MEASLES—UNITED STATES 2014

Course # DL-011

Adapted from Morbidity and Mortality Weekly Report, May 29, 2014 / 63
(Early Release;1-4) Measles – United States January 1-May 23, 2014

by

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Level of Difficulty: Basic

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COURSE NAME: MMWR REPORT ON MEASLES – UNITED STATES 2014  
COURSE # DL-011

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DISTANCE LEARNING EVALUATION FORM

According to state regulations, this form must be completed and returned in order to receive CE hours. Your comments help us to provide you with better continuing education materials in the distance learning format. Please circle the number that agrees with your assessment with, with 5 meaning you strongly agree and 1 meaning you strongly disagree.

1. Overall, I was satisfied with the quality of this Distance Learning course.  
5 4 3 2 1

2. The objectives of this Distance Learning course were met.  
5 4 3 2 1

3. The difficulty of this Distance Learning course was consistent with the number of CE hours.  
5 4 3 2 1

4. I will use what I learned from this Distance Learning course.  
5 4 3 2 1

5. The time to complete this Distance Learning course was: _________ hours

6. Please comment on this Distance Learning course on the back of this sheet. What did you like or dislike?
INTRODUCTION

Measles is a highly contagious, acute viral illness that can lead to serious complications and death. In 1963 a vaccine against measles was introduced in the United States, leading to a precipitous drop in the number of measles cases (an average of about 500,000 per year in the U.S. before the vaccine). Although measles elimination (i.e., interruption of year-round endemic transmission) was declared in the United States in 2000, importations of measles cases from endemic areas of the world continue to occur, leading to secondary measles cases and outbreaks in the United States, primarily among unvaccinated persons. To update national measles data in the United States, CDC evaluated cases reported by states from January 1 through May 23, 2014. A total of 288 confirmed measles cases have been reported to CDC, surpassing the highest reported yearly total of measles cases since elimination (220 cases reported in 2011). Fifteen outbreaks accounted for 79% of cases reported, including the largest outbreak reported in the United States since elimination (138 cases and ongoing). The large number of cases this year emphasizes the need for health-care providers to have a heightened awareness of the potential for measles in their communities and the importance of vaccination to prevent measles.

Confirmed measles cases in the United States are reported by state and local health departments to CDC using a standard case definition (available at http://www.cdc.gov/vaccines/pubs/surv-manual/chpt07-measles.pdf). A measles case is considered confirmed if it is laboratory-confirmed or meets the clinical case definition (an illness characterized by a generalized rash lasting ≥3 days, a temperature of ≥101°F [≥38.3°C], and cough, coryza, and/or conjunctivitis) and is linked epidemiologically to a confirmed case. Measles cases are laboratory confirmed if there is detection in serum of measles-specific immunoglobulin M, isolation of measles virus, or detection of measles virus nucleic acid from a clinical specimen. Cases are considered imported if at least some of the exposure period (7-21 days before rash onset) occurred outside the United States and rash occurred within 21 days of entry into the United States, with no known exposure to measles in the United States during that time. An outbreak of measles is defined as a chain of transmission of three or more confirmed cases.

Patients with reported measles cases this year have ranged in age from 2 weeks to 65 years. Forty-three were hospitalized, and complications have included pneumonia (five patients), hepatitis (one), pancytopenia (one), and thrombocytopenia (one). No cases of encephalitis and no deaths have been reported.
Measles cases have been reported from 18 states and New York City. Most cases were reported from Ohio (138), California (60), and New York City (26). Fifteen outbreaks have accounted for 227 (79%) of the 288 cases. The median outbreak size has been five cases (range: 3-138 cases). There is an ongoing outbreak involving 138 cases, occurring primarily among unvaccinated Amish communities in Ohio.

Of the 288 cases, 280 were associated with importations from at least 18 countries. The source of measles acquisition could not be identified for eight cases. Forty-five direct importations (40 U.S. residents returning from abroad and five foreign visitors) have been reported. Almost half of these importations were travelers returning from the Philippines, where a large outbreak has been occurring since October 2013. Imported cases were also associated with travel from other countries in the World Health Organization (WHO) Western Pacific Region (seven cases), as well as countries in the WHO South-East Asia (eight), European (four), Americas (three), and Eastern Mediterranean (one) regions. Measles genotype information was obtained from 103 of the 288 cases. Four measles virus genotypes were identified: B3 (67 cases), D9 (23), D8 (12), and H1 (one).

Most of the 288 measles cases reported this year have been in persons who were unvaccinated (200 [69%]); 30 (10%) were in persons who were vaccinated. Among the 195 U.S. residents who had measles and were unvaccinated 165 (85%) declined vaccination because of religious, philosophical, or personal objections, 11 (6%) were missed opportunities for vaccination, and 10 (5%) were too young to receive vaccination.

DISCUSSION

Measles elimination has been maintained in the U.S. since elimination was declared almost 15 years ago. However, approximately 20 million cases of measles occur each year globally, and importations into the U.S. continue to pose a risk for measles cases and outbreaks among unvaccinated persons. The 288 measles cases reported during January 1-May 23, 2014, including the ongoing outbreak involving 138 persons in Ohio, represent the highest number of measles cases reported for that period since 1994. The increase in measles this year serves as a reminder for health-care providers to be cognizant of the possibility of measles cases occurring in their communities.

Health-care providers should maintain a high suspicion for measles among febrile patients with rash. Patients with clinical symptoms compatible with measles (febrile rash plus cough, coryza, and/or conjunctivitis), should be asked about recent travel abroad and contact with returning travelers, and their vaccination status should be verified. Measles cases have been initially misdiagnosed as Kawasaki disease, dengue fever, and scarlet fever, among other diseases, underscoring the importance of considering measles in the differential diagnosis of clinically compatible cases. It is important to obtain viral specimens for confirmation and genotyping on any patient when measles is suspected, in addition to serology. Genetic characterization of measles virus can suggest the likely source of an imported virus. Because patients with measles often seek medical care, early recognition of suspected measles cases and implementation of appropriate infection control measures are vital to reduce transmission in health-care settings.

Where possible, because of the high transmissibility of measles, patients with suspected measles should be promptly screened before entering waiting rooms and appropriately isolated (i.e., in an airborne isolation room or, if not available, in a separate room with the door closed), or have their office appointments scheduled at the end of the day to prevent exposure of other
patients. To assist state and local public health departments with rapid investigation and control efforts to limit the spread of disease, suspected measles cases should be reported to local health departments immediately. State health departments should notify CDC about cases of measles within 24 hours of detection.

To date in 2014, a total of 40 importations have been reported among unvaccinated returning U.S. travelers. Among these, 22 acquired measles in the Philippines, where 32,030 measles cases and 41 measles deaths have been reported from January 1 through April 20. The large number of importations from the Philippines highlights how importations are related to increases in measles incidence in countries that are common destinations for U.S. travelers. Because measles remains endemic in countries in five out of the six WHO regions of the world, including India, from where six importations have occurred this year, the source of imported cases could be any country where measles continues to circulate. This underscores the importance of ensuring age-appropriate vaccination for all persons before international travel to any region of the world.

Health-care providers should remind persons who plan to travel internationally, including travel to large international events and gatherings (e.g., the 2014 FIFA World Cup in Brazil), of the increased risk for measles, and encourage timely vaccination of all persons aged ≥6 months without evidence of measles immunity. One dose of measles-mumps-rubella (MMR) vaccine is recommended for infants aged 6-11 months before travel, and 2 doses for persons aged ≥12 months, with a minimum interval between doses of 28 days.

In the three largest outbreaks of 2014, which account for over a half of all cases this year, transmission occurred after introduction of measles into communities with pockets of persons who were unvaccinated because of philosophical or religious beliefs. An example is the Ohio outbreak that began after Amish missionaries returned from the Philippines. As of August 15, 2014, 377 cases have been reported in Ohio. The center of the Ohio outbreak is Knox County, where 195 cases have been reported. Although there is no official count of how many Amish live in Ohio, researchers at Ohio State University estimate there are about 33,000 Amish living in the six-county area where the outbreak began. The Amish religion does not prevent them from seeking vaccinations, but because their children don’t attend traditional public schools, vaccinations are not required and therefore not routine. Since the outbreak started thousands of Amish in Knox and surrounding areas have lined up to be vaccinated. Some of the unvaccinated missionaries told local health officials they would have been vaccinated before going if they had been told there was an outbreak there.

In California there have been 61 cases as of July 18, 2014. Twenty-two of these occurred in Orange County. Over 93% have been import-associated, with almost 60% associated with returnees from the Philippines.

LABORATORY DIAGNOSIS OF MEASLES (adapted from reference 2)

It is recommended that measles be diagnosed using serological methods that measure virus-specific antibody in single or paired sera. However, measles virus can also be detected from various clinical samples by using cell culture techniques or molecular techniques. Assays based on detection of the measles virus are not suitable as diagnostic tests but are useful for detection of virus or genome for molecular epidemiological studies.
Summary of measles identification methods:

Serological assays:

   Measles infection is diagnosed serologically by 1) detecting measles specific IgM antibodies or 2) quantifying measles specific immunoglobulins in order to demonstrate a significant rise in IgG between paired acute and convalescent sera.

1. Measles specific IgM antibodies.

   Measles-specific IgM antibodies appear within the first few days of the rash and decline rapidly after one month. Their presence provides strong evidence of current or recent measles infection. IgM is also produced on primary vaccination, and, although it may decline more rapidly than IgM produced in response to the wild virus, vaccine and wild virus IgM cannot be distinguished by serological tests. A vaccination history is therefore essential for interpretation of test results.

   The following methods are commonly used to detect measles-specific IgM:

   a. IgM capture ELISA requires only one blood sample for case confirmation. Assays show 97% sensitivity compared with the plaque reduction neutralization test (PRNT) in detecting infection in vaccinated infants. In clinically confirmed cases, the sensitivity and specificity of capture assays were 91.8 and 98.2 respectively, while the positive and negative predictive values were 98.2 and 92.0 respectively. The test can be done with minimal training and results may be available within 2-2.5 hours of starting the assay. Capture ELISA assays are considered superior to indirect assays, since they do not require the removal of IgG antibodies. Several capture IgM ELISA kits are commercially available, though not all have the same sensitivity and specificity.

   b. IgM indirect ELISA requires only one blood sample for case confirmation. In clinically confirmed cases, the sensitivity and specificity in indirect assays were 90.3% and 98.2% respectively, while the positive and negative predictive values were 98.2 and 90.5 respectively. The test can be done with minimal training and results can be available within 3-3.5 hours of starting the assay. Indirect ELISA assays are the most widely used. However, this type of assay requires a specific step to remove IgG antibodies. Problems with the incomplete removal of IgG can lead to inaccurate results.

2. Quantification of measles-specific immunoglobulins by

   a. Virus neutralization: the plaque reduction neutralization test (PRNT) requires two serum samples, acute and convalescent, and shows 100% sensitivity in confirming clinical measles. Single titers of greater than 120 are consistent with 100% protection against clinical measles. The test is not easy since it requires trained technologists with expertise in tissue culture. Results are available 10 days after the receipt of the convalescent serum.

   b. Hemagglutinin inhibition: requires two serum samples, acute and convalescent, and shows 98% sensitivity in detecting antibody increase in vaccinated students and 100% sensitivity in vaccinated infants. The test is not easy since it requires technologists trained in viral serology. Results are available 2 days after receipt of the convalescent serum.
Virus Isolation:

Virus isolation is costly, time-consuming, and requires a sophisticated virology laboratory with cell culture facilities and virus isolation capabilities. Measles virus is extremely temperature labile and specimens for virus isolation must be transported to the laboratory rapidly under reverse cold chain conditions. For these reasons it has been recommended that virus isolation not be used for primary diagnosis and be limited to regional reference and global specialized laboratories for the purposes of genetic analysis only.

VACCINATION RECOMMENDATIONS

Although high population immunity throughout the United States (through maintaining ≥90% MMR (measles, mumps, rubella) vaccine coverage among children ages 19-35 months and adolescents) prevents spread from most importations, coverage varies at the local level, and unvaccinated children tend to cluster geographically, increasing the risk for outbreaks. Thus, maintaining high measles vaccination coverage is critical to prevent large measles outbreaks in the U.S., and to protect and limit spread to infants too young to be vaccinated and to persons who cannot be vaccinated because of medical contraindications.

In the United States, routine MMR vaccination is recommended for all children, with the first dose given at age 12-15 months, and a second dose at age 4-6 years. Catch-up vaccination is recommended for children and adolescents who have not received 2 appropriately spaced doses. Unless they have other evidence of immunity, adults should receive at least 1 dose of MMR vaccine, and 2 appropriately spaced doses of MMR are recommended for health-care personnel, college students, and international travelers.

SUMMARY

Despite maintenance of measles elimination in the United States, importations from endemic countries continue to occur and have caused an unusually high number of measles cases in 2014. The most frequent sources of importations were unvaccinated U.S. travelers returning from abroad, with subsequent transmissions among clusters of unvaccinated persons. Encouraging timely delivery of measles vaccination for persons traveling internationally and sustaining high vaccination coverage in the United States in accordance with the Advisory Committee on Immunization Practices routine immunization schedule are essential to limit measles importations and the spread of disease. To help expedite public health containment strategies, health-care providers should maintain a high awareness of measles, implement appropriate infection control measures when measles is suspected, and promptly report suspected cases to their local health departments.

REFERENCES

REVIEW QUESTIONS
Course #DL-011
Choose the one best answer

1. Measles elimination was declared in the United States in
   a. 2000
   b. 1980
   c. 2005
   d. 2010

2. Immunization for measles in the U.S. began in
   a. 1956
   b. 1963
   c. 1984
   d. 1990

3. The majority of measles cases in 2014 were imported to the U.S. from
   a. Brazil
   b. The Philippines
   c. China
   d. Europe

4. Typical symptoms of measles include all but
   a. rash
   b. fever
   c. nausea
   d. conjunctivitis

5. The largest outbreak of measles in 2014 occurred in the Amish in Ohio because of
   a. genetic susceptibility
   b. lack of immunization because Amish children don’t go to public schools
   c. importation by missionaries from China
   d. lack of immunization because their religion bans it

6. Measles cases may be confirmed in the laboratory by all but
   a. detection of measles-specific IgG antibodies
   b. detection of measles virus nucleic acid
   c. detection of measles-specific IgM antibodies
   d. isolation of measles virus

7. Immunization recommendations in the U.S. include all but
   a. MMR vaccine coverage for infants starting at 12 months
   b. second MMR dose at age 7-10 years
   c. adults showing no evidence of immunity receive one MMR vaccine dose
   d. Health-care personnel with no evidence of immunity receive two appropriately spaced MMR doses
8. IgM capture ELISA assays are preferable to IgM indirect ELISA because
   a. indirect ELISA requires two blood samples
   b. capture ELISA kits are more readily available
   c. indirect ELISA requires a step to remove IgG antibodies
   d. indirect ELISA requires more training of personnel

9. To implement public health containment strategies, health-care providers should do all the following except
   a. implement appropriate infection control measures when measles is suspected
   b. practice routine immunization schedules
   c. promptly report suspected cases to the CDC
   d. maintain high awareness of measles symptoms

10. Immunization recommendations for international travelers without evidence of measles immunity include all but
    a. one dose of MMR for infants 6-11 months
    b. two doses of MMR for persons ≥ 12 months of age
    c. use of measles only vaccine
    d. minimum interval of 28 days between the two MMR doses