Pertussis (whooping cough)

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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

Pertussis, also known as whooping cough, is a highly contagious bacterial infection that usually causes mild respiratory infections. It is most dangerous in infants and is a significant cause of complications and death in this age group. Epidemics of pertussis occur in communities with low immunization coverage.

Whooping cough is an important cause of morbidity and mortality in infants worldwide. Periodic large outbreaks of the infections occur with an inter-epidemic cycle of two to five years. In 2018, there were more than 151,000 cases of pertussis globally (data from WHO).

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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 surveillance, ***volunteers*** *should use broad (simplified) case definitions to recognize most or all possible cases 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.*

Clinical case definition

A case diagnosed as pertussis by a physician OR a person with a cough lasting at least two weeks with at least one of the following symptoms: paroxysms (i.e. fits) of coughing, inspiratory whooping (i.e. ”whooping” sound when breathing in), post-tussive vomiting (i.e. vomiting immediately after coughing) without other apparent cause.

Criteria for laboratory confirmation: Isolation of *Bordetella pertussis* OR detection of genomic sequences by means of the polymerase chain reaction (PCR) OR positive paired serology.

WHO case definition source of information: 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.

A single case in non-endemic areas.

A cluster of pertussis cases in endemic areas.

Risk factors

- Unvaccinated adults, infants and children.
- Crowded settings in outbreak areas, e.g. displaced people in emergency shelters.
- Refugees, internally displaced people and migrants are at increased risk to become infected if living in crowded conditions and when missing routine immunization programmes.
- Inadequate sanitation and hygiene measures.
- Vaccine-preventable disease 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.

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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.

Secondary attack rates among non-immunized household contacts are high (up to 90 per cent). Infected people are contagious up to about two weeks after the cough begins and can therefore infect many people.

Groups at increased risk of severe illness (most vulnerable)

- Infants.

- Unvaccinated teenagers and adults.
- Immunosuppressed persons such as those receiving chemotherapy, transplant recipients or HIV carriers.
- People with chronic diseases such as renal disease, cancer, chronic liver or lung disease, and diabetes.

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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.

Bordetella pertussis (bacterium).

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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.

Airborne and droplet spread: sneezing, coughing, talking can transmit *Bordetella pertussis* bacterium. Many babies who get pertussis are infected by older siblings, parents or caregivers who are asymptomatic and might not know they have the disease. Sharing eating and drinking utensils can increase droplet spread.

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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—10 days (range 6—20 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.

Untreated patients may be contagious for three weeks or more following onset of the cough. Antibiotics may shorten the amount of time someone is contagious.

Clinical signs and symptoms

- The first symptoms of pertussis include mild fever, runny nose and cough, which in typical cases gradually develops into a paroxysmal (i.e. fits) of coughing, followed by inspiratory whooping (i.e. “whooping” sound when breathing). Coughing can occur more often at night. The cough can lead to respiratory exhaustion, vomiting and broken ribs.
- Infants can present with a cough that is minimal or that almost cannot be perceived. Infants often present with apnoeas (a pause in breathing), fever, poor feeding, convulsions. Almost 50 per cent of infants require hospital care.
- Pneumonia is a relatively common complication especially in infants. Other complications include encephalopathy, rib fractures, convulsions and loss of bladder control in adults.
- Many children who contract the infection have coughing that lasts four to eight weeks. Recovery from pertussis can happen slowly.

Other diseases with similar clinical signs and symptoms

Influenza, parotitis due to other causes, respiratory syncytial virus (RSV) infection, COVID-19 disease, diphtheria, measles, other infections of the respiratory tract. Non-infectious diseases like exacerbated chronic respiratory diseases or allergies.

Diagnosis

Diagnosis of pertussis is based on recovering *Bordetella pertussis* bacteria from nasopharyngeal mucous.

- Serological diagnosis can be helpful and is usually based on detection of a significant increase in the

concentration of specific antibodies against *Bordetella pertussis* in paired serum samples which should be collected during the early stage (acute serum) and about one month later.
- It can also be confirmed by detection of *Bordetella pertussis* by polymerase chain reaction (PCR).

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.

- Patient isolation is necessary.
- Pertussis is treated with antibiotics and early treatment is very important to prevent complications.
- The best way to prevent pertussis is through immunization. The World Health Organization (WHO) recommends that the first vaccine dose is administered as early as 6 weeks of age with subsequent doses given 4—8 weeks apart, at age 10—14 weeks and 14—18 weeks. Pertussis vaccines are commonly available in combination with other vaccines such as vaccines against diphtheria and tetanus. A booster is recommended, preferably during the second year of life. Based on local epidemiology, further booster doses may be warranted later in life.
- Vaccination of pregnant women is also effective at preventing disease in infants, and many countries include the DPT-3 (Diphtheria, Pertussis and Tetanus) vaccine in vaccination schedules during pregnancy.

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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.

- Natural pertussis infection does not confer long-lasting protection against pertussis. Symptomatic reinfections can occur in adolescents and adults and have also been reported in children.
- While pertussis vaccines are the most effective tool to prevent this disease, there is still a chance that fully vaccinated people can catch the disease. This may happen in contexts where the disease is circulating in the community. Nevertheless, the infection is usually less serious. The vaccine typically offers good levels of protection within the first two years after getting the vaccine, but then protection decreases over time. Pertussis vaccine booster doses are required to provide longer-lasting 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.
  - Coughing etiquette (cover mouth when coughing or sneezing; tissues should be disposed of immediately). People should keep a distance of about one metre if possible from those who present symptoms such as coughing or sneezing.
  - Regular handwashing with soap.
  - Correct use of antibiotics. Ensure that community members understand that antibiotics should only be taken if prescribed by a health professional and that they should carefully follow instructions on the duration of the antibiotic's administration. This includes completing the antibiotics course even when people are already feeling well.
- Social mobilization for mass vaccination, including extensive Information, Education and Communication (IEC) activities on the benefits of the pertussis vaccine, the routine vaccination schedule in-country and/or Supplementary Immunization Activity (SIA) campaign dates and locations, and the importance of completing the vaccination schedule according to national immunization guidelines. The WHO recommends a three-dose primary series of Diphtheria-Pertussis-Tetanus (DTP-3) vaccines in infancy, plus a booster during the second year of life; further booster doses may be required based on the epidemiological profile of the country of intervention.
- Rapid detection of suspect cases and encouragement of early health-seeking behaviours at health care centres.
- Contact tracing and follow-up. All contact tracing activities must be done in close coordination with health authorities.
- Promote vaccination of pregnant women as a strategy additional to routine primary infant pertussis vaccination in settings with high or increasing infant morbidity/mortality from pertussis.

Which interventions have NO evidence and therefore are NOT recommended?

- In some countries there is a myth that the Diphtheria, Pertussis and Tetanus (DPT-3) vaccine may lead to sudden infant death syndrome. As a result, people avoid the vaccine altogether. There is no evidence of a causal link between the administration of the vaccine and sudden infant death. It should be noted however, that vaccines such as the DPT-3 vaccine are administered during infancy, which is also a time when babies may suffer sudden infant death syndrome. That is, reported cases of sudden infant death syndrome would have happened even if the vaccine had not been administered and are co-incidental to vaccination.

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
Suspected cases per week (disaggregate by age, sex)
Confirmed cases per week (disaggregate by age, sex)
Vaccination coverage (total population, children under 12 months/18 months/5 years/10 years etc. – select most appropriate for disease) Target: Over 80 per cent for children less than 12 months *Refer to national EPI (Expanded Programme on Immunization) programme*
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
Suspect cases detected by volunteers who were encouraged to seek healthcare and who arrived at a 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:*** 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 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
If supporting vaccination campaigns: Number of households covered during the Supplementary Immunization Activity (SIA) Number of volunteers participating in the SIA Number of vaccinations realized during the SIA among children aged 6 months – 15 years Source of information: Vaccination 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

Impact on other sectors

Sector	Link to the disease
WASH	The spread of droplets is reduced by proper hygiene and sanitation like correct coughing etiquette and regular handwashing. Sharing eating and drinking utensils can increase droplet spread.
Nutrition	Malnutrition increases the risk for pertussis.
Shelter and settlements (including household items)	Outbreaks are of particular concern in crowded settings when hygiene and sanitation is poor and vaccination rates are low.
Psychosocial support and mental health	Pertussis can have several negative impacts on psychological, social and emotional aspects of a person's life, apart from its physical effects only. Psychological reactions may include anxiety and worry about the outcome, among others. Infants and young children getting pertussis can have serious symptoms with paroxysmal cough or temporary cessation of breathing which can be traumatic for parents and relatives and heavily impact their psychological well-being.
Gender and sex	Mortality from whooping cough is higher in female children. This could be because in some countries boys are more often and/or more quickly taken for treatment outside the home. Other risk factors influenced by gender include being malnourished, which can primarily affect girls in societies where males are valued more and receive better nutrition; or having more limited access to vaccines among females for the same reasons.
Education	Pertussis is an infectious disease which occurs mainly in unvaccinated infants and children. Outbreaks in schools can happen as children stay close to each other. 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 because of isolation or illness. 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	Illness and isolation lead to reduction in productivity as people may not be able to work due to disease. 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.

Resources :

- CDC (2020) *Pertussis (Whooping Cough)*. Available at: https://www.cdc.gov/pertussis/about/prevention/index.html
- WHO (2019) *Pertussis*. Available at: https://www.who.int/health-topics/pertussis#tab=tab_2