



Measles Virus (Rubeola)

Essential Information



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Origins

Measles (also called Rubeola) is a highly contagious respiratory infection caused by the measles virus, which infects the nose and throat mucus. The measles virus is a large enveloped virus (150-200 nm genome size) that is part of the paramyxovirus family. First identified in the 9th century, in 1957 Francis Home is credited with determining that measles was caused by an infectious agent.

The infection is primarily spread through coughing and sneezing, which can produce small droplets that can stay suspended in the air for up to two hours or active on surfaces for up to 2 hours as well. People who breathe in these infected droplets and have no resistance to measles can develop the disease. As measles is considered one of the most highly contagious of diseases, exposure to even small amounts of the virus in a brief amount of time can result in infection.

The virus may also be transmitted through hand and surface contact with secretions and then touching one's eyes, nose, or mouth. Once infected, the virus attaches itself to the lining of the nose/throat. Despite the availability of a vaccine, measles occurs worldwide with the majority of the cases being people that are not immunized. Measles appears to be only a human disease. There are no known animal or insect sources.

A recent study published in the journal Science (Mina 2015) discussed a disturbing side effect of being infected with measles. The authors concluded from the data they analyzed that one of the side effects of having measles is that it suppresses a child's immune system. For a period of up to 2-3 years, their immune system will be suppressed, making them more susceptible to other infectious diseases, including those they previously had been vaccinated against. This phenomenon, "measles induced immunity amnesia", is an argument for measles vaccinations for children, and potentially adults, as the measles vaccination can not only prevent measles, but help protect the person from other infectious diseases, which is especially important for children.

Diagnosis

A person infected with measles will develop symptoms from 7-14 days after infection. The initial symptoms include:

- High fever
- Cough
- Runny nose
- Red, watery eyes

Two to three days after symptoms appear, small white spots (Koplik spots) will appear inside the mouth. Three to five days after initial symptoms appear, a rash of flat red spots will appear on the face near the hairline, and spread downward to the neck, trunk, arms, legs, and feet. A high fever of $>104^{\circ}\text{F}/>40^{\circ}\text{C}$ generally develops as the rash appears. The flat red spots may develop raised bumps and the spots may join together as the illness progresses and the rash spreads. After a few days the fever stops and the rash fades.

Many of the initial symptoms likely to present early in the illness are often seen in patients with other commonly occurring diseases, such as influenza. Diagnosis and treatment should only be performed by a trained physician who can rule out other potential diseases.

Method of Transmission/ Contagiousness

Measles is highly contagious. Infected people are contagious from 4 days before to 4 days after the rash appears. Measles is so contagious that if an infected person is within 1 meter (3 ft) of uninfected people, up to 90% of the people without immunity will become infected.

The disease is spread primarily by small airborne droplets and has an incubation period, with infected people generally showing symptoms in 7-14 days. Because the droplets can stay active for up to 2 hours in the air or on surfaces, the primary route of infection is inhaling or swallowing droplets from an infected person's sneeze or cough.

Infection is also believed to occur, with unknown frequency, through contact with contaminated objects. Droplets of respiratory secretions from an infected person can settle on surfaces and objects, where people can pick the virus on their hands and by touching their mouth, nose, or eyes, become infected.



Prevention

Vaccination: The measles vaccination was originally developed by John Enders and Thomas Peebles in 1963. An updated vaccination developed by Hilleman in 1968 is the vaccination still in use today. A measles vaccination, which is delivered as part of the measles, mumps and rubella or MMR vaccination, has a high degree of effectiveness in protecting people from getting measles, but no vaccine is 100% effective. There is always a chance that vaccinated people of any age can still become infected with measles.

Today most vaccination programs for children recommend 2 doses of the vaccine at 12-15 months of age and 4-6 years of age or at least 28 days apart, to help build longer lasting immunity. The 2 dose vaccination schedule is believed to have increased immunity from 93% with a single vaccination to >97% with 2 doses. When vaccinated people do get infected with measles, the vaccinations generally give them partial immunity, making the illness milder and making them less likely to spread the disease to others. Immunized adults moving to countries at higher risk of measles infections may be advised to get a booster immunization by their doctor.

In the United States, widespread use of the vaccination reduced the number of cases from 3-4 million a year (1950s) to 40-200 cases per year today (a 99% reduction). Most cases in the US are caused by unvaccinated people from outside the US carrying the virus into the country. The success of the vaccination has led some parents to not vaccinate their children. As the number of non-vaccinated people rises, the risk of outbreaks increases. The 2014 outbreak of measles in an amusement park in the west coast of the US caused 500+ cases and was linked to a number of non-vaccinated people being in close proximity to an infected person who attended the park.

Measles is common across the world, especially in countries that do not immunize their citizens. Since the virus is highly contagious and can spread rapidly through unvaccinated groups, estimates are that 20 million people get measles each year and 146,000 die from the disease (0.73% mortality rate.) As the measles vaccination can prevent measles induced immunity amnesia (as discussed previously), widespread vaccinations can also help reduce the risk of other infectious diseases for unvaccinated people who become infected with measles.

Reduce Contact: Non-immunized people should avoid or minimize contact with people who have an active measles infection. If around an infected person, avoiding touching your eyes, nose, and mouth can help prevent infection.

Transmission Based Precautions: When a person infected with measles is being treated in a hospital, they will generally be put into airborne isolation (or a negative pressure) room to protect the healthcare staff, even if the healthcare workers have been immunized. Healthcare workers entering the patient's room will observe airborne precautions, which includes wearing a small particle respirator.

Hand Hygiene: While the virus that causes measles is not believed to be primarily spread through "hand to hand" or "hand to surface to hand" contact, still it is believed to be a route of infection. Frequent hand washing with soap and water or the use of alcohol hand gel reduces the risk of this type of transmission.

Respiratory Hygiene: People with measles should cover their mouth with a tissue or use their elbow when they cough or sneeze. Dispose of the tissue once used. They should wash their hands or use alcohol hand gel after sneezing or coughing. As this virus is primarily transmitted via respiratory droplets, infected people should take steps to protect those around them that are not immunized.

Surface Cleaning/Disinfection: While the virus that causes measles is not believed to be primarily transmitted via environmental surfaces, it is a potential source of transmission and an environmental hygiene program should always include regular cleaning and disinfection of commonly touched environmental surfaces (door handles, light switches, elevator buttons, keyboards, phone, etc.) because the virus can live for several hours on environmental surfaces and the risk posed by environmental surfaces can be reduced through proper cleaning and disinfection. When cleaning and disinfecting, avoid spraying or splashing as this can further spread the virus.

Protocol for Sick Staff Members: Staff members with active measles infections should stay away from work until cleared by a doctor to return.

Good Health Practices: Practicing good health is also helpful in preventing the development of many illnesses. The strength of a person's immune system is often related to their overall health. Get plenty of sleep, eat healthy, be physically active, manage stress, and drink plenty of fluids to keep your immune system strong.

References and useful websites

Much of the Information used in the development of this brochure was taken from the sites listed below.

<http://www.cdc.gov/measles/>

<http://www.who.int/mediacentre/factsheets/fs286/en/>

[Mina et. Al, "Long-term measles-induced immunomodulation increases overall childhood infectious disease mortality", Science, 2015;348:694-699.](#)



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