Measles

1. DISEASE REPORTING

A. Purpose of Reporting and Surveillance

1. To rapidly identify measles cases.
2. To prevent the spread of measles.
3. To identify groups of unimmunized children and adults.

B. Legal Reporting Requirements

1. Health care providers: **immediately notifiable to local health jurisdiction**
2. Health care facilities: **immediately notifiable to local health jurisdiction**
3. Laboratories: **immediately notifiable to local health jurisdiction**; specimen submission required - isolate or clinical specimen associated with positive result (2 business days)
4. Local health jurisdictions: **immediately notifiable to Washington State Department of Health (DOH) Communicable Disease Epidemiology (CDE)**

C. Local Health Jurisdiction Investigation Responsibilities

1. Begin investigation immediately.
2. Report all *confirmed* and *probable* cases (see definitions below) as well as rash illness suspected to be measles to CDE by telephone immediately.
3. Facilitate transport of specimens immediately to Public Health Laboratories to confirm the diagnosis.
4. Isolate the case until 4 days after the rash onset (unless the diagnosis is ruled out).
5. Identify contacts of the case and potential sites of transmission during the period of communicability.
6. Provide consultation and assistance as needed to facilities, businesses, and schools within the jurisdiction where a case was present while contagious.
7. Make appropriate recommendations to susceptible contacts (see Section 6).
8. Enhance surveillance for additional cases.
9. Complete the measles case report form for all *confirmed* cases (http://www.doh.wa.gov/Portals/1/Documents/5100/210-073-ReportForm-Measles.pdf) and enter the data into the Public Health Issues Management System (PHIMS). Only confirmed cases are reported to the CDC. The rash illness form (http://www.doh.wa.gov/Portals/1/Documents/5100/210-071-ReportForm-RashIllness.pdf) may be used to document work on probable or suspected cases.

2. THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

The measles virus—a single-stranded, RNA-encoded paramyxovirus.

B. Description of Illness

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

Measles has a distinct prodrome that begins with fever and malaise. Additional symptoms can be conjunctivitis, coryza (sneezing, nasal congestion, and nasal discharge), cough, photophobia, and 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 and labial (lip) mucosa usually opposite the molars.

Temperatures may exceed 40°C (104°F), and usually fall 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 prodrome generally lasts 2–4 days before the rash occurs. The rash is maculopapular and begins on the head often along the hairline and spreads downward reaching the hands and feet. In severe cases, the lesions usually become confluent, especially on the face and upper body. Diarrhea occurs in 8% of cases.

Complications of measles include otitis media (7%), pneumonia (6%), and encephalitis (0.1%). Death occurs in 1–3 per 1,000 cases in the United States.

C. Measles in Washington

Because two doses of measles-mumps-rubella (MMR) vaccine are now part of the routine childhood immunization schedule, measles is rarely reported in Washington. Most measles in the United States results from or can be linked to importation from areas of the world where measles is still endemic. In most years, fewer than 5 cases are reported in Washington.

D. Reservoirs

Acutely infected humans.

E. Modes of Transmission

Virus is spread directly from person to person by inhalation of suspended droplet nuclei or when infectious nasopharyngeal secretions come into contact with the mucous membranes of a susceptible person. Measles virus is sensitive to strong light and drying, but remains infectious in aerosol form in air for approximately 2 hours. Measles is one of the most contagious of all infectious diseases, with >90% attack rates among susceptible close contacts.

F. Incubation Period

The time from exposure to onset of fever ranges from 7–18 days (average 10 days), with the 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.

G. Period of Communicability

Measles is most communicable from the onset of prodrome through the first 3–4 days of rash. For investigation purposes, the "contagious period" is usually defined as the 4 days prior to the date of rash onset through the 4 days after the date of rash onset (9 days total). Immunocompromised persons should be considered contagious for the duration of the illness.

H. Treatment

No specific treatment.

I. Immunity

Immunity to measles after natural infection or vaccination is probably life-long in most persons. In a small proportion of people (≤5%), protection after vaccination may be incomplete.

(See Hickman, et al. J Infect Dis. (2011) 204 (suppl 1): S549-S558)

3. CASE DEFINITIONS

A. Clinical Case Definition

An illness characterized by all the following:

- a generalized rash lasting ≥ 3 days
- a temperature ≥ 101.0°F (≥ 38.3°C)
- cough or coryza or conjunctivitis

B. Laboratory Criteria for Diagnosis

- Isolation of measles virus from a clinical specimen, or
- Detection of measles-virus-specific nucleic acid by polymerase chain reaction, or
- Significant rise in serum measles immunoglobulin G (IgG) antibody level between acute- and convalescent-phase specimens, by any standard serologic assay (see Comment), or
- Positive serologic test for measles immunoglobulin M (IgM) antibody.

C. Case Classification (2013)

Probable: In the absence of a more likely diagnosis, a case that meets the clinical case definition, has noncontributory or no measles laboratory testing, and is not epidemiologically linked to a laboratory-confirmed case

Confirmed: An acute febrile rash illness[†] with:

- Isolation of measles virus[‡] from a clinical specimen; or
- Detection of measles-virus specific nucleic acid[‡] from a clinical specimen using polymerase chain reaction; or
- IgG seroconversion[‡] or a significant rise in measles immunoglobulin G antibody[‡] using any evaluated and validated method; or

- A positive serologic test for measles immunoglobulin M antibody[‡§]; or
- Direct epidemiologic linkage to a case confirmed by one of the methods above.

[†] Temperature does not need to reach ≥101°F/38.3°C and rash does not need to last ≥3 days.

[‡] Not explained by MMR vaccination during the previous 6-45 days.

[§] Not otherwise ruled out by other confirmatory testing or more specific measles testing in a public health laboratory.

D. Comment

- All classifications are reported to CDE but only confirmed cases are reported to CDC.
- IgG testing for acute measles requires demonstration of a rise in level of antibody against measles virus, so two serum specimens are always required. The first specimen should be drawn as soon after rash onset as possible, ideally within the first three days. The second specimen should be drawn 10–30 days later. The tests for IgG antibody should be conducted on both specimens using the same test at the same time. The specific criteria for interpreting such a test depend on the test used. However, seroconversion from negative IgG to positive IgG using specimens as described above confirms the diagnosis of measles. (Pink Book 2011 p.177)

E. Epidemiologic Classification of Internationally-Imported and U.S-Acquired

Measles is no longer considered endemic in the United States. Measles cases are classified as either internationally-imported or U.S.-acquired. An internationally imported case is one 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 United States during that time. All other cases are considered U.S.-acquired. (U.S. acquired cases are further subclassified into four mutually exclusive groups: Import-linked cases, Imported-virus cases, Endemic cases, and Unknown source cases. Further information about these subclassifications can be found in the 2013 measles case definition at: http://wwwn.cdc.gov/NNDSS/script/casedef.aspx?CondYrID=908&DatePub=1/1/2013%2012:00:00%20AM

4. DIAGNOSIS AND LABORATORY SERVICES

A. Laboratory Diagnosis

The laboratory diagnosis of measles is most often made by detection of measles IgM antibody in a single serum specimen. Approximately 80% of measles cases have detectable IgM antibody by IgM capture EIA within 72 hours of rash onset. Nearly 100% of measles cases demonstrate IgM antibody 72 hours after rash onset (JID 1997; 175:195–199). In most instances, a serum sample should be collected for measles IgM at the first clinical encounter. However, *if a negative result is obtained from a specimen drawn less than 72 hours after rash onset, another specimen will be required.*

In general, a positive IgM result obtained at any time during the illness is diagnostic for measles. However, 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. Further testing is recommended. Call the Communicable Disease Epidemiology (CDE) to discuss.

The diagnosis can also be made by isolation of measles virus from a clinical specimen. Urine and respiratory samples are both good clinical specimens for viral isolation. Measles virus isolation is most successful when samples are collected within three days of rash onset. However, virus may still be present in specimens 7 days following rash onset. **A negative culture for measles does not rule out the diagnosis.**

Lastly, the diagnosis can be confirmed by demonstrating a significant rise in measles IgG antibody level in acute and convalescent sera (see Section 3D). Demonstrating a rise in measles IgG or seroconversion is not necessary when measles has been confirmed by another method.

Note: A small percentage of individuals who have previously been exposed to measles antigen (i.e., vaccinated for or had measles disease) can subsequently become infected by wild-type measles virus. Such persons may have a modified disease presentation, as well as a blunted or transient production of IgM. Therefore a negative IgM test in vaccinated persons suspected of having measles should not be used to rule out the case. RT-PCR may be the best method to confirm such cases. If viral testing results are noncontributory, additional testing can be performed for highly suspicious cases at CDC laboratories. Please call Communicable Disease Epidemiology (CDE) to discuss the need for further testing.

B. Services Available at the Washington State Public Health Laboratories (PHL)

PHL performs an enzyme-linked immunoassay (ELISA) for measles-specific IgM and IgG antibodies. Serologic testing is also widely available at commercial laboratories but when measles is highly suspected specimens should be routed to WA PHL to expedite testing. In addition, PHL performs polymerase chain reaction on nasopharyngeal swab specimens only and viral culture for measles on clinical specimens (both nasopharyngeal secretions and urine preferred). Please contact an epidemiologist at CDE before sending specimens to PHL. Testing can be performed after hours and on the weekends if needed.

Note that PHL requires all clinical specimens have two patient identifiers, a name **and** a second identifier (e.g., date of birth) both on the specimen label and on the submission form. Due to laboratory accreditation standards, specimens will be rejected for testing if not properly identified. Also include specimen source and collection date.

C. Specimen Collection and Shipping

Persons suspected to have measles should specimens collected for viral isolation (nasopharyngeal swab and urine) at the time of the first health care provider visit. In most instances, serum should also be drawn. Keep in mind that measles-specific IgM antibody may not be present until 72 hours or more after rash onset. In some situations, for example when a very young child presents with possible measles, the health care provider may choose to collect the respiratory specimen and urine at the first visit, and then have

the child return 4 or more days after the rash onset when results of serologic testing would be more definitive for collection of a serum specimen.

Instructions for collecting specimens follow:

- **Serum:** Collect at least 1 cc of serum. Store specimen in refrigerator and transport on ice.
- **Nasopharyngeal swab (preferred respiratory specimen):** Swab the posterior nasal passage with a Dacron™ or rayon swab and place the swab in 2–3 ml of viral transport medium.
- **Urine:** Collect at least 50 ml of clean voided urine in a sterile container. Store specimen in refrigerator and transport on ice.
- **Throat swab:** Swab the posterior pharynx with a Dacron™ or rayon swab and place the swab in 2–3 ml viral transport medium.

For additional information regarding collection, storage and shipping of specimens for viral isolation, see: http://www.cdc.gov/vaccines/pubs/surv-manual/chpt22-lab-support.pdf.

All specimens sent to PHL must be accompanied by a completed PHL virology form: http://www.doh.wa.gov/Portals/1/Documents/5230/302-017-SerVirHIV.pdf. Along with the patient and submitter names, be sure to include the date of collection, date of rash onset, and immunization history (if known) on the form.

5. ROUTINE CASE INVESTIGATION

Interview the case and others who may be able to provide pertinent clinical 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 Child Profile. Names of vaccine products used outside the United States can be found in Appendix B of the Pink Book or online at: http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendices/B/foreign-products-tables.pdf.
2. Determine whether to test for measles.
   a. Testing should be performed on all unimmunized persons who meet the clinical case definition and have a known measles exposure 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.
   c. All other situations will require clinical judgment. Although the clinical case definition only includes a generalized rash, fever $\geq$ 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. The source of acquisition for 11% of measles cases reported in the United States during January–July 2008 could not be determined (MMWR 2008;57(No. 33):893); 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.

d. The occurrence of measles-like illness in recently vaccinated persons can pose particular difficulties: Fever and rash are known to occur 6-12 days post-vaccination in a small percent of vaccinated persons. A positive measles IgM test cannot be used to confirm the diagnosis of measles in persons with measles-like illness who received measles vaccine 6-45 days before onset of rash due to the measles IgM antibody response to the vaccine. Specimens for viral isolation should be obtained in addition to serologic testing isolation of wild type measles virus would allow confirmation of the case. In the absence of strain typing to confirm wild type infection, cases in persons with measles-like illness who received measles vaccine 6-45 days before onset of rash should be classified as confirmed cases only if a) they meet the clinical case definition, and b) they are epidemiologically linked to a laboratory-confirmed case.

e. A small number of individuals that were previously exposed to measles (more than 45 days before the onset of rash) may still become infected by wild-type measles virus, and are likely to have a modified disease presentation. These cases are usually detected during an outbreak or after a known exposure to a confirmed measles case. In rare instances, such cases can occur without a known exposure or other risk factor. If modified measles in a previously vaccinated person is suspected, call Communicable Disease epidemiology to discuss.

3. Collect serum, a respiratory specimen (nasal wash preferred), and urine at the first clinical encounter. See Appendix C for interpretation of serologic results.

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 specimen to Public Health Laboratories for confirmation of the diagnosis.

B. Identify Potential Sources of Infection

Using a guide such as the "Measles Worksheet Part A" (see Appendix A), evaluate the activities of the case 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 outside of the United States or to an area of the United States where measles has recently occurred

3. any contact with visitors from outside the United States or an area of the United States where measles has recently occurred

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. Using the "Measles Worksheet Part B" (Appendix A), evaluate the activities of the case during the contagious period (4–5 days before through 4 days after the date the rash started). Because measles is so contagious, anyone with direct contact with the case is exposed along with anyone who was in the same room with a case for even a few minutes. Measles virus lingers in the air, so anyone who enters a room within 2 hours after a measles case should also be considered exposed.
2. Consider initiating a "Measles Contact Tracking Form" (Appendix B) for each contact identified.
3. Determine measles immune status of exposed contacts. Persons are considered immune to measles if they (MMWR, Vol. 62/No. RR-4):18–19):
   a. were born before January 1, 1957 (except for health care workers who should consider receiving at least one dose of measles-containing vaccine), or
   b. have documentation of health care provider-diagnosed measles, or
   c. have laboratory evidence of immunity to measles, or
   d. have written documentation of adequate vaccination to measles that includes the date of administration (self-reported doses or parental history of vaccination alone are not acceptable).
      - Preschool children: one MMR given after 12 months of age
      - K–12 and adults at high risk (i.e., post-high school educational and college students, healthcare personnel, and international travelers): 2 MMR, with the first dose given on or after the first birthday and with a minimum of 28 days between the first and the second dose
      - All other adults born during or after 1957: history of having received at least one dose of live measles virus vaccine on or after the first birthday*

      * Persons who were vaccinated with an inactivated vaccine that was available from 1963-1967, and have not been re-vaccinated, may however be at risk for measles.
4. Alert health care facilities visited by the case during the contagious period and make recommendations regarding management of susceptible contacts (see Section 7B and Appendix E: Algorithm for assessment and management of persons with definite exposure to measles and public callers with possible exposure to measles at a public site).
5. 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. The press release should include information about the time and place of exposure, susceptibility,

symptoms of measles and ways people can protect themselves.

D. Enhance Surveillance for Additional Cases

Alert health care providers, hospital emergency rooms, and student infirmaries of the potential for additional cases; encourage health care providers to consider measles in persons with a rash illness, take appropriate infection control precautions, and report suspected cases to public health. See Appendix D for a sample health alert.

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. 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

Use the "Measles Contact Tracking Form" in Appendix B or a similar form to track all persons potentially exposed to the case. The algorithm in Appendix E outlines strategies that can be used for assessment and management of persons with definite exposure to measles versus public callers with possible exposure to measles at a public site.

1. **Symptomatic Contacts**
   - Any contact with a rash illness compatible with measles should be referred to a healthcare provider for assessment.
   - Susceptible contacts with respiratory symptoms or fever should stay home and call their local health jurisdiction.
   - If a contact goes a healthcare provider for evaluation of possible measles, the patient or public health 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 the diagnosis is known.
2. **Active Immunization with Measles Vaccine (persons 12 months of age or older)**

- Vaccinating susceptible contacts within 72 hours of exposure may prevent disease. If 72 hours has passed since the exposure, vaccination is unlikely to prevent disease due to the exposure. Vaccination is still recommended to prevent future infection but should be done after at least one incubation period has passed to avoid complications with diagnosis of true measles versus vaccine reaction should the person become symptomatic. 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 for recommendations and contraindications for vaccination.
- Whenever possible, persons without documentation of immunity should have blood drawn and tested for measles IgG prior to being vaccinated. Exclusion will not be necessary if the person is found to be immune.
- Public health may need to arrange special clinics to vaccinate susceptible contacts and others from the community.

3. Passive Immunization with Immune Globulin (IG)

- IG can prevent or attenuate infection with measles if given within 6 days after exposure. IG is recommended primarily for susceptible household contacts and other close contacts who are at increased risk of severe infection (e.g., children <1 year old, pregnant women without evidence of measles immunity, and severely immunocompromised persons). IG is not recommended for close contacts who have received one dose of vaccine on or after the first birthday unless they are immunocompromised.
- Patients should be warned that IG may modify but not prevent measles infection and may also increase the incubation period to 21 days.
- The recommended dose for IG administered intramuscularly (IGIM) is 0.0.5 ml/kg (maximum dose 15 ml) and for IG given intravenously (IGIV) is is 400 mg/kg. To be effective, IG must be administered as soon as possible but not more than 6 days after exposure. The recommended methods of IG administration for the groups at increased risk are as follows (Page 17, MMWR, Vol. 62/No. RR-4):
    - **Infants < 1 year old.** IGIM should be administered to all infants aged <12 months who have been exposed to measles. For infants aged 6 through 11 months, MMR vaccine can be administered in place of IG if administered within 72 hours of exposure.
    - **Pregnant women without evidence of measles immunity.** IGIV should be administered to pregnant women without evidence of measles immunity who have been exposed to measles. IGIV is recommended to administer doses high enough to achieve estimated protective levels of measles antibody titers.
    - **Immunocompromised patients.** Severely immunocompromised patients who are exposed to measles should receive IGIV prophylaxis regardless of immunologic or vaccination status because they might not be protected by the vaccine.

      Severely immunocompromised patients include patients with severe primary immunodeficiency; patients who have received a bone marrow transplant until at least 12 months after finishing all immunosuppressive treatment, or longer in

patients who have developed graft-versus-host disease; patients on treatment for ALL within and until at least 6 months after completion of immunosuppressive chemotherapy; and patients with a diagnosis of AIDS or HIV-infected persons with severe immunosuppression defined as CD4 percent <15% (all ages) or CD4 count <200 lymphocytes/mm3 (aged >5 years) and those who have not received MMR vaccine since receiving effective ART. Some experts include HIV-infected persons who lack recent confirmation of immunologic status or measles immunity.

- Unless known to be susceptible to measles (i.e. unvaccinated and with no history of measles disease) persons without documentation of immunity should have blood drawn prior to administration of IG, if possible, to test for the presence of measles IgG (prior immunity). However, administration of IG should not be delayed past 72 hours when results of immunity testing are pending.
- Susceptible contacts who received IG for measles prophylaxis should subsequently be immunized against measles 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.
- *Please note that these IG recommendations were published in the June 14, 2013 MMWR (Vol. 62 / No. RR-4) and therefore are not reflected in 2012 Red Book.*

4. Exclusion

- Susceptible, previously <u>unimmunized</u> contacts should avoid all public settings from 7 days after the first date of exposure until 21 days after the last date of exposure <u>regardless of whether or not they received vaccine within 72 hours or IG within 6 days of exposure.</u>
- Contacts who had received one dose of measles-containing vaccine prior to the exposure and who now receive a second dose following the exposure do not need to be excluded from public settings. However, they should be educated about symptoms of measles and told to isolate themselves and notify the local health jurisdiction if symptoms develop.
- Contacts who had received one dose of measles-containing vaccine prior to the exposure that choose not to receive a second dose of vaccine after exposure should be told to avoid public settings until 21 days after the last possible date of exposure to the case, educated about symptoms of measles, and instructed to notify the local health jurisdiction if symptoms develop.

5. Education

- All exposed persons regardless of immune status should be told 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 local health department 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 case 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 to 21 days following exposure regardless of immune status.

D. Environmental Measures

None. If a person communicable with measles is examined in a health care facility, the examination room should be cleaned and closed to use for 2 hours.

7. MANAGING SPECIAL 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 (that is they can return on the 5th day after the day of rash onset) if not immunocompromised.
2. All students and school staff born in or after 1957 who cannot provide adequate evidence of immunity should be vaccinated. Vaccine should be offered, if possible, to those who are not up to date with age-appropriate vaccination. A first dose should be given to those who are unvaccinated. Recommend a second MMR to persons who have previously received only one MMR as long as 28 days have passed since the first dose.
3. Identify all persons at the school who were potentially exposed to the case.
   a) Recommend that susceptible, unimmunized persons receive the MMR vaccine within 72 hours of exposure (or if immunocompromised, pregnant or under one year of age, immune globulin (IG) within 6 days). Exclude all exposed persons who were susceptible and unimmunized at the time of exposure regardless of whether or not they have received post exposure vaccine or IG.
   b) Exposed persons who had received one dose of measles-containing vaccine prior to the exposure can return to school or child care after they receive their second dose of MMR, but should be educated about symptoms of measles and told to stay home if symptoms develop.
   c) Susceptible, unimmunized persons and partially immunized persons (i.e. persons who had received only one prior dose of MMR) who continue to refuse the recommended measles vaccination(s) following exposure to measles should be excluded from the school or child care until 21 days after rash onset in the last cases of measles.
4. Maintain daily active surveillance of all school or child care contacts to assess for prodromal signs and symptoms of rash illnesses 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. Acceptable evidence of immunity to measles in health care workers includes (MMWR 1998;47[No. RR-8]:11):

- Documented administration of 2 doses of live measles virus vaccine given on or after the first birthday (inactivated measles vaccines were in use from 1963–1967), or
- Laboratory evidence of immunity, or
- Born before January 1, 1957 – Healthcare facilities should consider recommending measles, mumps, rubella (MMR) vaccination for unvaccinated workers born before 1957 without a history of measles disease or laboratory evidence of immunity, or
- Documentation of health care provider-diagnosed measles.

2. If a person with measles is treated in a health care setting during the contagious period, identify potentially all exposed health care workers, volunteers and other staff and assess status of their immunity to measles.
3. If an exposed healthcare worker has had only one documented dose of measles-containing vaccine, give an additional dose of vaccine. If the second dose can be given with 72 hours of the exposure, consider the person immune. If vaccine cannot be administered within 72 hours, send a specimen for measles IgG serology and consider the person immune if the test is positive for measles specific IgG.
4. If the exposed healthcare worker was born on or after January 1, 1957 and has no documented evidence of immunity, a dose of measles-containing vaccine should be given immediately and no more than 72 hours after exposure. At the same time, a serologic test for measles IgG should be done to verify immunity. If immunity to measles is not serologically confirmed, the person must be furloughed from day 5 after the first exposure to day 21 after the last exposure.
5. If the exposed healthcare worker was born before January 1, 1957 and has no documented evidence of immunity, a serologic test for measles IgG should be considered to verify immunity. If immunity is not confirmed, the person must be furloughed from day 5 after the first exposure to day 21 after the last exposure.
6. If the exposed healthcare worker has had two documented doses of measles vaccine given on or after the first birthday and at least 28 days apart, consider the person immune.
7. In summary, exposed **susceptible** health care workers should be immunized immediately and no more than 72 hours after exposure, and furloughed from day 5 after the first exposure to day 21 after their last exposure. This includes healthcare workers born in 1957 or later who have no documented evidence of immunity, and workers born in 1957 or later with only one previous dose of measles-containing vaccine documented who did not receive a second dose within 72 hours of exposure. (If furloughing of this second group is not possible due to large numbers exposed, these staff should have their temperatures taken and be assessed for prodromal symptoms when they come to work on the 5th through 21st day after the exposure. Anyone with a fever, cough, coryza, or conjunctivitis should be furloughed for the duration of symptoms and assessed for measles if a rash develops. <u>This screening procedure must be followed rigorously to</u>

prevent staff members with prodromal measles from infecting others.)

8. Healthcare workers who develop measles must avoid patient contact until 4 days have passed since the rash onset.
9. Only health care workers with documented immunity to measles should enter the room of a suspected measles patient.
10. Exposed patients should likewise have their immune status assessed and be given vaccine if they are not immune; school and work restrictions of unimmunized contacts apply.

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 healthcare 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.

Before any international travel, infants 6 months through 11 months of age should have 1 dose of measles vaccine. Infants who received 1 dose of measles vaccine before their first birthday should get 2 additional doses of the vaccine (one dose at 12 through 15 months of age and another dose at least 28 days later).

In certain outbreak settings, health officials may recommend the MMR vaccine be given to infants younger than 12 through 15 months of age, sometimes even to children as young as 6 months of age. However, since the decision to vaccinate children less than 12 months of age has vaccine supply implications for the state, the decision to implement this recommendation at the local level should include a prior discussion between the local health jurisdiction, CDE, and the WA DOH Immunization Program.

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, 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.

For more information about MMR vaccine schedules, adverse reactions and contraindications please see the 2006 Red Book pp. 444–451.

B. Prevention Recommendations

Vaccination is best way to prevent measles.

ACKNOWLEDGEMENTS

This document is a revision of the Washington State Guidelines for Notifiable Condition Reporting and Surveillance published in 2002 which were originally based on the Control of Communicable Diseases Manual (CCDM), 17th Edition; James Chin, Ed. APHA 2000. We would like to acknowledge the Oregon Department of Human Services for developing the format and select content of this document.

UPDATES

December 2008:

Section 3: The case definition was updated to include detection of measles specific nucleic acid by PCR as a laboratory criterion for diagnosis.
Section 4: Information was added regarding false positive IgM results.
Section 5A: Guidance was added regarding when to test for measles.

January 2011:
The Legal Reporting Requirements section has been revised to reflect the 2011 Notifiable Conditions Rule revision.

January 2014:

Section 3: The case definition was updated to exclude the suspect case classification and edit the probable and confirmed definition and reflects the most recent January 2013 CSTE changes.
Section 4: Laboratory confirmed methods performed by WA PHL were updated to include newly validated polymerase chain reaction testing on nasopharyngeal swab specimens. Nasal wash removed from the list of acceptable respiratory specimens.
Section 5: Information on potential susceptibility of persons receiving inactivated measles vaccine only was added.
Section 6: Guidance on when to vaccinate susceptible contacts to prevent future infection in circumstances when more than 72 hours have passed since exposure was included.
Guidance on vaccination and management of exposed contacts was clarified.
Guidance for use of immune globulin for post-exposure prophylaxis was updated to reflect CDC recommendations published in June 2013 (Prevention of Measles, Rubella, Congenital Rubella Syndrome, and Mumps, 2013: Summary Recommendations of the Advisory Committee on Immunization Practices (ACIP), MMWR, Vol. 62 / No. RR-4:
http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm?s_cid=rr6204a1_e)
Section 7: Language was added to clarify when to exclude students or attendees from a school or childcare setting.

August 2014:

Addition of Appendix E: Assessment and management of persons with definite exposure to measles and public callers with possible exposure to measles at a public site.
Section 8A: Language was added regarding the need for a discussion between the local health jurisdiction, CDE, and WA DOH Immunization Program staff prior to implementation of a recommendation by a local jurisdiction to vaccinate 6-11 month old infants during an outbreak.
Section 4A: Note added about testing issues in previously vaccinated persons with a modified measles presentation.
Section 5A (2d & e): Added information about evaluating measles diagnosis in previously vaccinated persons.

APPENDIX A: MEASLES WORKSHEET

Patient Name: _____ Patient DOB: ____/_____/_____

Immunization Status: _____

PART A: Identifying Sources of Infection

	DATE	DAY	LOCATIONS (with times)	CONTACTS
EARLIEST EXPOSURE DATE		-21		
		-20		
		-19		
		-18		
		-17		
		-16		
		-15		
Exposure Period		-14		
		-13		
		-12		
		-11		
		-10		
		-9		
		-8		
		-7		
RASH ONSET		0	See Part B for Contagious Period	

PART B: Identifying Exposed Contacts and Sites of Transmission

	DATE	DAY	LOCATIONS (with times)	CONTACTS
Earliest Possible Contagious Date DEFINITELY CONTAGIOUS FROM HERE FORWARD		-5		
		-4		
		-3		
		-2		
Contagious Period		-1		
RASH ONSET		0		
		1		
		2		
		3		
Contagious for at least 4 days after rash onset		4		

COLLECT THE FOLLOWING INFORMATION FOR EACH DATE:

Locations of potential exposure and transmission

- Addresses and phone numbers of locations
- Dates and times visited (time of arrival and length of stay)
- Complete travel information (e.g., departure & arrival cities, method of transport, transport company, transport numbers)
- Remember to ask about stops at grocery stores, gas stations, churches, healthcare facilities, schools and child care centers

Information about Contacts

- Names and phone numbers of contacts
- Relation to case
- Are contacts symptomatic?
- Immunization status of contacts, if known

APPENDIX B: MEASLES CONTACT TRACKING FORM

Date	____ / ____ / ____	Time:	Investigator:
Case Name		Case rash onset date:____/____/____	
Contact Name			
Date of first contact	____/____/____	Date of last____/____/____	
Symptom watch dates	____/____/____ (1st contact + 7 days) to ____/____/____ (Last contact +21 days)		
Relation to Case	☐Household	☐Family, non-household	☐Co-Worker
	☐Healthcare Worker	☐Friend	☐Other _____
DOB	____ / ____ / ____		
Age	☐Years	☐Months	
Address			
City, State, Zip			
County			
Home Phone	( ) _____ - _____		
Work Phone	( ) _____ - _____		
Other Phone	( ) _____ - _____		
Contact location			
Location details			
Is contact symptomatic? Date of onset Briefly describe symptoms	☐Yes ☐No ____ / ____ / ____		
Last date contact followed	____ / ____ / ____		
Immune Status	☐Had measles	☐Born before 1957	
	☐Unknown	☐Pending serology Date collected___/___/___ Results:_____	
	☐Unvaccinated	☐Vaccinated # MMR rec'd before exposure:___ #1 ___/___/___ #2 ___/___/___	
Contacted by PH?	☐Recommendations given	☐Left message	☐Not contacted
Notes or actions needed			

APPENDIX C: MEASLES TESTING - QUICK REFERENCE SHEET

Measles clinical case definition:

An illness characterized by all the following:

- a generalized rash lasting greater than or equal to 3 days
- a temperature greater than or equal to 101.0°F (greater than or equal to 38.3°C)
- cough, coryza, or conjunctivitis

Sometimes the characteristic rash does not develop in immunocompromised patients.

Deciding whether to test for measles:

Testing should be performed on all unimmunized persons who meet the clinical case definition and have a known measles exposure or were in a high-risk setting during the likely exposure period (7–21 days prior to the rash onset). All other situations will require clinical judgment.

Specimen(s) for viral isolation:

If you think the person has measles, always get a specimen for viral isolation as soon as possible (the earlier in the illness, the better). Desired specimens include a respiratory specimen (nasopharyngeal swab preferred) and urine. Measles virus isolation is most successful when samples are collected within three days of rash onset. However, virus may still be present in respiratory specimens 7 days following rash onset and in urine for up to 10 days.

Specimens for serology:

In most instances, a serum specimen should also be collected at the time the patient is first seen. Send a serum if available regardless of timing or immunization status. (One exception might be an unimmunized young child, when less than 72 hours has passed since rash onset. Serum collection could be delayed until results would be definitive in order to avoid repeat venipuncture.)

Interpretation of serology results:

The person's immune status plays a role in deciding which serologic tests should be ordered and in the interpretation of the results. Here is a quick overview:

On an unimmunized person

- Specimen collected less than 72 hours after the date of rash onset:

  Test for IgM.

  IgM positive = measles confirmed

  IgM negative = cannot rule out measles

  Collect another specimen 72 hours or more after rash onset

- Specimen collected 72 hours or more after the date of rash onset:

  Test for IgM and IgG

  IgM positive/IgG positive or negative = measles confirmed

  IgM negative/IgG negative = measles ruled out

On a person with unknown immunization history or on a person with documented history of one or more doses of measles-containing vaccine

- Specimen collected less than 72 hours after the date of rash onset:

  Test for IgM and IgG

  IgM positive/IgG positive or negative = measles confirmed

  IgM negative/IgG negative = cannot rule out measles

  Collect another specimen 72 hours or more after rash onset

  Did not respond to vaccination or was never vaccinated

  IgM negative/IgG positive = measles ruled out

  Demonstrates previous immunity to measles due to either prior vaccine or previous disease

- Specimen collected more than 72 hours or more after the date of rash onset:

  Test for IgM and IgG

  IgM positive/IgG positive or negative = measles confirmed

  IgM negative/IgG negative = measles ruled out

  Recommend immunization

  IgM negative/IgG positive = measles ruled out

  Demonstrates previous immunity to measles due to either prior vaccine or previous disease

Please note: False positive IgM results for measles are not uncommon. False- positive IgM results may be due to the presence of rheumatoid factor in serum specimens. Serum specimens from patients with other rash illness, such as parvovirus B19, rubella, and roseola, have been observed to yield false-positive reactions in some IgM tests for measles. False-positive tests may be suspected when thorough surveillance reveals no source or spread of cases, when the case does not meet the clinical case definition, or when the IgG result is positive within 3 days of rash onset. When a laboratory IgM test result is suspected of being false-positive, additional tests may be performed following consultation with WA DOH Communicable Disease Epidemiology.

APPENDIX D: SAMPLE HEALTH ALERT

Measles Alert for [LHJ] Health Care Providers and Clinic Directors
[Date]

Two confirmed cases of measles (rubeola) have occurred in 8 and 10 year-old siblings who live in [town] and attend [school]. The children last attended school on 1/10/01. One or both children attended the following events while contagious for measles:

- Basketball game (Seminoles team and opponents) at the Boys and Girls Club on 1/8
- Basketball practice at Sparks Gym on 1/9
- Boys and Girls Club (Seminoles team) game on 1/12
- Medical office visit at Generic Pediatrics Inc on 1/15

Rash onsets were 1/12/01 and 1/14/01.

Whenever possible, contacts of a measles case are notified of their exposure, but in a sports event setting it is not possible to determine all who may have been exposed. If susceptible persons were exposed to this individual at the basketball team events, we would expect to see resultant cases become ill 1/15/01 through 2/03/01. At this time we are not aware of additional cases. **However, we urge your office to be prepared for handling potential cases of measles.**

Recognizing a potential case of measles:

Measles is a viral illness consisting of fever, cough, coryza, conjunctivitis, maculopapular rash, and Koplik spots. Usually cold symptoms and fever precede the onset of the rash by two to four days, and a measles case will often feel ill enough to seek medical care BEFORE rash onset. If a patient has presented with coryza, light sensitivity, or cough with high fever and has a possible history of having been present at one of the events mentioned above, please consider measles a possibility and notify the health department immediately. Unfortunately, we are now at a point where we could be seeing “third generation” cases soon. The red rash usually begins on the face and spreads to the rest of the body. Koplik spots appear inside the mouth on the buccal mucosa and look like grains of sand. (Absence of Koplik spots does not rule out measles). Ideally, a suspect measles case should bypass other patient waiting areas. Alert your reception staff on how to identify and isolate patients who present with these symptoms. Complications of measles can include otitis media, bronchopneumonia, laryngotracheobronchitis, diarrhea, and encephalitis.

Diagnosing measles:

Control measures are more effective when applied as early as possible. **If you have any concern about measles in your patient, contact [LHJ] immediately**. During regular business hours call [phone number]. After hours call our answering service after hours at [phone number] to have the physician on call paged. We will assist you with collection of specimens and rapid testing at a public health laboratory**. Please do not send specimens to a commercial lab and wait for serologic confirmation in order to report.** Control measures are most effective if public health is able to contact those exposed within 72 hours of exposure.

APPENDIX E: Algorithm for assessment and management of persons with definite exposure to measles and public callers with possible exposure to measles at a public site

Immunization Status →	Birth before 1957	2 doses	1 dose[&]	0 doses		Unknown	
Risk assessment:	Presumed immune	Presumed immune	~95% effective	Susceptible!		Presume susceptible	
Prophylaxis:	None	None	MMR within 72 hours of exposure	MMR within 72 hours of exposure; Consider IG (if indicated[1]) within 6 days of exposure*		MMR within 72 hours of exposure; Consider IG (if indicated[1]) within 6 days of exposure*	
Recommendations:	No recommendations or restrictions	No recommendations or restrictions	Second MMR recommended even if >72 hours after exposure (but MMR within 72 hours preferred)	**Close Contacts[€]** (Asymptomatic)	**Public Callers[#]** (Asymptomatic)	**Close Contacts[€]** (Asymptomatic)	**Public Callers[#]** (Asymptomatic)
				Do not vaccinate if too late for prophylactic MMR (i.e. >72 hours after exposure)[2]	Get a dose of MMR	Draw blood for serum IgG titer and then give a dose of MMR.	Get a dose of MMR. Strongly encourage drawing blood for serum IgG titer.
Symptom Watch:	Yes Discuss date of exposure and symptom watch times.	Yes Discuss date of exposure and symptom watch times.	Yes Discuss date of exposure and symptom watch times. Adverse event a possibility 5-12 days after MMR received[3] • 5% get rash • 15% get fever	Yes Discuss date of exposure and symptom watch times. Explain what to do if symptoms: i.e. stay home Call PH/HC provider before going to HCF.	Yes Discuss date of exposure and symptom watch times. Explain what to do if symptoms: i.e. stay home Call PH/HC provider before going to HCF.	Yes Discuss date of exposure and symptom watch times. Explain what to do if symptoms: i.e. stay home Call PH/HC provider before going to HCF.	Yes Discuss date of exposure and symptom watch times. Explain what to do if symptoms: i.e. stay home Call PH/HC provider before going to HCF.
Exclusion:	None unless symptoms develop.	None unless symptoms develop.	None unless symptoms develop.	Yes! Quarantine[4] at home with no non-immune visitors and avoidance of all public settings from 7- 21 days after exposure regardless of whether they received vaccine within 72 hours or IG within 6 days of exposure.	None unless symptoms develop If becomes symptomatic, during the 7-21 days after exposure, isolate[4] and test for measles if rash develops.	Stay home from day 7 after exposure until titer results available. If titer positive: no further restrictions and no MMR needed. If titer negative or not done: Quarantine at home[4] for 7-21 days after exposure.	None unless symptoms develop If becomes symptomatic, during the 7-21 days after exposure, isolate[4] and test for measles if rash develops. If titer positive: no further restrictions.
Follow-up:	None	None	None	Vaccinate after 21 days if measles did not develop.	None	Vaccinate after 21 days if no MMR was given and measles did not develop.	None

[€] Named close contacts that can be monitored daily and who have had a specific measles exposure identified.

[#]Public callers are members of the public who may have been exposed to measles because of being in the same place/time as the infectious measles case but who are not named close contacts. This excludes other members of the general public (who should be recommended to follow CDC vaccination schedules and get up to date on vaccines).

[&]Health Care Workers (HCW) with one dose of MMR who have a definite or possible measles exposure (i.e. who are named close contacts or public callers) should be treated as a close contact with unknown MMR status. This additional caution is necessary due to the higher risk that a HCW contagious for measles might expose medically fragile individuals.

[*]Vaccination and IG recommendations (such as recommended timing between MMR doses, vaccination of infants <1 year, and circumstances under which to give IG), may vary between local health jurisdictions depending on outbreak circumstances in each locale.

[1]Indications for IG include: Age <1 year, pregnancy, immunosuppression.

[2]MMR >72 hours after last exposure is not recommended for close contacts with 0 previous doses because of the possibility of adverse event (fever and/or rash) after first MMR. Vaccine-associated fever/rash , if they occur, typically develop ~2 weeks after vaccination, mimicking the incubation and symptoms of the measles virus. MMR given >72 hours after last exposure is not effective prophylaxis. To avoid investigating MMR-associated fever/rash as a measles case, MMR not indicated for unvaccinated close contacts >72 hours after last exposure. Vaccinate 21 or more days after exposure risk has ended.

[3]Rash and fever rates after MMR refer to adverse events after the first dose; fever and rash are less common after the second dose.

[4]Quarantine and isolation are at the discretion of each LHJ and are typically voluntary, but under some circumstances quarantine/isolation may be legally mandated or enforced, as per LHJ discretion and determination.