Ready or Not: Responding to Measles in the Postelimination Era

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Although endemic measles was eliminated in the United States in 2000 (1), 2 concurrent measles outbreaks at opposite ends of the country offer a sobering reminder of the threat of this global disease. As more parents decline to vaccinate their children, measles incidence is increasing—a fact that alarms me both as a hospital epidemiologist and as a parent of a vulnerable infant too young to receive the measles vaccine. Because infected patients are likely to seek medical care, hospitals and clinics may inadvertently fuel transmission if patients with measles are not rapidly triaged and isolated. Yet, because of the success of the measles vaccine, many clinicians have never seen measles and may not be able to recognize its features. It is crucial that providers become familiar with this deadly disease and apply the necessary control measures to contain it.

An estimated 20 million cases of measles occur each year worldwide (2). In the prevaccine era, approximately 500 000 measles cases occurred in the United States annually, with 500 deaths and 48 000 hospitalizations (1). After elimination, the median annual number of cases decreased to 60, but this number is steadily increasing. Since 2010, there has been an average of 155 cases per year (2, 3). In 2014, there has been 106 measles cases reported in the first 3 months alone (3).

High vaccination coverage is essential to prevent spread after importation. However, coverage with measles, mumps, and rubella (MMR) vaccine varies by state. The recent outbreaks in New York City and Orange County, California, remind us how quickly imported cases of measles can spread in communities with large numbers of unvaccinated persons. Although vaccination coverage among children aged 19 to 35 months continues to be near or above 90% nationwide, 15 states had MMR vaccination rates below 90% according to the National Immunization Survey (4). States allowing philosophical exemptions from vaccination have significantly higher rates of unvaccinated children (5). In addition, unvaccinated children are likely to cluster geographically, thus increasing the risk for outbreaks after importation (5). In fact, most postelimination measles cases have been due to outbreaks. In 2013, 75% of cases in the first 8 months of the year were due to 8 outbreaks (2). Most occurred in unvaccinated persons (82%) or those with unknown vaccination status (9%) (2). As expected, 99% of cases could be linked to an imported case that led to a community-based outbreak. Of the imported measles cases, 50% were from Europe (2).

Measles is one of the most contagious infectious diseases known, with secondary attack rates greater than 90% in susceptible contacts (6). Transmission occurs primarily through direct contact with infectious droplets; however, measles virus can survive for up to 2 hours in fine particle aerosols and be transmitted via inhalation of small droplets even without face-to-face contact (6). The incubation period ranges from 7 to 21 days but is generally 8 to 12 days from exposure to symptom onset. Persons with measles are contagious from 4 days before to 4 days after appearance of rash, underscoring the importance of early recognition for returned travelers with relevant symptoms even before the rash appears (7).

It is essential that providers maintain a high level of suspicion for measles in persons with febrile rash illness who have recently traveled or have had contact with travelers and are able to recognize its clinical features (8). Measles is characterized by a prodrome of fever (up to 40.6 °C), cough, coryza, and conjunctivitis. A characteristic red, blotchy, "morbilliform" rash appears 2 to 4 days after symptom onset (**Figure 1**); it typically begins on the face before spreading downward and becoming confluent (8). Pathognomonic Koplik spots appear 1 to 2 days before the rash and last 2 to 3 days; they are small, slightly raised, bluish-white spots on an erythematous base and have been reported in 60% to 70% of patients with measles, although they are probably present in all cases (**Figure 2**) (7, 9). Measles rash may be confused with other viral exanthems (erythema infectiosum [fifth disease] or roseola), Kawasaki disease, or scarlet fever. Immunocompromised patients may not develop a characteristic rash (7). Complications are common in young children and include diarrhea, otitis media, bronchopneumonia, and croup; acute encephalitis

Figure 1. **Measles rash.**

Photograph from the Centers for Disease Control and Prevention Public Health Image Library, 1963 (ID 1150).

This article was published online first at www.annals.org on 29 April 2014.

Figure 2. **Pathognomonic Koplik spots.**

Photograph courtesy of Dr. Jerome O. Klein.

occurs in 1 per 1000 cases and can lead to permanent brain damage. Death occurs in 1 to 3 per 1000 reported cases and is most common in young children or immunocompromised patients (1).

For suspected cases of measles, early reporting and rapid control efforts are vital to prevent spread in health care facilities. Providers should encourage patients and their parents to call before coming into medical offices or emergency departments so that appropriate precautions can be taken. Prompt consultation with the facility's infection control department is advisable, not only to provide real-time advice on appropriate control measures but also to assist with contact tracing and exposure management if needed. Laboratory confirmation should be sought through serologic testing or isolation of measles virus or identification of measles RNA from a clinical specimen (7). All cases should be reported promptly to the local health department.

If measles is suspected, airborne precautions should be implemented immediately (8). Such precautions include appropriate patient isolation and the use of personal protective equipment. Patients with suspected measles should be isolated in a negative-air-pressure isolation room, or airborne-infection isolation room. These rooms are equipped with special air handling and ventilation systems that contain and safely remove infectious particles (10). Once the patient is appropriately isolated, providers should wear respiratory protection according to their facility's policies. Because current guidelines do not include specific guidance on respiratory protection (surgical mask vs. particulate respirator) (10), the practices of individual facilities may vary. If an airborne infection isolation room is unavailable, the patient should be placed in a private room with the door closed (10). A surgical mask can be worn by the patient to limit spread. If an examination room is not immediately available and the patient must remain in a waiting room, use of a surgical mask and distancing the patient from others may reduce the potential for exposures (10). Airborne precautions should be continued for 4 days after rash onset in healthy persons or for the duration of illness in immunocompromised patients; for those not requiring hospitalization, voluntary quarantine is advised.

As measles incidence increases, clinicians have a vital role to play. We need to talk to our patients about measles vaccination and remind them what is at stake if imported measles cases continue to land in communities of unvaccinated persons, especially for those who are too young or ineligible to be vaccinated. Meanwhile, we must ensure that our facilities do not become centers for secondary measles transmission—prompt recognition of suspected cases and rapid implementation of control measures are critical to prevent further spread.

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Disclosures: Authors have disclosed no conflicts of interest. Forms can be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M14-0892.

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Ann Intern Med. 2014;161:145-146. doi:10.7326/M14-0892

References

1. **McLean HQ, Fiebelkorn AP, Temte JL, Wallace GS; Centers for Disease Control and Prevention.** Prevention of measles, rubella, congenital rubella syndrome, and mumps, 2013: summary recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep. 2013;62(RR-04):1-34. [PMID: 23760231]
2. **Centers for Disease Control and Prevention (CDC).** Measles—United States, January 1-August 24, 2013. MMWR Morb Mortal Wkly Rep. 2013;62:741-3. [PMID: 24025755]
3. **Centers for Disease Control and Prevention (CDC).** Notifiable diseases and mortality tables. MMWR Morb Mortal Wkly Rep. 2014;63:277-300.
4. **Centers for Disease Control and Prevention (CDC).** National, state, and local area vaccination coverage among children aged 19-35 months—United States, 2012. MMWR Morb Mortal Wkly Rep. 2013;62:733-40. [PMID: 24025754]
5. **Smith PJ, Chu SY, Barker LE.** Children who have received no vaccines: who are they and where do they live? Pediatrics. 2004;114:187-95. [PMID: 15231927]
6. **Centers for Disease Control and Prevention (CDC).** Epidemiology and Prevention of Vaccine-Preventable Diseases: The Pink Book. 12th ed. Atlanta, GA: Centers for Disease Control and Prevention; 2012.
7. **Pickering L, ed.** Red Book: The Report of the Committee on Infectious Diseases. 29th ed. Elk Grove Village, IL: American Acad Pediatrics; 2012.
8. **Kutty P, Rota J, Bellini W, Redd SB, Barskey A, Wallace G.** Measles. In: Manual for the Surveillance of Vaccine-Preventable Diseases. 6th ed. Atlanta, GA: Centers for Disease Control and Prevention; 2013.
9. **Perry RT, Halsey NA.** The clinical significance of measles: a review. J Infect Dis. 2004;189 Suppl 1:S4-16. [PMID: 15106083]
10. **Siegel JD, Rhinehart E, Jackson M, Chiarello L; Health Care Infection Control Practices Advisory Committee.** 2007 guideline for isolation precautions: preventing transmission of infectious agents in health care settings. Am J Infect Control. 2007;35:S65-164. [PMID: 18068815]

Author Contributions: Conception and design: J.S. Sammons.
Analysis and interpretation of the data: J.S. Sammons.
Drafting of the article: J.S. Sammons.
Final approval of the article: J.S. Sammons.
Collection and assembly of data: J.S. Sammons.