

(91%) were in unvaccinated persons or persons whose vaccination status was unknown; all 40 were age eligible for vaccination, including 2 infant travelers aged 6 to 11 months. Source countries included Philippines (14 cases), Ukraine (8), Israel (5), Thailand (3), Vietnam (2), and Germany (2), with one importation each from Algeria, France, India, Lithuania, Russia, and the United Kingdom. Four travelers went to multiple countries during their exposure period, including Italy and Singapore; Thailand and Cambodia; Ukraine and Israel; and Cambodia, Thailand, China, and Singapore. Among 245 cases (35%) for which molecular sequencing was performed, B3 and D8 were the only genotypes identified, which were the most commonly detected genotypes worldwide in the past 12 months.

DISCUSSION

Before 2019, the highest number of measles cases after elimination in the United States occurred in 2014, when 667 cases were reported; 383 of those cases (57%) were associated with an outbreak in an underimmunized Amish community in Ohio.⁶ Worldwide, 7 million measles cases are estimated to occur annually, and since 2016, measles incidence has increased in 5 of the 6 World Health Organization regions,⁷ contributing to increased opportunities for measles importations into the United States. Fortunately, the majority of importations do not lead to outbreaks because of rapid implementation of control measures by state and local health departments. Additionally, the United States benefits from a long-standing vaccination program, with overall measles vaccination coverage of greater than 91% in children aged 19 to 35 months.⁸ However, unimmunized or underimmunized subpopulations within US communities are at risk for large outbreaks of long duration that are resource intensive to control.⁹ Recent outbreaks have been driven by misinformation about measles and MMR vaccine, which has led to undervaccination in vulnerable communities.

Unvaccinated US residents traveling internationally are at risk for acquiring measles. Health care providers should vaccinate persons without contraindications and without acceptable evidence of immunity to measles before travel to any country outside the United States. Only written (not self-report) documentation of age-appropriate vaccination, laboratory evidence of immunity, laboratory confirmation of disease, or birth before 1957 is considered acceptable presumptive evidence of immunity. In addition to routine recommendations for MMR vaccination,³ infants aged 6 to 11 months should receive 1 dose of MMR vaccine, and adults should receive a second dose before international

travel³; infants who receive MMR vaccine before their first birthday should receive 2 additional doses (1 dose at 12 to 15 months and another dose at least 28 days after the first dose). Measles is a nationally notifiable disease in the United States; health care providers should rapidly report all cases of suspected measles to public health authorities to ensure that timely control measures are implemented. High coverage with MMR vaccine is the most effective strategy to limit transmission and maintain elimination of measles in the United States.

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COMMENTARY

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Despite high efficacy of MMR vaccines, measles caused 110,000 deaths worldwide in 2017.¹ Only 4 months into 2019, the United States has already faced 13 measles outbreaks across 22 states, with 66 patients requiring

hospitalization. Measles is a highly contagious respiratory virus that is associated with common complications such as diarrhea, otitis media, and pneumonia, but can also lead to encephalitis, transient immunosuppression, premature birth or low birth weight, and death.² The virus's unmatched ability to spread, undervaccinated communities with decreased herd immunity, and a global increase of measles cases all contribute to this year's alarming US outbreaks. Providers must be aware of who is at risk, signs of measles infection, and how to minimize spread during this epidemic.

When exposed to measles, 90% of nonimmune individuals will become infected.³ In a fully susceptible population, each individual with measles will infect 11 to 18 new individuals on average.⁴ Early illness may appear similar to common upper respiratory infections, but can spread the virus 4 days before rash onset.⁵ Furthermore, aerosolized droplets remain in a room up to 2 hours after the infected individual has left.² Patients with suspected measles should be identified early so they are not placed in waiting rooms and should be immediately placed in airborne isolation (a negative-pressure room). After a person with suspected measles has left a room, it should not be used for other patients for at least 2 hours.

In 2000, measles was declared eliminated in the United States because of high coverage with MMR vaccination. One dose is effective in 93% of vaccinated children and in 97% after a second dose.² Within a population, there are always unimmunized people who cannot safely receive live vaccines, such as pregnant and immunocompromised individuals. Infants do not receive the vaccine until 12 months because of immature immune systems and interference from maternal antibodies. These individuals remain susceptible to measles. Historically, such groups were protected by herd immunity, which prevented transmission and epidemics when there was a high prevalence of immune individuals above a critical value.⁴ Because measles is so contagious, 92% to 95% of a population must be vaccinated to achieve herd immunity and prevent outbreaks.^{4,6,7} In the United States, approximately 91% of children aged 19 to 35 months have received at least 1 dose of the MMR vaccine.

However, subpopulations with low immunization rates exist. For example, in uninsured families in 2017, only 74% of children aged 19 to 35 months were vaccinated.⁸ Additionally, rates of nonmedical exemptions, which allow parents to opt out of required vaccines for school-aged children, are increasing.⁹ The *Morbidity and Mortality Weekly Report* noted that US travelers import most initial measles cases in the United States; however, 94% of cases through April 26 of this year were associated with

local outbreaks among susceptible, unimmunized, US residents.

Additionally, any traveler who develops a rash within 21 days of returning to the United States should be considered for measles infection. Despite a highly efficacious vaccine, 11% of measles cases this year had documentation of vaccination and another 18% had unknown vaccine status. Therefore, a high level of suspicion should be maintained for measles when any individual presents with typical symptoms starting with a prodrome of high fever, followed by cough, coryza, and conjunctivitis (and sometimes Koplik's spots, blue-white lesions with a red base on buccal mucosa), followed several days later by a confluent maculopapular rash starting on the face or neck and spreading to the body.

People who are immunocompromised or at extremes of age are at higher risk of severe complications. Pneumonia is the most common cause of death from measles and is present in 6% of cases. Acute encephalitis occurs in 0.1% of cases.¹⁰ Subacute sclerosing panencephalitis is an extremely rare, insidious measles infection of the brain that leads to progressive neurologic decline, ataxia, myoclonus, and death an average of 7 years after measles infection. Measles infection is much more severe in immunocompromised individuals and malnourished children, especially those with vitamin A deficiency, who have a case fatality rate of 25%.¹⁰

The presumptive diagnosis of measles should be determined by clinical judgment. Laboratory confirmation will take several days in most places; isolation and contact tracing should proceed while results are pending. Serologic and viral identification can help confirm disease and facilitate public health investigations. Measles PCR should be performed from nasopharyngeal swabs and urine samples. Serum for immunoglobulin M should also be collected and will often appear positive for measles 1 to 3 days after rash onset, a result that persists for 1 to 2 months.

Treatment for measles is supportive, but clinicians should evaluate for serious complications such as pneumonia. All cases of suspected measles must be reported to public health officials immediately to facilitate rapid investigation and implementation of control measures to prevent further transmission. Postexposure prophylaxis with the live measles vaccine may prevent disease if given within 72 hours of exposure. Postexposure prophylaxis with immunoglobulin can be considered for contacts who are at high risk for serious complications, such as children younger than 12 months, nonimmune pregnant women, and immunocompromised persons. Immunoglobulin may prevent or modify disease if given within 6 days of

exposure. In addition, when taking an immunization history and discovering inadequate vaccine protection, emergency providers should review recommended immunizations with patients and parents, particularly in communities experiencing a measles outbreak.

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Future Meetings of the American College of the Emergency Physicians

The following are the planned sites and dates for the future annual meetings of the American College of Emergency Physicians:

2018	San Diego, CA	October 1-4
2019	Denver, CO	October 28-31
2020	Dallas, TX	October 26-29
2021	Boston, MA	October 25-28