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EPIDEMIOLOGICAL CHARACTERISTICS OF MEASLES

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Annotation: Measles is a highly contagious viral disease that continues to pose a serious public health challenge despite the availability of an effective vaccine. It is caused by the measles virus, an RNA virus belonging to the genus Morbillivirus. The disease is transmitted through airborne droplets and direct contact with respiratory secretions, allowing rapid spread in susceptible populations. Measles primarily affects unvaccinated individuals, especially children, but outbreaks increasingly involve adolescents and adults due to gaps in immunization coverage. Epidemiologically, measles is characterized by high transmissibility, periodic outbreaks, seasonal variation, and a strong dependence on population immunity levels. The incubation period ranges from 7 to 14 days, and infected individuals are contagious several days before and after the onset of rash, contributing to silent transmission. Global epidemiological data show that measles incidence rises sharply when vaccination coverage falls below the herd immunity threshold of approximately 95%. Developing countries experience higher morbidity and mortality due to malnutrition, vitamin A deficiency, and limited access to healthcare services. Although global vaccination programs have significantly reduced measles-related deaths, recent years have seen a resurgence of outbreaks linked to vaccine hesitancy, migration, and disruptions in routine immunization services. Understanding the epidemiological characteristics of measles is essential for effective disease surveillance, outbreak prevention, and implementation of elimination strategies.

Keywords: Measles, epidemiology, measles virus, transmission, outbreak, vaccination, herd immunity, susceptibility, morbidity, mortality, public health, surveillance, elimination.

Measles is one of the most contagious infectious diseases known in humans, with a basic reproduction number (R_0) estimated between 12 and 18. This means that one infected individual can transmit the virus to 12–18 susceptible persons in the absence of immunity. The disease is transmitted primarily via airborne spread, and the virus can remain infectious in the air for up to two hours after an infected person leaves the area. The only source of infection is a human case, either symptomatic or in the prodromal stage. The disease occurs worldwide and affects all age groups; however, the highest incidence is observed among unvaccinated children under five years of age. Infants are partially protected by maternal antibodies, but this protection declines within the first year of life. In populations with insufficient vaccination coverage, measles outbreaks occur cyclically every 2–5 years. Seasonal trends are also observed, with higher incidence in late winter and early spring in temperate regions. Measles remains endemic in some low- and middle-income countries, where case fatality rates are higher due to malnutrition, vitamin A deficiency, immunodeficiency, and coexisting infections. Complications such as pneumonia, diarrhea, encephalitis, and severe dehydration contribute

significantly to measles-related mortality. In contrast, in countries with strong immunization programs, measles outbreaks are usually associated with imported cases and clusters of unvaccinated individuals. Vaccination with two doses of a measles-containing vaccine is the cornerstone of prevention. Maintaining high vaccination coverage, strengthening surveillance systems, early case detection, and rapid outbreak response are essential epidemiological measures to control and ultimately eliminate measles.

Detailed Epidemiological Information

Measles is among the most infectious human diseases, with a basic reproduction number (R_0) estimated at 12–18. This high transmissibility is primarily due to airborne transmission via respiratory droplets and aerosols produced during coughing, sneezing, or speaking. The virus can remain viable in the air or on surfaces for up to two hours, facilitating indirect transmission in closed environments such as schools, healthcare facilities, and public transport. Humans are the only natural reservoir of the measles virus, making eradication theoretically achievable. The incubation period of measles typically ranges from 7 to 14 days, with a prodromal phase characterized by fever, cough, coryza, and conjunctivitis. Infected individuals are contagious from approximately four days before to four days after the appearance of the maculopapular rash, contributing to unnoticed transmission before clinical diagnosis. Susceptibility to measles is nearly universal among non-immune individuals. Infants are temporarily protected by maternal antibodies; however, this passive immunity declines within the first 6–9 months of life, increasing vulnerability prior to vaccination. Epidemiologically, measles exhibits cyclical outbreaks, particularly in areas where vaccination coverage falls below the herd immunity threshold of approximately 95%. Outbreaks commonly occur every 2–5 years in under-immunized populations. Seasonal variation is evident in many regions, with increased incidence during late winter and early spring in temperate climates. In tropical regions, measles transmission may correlate with rainy seasons or periods of increased population movement. Globally, measles remains endemic in several low- and middle-income countries, where disease burden is amplified by malnutrition, vitamin A deficiency, immunosuppression, and limited healthcare access. Case fatality rates in these settings may reach 1–5%, and even higher during humanitarian emergencies. Severe complications include pneumonia, acute encephalitis, subacute sclerosing panencephalitis, and profound immune suppression leading to secondary infections. In contrast, high-income countries typically report lower mortality, but outbreaks continue to occur due to imported cases and clusters of unvaccinated individuals. Vaccination is the cornerstone of measles prevention. Two doses of a measles-containing vaccine, usually administered as the measles-mumps-rubella (MMR) vaccine, provide long-term immunity in over 97% of recipients. Epidemiological evidence demonstrates that sustained high vaccination coverage, effective disease surveillance, rapid outbreak response, and public trust in immunization programs are critical for interrupting transmission. Failure to maintain these measures results in the re-emergence of measles even in countries that previously achieved elimination status.

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