

Mosquito-borne disease

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Mosquito-borne diseases or **mosquito-borne illnesses** are diseases caused by bacterial, viruses or parasites transmitted by mosquitoes. They can transmit disease without being affected themselves.

Diseases transmitted by mosquitoes include: malaria, dengue, West Nile virus, chikungunya, yellow fever,^[1] filariasis, Japanese encephalitis, Saint Louis encephalitis, Western equine encephalitis, Eastern equine encephalitis, Venezuelan equine encephalitis, La Crosse encephalitis and Zika fever.

Nearly 700 million people get a mosquito borne illness each year resulting in greater than one million deaths.^[1]

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Endemic range of yellow fever in Africa (2005)



Endemic range of yellow fever in South America (2005)

Types

Protozoa

The female mosquito of the genus *Anopheles* carries the malaria parasite (see *Plasmodium*). Worldwide, malaria is a leading cause of premature mortality, particularly in children under the age of five, with an estimated 207 million cases and more than half a million deaths in 2012, according to the World Malaria Report 2013 published by *WHO*.

Myiasis

Botflies are known to parasitise humans or other mammals thus causing myiasis and to use mosquitoes as intermediate vector agents to deposit eggs on a host. The human botfly *Dermatobia hominis* attaches its eggs to the underside of a mosquito, and when the mosquito takes a blood meal from a human or an animal, the body heat of the mammalian host induces hatching of larvae.

Helminthiasis

Some species of mosquito can carry the filariasis worm, a parasite that causes a disfiguring condition (often referred to as elephantiasis) characterized by a great swelling of several parts of the body; worldwide, around 40 million people are living with a filariasis disability.

Virus

The viral diseases yellow fever, dengue fever, Zika fever and chikungunya are transmitted mostly by *Aedes aegypti* mosquitoes.

Other viral diseases like epidemic polyarthritis, Rift Valley fever, Ross River fever, St. Louis encephalitis, West Nile virus (WNV), Japanese encephalitis, La Crosse encephalitis and several other encephalitic diseases are carried by several different mosquitoes. Eastern equine encephalitis (EEE) and Western equine encephalitis (WEE) occurs in the United States where it causes disease in humans, horses, and some bird species. Because of the high mortality rate, EEE and WEE are regarded as two of the most serious mosquito-borne diseases in the United States. Symptoms range from mild flu-like illness to encephalitis, coma and death.^[2]

Viruses carried by arthropods such as mosquitoes or ticks are known collectively as arboviruses. West Nile virus was accidentally introduced into the United States in 1999 and by 2003 had spread to almost every state with over 3,000 cases in 2006.

Other species of *Aedes* as well as *Culex* and *Culiseta* are also involved in the transmission of disease.

Transmission

A mosquito's period of feeding is often undetected; the bite only becomes apparent because of the immune reaction it provokes. When a mosquito bites a human, it injects saliva and anti-coagulants. For any given individual, with the initial bite there is no reaction but with subsequent bites the body's immune system develops antibodies and a bite becomes inflamed and itchy within 24 hours. This is the usual reaction in young children. With more bites, the sensitivity of the human immune system increases, and an itchy red hive appears in minutes where the immune response has broken capillary blood vessels and fluid has collected under the skin. This type of reaction is common in older children and adults. Some adults can become desensitized to mosquitoes and have little or no reaction to their bites, while others can become hyper-sensitive with bites causing blistering, bruising, and large inflammatory reactions, a response known as Skeeter syndrome.

Mechanism

Mosquitoes carrying such arboviruses stay healthy because their immune systems recognizes the virions as foreign particles and "chop off" the virus's genetic coding, rendering it inert. Human infection with a mosquito-borne virus occurs when a female mosquito bites someone while its immune system is still in the process of destroying the virus's harmful coding.^[3] It is not completely known how mosquitoes handle eukaryotic parasites to carry them without being harmed. Data has shown that the malaria parasite *Plasmodium falciparum* alters the mosquito vector's feeding behavior by increasing frequency of biting in infected mosquitoes, thus increasing the chance of transmitting the parasite.^[4]

Prevention

When a mosquito bites, it also injects saliva and anti-coagulants into the blood which may also contain disease-causing viruses or other parasites. This cycle can be interrupted by killing the mosquitoes, isolating infected people from all mosquitoes while they are infectious or vaccinating the exposed population. You can also make your own mosquito repellent to keep mosquitoes away. All four techniques have been used, often in combination, to control mosquito transmitted diseases. Window screens, introduced in the 1880s, were called "the most human contribution, the 19th century made to the preservation of sanity and good temper."^[5]

Epidemiology

Mosquitoes are estimated to transmit disease to more than 700 million people annually in Africa, South America, Central America, Mexico and much of Asia with millions of resulting deaths. In Europe, Russia, Greenland, Canada, the United States, Australia, New Zealand, Japan and other temperate and developed countries, mosquito bites are now mostly an irritating nuisance but still cause some deaths each year.^[6]

Historically, before mosquito transmitted diseases were brought under control in the 20th century, they caused tens of thousands of deaths in these countries and hundreds of thousands of infections.^[7] Mosquitoes were shown to be the method by which yellow fever and malaria were transmitted from person to person by Walter Reed, William C. Gorgas and associates in the U.S. Army Medical Corps first in Cuba and then around the Panama Canal in the early 1900s.^{[8][9]} Since then other diseases have been shown to be transmitted the same way.

Mosquitoes are a perfect example of one of the many organisms that can host diseases. Of the known 14,000 infectious microorganisms, 600 are shared between animals and humans. Mosquitoes are known to carry many infectious diseases from several different classes of microorganisms, including viruses and parasites. Mosquito-borne illnesses include malaria, West Nile virus, elephantiasis, dengue fever, yellow fever etc. These infections are normally rare outside of certain geographic areas. For instance dengue hemorrhagic fever is a viral, mosquito borne illness usually regarded only as a risk in the tropics. However, cases of dengue fever have been popping up in the U.S. along the Texas-Mexican border where it has never been seen before. In 2015 it was also reported that, due to climate change, mosquitoes had started to spread historically rare diseases to Europe - malaria to Greece, West Nile virus to eastern Europe and chikungunya to Italy and France.^{[10][11]}

Latest Treatment

The Sterile Insect Technique (SIT) uses irradiation to sterilize insect pests before releasing them in large numbers to mate with wild females. Since they do not produce any offspring, the population, and consequently the disease incidence, is reduced over time. Used successfully for decades to combat fruit flies and livestock pests such as screwworm and tsetse flies, the technique can be adapted also for some disease-transmitting mosquito species. Pilot projects are being initiated or are under way in different parts of the world.

^{[12][13]}

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