



Poliomyelitis (polio)

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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

Poliomyelitis (polio) is a contagious disease that can cause permanent disability, paralysis and death. It can be caused both by wild-type poliovirus and by circulating vaccine-derived poliovirus (cVDPV). An outbreak of either type of polio is considered an emergency that warrants a full response. As the world moves towards the elimination of polio, rapid detection and control of community cases, whether from wild-type or vaccine-derived, is extremely important. Type 2 wild poliovirus was declared eradicated in 2015. Type 3 wild poliovirus was declared eradicated in 2019. Only Type 1 wild poliovirus remains. In 2020, 84 cases of wild-type polio were reported worldwide, all of them in Afghanistan and Pakistan. Countries with low polio vaccination rates and poor water and sanitation are at risk of outbreaks caused by cVDPV. 32 countries experienced cVDPV outbreaks in 2020.

The oral polio vaccine that has brought the wild poliovirus to the brink of eradication has many benefits: the weakened vaccine virus provides better immunity in the gut, which is where polio replicates. The vaccine virus is also excreted in the stool, and in communities with low-quality sanitation, the vaccine can be spread from person to person and actually help protect the community. However, in communities with low immunization rates, as the virus is spread from one unvaccinated child to another over the course of about 12–18 months, it can mutate and take on a form that can cause paralysis just like the wild poliovirus. This mutated poliovirus can then spread in communities, leading to circulating vaccine-derived poliovirus outbreaks.

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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 definition: Any child under 15 years of age with acute flaccid paralysis (AFP), including Guillain-Barré syndrome, or any person of any age with paralytic illness if polio is suspected by a clinician. An AFP case is defined as presenting with recent or sudden onset of floppy paralysis or muscle weakness due to any cause.

Confirmed case definition: A final case classification can be confirmed, compatible or discarded. For more information please consult the WHO guidelines: <https://www.who.int>.

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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.

In a country that has been free from polio for at least six months, a poliovirus outbreak is:

- A single case or multiple cases of poliomyelitis due to wild polio virus (WPV) or vaccine-derived polio virus (VDPV).
- A positive environmental sample for WPV or VDPV given that:
 - Two or more separate samples contain WPV/VDPV with genetic sequencing information that indicates sustained local transmission
 - OR
 - A single sample is positive for WPV or VDPV and follow-up investigation identifies polio compatible cases or WPV or VDPV-infected persons.

Risk factors

- Anyone who has not been vaccinated against poliomyelitis and lives in an area where the *poliovirus* is circulating is at risk of contracting the disease.
- Overcrowded areas with *poliovirus* circulation where a person-to-person spread is easily possible. Typical at-risk areas include peri-urban slums, and camps for internally displaced persons or refugees, where minimum requirements of clean water and sanitation are not met.
- Water contaminated with human faeces, for example from sewage, septic tanks and latrines, is a source of infection. Water can also be contaminated during transport, storage and handling.
- Food and water when prepared or stored in unhygienic conditions. Raw fruits and vegetables that are washed in contaminated water. Seafood taken from contaminated water and eaten raw or insufficiently cooked.

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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.

28 per cent (includes minor and major clinical manifestations; 24 per cent with minor illness, 4 per cent non-paralytic aseptic meningitis and less than one per cent paralysis).

Mortality rate among paralytic cases is generally 2—5 per cent among children, and 15—30 per cent among adolescents and adults.

Groups at increased risk of severe illness (most vulnerable)

- Children who are not vaccinated, and particularly those under the age of five years.
- Immunosuppressed persons such as those receiving chemotherapy, transplant recipients or people living with HIV/AIDS.
- People with chronic diseases such as renal disease, cancer, chronic lung or liver disease, and diabetes.
- The reasons for which a small percentage of infections result in paralysis are not clear. However, a number of risk factors that may increase the likelihood of paralysis among poliomyelitis cases include: pregnancy, strenuous exercise, injury, immune deficiency, removal of the tonsils and intramuscular injections.

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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.

Poliovirus.

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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.

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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.

Faecal oral transmission: The virus is most often spread by the faecal-oral route. *Poliovirus* enters through the mouth and multiplies in the intestine. Infected individuals shed *poliovirus* into the environment for several weeks, where it can spread rapidly through a community, especially in areas of poor sanitation. Eating contaminated food, food that has been washed in contaminated water, or drinking water contaminated with faeces (from sewers, latrines, septic tanks or open defecation).

Droplet transmission: Sometimes *poliovirus* is spread through saliva from an infected person or droplets expelled when an infected person sneezes or coughs. People become infected when they inhale droplets in the air, or touch something contaminated with the infected saliva or droplets.

Transmission through objects: Sharing eating and drinking utensils can increase droplet spread. Polio in faeces can pass from one person to the mouth of another person through contaminated hands, surfaces, objects or utensils.

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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.

7 to 10 days (range 4—35 days).

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Period of infectiousness

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

An infected person may spread the virus to others immediately before and about one to two weeks after symptoms appear. The virus can live in an infected person's faeces for up to six weeks. It can contaminate food and water in unsanitary conditions.

Clinical signs and symptoms

- Most people who get infected with *poliovirus* (about 72 per cent) will not have any visible symptom.
- About one in four people with *poliovirus* infection will have flu-like symptoms that may include: sore throat, fever, tiredness, nausea, headache and stomach pain. These symptoms usually last two to five days then go away on their own.
- A smaller proportion of people with *poliovirus* infection will develop other more serious symptoms that affect the brain and spinal cord: paraesthesia (feeling of pins and needles in the legs) and meningitis (infection of the covering of the spinal cord and/or brain) occurs in about one out of 25 people with *poliovirus* infection.
- Paralysis (unable to move parts of the body) or weakness in the arms, legs, or both, occurs in about one out of 200 people with *poliovirus* infection.
- Paralysis is the most severe symptom associated with poliomyelitis because it can lead to permanent disability and death. Between 2—10 per cent of people who have paralysis from *poliovirus* infection die because the virus affects the muscles that help them breathe.
- Between 25 and 40 per cent of polio survivors experience post-polio syndrome, starting 15—40 years after the initial infection. Affected people can begin experiencing progressive muscle weakness of the muscles that were previously affected by the polio infection, mental and physical fatigue, joint pain, and increasing skeletal deformities such as curvature of the spine.

Other diseases with similar clinical signs and symptoms

Polio resulting in AFP: various neurological illnesses and other diseases with paralysis.

Polio not resulting in AFP: meningitis, encephalitis, flu.

Diagnosis

Poliovirus can be detected in specimens from the throat, and faeces (stool), and occasionally cerebrospinal fluid, by isolating the virus in cell culture or by detecting the virus by polymerase chain reaction (PCR). The virus is most likely to be isolated from stool specimens.

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.

- There is no cure for poliomyelitis, but it can be prevented with a vaccine.
- There are two types of **vaccines** that can prevent poliomyelitis: inactivated poliovirus vaccine (IPV) and oral poliovirus vaccine (OPV, including monovalent and bivalent vaccines).
- For people with the disease, the focus is on treating symptoms to speed up recovery and prevent complications. Supportive treatments include isolation, rest, pain relievers, portable ventilators to assist breathing, moderate exercise (physical therapy) to prevent deformity and loss of muscle

function, a nutritious diet.

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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.

- *Poliovirus* infection can provide lifelong immunity against the disease, but this protection is limited to the serotype involved. Infection with one type does not protect an individual against infection with the other types.
- Vaccine efficacy is approximately 90 per cent for the prevention of paralysis.

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:
 - Safe disposal of faeces (promote the use of improved sanitation facilities). Latrines/toilets should be maintained. A handwashing device (with soap and water) must be present near latrines.
 - Safe drinking water supply: water storage containers should be protected from contamination and kept clean.
 - Handwashing with soap at critical times (before breastfeeding, after changing napkins, before cooking, before eating, after using toilets). This includes not only communication and community mobilization activities to promote handwashing with soap practices, but also when possible providing handwashing stations in public spaces (e.g. markets, schools).
 - Promote food hygiene:
 - Consume properly cooked food.
 - Wash fruits and vegetables carefully. If possible it is best that vegetables and fruits are peeled.
 - Plates and utensils must be kept off the ground.
 - Food must be covered and protected from flies at all times.
 - All food preparation surfaces must be cleaned.
- Social mobilization for mass vaccination, including extensive Information, Education and Communication (IEC) activities on the benefits of the vaccine, the routine vaccination schedule in country and/or

Supplementary Immunization Activity (SIA) campaign dates and locations.

- Rapid detection and encouragement of early health-seeking behaviours at healthcare centres and treatment units. This includes early detection of acute flaccid paralysis (AFP) cases.
- Inclusion of AFP as a health risk in community-based surveillance activities in at-risk communities, particularly those with low vaccine coverage.
- Distribution of essential non-food items (NFIs), including soap and water chlorination tablets (if context-appropriate).

Which interventions have NO evidence and therefore are NOT recommended?

- Misconceptions about the polio vaccine exist and these may lead to avoiding the vaccine altogether.
 - There is a misconception in several countries that the vaccine may have anti-fertility agents or that it may cause impotence. This is false. The vaccine is a safe and effective way to protect children from poliomyelitis.
 - Another misconception suggests that the vaccine brings the disease itself to a population. This is related to the fact that there are not only wild types of polioviruses, but also vaccine-derived (mutated) polioviruses. However, it is important to understand that unvaccinated children have an immune system that cannot appropriately respond to the virus when they contract it from the environment. In turn, the presence of many unvaccinated children contributes to a population that is more susceptible to the virus and where there are more sick children with both wild and vaccinated-derived polio viruses. Outbreaks of vaccine-derived polioviruses are therefore the result of low immunity and under-immunization of communities, rather than caused by a problem with the vaccine itself.
- 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 polio vaccine 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

National preparedness plans developed

Annual percentage of children who have age-appropriate vaccination coverage for DTP3 in settings with humanitarian crises or emergencies

Epidemic characteristics and progression

Affected districts

Number of cases in the population/children under five years

Indicators for Red Cross Red Crescent activities

Number of volunteers trained on a specific topic (e.g. Epidemic Control for Volunteers (ECV); Community-based surveillance (CBS); WASH training; CBHFA training, etc.)

Numerator: Number of volunteers trained

Source of information: Training attendance sheets

Polio suspected cases detected by volunteers and encouraged to seek care, who arrived at a designated health facility (*NB. This indicator requires the implementation of a system in collaboration with the health facility, whereby health workers specifically asked the patient how they heard about the service*)

Numerator: Polio suspect cases detected by volunteers in a determined period preceding this survey (e.g. two weeks) for whom advice or treatment was sought from a health facility

Denominator: Total number of polio suspect cases in the same period preceding the survey

Source of information: Survey

Percentage of people recognizing at least one transmission route and at least one measure for preventing it

Numerator: Total number of people who cited at least one transmission route and at least one measure for preventing it during the survey

Denominator: Total number of people surveyed

Source of information: Survey

Number of community members who received epidemic prevention and control material (e.g. soap, chlorination tablets, IEC material)

Numerator: Number of community members who received materials

Source of information: Distribution lists

Percentage of households where soap and water (or ash) are available for handwashing

Numerator: Total households where soap or ash was available during the survey

Denominator: Total households surveyed

Source of information: Survey

Number of zero-dose children referred to a health facility for polio vaccination (*NB. This indicator requires volunteers to ask and document whether the children they identify and refer are in fact, zero-dose*)

Numerator: Total number of zero-dose children referred to a health facility for polio vaccination

Denominator: Total number of children referred to a health facility for polio vaccination

Source of information: Volunteer activity records

Indicators for Red Cross Red Crescent activities

Number of people who were referred by volunteers to a health facility and received vaccination during a polio vaccination campaign (*NB. This indicator requires the implementation of a system in collaboration with the health facility, whereby health workers specifically asked the patient how they heard about the vaccination campaign*)

Numerator: Total number of people referred by volunteers to a health facility to receive vaccination during a polio vaccination campaign *and who received the vaccine*

Denominator: Total number of people referred to a health facility to receive vaccination during a polio vaccination campaign

Source of information: Health facility registers and volunteer activity records

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/wp-content/uploads/2020/01/1_SM-Guide-RC_version-1.pdf
- To find protocols, tools and guidelines for vaccination, outbreak preparedness and response, and surveillance activities, among others, visit the Polio Global Eradication initiative. Available at: <https://polioeradication.org>

Impact on other sectors

Sector	Link to the disease
WASH	Primary cause of poliomyelitis includes insufficient access to safe water. proper sanitation and hygiene. Food and water contaminated with human waste can transmit poliomyelitis.
Nutrition	Malnutrition increases the risk for severe poliomyelitis. Polio is more likely to spread in places where malnutrition is common, e.g. displacement sites, areas affected by natural disasters, areas impacted by famine, etc.
Shelter and settlements (including household items)	Functional toilets and good waste management are important to decrease transmission risk for faecal oral infections. Often basic infrastructure with safe water and proper hygiene is disrupted when there is a need for shelters and settlements.

Sector	Link to the disease
Psychosocial support and mental health	Polio can have several negative impacts on psychological, social and emotional aspects of a person's life, in addition to its physical effects. Psychological reactions may include fear of social stigma, anxiety and worry about the outcome, shame, social isolation, among others.
Education	When schools do not have clean running water or basic toilets, these can add transmission risks in places where there are outbreaks ongoing. Children may then be at risk of getting the disease if attending classes, or at risk of losing out on education if staying at home. 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.
Livelihoods	Illness leads to reduction in productivity as people may not be able to work due to disease or even be paralysed or otherwise disabled for a lifetime. This can lead to a loss of income due to the reduction in work activity and to the diversion of resources to seek medical treatment. Caring for a permanently disabled family member can dramatically reduce livelihoods for the family over the long term. Polio survivors can become disabled years after recovery due to post-polio syndrome, newly affecting their livelihood as adults.
Gender and sex	Biologically, sex is a risk factor for polio: males are more at risk of developing paralytic polio; at the same time, adult females are also at high risk when pregnant. Socially, there are a number of risk factors for polio that are influenced by gender. Notably, being malnourished, which can primarily affect girls in societies where males are valued more and receive better nutrition; or having more limited access to health care and vaccines among females for the same reasons. Another risk factor is conducting strenuous physical activity (often regulated by gender roles) which is associated with the severity of paralysis.

Resources:

- Kalbarczyk, A., Rao, A., Adebayo, A. *et al.* (2021) The influence of gender dynamics on polio eradication efforts at the community, workplace, and organizational level. *glob health res policy* **6**, 19. <https://doi.org/10.1186/s41256-021-00203-5>
- WHO (2019) *Poliomyelitis*. Fact Sheets. Available at: <https://www.who.int/news-room/fact-sheets/detail/poliomyelitis>
- Polio Global Eradiction Initiative (2021) *Gender*. Available at: <https://polioeradication.org/gender-and-polio/gender-and-polio-eradication/>