



# Yellow fever

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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

Yellow fever affects countries in Africa and Central and South America. Increased contact between people and infected mosquitoes, the vector of yellow fever, can lead to an increase in transmission. Large epidemics happen when people who are infected introduce the virus in densely populated urban areas with a high density of *Aedes aegypti* mosquitoes and where most people have little or no immunity. There is no anti-viral drug but the vaccine is sufficient to provide immunity for life. The Eliminate Yellow Fever Epidemics (EYE) Strategy launched in 2017 aims at building a global coalition to protect at-risk populations, prevent international spread and contain outbreaks rapidly.

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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:** Any person with acute onset of fever, with jaundice appearing within 14 days of onset of the first symptoms.

**Probable case:** A suspected case and one of the following: presence of yellow fever IgM antibodies in the absence of yellow fever immunization within 30 days before onset of illness; OR

positive post-mortem liver histopathology; OR

epidemiological link to a confirmed case or an outbreak.

Confirmed case: a) A probable case AND absence of yellow fever immunization within 30 days before onset of illness AND one of the following: detection of yellow fever-specific neutralizing antibodies.; OR

b) absence of yellow fever immunization within 14 days before onset of illness AND one of the following: detection of yellow fever virus genome in blood or other organs by polymerase chain reaction (PCR) OR detection of yellow fever antigen in blood, liver or other organs by immunoassay OR isolation of yellow fever virus.

WHO case definition source of information [here](#).

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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.

One confirmed case is sufficient to identify a potential outbreak, but this needs to be interpreted in context (e.g. vaccination history, specific serologic test). For example one confirmed case in an unvaccinated urban population requires immediate intervention.

## Risk factors

- Environments where mosquitoes breed such as tropical rainforests, humid, and semi-humid environments, as well as around bodies of stagnant water in and close to human habitations in urban settings.
- Increased contact between humans and infected mosquitoes, particularly in urban areas where people have not been vaccinated for yellow fever, can create epidemics.
- Outbreaks of the disease are of particular concern when they occur in overcrowded settings with inadequate water supply and waste management services that allow the mosquitoes to breed easily.
- Seasonality is a risk factor for yellow fever, though this will vary geographically. In west Africa for instance, risk is higher at the end of the rainy season and beginning of the dry season. However, in South America the risk of infection is highest during the rainy season.

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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.**

## Groups at increased risk of severe illness (most vulnerable)

- Infancy and older age are associated with increased severity and lethality of infection with yellow fever virus.
- 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.

*Yellow fever virus.*

**Vector:** Mosquitoes (*Aedes* and *Haemagogus*) that carry the *yellow fever virus*.

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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.

Monkeys and 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.

**Vector borne:** *Yellow fever virus* is transmitted to people primarily through the bite of infected *Aedes* or *Haemagogus* species mosquitoes. It is primarily a day biting mosquito. The transmission of yellow fever has three different cycles: **jungle** (sylvatic), **intermediate** (savannah) and **urban**. It is important to know the difference to ensure the right prevention measures are being used:

- The **jungle** (sylvatic) cycle happens when mosquitoes found in the forest canopy infect monkeys. The virus can be transmitted by mosquitoes from monkeys to humans when humans are visiting or working in the jungle. This does not cause large epidemics but should be prevented and controlled quickly.
- In Africa, an **intermediate** (savannah) cycle occurs when the virus is transmitted from mosquitoes to humans living or working at the border of the jungle. Human-to-human transmission can occur.
- The **urban** cycle involves transmission of the virus between humans and urban mosquitoes, primarily *Aedes aegypti*. The virus is usually brought to the urban setting by a human who was infected in the jungle or savannah. This is the type of transmission that can create large epidemics.

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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.

Six to seven days (range three to ten 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.

People infected with *yellow fever virus* can infect a mosquito shortly before they suffer from a fever and up to five days after they first get sick. Infected mosquitoes go on to infect other people.

## Clinical signs and symptoms

- Most people infected with the *yellow fever virus* have no illness or only have a mild illness which improves after the initial presentation.
- The initial symptoms include sudden onset of fever, chills, severe headache, back pain, general body aches, nausea, vomiting, fatigue and weakness.
- Approximately 15 per cent of cases progress to develop a more severe form of the disease after a periodic decrease of symptoms for one to two days. This is characterized by high fever, jaundice, bleeding and eventual shock and failure of multiple organs.

## Other diseases with similar clinical signs and symptoms

Other haemorrhagic fevers (dengue fever, Rift Valley fever, Crimean-Congo fever, Lassa fever, Marburg haemorrhagic fever, Ebola virus disease, South American haemorrhagic fevers), viral and non-infectious

hepatic diseases, malaria, leptospirosis, tick-borne relapsing fever, typhus and typhoid fever.

## Diagnosis

- Laboratory diagnosis of yellow fever by testing serum to detect virus-specific IgM antibodies and neutralizing antibodies.
- Sometimes the virus can be found in blood samples taken early in the course of the disease.

## 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.**

Important therapy principles include:

- No specific treatments have been found to benefit patients with yellow fever. Whenever possible, these patients should be hospitalized for supportive care and close observation.
- Yellow fever patients should be protected from further mosquito exposure (staying indoors and/or under a mosquito net) for up to five days after the onset of fever. This way, the *yellow fever virus* in their bloodstream will be unavailable to uninfected mosquitoes, thus breaking the transmission cycle and reducing risk to the people around them.
- **Yellow fever is vaccine-preventable.**

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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.

- Those who recover from yellow fever generally have lasting immunity against subsequent infection.
- The one-time vaccine provides effective immunity within 30 days for 99 per cent of persons vaccinated. Vaccination provides life-long 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.*

- The primary control measure is vaccination. Reduction in exposure to mosquitoes through personal protection or reducing vectors (spraying or environmental sanitation) is a useful supplementary activity.
- 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:
  - Wearing clothes that minimize skin exposure. It is important to assess whether this is culturally accepted, accessible and affordable in the context of intervention.
  - Screening in homes (windows and door screens).
  - Covering water containers (community-based mobilization and action).
  - Application of “DEET” mosquito repellent to exposed skin or clothing (in accordance with product label instructions). It is important to assess whether this is culturally accepted, accessible and affordable in the context of intervention.
  - Outdoor space spraying of flying mosquitoes, on surfaces or around containers where mosquitoes land.
    - Considerable literature supports the gender-related role regarding vector control activities. Targeting males and females separately and being sensitive to their specific gender roles is essential when enlisting their support for vector control.
- Social mobilization for vaccination campaigns.
- Community-based environmental management and clean-up campaigns
- Indoor residual spraying.
- Larviciding, which is the application of insecticides to water bodies, reducing vector density. Note that it is most effective in areas where aquatic habitats (where larvae lie) are easy to identify and are fixed. Larviciding will be costly and less effective in areas where water habitats are predominant, scattered and where their location may vary.

## **Which interventions have NO evidence and therefore are NOT recommended?**

- Bed nets are an effective way to prevent mosquito bites; but for yellow fever, these should be used as a preventive measure for those who sleep during the day. As the mosquito bites during the day, bed nets during the night will not be an effective preventive measure for this disease.

# 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
Vaccine coverage (population)
Number of suspect and number of confirmed cases per day/week
Case fatality rate
Number of new districts (or clusters) affected each week
Indicators for Red Cross Red Crescent activities
<p>Number of volunteers trained on a specific topic (e.g. Epidemic Control for Volunteers (ECV))</p> <p><b>Numerator:</b> Number of volunteers trained in ECV</p> <p>Source of information: Training attendance records</p>
<p>Percentage of population detected by volunteers with suspected yellow fever for whom advice or treatment was sought (<i>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</i>)</p> <p><b>Numerator:</b> Number of population for whom advice or treatment was sought from a health facility or provider</p> <p><b>Denominator:</b> Total number of people surveyed</p>
<p>Percentage of people who know the cause, symptoms, treatment or preventive measures (this indicator can be split into three or four separate indicators)</p> <p><b>Numerator:</b> Number of people who cite the cause, symptoms, treatment or preventive measures for yellow fever</p> <p><b>Denominator:</b> Number of people surveyed</p> <p>Source of information: Survey</p>
<p>If supporting vaccination campaigns:</p> <ul style="list-style-type: none"> <li>Number of households covered during the Supplementary Immunization Activity (SIA)</li> <li>Number of volunteers participating in the SIA</li> <li>Number of vaccinations realized during the SIA</li> </ul> <p>Source of information: Vaccination activity records</p>

## 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](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
<b>WASH</b>	Inadequate water supply and waste management allow mosquitoes to breed easily. Stagnant water in and around the household such as in flowerpots, vehicle tyres or rock pools contribute to the increase of mosquito breeding sites.
<b>Nutrition</b>	Malnutrition increases the risk for severe yellow fever.
<b>Shelter and settlements (including household items)</b>	People in rural areas and sleeping outdoors during the day are at increased risk of mosquito bites in epidemic regions. Different household actions like screening in homes and covering water containers are a good prevention strategy to decrease the transmission of yellow fever virus from mosquitoes to humans.
<b>Psychosocial support and mental health</b>	As in the case of a range of other diseases, yellow fever 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 fear of social stigma, anxiety and worry about the outcome, or social withdrawal, among others.
<b>Education</b>	If kindergartens and schools do not have the appropriate equipment, such as window and door screens, mosquito nets for naps or covered water containers, the risk of mosquito breeding sites emerging and of subsequent transmission, increases. 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 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.
<b>Livelihoods</b>	Illness leads 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.



Sector	Link to the disease
<b>Gender and sex</b>	In many cultures, it is women who maintain the primary responsibility for the maintenance of containers for household drinking water and for vessels to do laundry, which are prime breeding sites for the <i>Aedes</i> mosquito. Men, on the other hand, may be responsible for the disposal of solid waste or for maintaining larger water vessels stored outside the immediate living area. It is therefore important to understand and consider gendered roles in vector control activities.

## Resources:

- World Health Organization (2007) *Addressing sex and gender in epidemic-prone infectious diseases*. Available at: <https://www.who.int/csr/resources/publications/SexGenderInfectDis.pdf>
- World Health Organization (2019) *Yellow fever Fact sheet*. Available at: <https://www.who.int/news-room/fact-sheets/detail/yellow-fever>
- Centers for Disease Control and Prevention (CDC) (2021). *Yellow fever*. Available at: <https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/yellow-fever>