

JAMA Insights

Measles

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Measles (rubeola), a highly contagious viral disease, is a leading cause of morbidity and mortality worldwide, particularly in regions with low immunization coverage.¹ In 2023, an estimated 107 500 measles deaths occurred worldwide, mostly among children younger than 5 years. Prior to authorization of the first measles vaccine in 1963, the US had an estimated 3 million to 4 million cases of measles annually, with 400 to 500 deaths and 48 000 hospitalizations.² The Centers for Disease Control and Prevention declared measles had been eliminated in the US in 2000.² Recent measles outbreaks in the US have occurred due to declining vaccine coverage. As of July 23, 2025, a total of 1319 cases have been reported, mostly (92%) among unvaccinated people or those with unknown vaccination status; 165 cases (13%) required hospitalization and 3 patients died (2 unvaccinated school-age children and 1 unvaccinated adult). Globally, multiple ongoing measles outbreaks continue.

Transmission

Measles is transmitted through airborne spread when an infected individual breathes, coughs, or sneezes² or by direct contact with respiratory secretions such as nasal mucus and saliva. Measles is highly transmissible, with a basic reproductive number (R_0) of 12 to 18, meaning that, on average, a single infected person can transmit measles to 12 to 18 others in a susceptible population. The virus remains viable in the air of enclosed spaces for up to 2 hours, thus a single infected individual in a public area (eg, restaurant, airport) can lead to multiple exposures. Up to 90% of individuals who are not immune develop measles after exposure. The incubation period is 10 to 14 days (range, 7-21 days), with infectivity beginning 4 days before the rash and lasting for approximately 4 days.

Clinical Presentation

The initial prodrome of measles resembles symptoms of other viral infections, with fever and malaise followed by coryza and conjunctivitis.² Overall, 60% to 70% of patients with measles develop Koplik spots, small blue-white lesions inside the mouth, which appear transiently 1 to 2 days before the characteristic rash and are a pathognomonic feature. An erythematous, maculopapular rash appears 3 to 5 days after initial symptoms, starting at the hairline and spreading to the face, trunk, and extremities. The rash is initially blanching, then may turn brownish and desquamate, and lasts approximately 1 week.

Diagnosis

Measles should be considered in patients presenting with fever and rash, particularly if they lack presumed immunity to measles, have traveled internationally or to an area in the US with a known outbreak, or had a known exposure to measles within the past 21 days.² Suspicion of measles should prompt consultation with

a local health department and a health system infection prevention department for advice on testing and prevention of possible transmission.

A throat swab or nasopharyngeal swab for measles ribonucleic acid (RNA) by reverse transcriptase-polymerase chain reaction (RT-PCR) testing should be obtained from all patients with suspected measles; adding urine PCR increases sensitivity.^{2,3} Viral RNA is detectable for about 3 days after rash onset, with sensitivity of 94% and specificity of 99%.

Serum should be tested for measles-specific IgM antibody, which is typically detectable 3 to 30 days after rash onset (sensitivity of 83% to 98.8% and specificity 93.7% of 100%). Measles-specific IgG antibody is not detectable until at least 7 days after rash onset and indicates immunity due to previous infection or vaccination.

Complications

Children younger than 5 years, adults older than 20 years, immunocompromised individuals, and pregnant individuals are at highest risk of complications from measles.¹⁻³ Malnutrition, particularly vitamin A deficiency, increases the risk of complications, which include diarrhea, otitis media, hearing loss, pneumonia, and blindness from corneal ulcers and scarring. Rare complications include encephalitis (1 per 1000 cases) and subacute sclerosing panencephalitis (7-11 per 100 000 cases), a fatal central nervous system degenerative disease that can occur years after infection. Overall, 1 to 3 per 1000 people die of measles. Complications during pregnancy include miscarriage, premature birth, low birth weight, and stillbirth. Measles infection causes immunosuppression lasting up to 2 to 3 years (immune amnesia), increasing the risk of secondary bacterial and viral infections.⁴

Management

There is no specific antiviral therapy for measles; treatment is supportive. Ribavirin shows in vitro activity against measles virus, but is not approved by the US Food and Drug Administration for treatment. The American Academy of Pediatrics recommends vitamin A for all infants and children hospitalized with measles, with dose determined by age, administered in 2 oral doses on consecutive days.²

Prevention

Immunization with the measles, mumps, and rubella (MMR) vaccine is highly effective, providing immunity against measles in approximately 93% of individuals after 1 dose and 97% after 2 doses.²

The Advisory Committee on Immunization Practices recommends immunizing all children with 2 doses of MMR vaccine: the first dose at 12 to 15 months of age and the second dose at 4 to 6 years of age.⁵ The combined MMR and varicella (MMRV) vaccine can replace the MMR vaccine for children up to 12 years of age.⁶ Infants aged 6 to 12 months should receive 1 MMR dose before traveling internationally or to an area of the US with an ongoing measles outbreak, followed by 2 doses after 12 months of age according to the

standard immunization schedule.^{5,7} The minimum interval between MMR vaccine doses is 28 days.⁵

Adults are presumed to have immunity to measles if they were born prior to 1957, received at least 1 dose of MMR vaccine, or have a positive measles-specific IgG antibody test result.⁵ Health care personnel, college students, and international travelers, all at higher risk of exposure, should receive 2 MMR vaccine doses.

The MMR vaccine has rare serious adverse events. Mild adverse effects include fever in 5% to 15% of recipients typically 5 to 12 days after vaccination and rash in 5% of recipients.² MMR is a live attenuated virus vaccine, so it is contraindicated for pregnant women and severely immunocompromised individuals, for example, individuals with HIV with CD4 count less than 200 cells/ μ L, receiving high-dose immunosuppressive medications (eg, ≥ 20 mg prednisone equivalent for ≥ 14 days, use of tumor necrosis factor alpha inhibitors, JAK inhibitors, high-dose methotrexate, or azathioprine), or with history of solid organ or recent bone marrow transplant.⁵

MMR vaccination rates in the US have declined recently, with only 11 states exceeding the 95% vaccination that confers herd immunity as of the 2023-2024 school year.² From 2019-2020 to 2023-2024, the national kindergarten MMR vaccination rate declined from 95.2% to 92.7%, leaving approximately 280 000 kindergarteners at risk. Addressing vaccine hesitancy is crucial for achieving high coverage rates.⁸

Isolation and Exposure Management

Patients with suspected measles presenting to health care facilities should be immediately masked and placed in an airborne isolation room, if available, or in a private room with a closed door.^{9,10} Only

clinicians with presumptive immunity to measles should care for patients with suspected or confirmed measles. Clinicians should wear an N95 mask or powered air-purifying respirator, and standard examination rooms should not be used for 2 hours after the patient has left the room. Outside of health care settings, individuals with suspected or confirmed measles should isolate at home under the guidance of the local health department. For confirmed measles cases, isolation should continue until 4 days after rash onset.

Individuals with presumptive measles immunity do not need to take any special precautions following an exposure, defined as sharing the same air space with an infected individual or within 2 hours after they have left. Postexposure prophylaxis is recommended for nonimmune individuals (or those with unknown vaccination/immune status) exposed to measles.² Nonpregnant, immunocompetent individuals older than 6 months may receive the MMR vaccine within the first 72 hours after exposure or immune globulin within 4 to 6 days after exposure. Individuals younger than 6 months, those who are pregnant, and those who are immunocompromised can only receive immune globulin as prophylaxis. Nonimmune individuals without MMR vaccine prophylaxis may be required to quarantine for 21 to 28 days after exposure under the guidance of the local health department.

Conclusions

Measles, a highly contagious but preventable viral infection, has re-emerged in the US. Clinicians and public health officials should promote vaccination as the most effective way to protect young children, immunocompromised individuals, and pregnant individuals from potential serious health complications from measles infections.

ARTICLE INFORMATION

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