Anthrax

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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 in epidemiology.

Importance

Anthrax is a zoonotic disease that occurs on all continents throughout the world and can cause high mortality among domestic and wild herbivores. It can be passed on to humans and carnivores. Outbreaks continue to be reported from many countries worldwide, specifically where livestock vaccination programmes are inadequate or have been disrupted. Humans generally acquire the disease directly or indirectly from infected animals, or through occupational exposure to infected or contaminated animal products. Anthrax is a seasonal disease and its incidence is related to temperature, rains or drought, although conditions that predispose to outbreaks vary from one area to another. A One Health approach including animal, environmental and human health is essential to prevent anthrax 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.*

As with other zoonotic diseases, control of anthrax among humans is highly dependent on the integration of the human health and veterinary surveillance and control systems. The following include case definitions for human surveillance and exclude case definitions for veterinary surveillance. For more information on veterinary surveillance or clinical presentations, please visit OIE's page on anthrax.

Clinical description: An illness with acute onset characterized by several clinical forms

- **Cutaneous:** skin lesion evolving over two to six days from small bumps or blisters, evolving to black

skin lesions/ulcer accompanied by oedema (typically painless skin sores)

- **Gastrointestinal:** abdominal distress characterized by nausea, vomiting, loss of appetite and followed by fever. Additional symptoms can include sore throat, hoarseness, painful swallowing, or watery or bloody diarrhoea
- **Pulmonary** (inhalation): brief prodrome resembling acute viral respiratory illness, followed by rapid onset of low level of oxygen in the blood, difficulty breathing and high temperature, with X-ray typical evidence
- **Meningeal:** acute onset of high fever possibly with convulsions and loss of consciousness, meningeal signs and symptoms

Suspected case: A case that is compatible with the clinical description and has an epidemiological link to confirmed or suspected animal cases or contaminated animal products.

Probable case: A suspected case that has a positive reaction to allergic skin test (in non-vaccinated individuals).

Confirmed case: A suspected case that is laboratory-confirmed.

WHO case definition source of information: https://www.who.int

Risk factors

- People who work with animals (farmers, veterinarians, livestock breeders) or animal products such as wool, hides or hair (butchers, weavers).
- People who eat raw or undercooked meat from infected animals.
- People who inject drugs.
- People living in known anthrax endemic areas with low vaccination rates among livestock, and/or lack of infection prevention and control measures during and after a known outbreak are at higher risk.
- Communities where opening dead animal carcasses (including after unusual illness) is common practice as exposure to oxygen allows the bacteria to form spores.

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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.

Generally low and depends on the type of exposure.

Groups at increased risk of severe illness (most vulnerable)

- People with gastrointestinal and pulmonary anthrax have an increased risk of severe illness and poorer prognosis.

- Older people.
- People with weakened immune systems.
- Immunosuppressed persons such as those receiving chemotherapy, transplant recipients or HIV carriers.
- People with chronic diseases such as renal disease, cancer, chronic lung or liver 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.

> *Bacillus anthracis* (bacterium). When conditions are not conducive to growth and multiplication of the bacilli, they tend to form spores able to outlast many years and resistant to heat and usual disinfection. Within the infected host the spores germinate to produce the vegetative forms which multiply, eventually killing the host.

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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.

> **Zoonotic disease:** domestic and wild animals such as cattle, sheep, goat, antelope and deer. Animals typically become infected when they ingest or inhale the bacterial spores present in the soil where they are feeding. Carnivores or humans can also (more rarely) become infected by eating meat from infected animals. Insects can spread the bacteria to other animals.

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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.

> People get infected with anthrax when spores get into the body. This can happen via:

- **Airborne spread:** People breathe in spores (pulmonary anthrax).
- **Vehicle-borne transmission:** Animals may become infected by eating contaminated feedstuff, or inhaling/ingesting spores from the soil as they feed. Humans may be infected by eating food or drinking water that is contaminated with spores or when injecting drugs. Carcasses pose a risk both to humans and animals through their meat, hides, hair, wool or bones.
- **Contact transmission:** Getting spores in a cut or scrape in the skin (cutaneous anthrax).

The disease is generally regarded as being non-contagious as human-to-human infection is rare (cutaneous anthrax only).

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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.

One to seven days but can be as short as a few hours and as long as several weeks (or up to two months for inhaled anthrax) depending on the transmission pathway.

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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.

Humans are not infectious.

Clinical signs and symptoms

- **Cutaneous or skin anthrax** is the most common form. It is usually contracted when a person with a break in their skin, such as a cut or abrasion, comes into direct contact with anthrax spores (including through injection). The resulting itchy bump rapidly develops into a black sore. Some people can then develop headaches, muscle aches, fever and vomiting. Cutaneous anthrax must be treated quickly. Appropriate medical evaluation and treatment are essential. Without treatment cutaneous anthrax has a mortality rate up to 20 per cent, but with proper treatment is reduced to under two per cent.
- **Gastrointestinal anthrax** is caught from eating meat from an infected animal. It causes initial symptoms similar to food poisoning but these can worsen to produce severe abdominal pain, vomiting of blood and severe diarrhoea. Without treatment more than 50 per cent of those infected with gastrointestinal anthrax die. Appropriate medical evaluation and treatment are essential to reducing mortality.
- The most severe form of human anthrax is called **inhalation or pulmonary anthrax**. This form of the disease is caused when a person is directly exposed to a large number of anthrax spores suspended in the air, and breathes them in. The first symptoms are similar to those of a common cold, but this can rapidly progress to severe breathing difficulties and shock. Appropriate medical evaluation and

treatment are essential. Without treatment inhalation or pulmonary anthrax is almost always fatal. With proper treatment mortality is reduced to approximately 50 per cent.

- **Meningeal anthrax** can occur in rare cases when the bacteria passes the blood-brain barrier and affect the central nervous system. Clinical signs and symptoms include neck pain, headache, changes in mental state, vomiting and high fever. Meningeal anthrax infections are very dangerous with fatality rates of over 90 per cent.

Other diseases with similar clinical signs and symptoms

Boil (early lesion), arachnid bites, ulcer (especially tropical); erysipelas, glanders, plague, syphilitic chancre, ulceroglandular tularaemia; clostridial infection; rickettsial diseases; orf disease, vaccinia and cowpox, rat bite fever, leishmaniasis, diphtheria, tonsillitis, streptococcal angina, food poisoning, acute abdomen, pneumonia.

Diagnosis

- Demonstration of *Bacillus anthracis* in a clinical specimen by microscopic examination of stained smears of vesicular fluid, blood, cerebrospinal fluid, pleural fluid, stools, etc.
- Isolation of *B. anthracis* from a clinical specimen (e.g. blood, lesions, discharges).
- Positive serology (Enzyme linked immune-sorbent assay (ELISA), Western blot, toxin detection, chromatographic assay, fluorescent antibody test (FAT)).
- 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 a treatment or vaccine should be conducted by a health professional.

- All types of anthrax can be prevented and treated with antibiotics.
- There is a vaccine licensed to prevent anthrax, but it is only recommended for routine use in certain groups of at-risk adults.

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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.

Anthrax infection results in long-term 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 including:
  - Since anthrax is a disease primarily of herbivorous mammals, control in livestock is the best way to control outbreaks. Control in livestock includes the correct disposal of carcasses (preferably through incineration), and treatment and/or vaccination of animals as appropriate.
  - Quarantine of herds where anthrax has occurred (limiting contact between sick and non-exposed animals; preventing sick animals from reaching market).
  - Safe slaughtering practices, including improved supervision of slaughter and meat inspection.
  - On infected farms, control possible vectors such as insects and rodents and ensure cleaning and disinfection.
- Social mobilization to support animal vaccination in endemic areas, where possible. This includes extensive Information, Education and Communication (IEC) activities on the benefits of the vaccines, vaccination schedules and where/when to get the vaccines for livestock.

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)
Case fatality rate
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 ***Numerator:*** Anthrax 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 people who are anthrax 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 recognized 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
Percentage of people who know the cause, symptoms, treatment or preventive measures ***Numerator*:** Number of people who cite the cause, symptoms, treatment or preventive measures ***Denominator*:** Number of people surveyed

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 community-based surveillance guidance please see: IFRC, Norwegian Red Cross, Croix-Rouge de Belgique (2022), *Community Based Surveillance Resources*. Available at: www.cbsrc.org/resources.

Impact on other sectors

Sector	Link to the disease
WASH	Human-to-human transmission is rare and only reported for cutaneous anthrax. The main WASH activities concern environmental and animal hygiene before, during and after exposure to potentially infected livestock.
Food security	*Bacillus anthracis* can be transmitted by contaminated food. Safe slaughtering practices, including improved supervision of slaughter and meat inspection is an effective prevention measure.
Nutrition	Malnutrition increases the risk for severe anthrax.
Shelter and settlements (including household items)	Housing located closely to infected livestock can be exposed to anthrax through vectors like rodents or insects transmitting the spores from the infected livestock to humans. Reduction of rodent habitat around homes and rodent control is important in these areas.
Psychosocial support and Mental health	Anthrax is a stigmatized disease and can have several negative impacts on psychological, social and emotional aspects of a person's life, apart from its physical effects only. Because of the stigma and lack of reporting at community level, most cases go undetected, putting many more at risk. Psychological reactions may include fear of social stigma, anxiety and worry about the outcome, social withdrawal, among others. Source : In pictures: Preventing the spread of anthrax among Maasai communities in Kenya - International Federation of Red Cross and Red Crescent Societies (ifrc.org)
Education	Importantly, 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	Humans generally acquire the disease directly or indirectly from infected animals, or via occupational exposure to infected or contaminated animal products. Control in livestock is therefore the key to reduce incidence. Livelihoods based on livestock breeding or work with animal products can be significantly affected during anthrax outbreaks (quarantine of herds, slaughtering of livestock). 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 when sick.

Resources :

- WHO (2008) *Anthrax in humans and animals*. Available at:

https://www.who.int/csr/resources/publications/anthrax_webs.pdf

- Centers for Disease Control and Prevention (CDC) (2016) *Guide to Understanding Anthrax*. Available at: https://www.cdc.gov/anthrax/pdf/evergreen-pdfs/anthrax-evergreen-content-english.pdf
- IFRC (2020) *In pictures: Preventing the spread of anthrax among Maasai communities in Kenya*. Available at: https://oldmedia.ifrc.org/ifrc/2020/03/01/pictures-preventing-spread-anthrax-among-maasai-communities-kenya/
- IFRC (2021) *Case study Anthrax in Kenya. Building community trust: How Kenya controlled a deadly anthrax outbreak.* Available at: https://www.ifrc.org/document/case-study-anthrax-kenya