations

Routine immunization with MMR is recommended during childhood; the first dose of MMR is recommended at 12-15 months of age, with a second dose recommended at 4-6 years. Two doses of MMR vaccine are also recommended for students attending college and other post-high school institutions, international travelers, and health care personnel. Persons born in 1957 or later should receive at least one dose of MMR if they do not have evidence of immunity to these three diseases. Approximately 95-98% of susceptible persons develop measles antibodies after a single dose of vaccine. After two doses of vaccine, 99% of persons develop serologic evidence of measles immunity.

Contraindications to vaccine include:

- a history of a severe allergic reaction (i.e., hives, swelling of the mouth or throat, difficulty breathing, low blood pressure, or shock) following a previous dose of measles vaccine or vaccine components (e.g., neomycin, gelatin) (MMR can be given to egg-allergic persons);
- pregnancy;
- significant immunosuppression;
- recent receipt of antibody-containing blood products.

Moderate or severe acute illness is a precaution, not a contraindication, and vaccination should be considered during an outbreak.

Infants 6 through 11 months of age should receive one dose of MMR vaccine prior to international travel. This dose is not considered valid and two doses administered on or after the first birthday are required.

For more information about MMR vaccine schedules, adverse reactions and contraindications, please see: http://www.cdc.gov/measles/vaccination.html.

B. Prevention recommendations

Vaccination is the best way to prevent measles.

9. IMPORTANT LINKS

A. Measles webpage, Centers for Disease Control: http://www.cdc.gov/measles/index.html

B. *Manual for the Surveillance of Vaccine-Preventable Diseases,* 6th Edition, 2013: http://www.cdc.gov/vaccines/pubs/surv-manual/index.html

C. *Epidemiology and Prevention of Vaccine-Preventable Diseases, The Pink Book*: Course Textbook, 13th Edition (2015): http://www.cdc.gov/vaccines/pubs/pinkbook/index.html