Rabies

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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

Rabies, classified as a neglected tropical disease (NTD), predominantly affects marginalized populations and underserved populations. It is a highly fatal viral zoonosis caused by the Rabies virus, a member of the Lyssavirus genus. The virus primarily targets the central nervous system, leading to inflammation of the brain, which is almost always fatal once clinical symptoms appear. Worldwide, rabies results in approximately 59,000 human deaths annually, mostly in Asia and Africa, where domestic dogs are the primary transmitter of the virus. Rabies remains a significant public health concern despite the availability of very effective vaccines, particularly in underserved areas and areas with poor health resources and facilities. The disease is 100% vaccine-preventable through timely post-exposure prophylaxis (PEP).

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.*

The control of rabies amongst humans is highly dependent on the elimination of the virus in dogs, the primary transmitters. 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 WOAH's page on Rabies.

Clinical description: The prodromal phase is characterised by non-specific symptoms such as fever, headache, and paresthesia (an unusual skin sensation – tingling, burning, numbness, or a "pins and needles" feeling) at the exposure site. Rabies manifests in two clinical forms:

- **Furious (Encephalitic) Rabies**: This is the more common form, involving hyperactivity, hydrophobia (difficulty and fear of swallowing water), aerophobia (fear or discomfort caused by air), and convulsions. Patients may also exhibit periods of hyperexcitability interspersed with calm, and in the terminal stages, experience cardiorespiratory arrest.
- **Paralytic (Dumb) Rabies**: This form accounts for about 20% of cases, characterised by gradual paralysis that begins at the site of the bite, leading to coma and death. Paralytic rabies is often misdiagnosed, leading to underreporting.

Suspected case: A case presenting with an acute neurological syndrome (e.g., encephalitis) characterised by inexplicable hyperactivity, aerophobia, or hydrophobia, and a history of contact with a suspect rabid dog.

Probable case: A probable case is a suspected case with a supportive history of exposure (in non-vaccinated individuals).

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

Source of information: https://www.hpsc.ie/a-z/zoonotic/rabies/casedefinitions/

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.

Single case

Risk factors

- People who work with animals (farmers, veterinarians, livestock breeders) or animal products such as wool, hides or hair (butchers, weavers).

- People who own dogs.
- People who work with the virus.
- People living in known rabies- endemic areas with low dog vaccination rates, and/or lack of infection prevention and control measures during and after a known outbreak are at higher risk.

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.

- Usually high without the administration of PEP.

Groups at increased risk of severe illness (most vulnerable)

- Anyone bitten by an infected dog (or other animal) without pre-exposure prophylaxis or post-exposure vaccination.

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.

Rabies virus. It primarily affects the central nervous system. It travels through the nerves centripetally and centrifugally to the brain and other other organs respectively.

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: It occurs primarily in dogs with some wild animals such as raccoons, foxes, jackals, mongooses also serving as carriers. Humans get infected through the bites and scratches of an infected animal. There are no documented records of a human-to-human transmission.

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.

1. **Bite and Scratch Wounds:**

The primary mode of transmission is through the bite or scratch of an infected animal. The virus is present in the saliva of rabid animals and enters the human body through broken skin or mucous membranes.

2. **Non-Bite Exposure:**

Although less common, rabies can be transmitted when the saliva or neural tissue of an infected animal comes into contact with mucous membranes (eyes, nose, mouth) or an open wound-.

Organ transplantation: Rabies has also been transmitted through organ transplants from infected donors, although this is extremely rare (CDC, 2022).

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.

The incubation period for rabies typically ranges from 1 to 3 months but can extend from a few days to several years and this is influenced by;

- the location and severity of the bite
- the viral load
- the proximity to the central nervous system.

Period of infectiousness

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

Human-to-human transmission is possible but has not been confirmed.

Clinical signs and symptoms

Furious (Encephalitic) Rabies: The prodromal phase, which lasts 2-10 days, involves nonspecific symptoms like fever, headache, malaise, and pain or paresthesia at the site of exposure. As the virus ascends the nervous system, the patient enters the acute neurologic phase where aerophobia, hydrophobia, difficulty in swallowing, hyperexcitability, aggressive behaviour, confusion, and hallucinations are commonly seen. Autonomic nervous system dysfunction also leads to hypersalivation, sweating, and unstable blood pressure. As the disease progresses, coma sets in which eventually leads to death due to respiratory or cardiac arrest.

Paralytic (Dumb) Rabies: Paralytic rabies often begins with muscle weakness and loss of sensation at the site of exposure. This progresses to full-blown paralysis, starting in the extremities and moving upwards. There is also a lack of hyperactivity or aggressive behaviour, making it harder to diagnose. As the disease progresses, paralysis spreads to the respiratory muscles, leading to respiratory failure which often leads to death, without any intervention. Paralytic rabies is nearly always fatal, with death occurring within days to weeks after the onset of symptoms if left untreated.

Other diseases with similar clinical signs and symptoms

West Nile fever, Eastern Equine Encephalitis, Japanese Encephalitis, *Clostridium tetani* infection, cerebral malaria, bacterial meningitis, leptospirosis, Marburg fever, Lassa fever.

Diagnosis

Note: Clinical diagnosis of rabies remains challenging, as current diagnostic tools are generally unable to detect the virus before the onset of clinical symptoms. As a result, definitive diagnosis typically occurs in the late stages of the disease or post-mortem.

Diagnostic confirmation includes:

- Isolation of Lyssa virus from a clinical specimen
- Detection of Lyssa virus nucleic acid in a clinical specimen (e.g. saliva or brain tissue)
- Detection of viral antigens by a DFA in a clinical specimen
- Lyssa virus specific antibody response by virus neutralisation assay in serum or CSF

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.

- At the instance of a reported dog bite, wash the site of bite with detergents and water. Rabies virus is susceptible to detergents.
- Rabies can be prevented by vaccinations in dogs and humans.
- There is also a vaccine licensed to post exposure to the virus.

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.

Rabies vaccination results in immunity for a minimum period of 1 year.

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 rabies is a disease primarily of dogs, control in dogs is the best way to control outbreaks. Control in dogs involves vaccination of animals as appropriate.
  - Quarantine dogs where rabies has occurred (limiting contact between sick and non-exposed animals; preventing sick animals from roaming the community). Risk communication and behaviours change messages to encourage searching medical assistance, including post exposure prophylaxis in humans, after an accident has happened with a suspected infected animal
- Social mobilisation to support dog 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 dogs.

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 in dogs and humans (disaggregate by age, sex)
Confirmed cases per week in dogs and humans (disaggregate by age, sex)
Case fatality rate in dogs and humans

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:* Rabies 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 rabies 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. The main WASH activities concern environmental and animal hygiene before, during and after exposure to potentially infected dogs.
Food security	Rabies can also affect livestock like cattle. This could affect the availability of meat and milk or lead to the influx of infected meat in the market.

Nutrition	Death of infected livestock could lead to the unavailability of meat and milk, leading to poor nutrition in the affected community.
Shelter and settlements (including household items)	Housing located close to infected dogs and livestock can be exposed to rabies through dog bites from the infected dogs to humans.
Psychosocial support and Mental health	Rabies is a stigmatised disease and can have several negative impacts on psychological, social and emotional aspects of a person's life. Psychological reactions may include fear of social stigma, anxiety and worry about the outcome, social withdrawal, among others.
Sex and Gender	Gender and social roles influence exposure to rabies and access to post-exposure care. In many regions, men are at higher risk due to outdoor work such as farming or herding, while women and children—especially girls—may be exposed through caregiving roles or contact with domestic animals. Gender norms and financial barriers may delay or prevent women from accessing timely post-exposure prophylaxis. Rabies infection during pregnancy is extremely rare but almost always fatal if untreated, with potential for poor pregnancy outcomes including fetal loss. While rabies affects all sexes equally once symptomatic, gender-related factors strongly influence risk, care-seeking behavior, and survival.
Education	With support 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 dogs is therefore the key to reduce incidence. Outbreaks can lead to a loss of income due to the diversion of resources to seek medical treatment when sick.

Resources:

- Centers for Disease Control and Prevention (CDC); Rabies (2024)
- Health Protection and Surveillance Centre: Rabies: Case Definitions (2019)
- World Health Organization (WHO); Rabies (2024)
- World Organisation for Animal Health (WOAH); Rabies (2023)
- World Organisation for Animal Health (WOAH); Rabies (2023)