

WHO Factsheet

Vector-borne diseases

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KEY FACTS

- Vector-borne diseases account for more than 17% of all infectious diseases, causing more than 1 million deaths annually.
- More than 2.5 billion people in over 100 countries are at risk of contracting dengue alone.
- Malaria causes more than 600 000 deaths every year globally, most of them children under 5 years of age.
- Other diseases such as Chagas disease, leishmaniasis and schistosomiasis affect hundreds of millions of people worldwide.
- Many of these diseases are preventable through informed protective measures .

Vectors

Vectors are living organisms that can transmit infectious diseases between humans or from animals to humans. Many of these vectors are bloodsucking insects, which ingest disease-producing microorganisms during a blood meal from an infected host (human or animal) and later inject it into a new host during their subsequent blood meal.

Mosquitoes are the best known disease vector. Others include ticks, flies, sandflies, fleas, triatomine bugs and some freshwater aquatic snails.¹

Some main vectors and diseases they transmit

VECTORS	MAIN DISEASES
Mosquitoes <i>Aedes</i>	Dengue fever Rift Valley fever Yellow fever Chikungunya
<i>Anopheles</i>	Malaria
<i>Culex</i>	Japanese encephalitis Lymphatic filariasis West Nile fever

¹ See table

Sandflies	Leishmaniasis Sandfly fever (<i>phlebotomus</i> fever)
Ticks	Crimean-Congo haemorrhagic fever Lyme disease Relapsing fever (borreliosis) Rickettsial diseases (spotted fever and Q fever) Tick-borne encephalitis Tularaemia
Triatomine bugs Tsetse flies	Chagas disease (American trypanosomiasis) Sleeping sickness (African trypanosomiasis)
Fleas	Plague (transmitted by fleas from rats to humans) Rickettsiosis
Black flies	Onchocerciasis (river blindness)
Aquatic snails	Schistosomiasis (bilharziasis)

Vector-borne diseases

Vector-borne diseases are illnesses caused by pathogens and parasites in human populations. Every year there are more than 1 billion cases and over 1 million deaths from vector-borne diseases such as malaria, dengue, schistosomiasis, human African trypanosomiasis, leishmaniasis, Chagas disease, yellow fever, Japanese encephalitis and onchocerciasis, globally.

Vector-borne diseases account for over 17% of all infectious diseases.

Distribution of these diseases is determined by a complex dynamic of environmental and social factors.

Globalization of travel and trade, unplanned urbanization and environmental challenges such as climate change are having a significant impact on disease transmission in recent years. Some diseases, such as dengue, chikungunya and West Nile virus, are emerging in countries where they were previously unknown.

Changes in agricultural practices due to variation in temperature and rainfall can affect the transmission of vector-borne diseases. Climate information can be used to monitor and predict distribution and longer-term trends in malaria and other climate-sensitive diseases.

The brief description below does not cover all vector-borne diseases. For more detailed information, please refer to fact sheets for specific diseases.

WHO response

WHO responds to vector-borne diseases by:

- providing the best evidence for controlling vectors and protecting people against infection;
- providing technical support and guidance to countries so that they can effectively manage cases and outbreaks;
- supporting countries to improve their reporting systems and capture the true burden of the disease;
- providing training on clinical management, diagnosis and vector control with some of its collaborating centres throughout the world; and
- developing new tools to combat the vectors and deal with the disease, for example insecticide products and spraying technologies.

A crucial element in vector-borne diseases is behavioural change. WHO works with partners to provide education and improve awareness so that people know how to protect themselves and their communities from mosquitoes, ticks, bugs, flies and other vectors.

For many diseases such as Chagas disease, malaria, schistosomiasis and leishmaniasis, WHO has initiated control programmes using donated or subsidized medicines.

Access to water and sanitation is a very important factor in disease control and elimination. WHO works together with many different government sectors to control these diseases.

Malaria

Malaria is a parasitic disease spread by infected *Anopheles* mosquitoes, which bite mainly between dusk and dawn. Globally there are more than 60 species of anophelines which are recognized vectors. Malaria is caused by 4 parasite species in humans: *Plasmodium falciparum*, *P. vivax*, *P. malariae* and *P. ovale*.

According to the latest WHO estimates, malaria kills more than 600 000 people every year, most of them children under 5 years of age. Around the world, malaria transmission occurs in 97 countries, putting about 3.4 billion people at risk of illness.

The disease burden is heavily concentrated in sub-Saharan Africa, where an estimated 90% of annual global malaria deaths occur.

Poor and vulnerable communities living in rural areas with limited access to health facilities suffer the most. Four out of 10 people who die of malaria live in the 2 highest burden countries: the Democratic Republic of the Congo and Nigeria.

Malaria triggers fever, chills and a flu-like illness at first. If left untreated, the disease can lead to severe complications and death. Malaria symptoms usually appear after a period of seven days or longer after the bite of the mosquito.

The best way to prevent malaria infection is through the regular use of long-lasting insecticidal nets, indoor spraying of homes with residual insecticides, and the use of WHO-recommended preventive therapies.

For more information, see the factsheet on malaria.

Dengue

Dengue is the most rapidly spreading mosquito-borne viral disease in the world. Unlike other mosquitoes, *Aedes Aegypti*, the main vector for dengue, bites during the day. *Aedes albopictus*, a secondary dengue vector, can survive in cooler temperate regions. There are 4 closely related serotypes of the virus that cause dengue and the lifelong immunity developed after infection.

In the past 50 years, incidence has increased 30-fold with increasing geographical expansion to new countries and, in the present decade, from urban to rural settings.

More than 2.5 billion people – over 40% of the world's population – are now at risk from dengue. WHO currently estimates there may be 50–100 million dengue infections worldwide every year.

Severe dengue (also known as dengue haemorrhagic fever) is found in tropical and sub-tropical locations in most Asian and Latin American countries. An estimated 500 000 people with severe dengue require hospitalization each year, a large proportion of these are children. About 2.5% of those affected die.

Symptoms of dengue include fever, severe headache, pain behind the eyes, muscle and joint pain, swollen glands and rash. There is no vaccine or any specific medicine to treat dengue. People who have dengue fever should rest, drink plenty of fluids and reduce the fever using paracetamol.

Severe dengue (also known as dengue hemorrhagic fever) is characterized by fever, abdominal pain, persistent vomiting, bleeding and difficulty breathing. It is a potentially lethal complication, affecting mainly children.

For severe dengue, experienced medical care can save lives, decreasing mortality rates from more than 20% to less than 1%. Maintenance of the patient's body fluid volume is critical to severe dengue care.

The only method to reduce the transmission of dengue virus is to control vector mosquitoes and protect against mosquitoes bites.

For more information, see the factsheet on dengue.

Chikungunya

Chikungunya is a viral tropical disease transmitted also by *Aedes* mosquitoes.

It is relatively uncommon and poorly documented. The disease has been found in Africa, Asia, and on islands in the Caribbean, Indian and Pacific Oceans.

Typical symptoms are an acute illness with fever, skin rash and incapacitating joint pains that can last for weeks. The latter distinguishes chikungunya virus from dengue, which otherwise shares the same vectors, symptoms and geographical distribution.

There is no cure or commercial vaccine for the disease. Most patients recover fully but, in some cases, joint pain may persist for several months or even years.

As with dengue, the only method to reduce transmission of chikungunya virus is to control vector mosquitoes and protect against mosquitoes bites.

For more information, see the factsheet on chikungunya.

Yellow fever

Yellow fever is an acute viral haemorrhagic disease transmitted by *Aedes* mosquitoes. The “yellow” in the name refers to the jaundice that affects some patients.

There are an estimated 200 000 cases of yellow fever causing 30 000 deaths worldwide each year.

The virus that causes yellow fever is endemic in tropical areas of Africa and Latin America where a combined population of over 900 million people lives. Small numbers of imported cases occur in countries free of yellow fever.

Symptoms of the disease include fever, muscle pain with prominent backache, headache, shivers, loss of appetite, and nausea or vomiting. Most patients improve and their symptoms disappear after 3 to 4 days.

However, 15% of patients enter a second, more toxic phase within 24 hours of the initial remission. High fever returns and several body systems are affected. The patient rapidly develops jaundice and complains of abdominal pain with vomiting and internal bleeding. Half of these patients die within 10 to 14 days.

There is no specific treatment for yellow fever, only supportive care to treat dehydration, respiratory failure and fever.

Vaccination is the most important preventive measure against yellow fever. The vaccine is safe, affordable and highly effective. A single dose of yellow fever vaccine is sufficient to provide life-long protection against the disease.

For more information, see the factsheet on yellow fever.

Japanese encephalitis

Japanese encephalitis virus is transmitted to humans through infected *Culex* mosquitoes.

Japanese encephalitis causes an estimated 50 000 cases and 10 000 deaths every year, mostly of children aged less than 5.

It occurs across Asia, from the islands of the Western Pacific in the east to the Pakistani border in the west, and from Korea in the north to Papua New Guinea in the south.

Most human infections are asymptomatic or result in only mild symptoms. However, a small percentage of infected people develop inflammation of the brain (encephalitis), with symptoms including the sudden onset of headache, high fever, disorientation, coma, tremors and convulsions. One quarter of severe cases can be fatal, and 30% of those who survive severe infection have lasting central nervous system damage.

Transmission of the Japanese encephalitis virus occurs primarily in rural agricultural areas, particularly around flooded rice fields, but can also occur near urban centres. In temperate areas of Asia, transmission of the virus is seasonal.

The virus is transmitted between mosquitoes, in particular *Culex tritaeniorhynchus*, and animals such as pigs and wading birds. Humans are incidental or “dead-end” hosts, because they usually do not develop high-enough concentrations of the virus in their bloodstreams to infect feeding mosquitoes.

There is no specific treatment for the disease; supportive care and management of complications can provide some relief.

The vaccine against Japanese encephalitis is the single most effective preventive measure against this disease. **Lymphatic filariasis**

Infection with lymphatic filariasis, commonly known as elephantiasis, occurs when thread-like, filarial parasites are transmitted to humans through mosquitoes.

Lymphatic filariasis is transmitted by different types of mosquitoes, for example by the *Culex* mosquito, widespread across urban and semi-urban areas; *Anopheles*, mainly in rural areas; and *Aedes*, mainly in the Pacific Islands and parts of the Philippines. It is also transmitted by 3 types of parasite (*Wuchereria bancrofti*, responsible for 90% of cases, *Brugia malayi* and *B. timori*).

Microscopic parasitic worms lodge in the lymphatic system and disrupt the immune system. They live for 6–8 years and, during their lifetime, produce millions of microfilariae (tiny larvae) that circulate in the blood.

More than 120 million people are currently infected with lymphatic filariasis, about 40 million of them are disfigured and incapacitated by the disease. Lymphatic filariasis afflicts more than 25 million men with genital disease and more than 15 million people with lymphoedema.

The majority of infections have no symptoms but silently cause damage to the lymphatic system and the kidneys as well as alter the body’s immune system. Acute episodes of local inflammation involving skin, lymph nodes and lymphatic vessels often accompany chronic lymphoedema (tissue swelling).

Approximately 65% of those infected live in the WHO South-East Asia Region, 30% in the African Region, and the rest in other tropical areas.

Recommended treatment to clear the parasites from the bloodstream is a single dose of albendazole given together with either diethylcarbamazine or ivermectin. Interruption of transmission of infection can be achieved if at least 65% of the population at risk is treated over 5 years.

For more information, see the factsheet on lymphatic filariasis.

Leishmaniasis

Leishmaniasis is caused by a parasite transmitted to humans by the bite of infected female phlebotomine sandflies.

There are 3 main types of leishmaniasis – visceral (often known as kala-azar and the most serious form of the disease), cutaneous (the most common) and mucocutaneous.

During the past 10 years, the disease has spread considerably. Around 1.3 million people are newly infected with leishmaniasis and around 30 000 people die from it every year.

Leishmaniasis are found in the Americas, South-East Asia, East Africa, West Asia, Central Asia and the Mediterranean region. The disease affects the poorest people in the community, and is associated with malnutrition, population displacement, poor housing, weak immune systems and lack of resources. Its spread is linked to migration and environmental changes such as deforestation, building of dams, irrigation schemes and urbanization.

Depending on the types of leishmaniasis, the disease can cause fever, weight loss, enlargement of the spleen and liver, anaemia, rashes and skin ulcers.

Leishmaniasis is treatable and curable. Early diagnosis and treatment reduces the spread of the disease and can prevent disabilities and death. Prevention and control of leishmaniasis require a combination of strategies including control of sandflies and their animal hosts (including dogs and cattle), improving living conditions and personal protection against sandfly bites.

For more information, see the factsheet on leishmaniasis.

Crimean-Congo haemorrhagic fever

Crimean-Congo haemorrhagic fever is a tick-borne viral disease that kills 30% of infected people.

The virus is transmitted to people either from tick-bites or through contact with blood or tissues of infected animals such as cattle, sheep, goats and ostriches.

Human-to-human transmission can occur resulting from close contact with the blood, organs or other bodily fluids of infected persons.

The virus occurs in Africa, the Balkans and Asia.

Onset of symptoms is sudden, with fever, muscle ache, dizziness, neck pain and stiffness, backache, headache, sore eyes and sensitivity to light. There may be nausea, vomiting, diarrhoea, abdominal pain and sore throat early on, followed by sharp mood swings and confusion. Other signs include a faster heart rate, a rash, enlarged lymph nodes and liver and kidney failure.

More than one third of those infected die within the second week of illness.

The main approach to treating Crimean-Congo haemorrhagic fever is treating symptoms. The antiviral drug ribavirin has been shown to be effective.

There is currently no safe and effective vaccine widely available for human use.

The best way to reduce infection in people is to control tick infestations and prevent tick-bites. People handling animals during slaughtering or butchering should wear protective clothing and the animals should be treated with pesticides two weeks before the slaughter.

Health workers should follow WHO recommendations for infection control when caring for people with suspected Crimean-Congo haemorrhagic fever.

For more information, see the factsheet on Crimean-Congo haemorrhagic fever.

Chagas disease

Chagas disease is a potentially life-threatening illness caused by the protozoan parasite, *Trypanosoma cruzi* (*T. cruzi*).

It is mostly transmitted to humans by the faeces of triatomine bugs, also known as “kissing bugs”. Infected people can transmit the disease by blood or organ donation or from an infected mother to her newborn during pregnancy and childbirth.

About 7–8 million people are estimated to be infected worldwide, mostly in Latin America where Chagas disease is endemic. It has spread to other countries by migrants through transfusion or organ donation.

In most cases, symptoms are absent or mild, but can include fever, headache, enlarged lymph glands, pallour, muscle pain, difficulty in breathing, swelling and abdominal or chest pain. In less than 50% of people bitten by a triatomine bug, the characteristic first visible signs can be a skin lesion or a purplish swelling of the lids of one eye.

The disease can then become chronic, causing heart disorders and digestive and/or neurological problems. In later years, the infection can lead to sudden death or heart failure caused by progressive destruction of the heart muscle.

There is no vaccine for Chagas disease.

Treatment can be effective in killing the parasite if medication is given soon after infection.

Screening of blood and organ donors, as well as babies of infected mothers, prevents the spread of infection and enables early diagnosis and treatment.

Vector control, such as spraying of houses and use of bednets, is the most effective method of preventing Chagas disease in Latin America.

For more information, see the factsheet on Chagas disease.

Lyme disease

Lyme disease (Lyme Borreliosis) is caused by *Borrelia* bacteria and is transmitted through the bite of infected deer ticks (of the *Ixodes* species). Many species of mammals can be infected and rodents and deer act as important reservoirs.

The first recognized outbreak of this disease occurred in Connecticut, United States, in 1975. The current burden is estimated at 7.9 cases per 100 000 people in the United States, according to the US Centers for Disease Control and Prevention.

Since the mid-1980s, the disease began to be reported in several European countries. Lyme disease occurs in rural areas of Asia, north-western, central and eastern Europe, and the United States of America. It is now the most common tick-borne disease in the Northern Hemisphere.

People living in or visiting rural areas, particularly campers and hikers, are most at risk. If bitten, the tick should be removed as soon as possible

Lyme disease symptoms include fever, chills, headache, fatigue, muscle and joint pain. A rash often appears at the site of the tick bite and gradually expands to a ring with a central clear zone, before spreading to other parts of the body. If left untreated, infection can spread to joints, the heart and central nervous system. Arthritis may develop up to 2 years after onset.

Most cases of Lyme disease can be treated successfully with a course of antibiotics.

Schistosomiasis

Schistosomiasis is a chronic, parasitic disease caused by blood flukes (trematode worms).

People become infected when larval forms of the parasite – released by freshwater snails – penetrate the skin during contact with infested water.

In the body, the larvae develop into adult schistosomes. Adult worms live in the blood vessels where the females release eggs. Some of the eggs are passed out of the body in the faeces or urine to continue the parasite life-cycle. Others become trapped in body tissues, causing an immune reaction and progressive damage to organs and blood vessels.

In 2011, more than 28 million people were treated for schistosomiasis.

Schistosomiasis is found in 78 countries in tropical and sub-tropical areas, mostly in Africa. People are at risk of infection due to agricultural, domestic and recreational activities which expose them to infested water.

Symptoms of schistosomiasis are caused by the body's reaction to the worms' eggs, and not by the worms themselves.

Intestinal schistosomiasis can cause abdominal pain, diarrhoea, blood in the stool, liver and spleen enlargement, fluid in the peritoneal cavity and hypertension of the abdominal blood vessels.

Urogenital schistosomiasis causes blood in the urine, lesions and fibrosis of the bladder, ureter and genitals, kidney damage and sometimes bladder cancer. It can cause infertility.

In children, schistosomiasis can cause anaemia and stunting, reducing their learning abilities.

The control of schistosomiasis is based on regular, large-scale treatment of at-risk population groups, access to safe water, improved sanitation, hygiene education and snail control.

For more information, see the factsheet on schistosomiasis.