



Measles

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Key facts

To better understand public health terms included in this Disease Tool (e.g. What is a case definition? or What is an infectious agent?), consult our page on Key concepts on epidemiology.

Importance

Measles is one of the leading causes of death in young children globally, despite the availability of a safe and effective vaccine. In 2018 there were more than 140,000 measles deaths globally, mostly among children younger than five years. A measles outbreak occurs when the measles vaccine coverage is low or has dropped below 95 per cent. Vaccination has reduced deaths caused by measles by 73 per cent between 2000 and 2018 globally, but measles remains common in many countries, particularly in parts of Africa and Asia. That said, measles cases skyrocketed from 2017 to 2019, with outbreaks happening in seven previously measles-free countries. Many countries not previously considered at risk are now experiencing outbreaks. Measles is one of the most contagious infectious diseases and can spread very quickly but can be controlled with mass vaccination campaigns. Measles infection leads to loss of immunity to other deadly diseases, increasing the risk of death from other causes.

Case definition

A **case definition** is a set of uniform criteria used to define a disease for public health surveillance. It enables public health officials to classify and count cases consistently.

*The following are standard case definitions to allow national health authorities to interpret data in an international context. However, during an outbreak case definitions may be adapted to the local context and the Red Cross Red Crescent should use those agreed/established by national health authorities. NB: Consider that during community-based surveillance, **volunteers** should use broad (simplified) case definitions (referred to as community case definitions) to recognize most or all possible cases, provide relevant risk communication and appropriate actions and encourage them to seek care. Other actors such as **healthcare workers or investigators** studying the cause of a disease, on the other hand, can use more specific case definitions that*

may require laboratory confirmation.

Suspected case: Any person with fever greater than or equal to 38 °C AND generalized rash (lesions with a flat base called maculopapular, and a number of small fluid-filled blisters) AND ONE of the following: cough, runny nose or red eyes (conjunctivitis) OR any person in whom a clinician suspects measles.

Confirmed case:

- Laboratory confirmed case: symptomatic case with laboratory confirmation.
- Epidemiologically linked case: a suspect case of measles that has not been laboratory confirmed, but was linked by geography and time, with rash starting 7–23 days apart from another laboratory confirmed or epi-linked measles case

WHO case definition source of information:

https://www.who.int/immunization/monitoring_surveillance/burden/vpd/WHO_SurveillanceVaccinePreventable_11_Measles_R2.pdf

Alert / epidemic threshold

An **alert threshold** is the pre-defined number of alerts that suggest the beginning of a possible disease outbreak and therefore warrant immediate notification.

Epidemic thresholds are the minimum number of cases indicating the beginning of a particular disease's outbreak.

The specific threshold must be developed based on local epidemiology and immunization programme objectives. The outbreak threshold may, and should, change as the incidence of measles changes. In countries with no recent measles cases reported, a single case should trigger a detailed case investigation.

Risk factors

- Children who are not vaccinated are most at risk. It is estimated that in an unvaccinated population, nearly all children develop measles before adolescence.
- Measles is common particularly in parts of Africa and Asia. More than 95 per cent of measles deaths occur in countries with low per capita incomes and weak health infrastructures.
- Measles outbreaks can be particularly deadly in countries experiencing or recovering from a natural disaster or conflict. Damage to health infrastructure and health services interrupts routine immunization and overcrowding in residential camps greatly increases the risk of infection.
- Overcrowded areas where a person-to-person spread is easily possible.
- Lack of proper sanitation and hygiene measures.

Attack rate (AR)

The **attack rate** is the risk of getting a disease during a specific time period (such as during an outbreak).

Attack rates will vary from one outbreak to another. In case of an outbreak, consult the latest information provided by health authorities.

Measles is an extremely contagious disease. In a completely unprotected population, one person infected with the measles virus will infect, on average, between 12 and 20 people. The attack rate is 90 per cent or greater among non-immune contacts (i.e. 9 out of 10 susceptible people who are exposed to measles will get sick). In areas where part of the population has been vaccinated or infected by the virus previously, the reproductive ratio is lower.

Groups at increased risk of severe illness (most vulnerable)

- Unvaccinated young children under five years old.
- Unvaccinated adults over 30.
- Unvaccinated pregnant women are at highest risk of severe measles disease and its complications. The pregnancy may end in miscarriage or preterm delivery.
- People with weakened immune systems, such as those receiving chemotherapy, transplant recipients, or people living with HIV/AIDS or other diseases.
- People with chronic diseases such as renal disease, cancer, chronic lung or liver disease and diabetes.
- People suffering from malnutrition and vitamin A deficiency.

Infectious agent

Infectious agents are bacteria, viruses, fungi, prions and parasites. A disease caused by an infectious agent or its toxic products is defined as an infectious disease.

Measles *morbillivirus* (also called measles virus).

Reservoir / host

A **reservoir of infection** is a living organism or material in or on which an infectious agent lives and/or usually multiplies. Reservoirs include humans, animals and the environment.

A **susceptible host** is a person at risk of being infected. The level of susceptibility depends on age, sex, ethnicity and genetic factors, specific immunity also depends on other factors that affect an individual's ability to resist infection or to limit its ability to cause infection.

A **zoonotic disease** or **zoonosis** is an infectious disease that has jumped from a non-human animal to humans.

Humans.

How disease is spread (modes of transmission)

Categorisation of **modes of transmission** varies from one agency to another. In addition, some infectious agents can be transmitted by more than one mode. A list of modes of transmission can be found in the key concepts to serve as guidance to better understand the diseases included in this website.

Airborne and droplet spread:

- Viral droplets of saliva/mucus from one person to another, mainly by coughing or sneezing.
- Sharing eating and drinking utensils can increase droplet spread.
- The virus remains active and contagious in the air or on infected surfaces for up to four hours.

Contact transmission:

- Close personal contact or direct contact with infected nasal or throat secretions.

Incubation period

This time from when infection occurs to the onset of symptoms is called the **incubation period**. It is a range of days and it can be different for each disease.

10 to 14 days (range 7—23 days).

Period of infectiousness

Period of infectiousness is the time interval during which an infected person can transmit the infection to other susceptible persons.

Infected people can spread measles to others from four days before up to four days after their rash appears. It can be longer in malnourished or immunosuppressed individuals.

Clinical signs and symptoms

- Measles generally starts with a high fever, runny nose, cough, red and watery eyes, and sometimes white spots inside the cheeks.
- Red blotchy rash appears after several days, usually on the face and upper neck, and over about three days spreads to the rest of the body.
- In severe cases, serious complications include blindness, brain swelling, severe diarrhoea and related dehydration, ear infections or severe respiratory infections like pneumonia.
- In populations with high levels of malnutrition and a lack of adequate health care, up to 10 per cent of measles cases result in death.

Other diseases with similar clinical signs and symptoms

Other diseases with rash and fever, e.g. hand, foot and mouth disease (HFMD), *Parvovirus B19* infection, rubella, dengue fever, chickenpox, monkeypox, mumps.

Diagnosis

- Detection of measles-specific IgM antibody and measles RNA by real-time Polymerase Chain Reaction (RT-PCR) are the most common methods for confirmation of measles infection.
- Efforts should be made to obtain a serum sample and throat swab (or nasopharyngeal swab) from suspected cases at first contact.

Vaccine or treatment

Please refer to the appropriate local or international guidelines for clinical management. All clinical management including the administration of any treatment or vaccine should be conducted by health professionals.

- No specific antiviral treatment exists for the measles virus.
- Severe complications from measles can be avoided through supportive care that ensures good nutrition, adequate fluid intake and treatment of dehydration with WHO recommended Oral Rehydration Solutions (ORS). This solution replaces fluids and other essential elements that are lost through diarrhoea or vomiting.
- All children in low-income countries diagnosed with measles should receive two doses of vitamin A supplements, given 24 hours apart. It can help prevent eye damage and blindness. Vitamin A supplements have also been shown to reduce the number of measles deaths.
- **This is a vaccine-preventable disease and measles vaccination is part of routine immunization programmes** (two doses). Please refer to the national immunization schedule. The measles vaccine is often incorporated with rubella and/or mumps vaccines. It is equally safe and effective in the single or

combined form.

Immunity

There are two types of immunity:

- **Active immunity** results when exposure to an agent triggers the immune system to produce antibodies to that disease.
- **Passive immunity** is provided when a person is given antibodies to a disease rather than producing them through his or her own immune system.

- Natural immunity after infection is lifelong.
- Vaccine efficacy is 93 per cent at 12 months of age and 98 per cent at 15 months of age. This increases to more than 99 per cent after two doses of the vaccine is received.
- Vaccine provides lifelong immunity.

Which interventions are most effective for prevention and control?

The following is a list of activities considered for Red Cross Red Crescent volunteers to take part in. It is not an exhaustive list of all prevention and control activities for the specific disease.

- Communicate risks about the disease or epidemic, not only to share information on prevention and mitigation measures, but also to encourage informed decision-making, positive behaviour change and maintenance of trust in the Red Cross Red Crescent response. This includes the identification of rumours and misinformation around disease—frequent during health emergencies—to manage them appropriately. Volunteers should use the most context-appropriate communication techniques (ranging from social media to face-to-face interactions).
- Community education and engagement activities to encourage the adoption of protective behaviours:
 - Isolation of those who are sick.
 - Cough etiquette (cover mouth when coughing or sneezing; tissues should be disposed of immediately).
 - Support for children between six months to five years diagnosed with measles to receive Vitamin A supplementation, if prescribed and managed by a health professional.
- Social mobilization for mass vaccination, including extensive Information, Education and Communication (IEC) activities on the benefits of the measles vaccine, the routine vaccination schedule in country and/or Supplementary Immunization Activity (SIA) campaign dates and locations, and the importance of the vaccine's two doses.
- Rapid detection and encouragement of early health-seeking behaviours at health facilities (e.g. through community-based surveillance, epidemic control for volunteers).
- Contact tracing and follow up. All contact tracing activities must be done in close coordination with health

authorities.

Which interventions have NO evidence and therefore are NOT recommended?

- There are a number of misconceptions about the measles vaccine and these may lead to avoiding the vaccine altogether. The following are some examples of such misconceptions, which may be difficult to address in communities. Volunteers are encouraged to consider that strongly refuting or dismissing a belief may in fact increase rather than decrease a perception of risk; therefore, encouraging an open discussion while relying on evidence-based facts to encourage reflection should always be the option.
 - It is a common misconception that it is best for children to acquire immunity by getting the disease instead of by getting the measles vaccine. While immunity is indeed acquired through disease, the vaccine protects against the disease without developing severe symptoms, complications and long-term health problems. Additionally, vaccination will not expose others as having the disease would; the vaccine will immunize the individual and the weakened virus in the vaccine cannot be transmitted to others.
 - Low uptake of the vaccine in some parts of the world is the result of a common myth that the measles vaccine may cause autism; other misconceptions include that it may cause irritable bowel syndrome (IBS). The link to autism was claimed by a scientist in 1998 and his work received much media attention; however, it was later discovered that the author had financial interests and that the data was falsified. To date, many independent studies have determined that the vaccine does not cause autism or other conditions like IBS: Gillbert and Heijdal, 1998; Taylor et al., 1999; DeWilde et al., 2001; Davis et al., 2001.
 - Another reason to avoid the measles vaccine is a misconception that a combined MMR (Measles, Mumps and Rubella) vaccine could increase harmful side effects for children or that it may overload the immune system. The immune system can deal with several vaccines or a combined vaccine against several diseases at the same time. The administration of multiple vaccines at the same time (e.g. Diphtheria, Tetanus, Pertussis (DPT) vaccine) has excellent safety records.
- Should hesitancy be a major fact in making people not want to get their children vaccinated, the tool “Psychological First Aid for vaccine hesitancy in the COVID-19 outbreak response” can be a helpful tool to be used for measles as well.

Epidemic characteristics and RCRC indicators and targets

The first table below includes data that should be gathered from health authorities and relevant non-governmental actors to understand the progress and characteristics of the epidemic in the specific country and area of intervention. The second table includes a list of suggested indicators that can be used for monitoring and evaluating Red Cross Red Crescent activities; wording of indicators may be adapted to specific contexts. Target values for a specific indicator can vary widely from one context to another and therefore managers should define them based on the specific population, area of intervention and programmatic capacity. Exceptionally, some indicators in this website may include target values when these are globally agreed as a standard; e.g. 80 per cent of individuals who slept under an insecticide-treated net (ITN) the previous night—the normative World Health Organization benchmark for universal coverage with ITNs.

Epidemic characteristics and progression

Suspect cases and confirmed cases (by district/location)

Case-fatality rate

Routine vaccination coverage (by district/location)

Districts with new cases

Red Cross and Red Crescent Activities

This is a set of suggested key performance indicators (KPIs) for responding to measles outbreaks. This document may be best used when drafting DREF requests or Emergency Plans of Action. KPIs are aimed at supporting a more structured approach to monitoring, quality assurance and evaluation. Indicators should be selected depending on: the pillar that is supported in a given outbreak response; specific-context needs; and available capacity to conduct the corresponding monitoring activities.

See also:

- For Community Engagement and Accountability (CEA) indicators for activities accompanying ECV actions, please refer to: IFRC *CEA toolkit (Tool 7.1: Template CEA logframe, activities and indicators)*. Available at: <https://www.ifrc.org/document/cea-toolkit>
- For vaccination activities, see:
 - IFRC (2020) *Social Mobilization Guide for Vaccination Campaign and Routine Immunization*. Available at: <https://oldmedia.ifrc.org/ifrc/document/social-mobilization-toolkit-vaccination-activities/>
- Tools to create a basic understanding among volunteers and community members of how immunization prevents sickness, are available at the IFRC eCBHFA Immunization module. Available at: <https://oldmedia.ifrc.org/ifrc/document/ecbhfa-immunization-module/>

Impact on other sectors

Sector	Link to the disease
WASH	The spread of droplets is reduced by proper hand hygiene and coughing etiquette. Avoiding the sharing of eating and drinking utensils is important to reduce droplet spread.
Nutrition	Malnutrition increases the risk for severe measles. A low vitamin A level increases the risk for measles-related eye damage and blindness. Vitamin A supplementation is part of the therapy strategy in children between six months and five years, even in well-nourished children.
Shelter and settlements (including household items)	Outbreaks are of particular concern in crowded settings as measles is one of the world's most contagious diseases.
Psychosocial support and mental health	Caring for a child or older person with measles can be challenging knowing that someone infected could end up being severely affected for life. If an infected person has long term effects this will impact the psychological, social and emotional aspects of a person's life, in addition to its physical effects. Psychological reactions may include anxiety and worry about the outcome, social withdrawal, among others. Long-term effects like blindness worsen mental health as this means a drastic change of way of living for the affected person. Isolation, contact tracing and social distancing in communities are highly stressful situations especially for children and very challenging psychologically.
Gender and sex	Infection rates for measles are similar for girls and boys but mortality is higher in female children. Reasons may be less adequate medical care accessed by girls including vaccination, and higher exposure to the disease at home for girls, usually spending more time indoors.
Education	Measles is a highly infectious disease which occurs mainly in unvaccinated children. Outbreaks in schools are common as many children spend time together. Children may be at risk of becoming infected while attending classes, or at risk of missing education if staying at home because of quarantine or illness. Schools and kindergartens are included in some national routine immunization programmes for measles as it is a good way to reach the concerned group of children under 15. Schools and other facilities dedicated to children and youth can offer an important space for them to engage, mobilize and raise awareness around health education issues. With support, trust and appropriate capacity-building, young people can be effective advocates for the adoption of preventive measures during an epidemic and are those best placed to mobilize their peers.

Sector	Link to the disease
Livelihoods	The majority of measles deaths occur in countries with low per capita incomes and weak health infrastructures. Job dismissal and economic problems could result from a person's challenges caused by complications of measles in adults.

Resources:

- Davis RL, Kramarz P, Bohlke K, et al. (2001) Measles-Mumps-Rubella and Other Measles-Containing Vaccines Do Not Increase the Risk for Inflammatory Bowel Disease: A Case-Control Study From the Vaccine Safety Datalink Project. *Arch Pediatr Adolesc Med.*155(3):354–359. doi:10.1001/archpedi.155.3.354
- DeWilde, S., Carey, I. M., Richards, N., Hilton, S. R., & Cook, D. G. (2001). Do children who become autistic consult more often after MMR vaccination? *The British journal of general practice : the journal of the Royal College of General Practitioners*, 51(464), 226–227.
- Shattock, P. & Whiteley, P. (1999). MMR and Autism: C. Gillberg & H. Heijdal, *Autism*, 1998, 2(4), 423-4. *Autism*, 3(1), 111–112. Available at: <https://doi.org/10.1177/1362361399003001010>
- Taylor, Brent et al. (1999) Autism and measles, mumps, and rubella vaccine: no epidemiological evidence for a causal association. *The Lancet*, Volume 353, Issue 9169, 2026 – 2029. DOI:[https://doi.org/10.1016/S0140-6736\(99\)01239-8](https://doi.org/10.1016/S0140-6736(99)01239-8)
- WHO (2007) *Addressing sex and gender in epidemic-prone infectious diseases*. Available at: <https://www.who.int/csr/resources/publications/SexGenderInfectDis.pdf>
- WHO (2019) *Measles*. Fact Sheet. Available at: <https://www.who.int/news-room/fact-sheets/detail/measles>
- WHO (2019) Vaccine-preventable diseases and vaccines (2019 update). Available at: https://cdn.who.int/media/docs/default-source/documents/emergencies/travel-advice/ith-travel-chapter-6-vaccines_cc218697-75d2-4032-b5b7-92e0fa171474.pdf?sfvrsn=285473b4_4