

Insect-Borne Disease to Fight while Traveling

updated February 2016

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Note: Insect Shield, Repellents, Permethrin products do not prevent disease but are effective in repelling insects that carry diseases.

Dengue Fever

Overview

Dengue fever is caused by viruses transmitted from person to person by mosquitoes. Widespread, the disease occurs in tropical regions all over the world—including North, Central and South America, as well as Australia, Africa and Asia. The global distribution of dengue fever compares to that of malaria, with an estimated 2.5 billion people living in at-risk regions. The four types of dengue virus do not provide cross-protective immunity, so an individual can be at risk for as many as four dengue infections over time.

Symptoms of dengue infection include high fever, severe headache, joint and muscle pain, nausea and rash. If a rash develops, it appears 3 to 5 days after the onset of fever, usually starting on the torso, then spreading to the arms, legs and face. In many cases, dengue fever does not require hospitalization. However, it can prove more serious, often resulting in a severe—and sometimes fatal—hemorrhagic disease called dengue hemorrhagic fever (DHF). It is estimated that millions of cases of dengue fever occur each year, and up to hundreds of thousands of cases of DHF. Dengue epidemics have become more widespread in recent years. In some regions, dengue fever and DHF have become a leading cause of hospitalization and death among children. According to the Centers for Disease Control and Prevention (CDC), “Dengue is the most significant mosquito-borne viral disease affecting humans.”

Air travel facilitates the spread of dengue viruses between population centers in the tropics. According to the CDC, “Cases of dengue are confirmed every year in travelers returning to the United States following visits to tropical and subtropical areas.”

The CDC also has stated that the emergence of dengue fever as a major public health problem has proven most dramatic in the western hemisphere, and “there is a small, but significant, risk for dengue outbreaks in the continental United States.”

For more details on dengue fever, see the “Traveler’s Health” section of the CDC website at www.cdc.gov/travel/diseases/dengue.htm.

Detailed Information:

What is dengue and how is it transmitted?

Dengue fever and DHF have become the most common arboviral (virus transmitted by insects) in the world. The virus is transmitted by day-biting *Aedes aegypti* mosquitoes that prefer to feed on people. There are four different strains of virus, and infection with one virus confers immunity against that strain, but not others—so multiple infections are possible in one's lifetime. Infection with the dengue virus causes a range of symptoms from sub-clinical infection and nonspecific flu-like symptoms to severe and fatal DHF. First infection with dengue increases the risk of DHF in subsequent infections. It is estimated that there are more than 100 million cases of dengue worldwide each year. However, since the majority of infections cause mild illness and are not reported, the actual number of cases in the population may be five or ten times higher than this. The incidence of DHD has increased dramatically in Asia, the South Pacific and tropical areas of the Americas over the past 25 years. *Aedes aegypti*, which can carry dengue fever is the most populous species of mosquito in the United States.



Aedes aegypti

Dengue fever has an incubation period of 3 to 14 days, after which the onset of symptoms occurs—high fever, severe frontal headache, as well as joint and muscle pain. Some patients experience a rash that spreads from the torso to the arms, legs and face. The illness is usually self-limiting, but approximately 1% of cases progress to the more serious DHF. Patients with DHF can develop hemorrhagic symptoms such as bruising, bleeding from the nose and mouth, circulatory failure, shock and death. The case fatality rate for DHF is about 5%.

Is there dengue in the United States?

Dengue is endemic in most countries of the South Pacific, Asia, the Caribbean, as well as tropical regions of the Americas and Africa. There have been occasional dengue cases in the United States associated with outbreaks in Mexico; a 2001 outbreak in Hawaii was likely imported by travelers from the South Pacific.

I'm traveling to an area where there is dengue. How can I protect myself?

Because there is no specific treatment available for dengue, you should take measures to prevent mosquito bites. Insect Shield® Repellent Apparel and Gear is proven and registered to repel mosquitoes, so it is a good option to help protect yourself from dengue. We've received positive feedback from travelers who have worn our repellent apparel in tropical regions.

I've heard that global warming may lead to an increase in dengue worldwide. Is this true?

Various predictions have been made regarding changes in distribution of dengue with current models of climate change. There is consensus that if warming trends continue, diseases of the tropics such as dengue will become more prevalent in higher latitudes.

How is dengue treated?

Because it is a viral disease, antibiotics cannot be used to treat dengue infections. Acetaminophen can be used to treat pain and fever, but aspirin or other anti-inflammatory medications should be avoided. Intravenous fluids can be given if necessary.

Is there a vaccine available for dengue?

There is no vaccine for dengue.

Leishmaniasis

Overview

Leishmaniasis is a parasitic disease transmitted by the bite of certain species of sandflies. Quite common in the Middle East, it is found in about 90 tropical and subtropical countries, in regions ranging from rain forests to deserts.

Visceral leishmaniasis usually causes fever, weight loss, an enlarged spleen and liver, and occasionally, swollen glands and anemia. Typically, symptoms develop months—or years—after the patient is bitten. Untreated cases often prove fatal.

In Africa, leishmaniasis is more prevalent in the northern regions, including Algeria and Sudan. In Asia, it is more common toward the west, including India and Bangladesh. In the western hemisphere, leishmaniasis affects people from northern Mexico—and occasionally rural southern Texas—to northern Argentina. Leishmaniasis is not found in Southeast Asia, Australia or the Pacific islands.

No vaccines or drugs for preventing leishmaniasis are currently available.

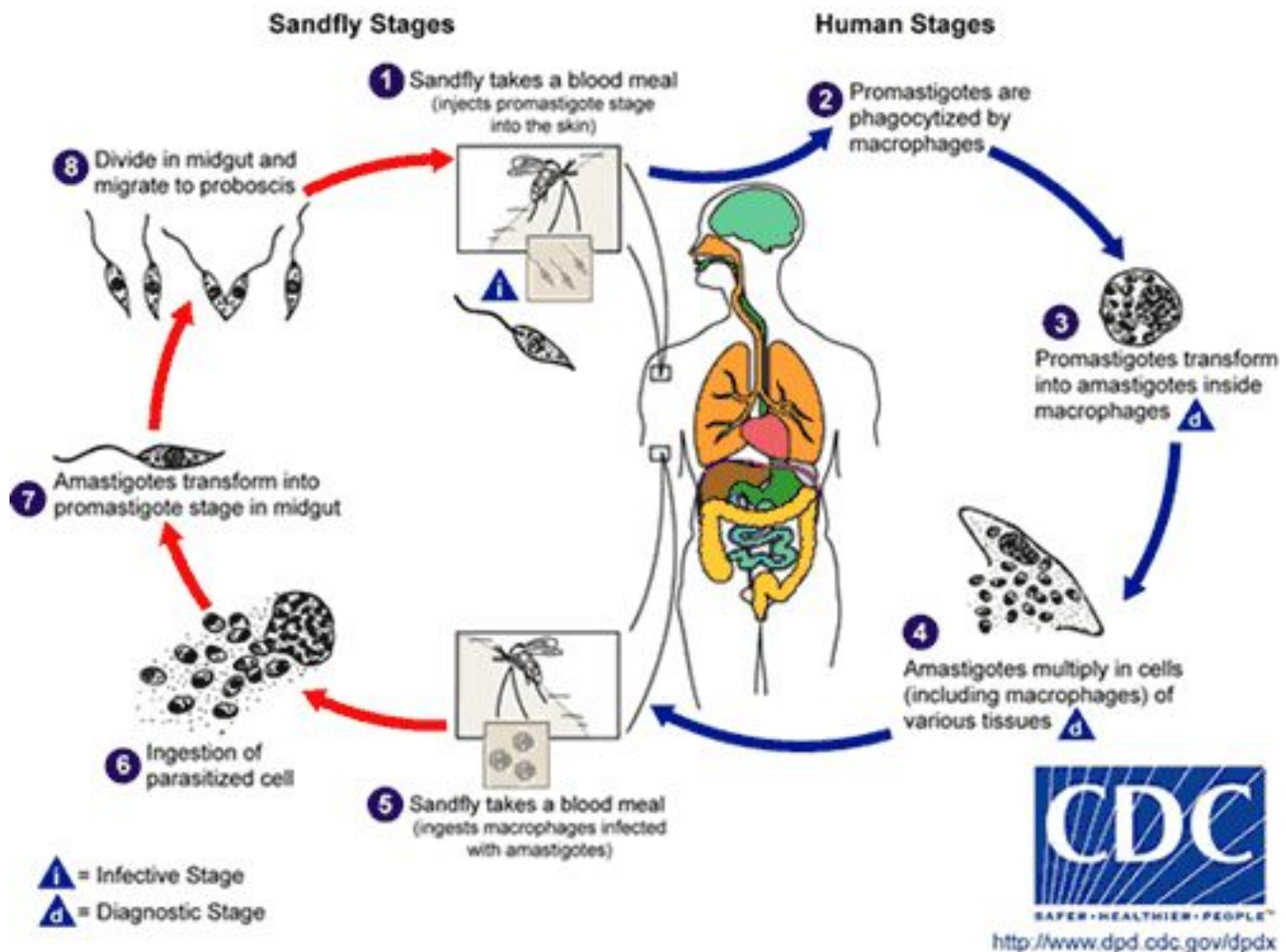
Additional information on leishmaniasis can be found on the Division of Parasitic Diseases' website at http://www.cdc.gov/ncidod/dpd/parasites/leishmania/factsht_leishmania.htm.

Detailed information:

What is Leishmaniasis and how is it transmitted?

Leishmaniasis is caused by a protozoan (single-celled) parasite of the genus *Leishmania* that is transmitted by *phlebotomine* sandflies. There are 21 species of *Leishmania* that infect people.

Sandflies inject the parasite while feeding, and it is engulfed by amoeba-like macrophage cells—a type of white blood cell that works to rid the body of infections. The parasite transforms itself inside macrophages, which are then ingested by sandflies when they bite an infected host. The final stage of the life cycle takes place in the gut of the sandfly, and the parasite is then injected into a new host when the sandfly bites again.



Leishmania life cycle

Source: CDC

Leishmaniasis can take two forms: cutaneous (affecting skin) and visceral (affecting internal organs). The type of infection that an individual gets depends on the geographic location, species of parasite and immune response of the host.

Cutaneous leishmaniasis causes large, sometimes painful sores near the site of the bite. Visceral leishmaniasis, also called *kala-azar*, proves a more serious infection. Patients experience fever, enlarged spleen, enlarged liver, weight loss and low blood-cell counts.

Sandflies are most active from dusk to dawn. Because they are very small insects and do not make noise when they fly, most people do not notice their presence.

Is there leishmaniasis in the United States?

There have been a few cases of cutaneous leishmaniasis in southern Texas. No cases of visceral leishmaniasis have ever been reported in the United States.

How is leishmaniasis treated?

Most cases of cutaneous leishmaniasis do not need to be treated, but a physician should make that decision. There are several medications available to treat both forms of leishmaniasis.

Is there a vaccine for leishmaniasis?

No, there is currently no vaccine for either form of leishmaniasis.

How can I protect myself from leishmaniasis?

If you travel to regions where leishmaniasis is endemic (i.e., Iraq, Afghanistan, etc.), be sure to take measures to prevent sandfly bites. Insect Shield® Repellent Apparel is proven protection against sandflies that can carry leishmaniasis.

Lyme disease

Overview

Lyme disease is caused by the bacterium *Borrelia burgdorferi*, which is transmitted to people by the bite of infected ticks (*Ixodes scapularis* or *Ixodes pacificus*).

According to the Centers for Disease Control and Prevention (CDC): "Individuals who live or work in residential areas surrounded by tick-infested woods or overgrown brush are at risk of getting Lyme disease." Therefore, anyone who works or plays in their yard, participates in recreational activities away from home like hiking, camping, fishing and hunting, or engages in outdoor occupations such as landscaping, brush clearing, forestry and wildlife or parks management in endemic areas may also be at risk of getting Lyme disease.

Certain regions of the United States have experienced a high incidence of Lyme disease. Go to <http://www.cdc.gov/ncidod/dvbid/lyme> to see a U.S. Lyme Disease Risk Map, an illustration of the deer tick, as well as more detailed information about Lyme disease.

Indications of Lyme disease include a characteristic "bull's-eye" rash, fever, malaise, fatigue, headache, as well as muscle and joint aches. The incubation period from infection to onset of the distinctive rash is typically 7 to 14 days, but may be as short as 3 days or as long as 30 days. Some infected individuals experience only fever, headache, fatigue and muscle pain.

Unfortunately, Lyme disease has a history of misdiagnosis. The untreated or inadequately treated patient may progress to experience intermittent swelling and pain of one or more joints—usually large, weight-bearing joints such as the knees. Some patients develop chronic axonal polyneuropathy or encephalopathy—the latter usually manifested by cognitive disorders, sleep disturbance, fatigue and personality changes. Infrequently, Lyme disease can be severe, chronic and disabling, but it is rarely, if ever, fatal. Symptoms can occur in some people following treatment, and Lyme disease can result in serious, life-long side effects.

For more information, visit the American Lyme Disease Foundation website at <http://www.aldf.com/About.asp>, the Lyme Disease Association website at <http://www.lymediseaseassociation.org>, and the International Lyme and Associated Diseases Society website at <http://www.ilads.org>.

Detailed Information:

What is Lyme disease and how is it transmitted?

Caused by the *Borrelia burgdorferi* bacterium, Lyme disease is transmitted by the bite of certain species of ticks. The bacterium, normally found in mice, squirrels and other small mammals, does not harm these animals—or the deer the ticks feed on—but causes potentially serious disease when transmitted to people. In the Northeast United States, the Lyme disease vector is the black-legged or deer tick (*Ixodes scapularis*); in Pacific coastal United States, the western black-legged tick (*Ixodes pacificus*) transmits the disease. Most cases occur in the early spring and summer when the ticks are in the nymph stage, and people are most likely to be outdoors. Nymph-stage ticks are difficult to see with the naked eye.



Ixodes pacificus



Ixodes scapularis

The first symptom of Lyme disease appears 3 to 30 days after the tick bite: a circular rash (*erythema migrans*) around the site the bite. It develops into a characteristic “bull’s eye” with a clear center that can be up to 12 inches in diameter. Patients also experience painful lymph node swelling, joint pain (arthralgia), chills, fever, headache, muscle aches (myalgia) and other non-specific symptoms. Left untreated, the infection can lead to more serious symptoms such as drooping of the face (Bell’s palsy), heart palpitations, dizziness, severe headaches and joint pain. After several months, approximately half of all patients with untreated Lyme disease develop arthritis in large joints as well as chronic neurological problems, including cognitive difficulties.



“bull’s-eye” rash typical of Lyme disease

How many cases of Lyme disease occur annually in the United States?

State health departments reported 28,921 confirmed cases and 6,277 probable cases of Lyme disease to CDC in 2008. This represents a 5% increase in confirmed cases compared to 2007. The definition and reporting of probable cases was initiated in 2008 based on revisions to the national surveillance case definition.

How is Lyme disease treated?

Most cases can be treated effectively with antibiotics if treatment begins early. However, a small percentage of those infected and treated continue to experience symptoms such as muscle and joint pain, neurological difficulties and fatigue—likely due to autoimmune disorders triggered by the infection.

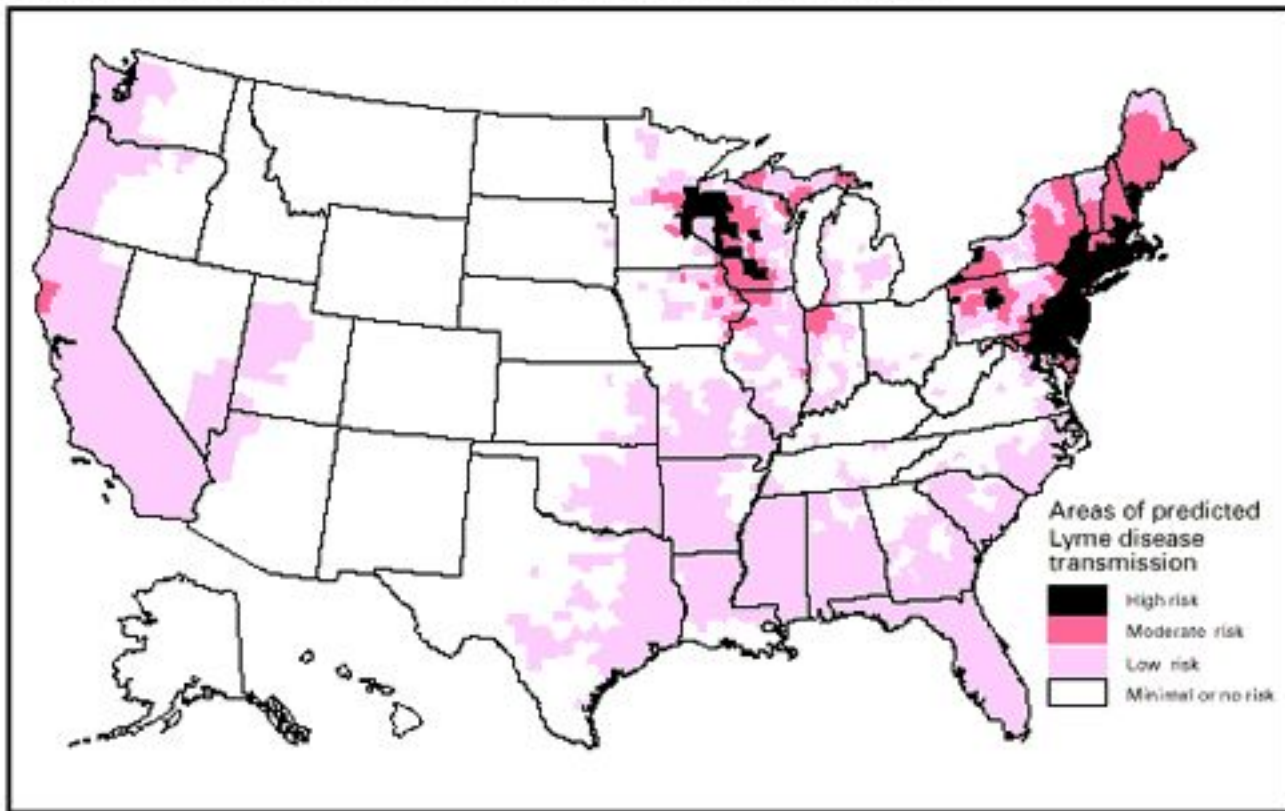
Is there a vaccine for Lyme disease?

Since 1998, there has been a FDA-approved vaccine for Lyme disease. However, this vaccine does not provide complete protection against all strains of the bacteria that cause Lyme disease. Therefore, protective measures should be taken—even by those who have been vaccinated.

How can I protect myself from Lyme disease?

You should take measures to prevent tick bites, particularly if you are planning on being in wooded areas where the carrier ticks are common. Insect Shield® Repellent Apparel is effective in repelling ticks, including the kind that can carry Lyme disease. We especially recommend Insect Shield socks and pants for tick protection, but other items of Insect Shield clothing can also prove helpful in thickly wooded areas.

National Lyme disease risk map with four categories of risk



Note: This map demonstrates an approximate distribution of predicted Lyme disease risk in the United States. The true relative risk in any given county compared with other counties might differ from that shown here and might change from year to year. Risk categories are defined in the accompanying text. Information on risk distribution within states and counties is best obtained from state and local public health authorities.

From CDC.gov

Malaria

Overview

Malaria is caused by parasites transmitted from person to person by infected female *Anopheles* mosquitoes—not through casual contact with infected people. There have also been rare cases of malaria transmitted through blood transfusions, organ transplants, shared use of contaminated needles or syringes, and from mother to baby before or during delivery (congenital malaria).

The World Health Organization (WHO) estimates that 41% of the world's population is exposed to malaria, and that more than 300 million episodes of acute illness from malaria occur every year. Malaria is one of the leading causes of death worldwide. Annual deaths are estimated to be a minimum of one million, mainly among young children in Africa.

There are four different species of malaria parasites that can be transmitted through the bite of an infected mosquito. Symptoms and severity of infection vary. Symptoms usually appear 7 to 30 days after the infecting mosquito bite, and typically include fever, sweats, headaches, malaise, muscle aches, nausea and vomiting. If malaria exposure is suspected—such as from travel to Africa, Latin America or Asia—a diagnostic test should be performed immediately. Note that antimalarial drugs can delay the appearance of symptoms.

According to the Centers for Disease Control and Prevention (CDC) website, people who have developed protective immunity (mainly adults in high-transmission areas) may be infected but not made ill. Severe malaria occurs more frequently in people with little protective immunity. Complications such as brain disease, severe anemia and kidney failure can develop—and can result in death or life-long neurological impairment. There is no vaccine for malaria, but it is curable if diagnosed and treated promptly.

The CDC website at <http://www.cdc.gov/travel/diseases/malaria/index.htm> features information on malaria, including advice for travelers to high-risk countries.

Detailed information:

What is malaria and how is it transmitted?

Malaria is a parasitic disease caused by a single-celled organism called *Plasmodium*. It is transmitted through the bite of infected female *Anopheles* mosquitoes, which are found on every continent of the world. Of the 430 *Anopheles* mosquito species, only 30-50 transmit malaria. Some *Anopheles* species prefer to feed on animals, while others feed exclusively on people, including *A. gambiae* and *A. funestus* which transmit malaria in Africa.



Anopheles gambiae



Dominant malaria vectors

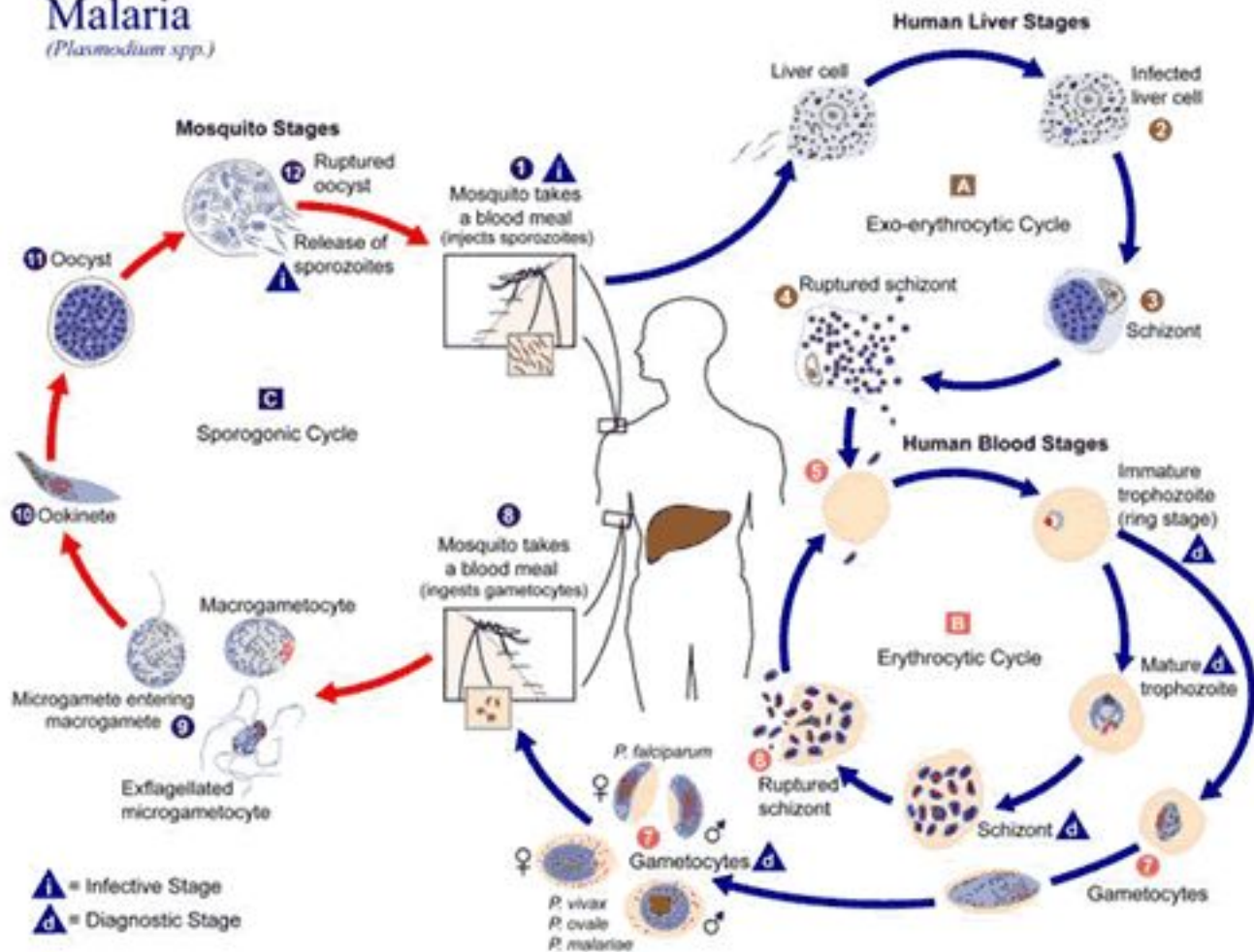
Species	Species	Species	Species	Species
albimanus	atroparvus	fluviatilis	labranthiae	punctulatus group
annularis	barbirostris	freeborni	maculatus	pharoensis
anthropophagus	califacies	funestus and anibiensis	melas	pseudopunctipennis
anibiensis	darlingi	funestus, anibiensis and gambiae s.s.	melleus	pulcherrimus
anibiensis and funestus	favirostris	funestus and gambiae s.s.	multicolor	quadrimaculatus
aquasalis	gambiae s.s.	gambiae s.s. and funestus	nuneztovari	sachinovi
	gambiae s.s. and funestus		ocellatus	sergenti
			pharoensis	shensi
			pulcherrimus	stephensi
			quadrimaculatus	sundewi
			sachinovi	superpictus
			sergenti	

Figure 1 from Anthony Kiszewski, Andrew Mellinger, Andrew Spielman, Pia Malaney, Sonia Erlich Sachs, and Jeffrey Sachs. A Global Index Representing The Stability of Malaria Transmission. Am J Trop Med Hyg 2004 70:486-498.

There are four species of *Plasmodium*: *P. falciparum*, *P. vivax*, *P. ovale* and *P. malariae*. The illness these parasites cause varies in severity from species to species, but the most dangerous infection is that of *P. falciparum*—resulting in an estimated 700,000 to 2.7 million deaths annually, mostly in children in Africa. *P. falciparum* is an extremely rapid and efficient killer; a child infected with this parasite can feel fine in the morning and be dead that night from cerebral malaria. *P. ovale* and *P. vivax* have dormant phases where the parasites reside in the liver for months to years, and can cause malaria long after an infective bite. *Plasmodium* has a complex life cycle with several intermediate stages, which makes it difficult for the immune system of those infected to fight. Mosquitoes ingest *Plasmodium* when they bite an infected person. The parasite reproduces in the gut of the mosquito, migrates to the salivary glands and then is delivered into a new host with each bite. *Plasmodium* travels through the bloodstream and enters the cells of the liver. It grows and reproduces from several days to several weeks, during which time the infected person experiences no symptoms. At some point, usually between 10 and 15 days after infection, the infected liver cells burst, releasing the parasites into the blood stream where they enter red blood cells. The parasites reproduce rapidly in the red blood cells, causing them to rupture and release millions of parasites into the blood, which then go on to infect additional red blood cells. Each time the red blood cells are reinfected, the host suffers chills, fever, muscle and headaches—typical malaria symptoms resulting from the body's effort to fight the parasites. Serious complications, including anemia, kidney failure and cerebral malaria, may result from *Plasmodium* infection—all of which can prove fatal.

Malaria

(*Plasmodium* spp.)



Is there malaria in the United States?

Malaria was mostly eradicated from the U.S. and Europe in the 1950s and 60s, largely due to the use of the insecticide DDT. Malaria was reduced in other parts of the world during this time, but once the environmental consequences of the indiscriminate spraying of DDT became apparent, the insecticide was banned in most countries. Additionally, mosquitoes developed insecticide resistance in many areas. These control measures were not implemented in most of Africa. As a result, malaria rates surged in poor countries where other control measures were not available.

I'm traveling to an area where there is malaria. How can I protect myself?

If you are traveling to an area where malaria is endemic, you should consult your physician or travel medicine clinic prior to your departure to discuss options for malaria prophylaxis. There are several different drugs available to help prevent malaria, and your physician can advise you on which is the most appropriate for you.

Additionally, you should take measures to prevent mosquito bites. Insect Shield® Repellent Apparel and Gear is proven to repel mosquitoes, including those that carry malaria. Many travelers have experienced the benefits of wearing Insect Shield apparel while visiting regions around the world where malaria is a threat.

How is malaria treated?

There are a variety of drugs available to treat malaria; unfortunately, they prove cost-prohibitive for the majority of the people who need them in the developing world. Recent initiatives such as the World Health Organization's Roll Back Malaria Partnership and the President's Malaria Initiative provide funding for

governments in poor countries to purchase these essential drugs. More and more people now have access to these drugs as well as to preventive measures such as insecticide-treated bednets and indoor spraying of insecticides. Time will tell if these initiatives actually reduce the incidence of malaria.

What is the global impact of malaria?

About 40% of the world's population is at risk for malaria—the majority of which is in developing countries, particularly sub-Saharan Africa. One in five childhood deaths in Africa result from malaria. Non-fatal malaria episodes and constant reinfection cause debilitating chronic illness, leaving people unable to work. Children miss many school days due to illness, and malaria often leads to learning difficulties and reduced cognitive functioning. In countries where the disease is endemic, malaria causes an estimated 1.3% loss of economic growth. Malaria is a disease of the poor, and perhaps more than any other factor, it has limited Africa's ability to reduce poverty and further development.

I've heard that global warming may lead to an increase in malaria worldwide. Is this true?

While predicting global warming trends is difficult, some projections of climate change anticipate a surge in global malaria incidence. This would occur due to shifts in tropical temperatures to more northern and southern latitudes, as well as changing global weather patterns. These models predict changes in a number of vector-borne disease transmission patterns, the impact of which would predominantly be felt in poorer countries.

Is there a vaccine available for malaria?

Efforts are currently underway to develop a vaccine for malaria. The Bill and Melinda Gates Foundation funds a number of vaccine development initiatives. Earlier versions of malaria vaccines have shown poor efficacy in clinical trials. Vaccine development proves challenging, due to the extremely complex nature of the malaria life cycle as well as the parasite's rapidly-mutating genes.

Rocky Mountain Spotted Fever

Overview

Rocky Mountain spotted fever is transmitted to people by the bite of a tick infected with the bacterial organism *Rickettsia rickettsii*, or by contamination from the contents of an attached tick when it is removed (from a person or animal). Tweezers should be used to remove ticks, along with a paper towel or rubber gloves to shield contact.

The primary carriers of Rocky Mountain spotted fever in the United States are the American dog tick, *Dermacentor variabilis*, and the Rocky Mountain wood tick, *Dermacentor andersoni*.

First recognized in 1896 in Idaho, Rocky Mountain spotted fever has a misleading name because the United States' highest incidence of the disease occurs in North Carolina and Oklahoma. In fact, relatively few cases are reported in the Rocky Mountain states. Each year from April through September, approximately 800 to 1,200 cases are reported in the United States, more than half of which occur in the Southeast (Maryland to Florida).

Rocky Mountain spotted fever is a serious disease, and it is likely that many cases are not reported. Initial symptoms, which can resemble other illnesses, usually appear about 5-10 days after a tick bite and can include fever, nausea, vomiting, severe headache, muscle pain and lack of appetite. Further symptoms include a rash, abdominal pain, joint pain and diarrhea. The rash generally appears 2-5 days after the onset of fever. Children and young people typically develop a rash earlier than older persons, but about 10-15% of patients never develop a rash.

Rocky Mountain spotted fever usually requires hospitalization. Cells lining blood vessels are infected, and the respiratory, gastrointestinal, renal and central nervous systems can be affected. The occurrence of severe or fatal Rocky Mountain spotted fever has been linked to advanced age, male sex, African-American race, chronic alcohol abuse and deficiency of a specific enzyme (G6PD). People who survive acute infection can develop chronic health problems including partial paralysis of the lower extremities, gangrene, hearing loss, loss of bowel or bladder control and language disorders.

There is no vaccine for Rocky Mountain spotted fever, but there are laboratory tests to confirm the disease, and early treatment with antibiotics proves effective. In fact, prompt and appropriate treatment is imperative. According to the Centers for Disease Control and Prevention (CDC), approximately 3-5 % of cases are fatal.

Go to <http://www.cdc.gov/ncidod/dvrd/rmsf/Index.htm> for extensive information on Rocky Mountain spotted fever.

Detailed Information:

What is Rocky Mountain spotted fever and how is it transmitted?

Rocky Mountain spotted fever is caused by a small bacterium, *Rickettsia rickettsii*, which is transmitted by members of the hard tick family, *Ixodidae*. The two major tick vectors in the United States include the dog tick, *Dermacentor variabilis*, and the Rocky Mountain wood tick, *Dermacentor andersoni*.



Dermacentor variabilis

distribution of dog tick



Dermacentor andersoni

distribution of Rocky Mountain wood tick

From CDC.gov

The dog tick prefers dogs as hosts, but it feeds readily on other large mammals including people. Larvae and nymphs of the Rocky Mountain wood tick feed on rodents and other small animals, and adults feed on large mammals.

Rickettsia is transmitted through the saliva of an infected tick. It usually takes several hours of feeding for transmission to occur, and the proportion of infected ticks is low—approximately 1%-3% of the population in areas where human cases have been reported.

In people, *rickettsia* infects the cells that line small to medium blood vessels, causing the cells to become damaged and die. This results in the leakage of plasma and blood into tissues adjacent to the cells—which creates the typical Rocky Mountain spotted fever rash, and can damage tissues and organs. Severe cases may involve the respiratory, gastrointestinal, nervous and renal systems. Long-term complications of Rocky Mountain spotted fever, particularly in those with severe disease, include paralysis of the lower extremities, gangrene requiring amputation of limbs, toes or fingers, loss of bowel and bladder control, as well as movement and language disorders.

Early clinical signs of Rocky Mountain spotted fever resemble those of other viral diseases, and include nausea, headache, muscle pain and lack of appetite. About 2-5 days after onset of fever, a rash appears consisting of small, flat, pink, non-itchy spots on the wrists and forearms. Later symptoms include rash, joint pain, abdominal pain and diarrhea. The characteristic red, Rocky Mountain spotted fever rash is usually not seen until after the sixth day of fever onset, and occurs on the palms and soles of the feet.



Rocky Mountain spotted fever rash

How many cases of Rocky Mountain spotted fever occur annually in the United States?

Between 250 and 1,200 cases of Rocky Mountain spotted fever occur each year.

How is Rocky Mountain spotted fever treated?

Because it is a bacterial infection, Rocky Mountain spotted fever is treatable with antibiotics, usually doxycycline. Patients generally respond well to treatment if started early, and the fever usually subsides within 72 hours. If Rocky Mountain spotted fever is not treated promptly, possible organ damage and failure means patients will need more intensive care. Infection generally confers lifelong immunity.

How can I protect myself?

You should take measures to prevent tick bites. Insect Shield® Repellent Apparel is proven and registered to repel ticks—as well as mosquitoes, ants, flies and chiggers. The United States Environmental Protection

Agency (EPA) requires extensive effectiveness data to prove a product's ability to repel insects. Many species and varieties of these insects have been tested, including those that carry dangerous diseases such as Rocky Mountain spotted fever.

West Nile Virus

Overview

Bites from infected mosquitoes cause most West Nile virus infections in people. In rare cases, the virus also has been spread to people through blood transfusions, organ transplants and from mother to baby during pregnancy or breastfeeding. Pregnant or nursing women should see a doctor if they develop symptoms indicative of West Nile virus.

The first recorded outbreak of West Nile virus in North America occurred in New York City in 1999. By the summer of 2004, the virus had spread to California.

Mosquitoes become carriers of West Nile virus by feeding on the blood of infected birds.

Approximately 80% of people infected with West Nile virus have no symptoms, so most never realize they have the disease. The unfortunate minority who develop symptoms typically become ill 3 to 14 days after being bitten by an infected mosquito, but they also are unlikely to know they have the virus.

West Nile virus affects the central nervous system. Mild infections cause flu-like symptoms, including fever, headache, body aches, nausea, vomiting and sometimes swollen lymph glands or a skin rash. Symptoms can last from a few days to several weeks. People over the age of 50 are more likely to develop symptoms.

Acute symptoms—including severe headaches or confusion, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis—requiring hospitalization occur in less than 1% of those infected. These symptoms may last several weeks, and neurological effects may be permanent. Intravenous fluids and respiratory support are common hospital treatments, but no cure for West Nile virus has been discovered. In 2003, 262 deaths were attributed to West Nile virus in the United States.

The Centers for Disease Control and Prevention (CDC) website at <http://www.cdc.gov/ncidod/dvbid/westnile> features up-to-date maps of West Nile virus activity for the United States, including state maps with county-level data.

Another online source of in-depth information on West Nile virus is the Cornell University Environmental Risk Analysis Program at <http://environmentalrisk.cornell.edu/WNV/>.

Up-to-date news articles about West Nile virus can be viewed at http://news.yahoo.com/fc?tmpl=fc&cid=34&in=health&cat=west_nile_virus.

Detailed Information:

What is West Nile virus and how is it transmitted?

The West Nile virus can infect mosquitoes, birds, people, horses and some other mammals. It is most commonly found in Africa, West Asia and the Middle East, but has emerged in the United States and Europe in

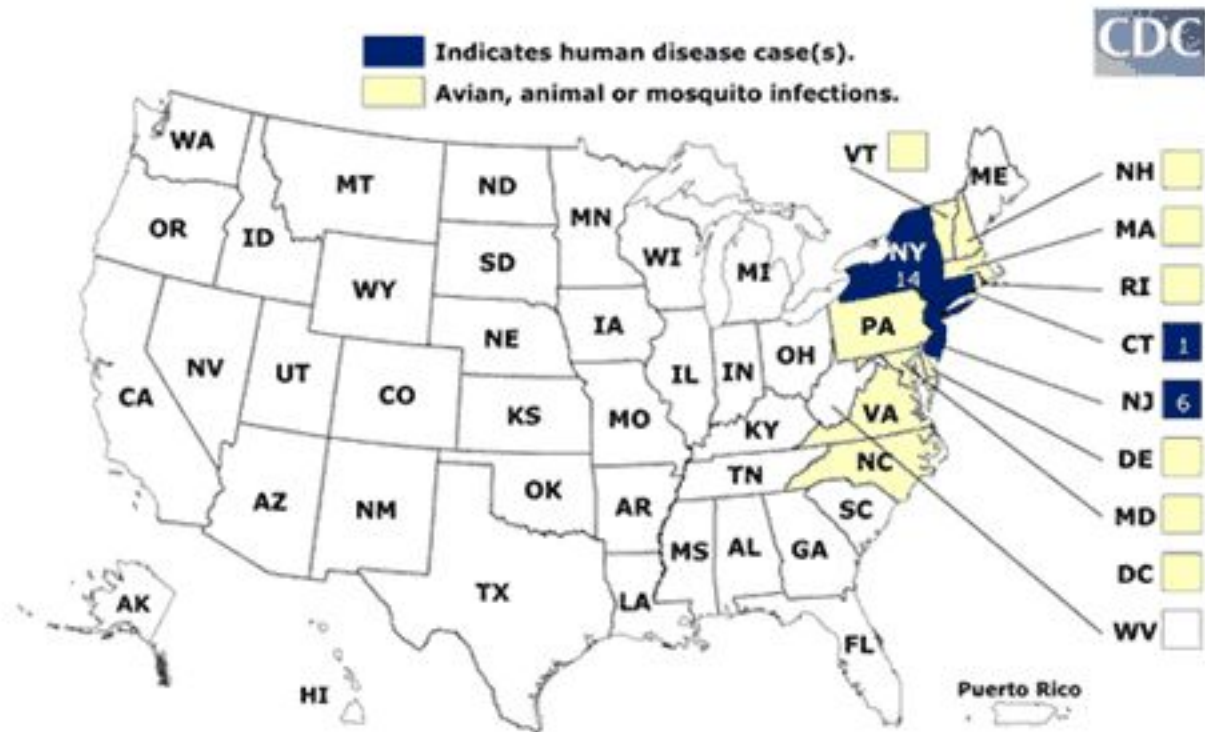
recent years. It causes a spectrum of clinical diseases ranging from flu-like West Nile fever to potentially fatal West Nile meningitis (inflammation of the covering of the brain and spinal cord) and West Nile encephalitis (inflammation of the brain). Of the 4,269 cases reported in 2006, 1459 (34%) were reported as West Nile meningitis or encephalitis, while 2,616 (61%) were reported as West Nile fever and 194 (5%) were unspecified. These figures most likely underestimate the prevalence of West Nile infection as the less serious fever is probably not apt to be reported to health officials as frequently as cases of encephalitis and meningitis. In the United States, the West Nile virus is transmitted by mosquitoes—primarily members of the *Culex* species, although other species have been implicated as well. The virus is maintained in a complex life cycle that involves birds as the reservoir of the virus. People are not the usual host and when infected, become “dead-end hosts” as the virus does not circulate in human blood. While 317 species of birds have been found to carry the West Nile virus, the majority do not usually show signs of illness and few die. However, West Nile virus infection can be fatal in crows and jays. It is also fatal for horses in approximately 40% of cases. Dogs and cats can also become infected but there is no evidence of transmission from these animals to people. *Culex tarsalis* mosquito is the primary vector of West Nile virus.

The virus was first isolated from a woman in the West Nile region of Uganda in 1937. It was found to be the cause of equine encephalitis (swelling of the brain and spinal cord in horses) in France and Egypt in the early 1960s. West Nile virus first appeared in the United States in 1999 with reports of encephalitis in horses and people. Since then, it has been reported in all states except Alaska and Hawaii.

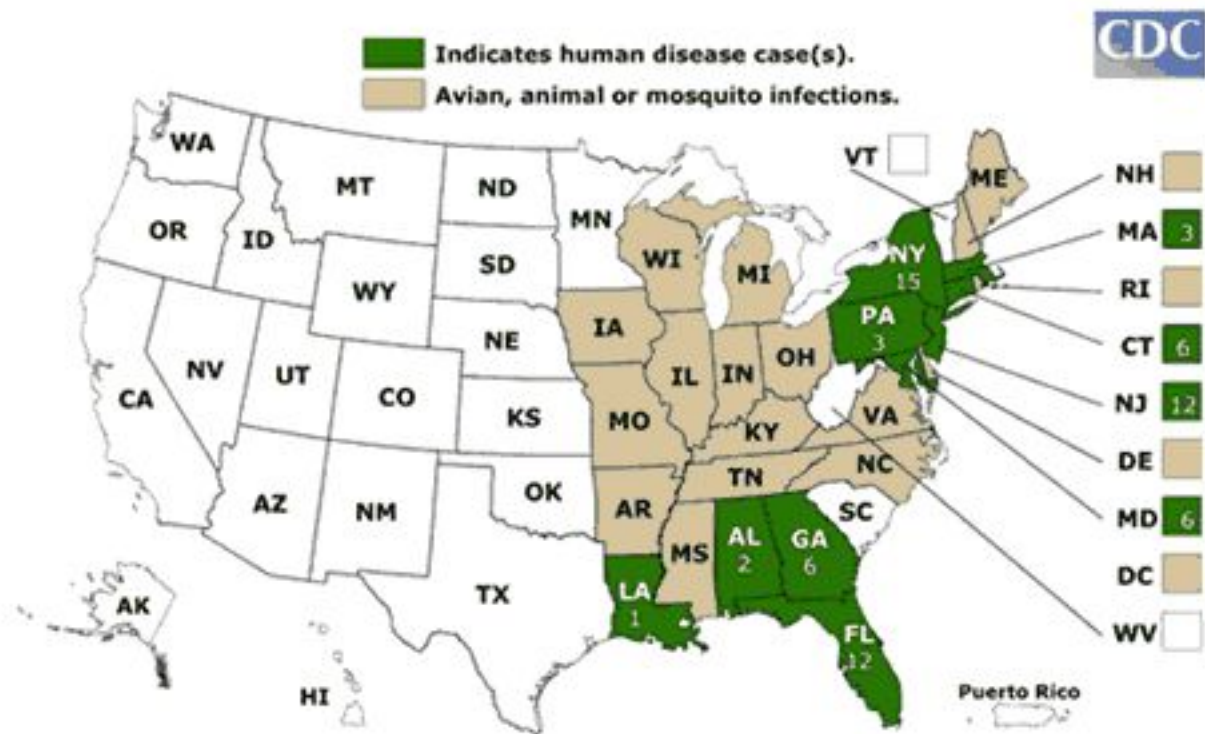
How many cases of West Nile virus infection occur in the United States annually?

Since first appearing on the East Coast in 1999, West Nile virus has spread westwards and now is endemic in all states except Alaska and Hawaii.

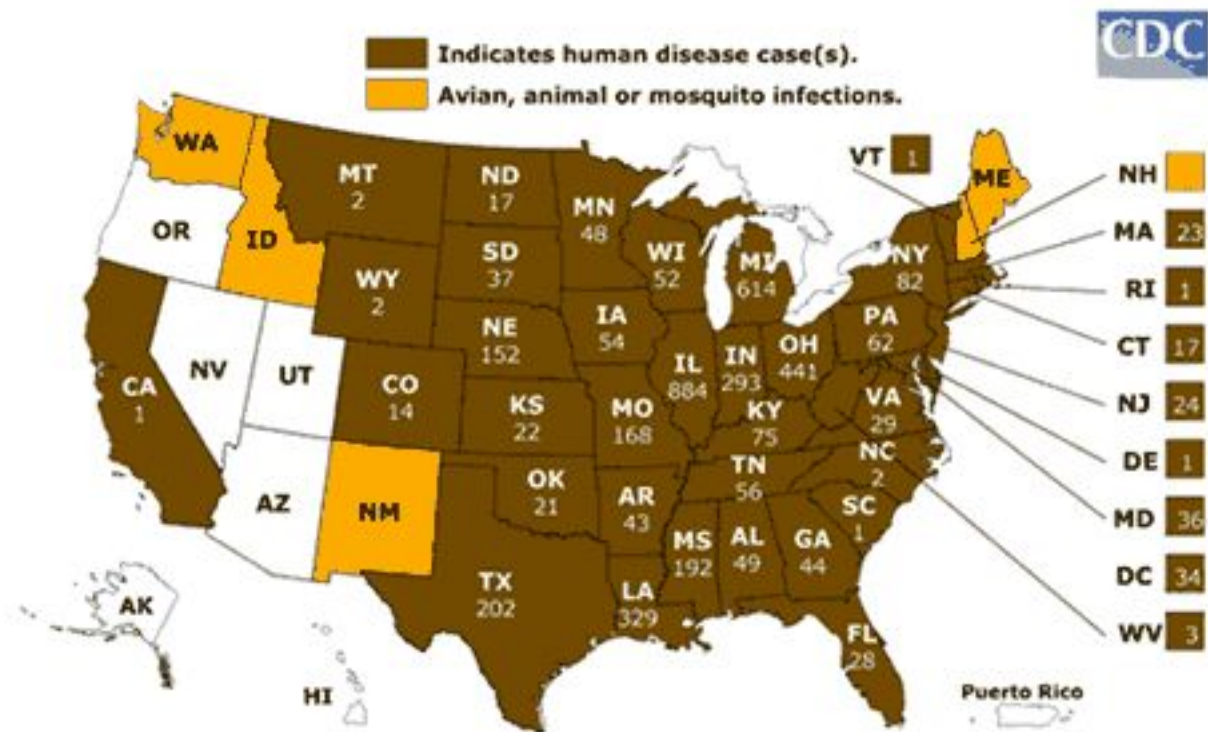




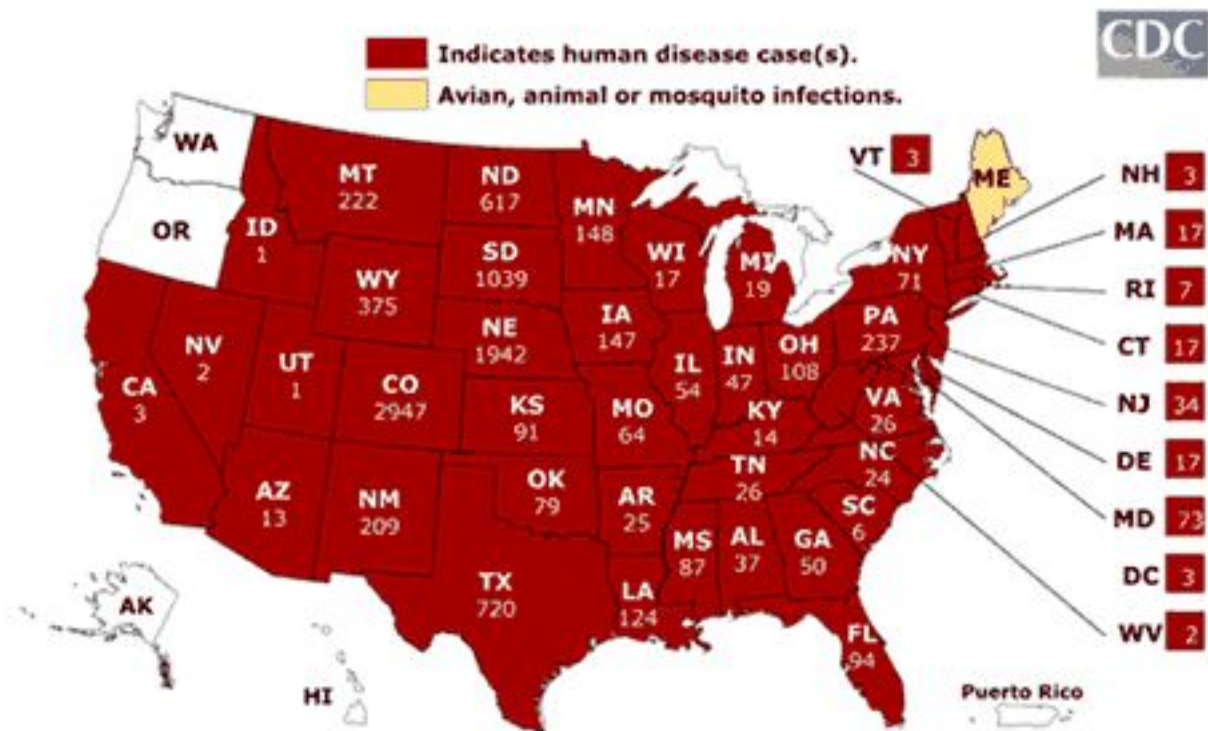
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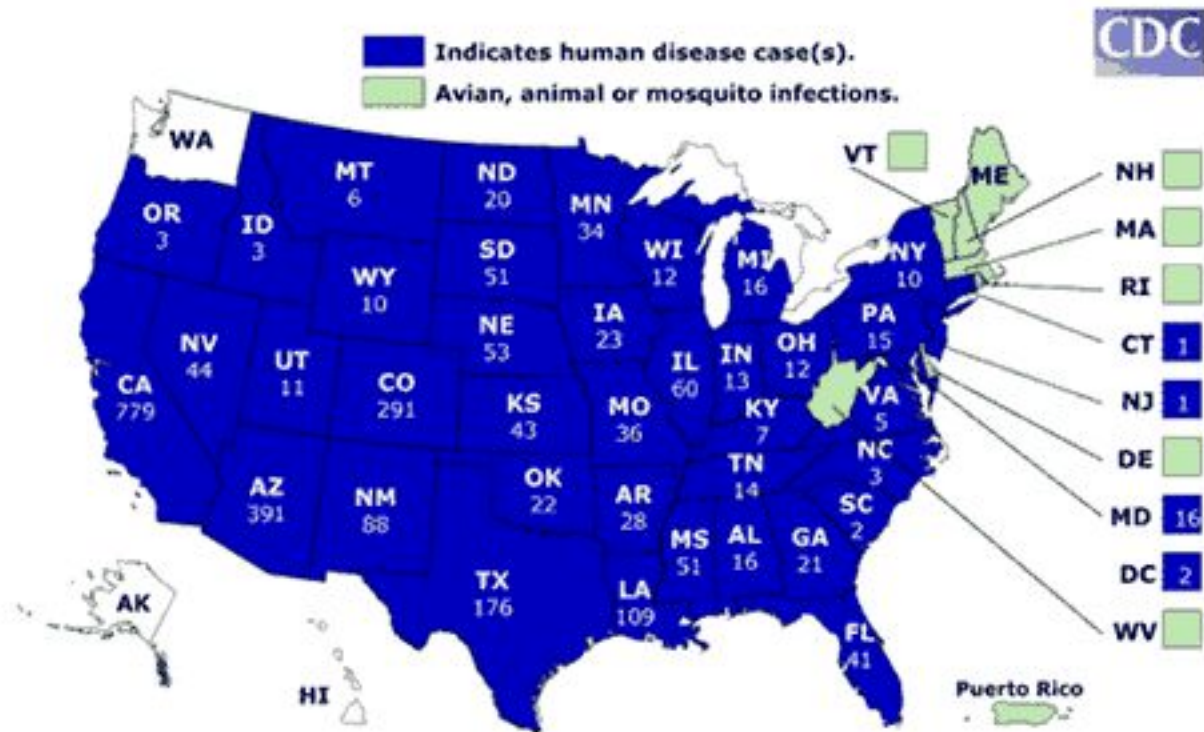
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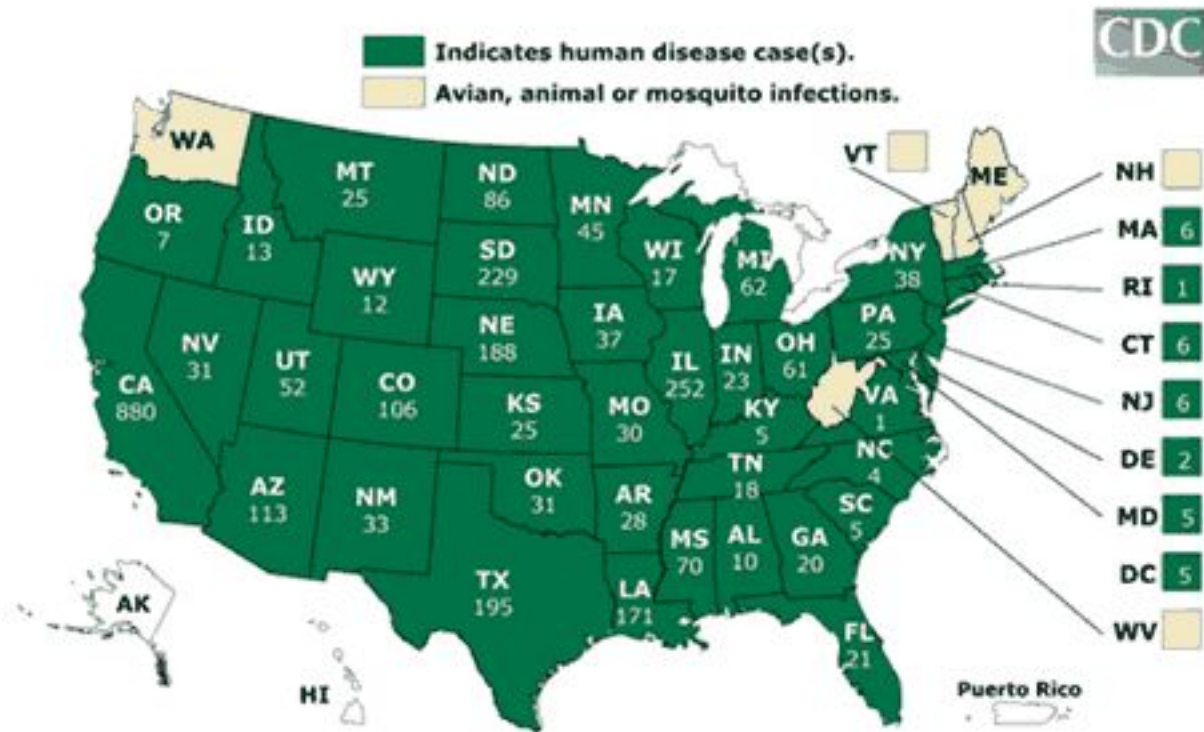
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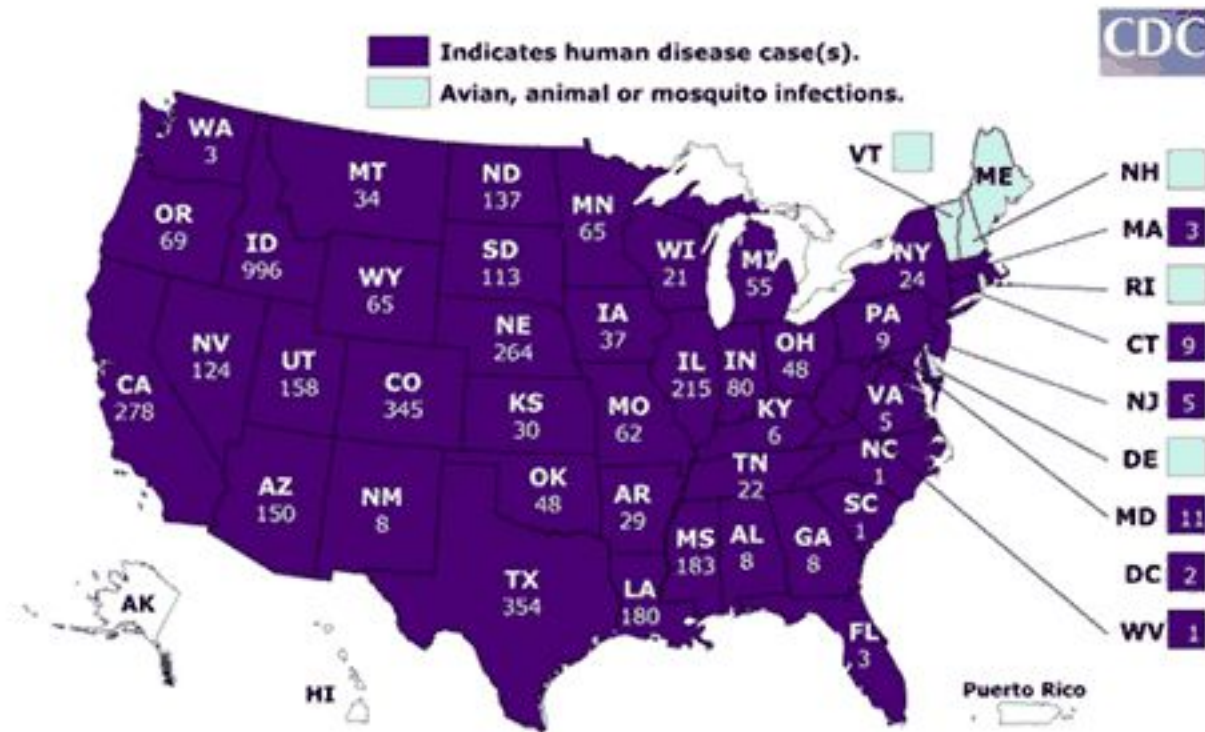
2004



2005



2006



How is West Nile virus infection treated?

As with other viral diseases for which there is no vaccine, West Nile virus infection has no specific treatment. Milder cases are usually self-limiting. Patients with encephalitis or meningitis are hospitalized, given intravenous fluids and respiratory support if necessary. These severe forms of West Nile virus infection are often life-threatening and require intensive medical treatment.

Is there a vaccine for West Nile virus?

There is a vaccine available to prevent West Nile virus infection in horses but not people. There are several initiatives in progress at present to develop a vaccine.

How can I prevent infection with West Nile virus?

Personal protection measures that prevent mosquito bites are key to reducing your risk. Eliminate potential mosquito breeding sites near your home by emptying containers that hold standing water. Your local government may have a mosquito control plan in place to eliminate mosquito breeding sites in public facilities such as stormwater drains and reservoirs.

Additionally, you should take measures to prevent mosquito bites. Insect Shield® Repellent Apparel is proven and registered to repel mosquitoes—including those that can carry West Nile virus.

Yellow Fever

Overview

Yellow fever is a viral disease found only in the forests of South America and the wet savanna areas of West and Central Africa. It is passed between people (and other primates) by mosquitoes. Hundreds of thousands of people become infected during epidemics in Africa—unfortunately, these epidemics have grown increasingly more common in both Africa and South America over the past 20 years.

There are two types of yellow fever. Jungle yellow fever is primarily a disease passed between mosquitoes and monkeys. It is rare in people, but occasionally affects workers in tropical rain forests.

Urban yellow fever is carried from person to person by mosquitoes. Found in cities and villages, it is the cause of most yellow fever outbreaks and epidemics.

Yellow fever infection can cause a mild flu-like illness, but symptoms can be more severe, including high fever, chills, headache, muscle aches, vomiting and backache. Severe hepatitis, hemorrhagic fever, as well as kidney and liver failure can also result—in fact, the disease was named for the jaundice (yellowing of the skin) caused by this liver failure.

Most mosquitoes that carry the disease pose more of a threat in the evening—yet the mosquitoes that spread yellow fever usually bite during the day. While this viral disease rarely affects travelers, daytime protection against mosquitoes is more important when visiting areas where there is a threat of yellow fever exposure.

Yellow fever vaccinations are necessary before gaining entry to many countries. According to the Centers for Disease Control and Prevention (CDC), yellow fever vaccination recommendations changed in 2002. For more information about yellow fever, visit www.cdc.gov/ncidod/dvbid/yellowfever/index.htm.

Detailed information:

What is yellow fever and how is it transmitted?

Yellow fever is caused by a virus that is transmitted by mosquitoes, and occurs in Africa and South America. The disease vectors in Africa are *Aedes aegypti*, *Aedes simpsoni* and *Aedes africanus*. In South America, the vectors are of the *Haemagogus* genus. The virus is a member of the *Flaviviridae* family, which also includes the West Nile virus, as well as the viruses that cause dengue, hepatitis C and several other insect-borne viruses.



Yellow fever endemic zones in Africa, 2007 (Source: CDC)



Yellow fever endemic zones in South America, 2007 (Source: CDC)

Over 200,000 cases of yellow fever are reported annually—90% of which are in Africa.

There are three transmission cycles for yellow fever: sylvatic, intermediate and urban. All three cycles exist in Africa; in South America, only sylvatic and urban cycles occur.

In the sylvatic, or jungle cycle, the yellow fever virus is transmitted between primates. People are infected when they interrupt this cycle by entering jungle habitats.

The intermediate cycle occurs in humid or semi-humid savannas of Africa. Small-scale epidemics occur in many separate villages at the same time, but few people die. Mosquitoes infect both primates and people. The urban cycle occurs when the virus is introduced into urban areas by migrants from endemic areas. In this cycle, the virus is transmitted from person to person, and no primate hosts are involved.

After infection, an incubation period of 3 to 6 days occurs, during which the patient experiences no symptoms. In some infections, no symptoms ever develop. In others, the patient suffers high fever, muscle pain with backache, headache, nausea, vomiting and loss of appetite. In most cases, symptoms abate after 3 to 4 days, and the patient returns to normal. In approximately 15% of cases, the patient progresses to a toxic phase 24 hours after apparent recovery, experiencing jaundice, severe abdominal pain, vomiting, bleeding from the mouth, nose, eyes and stomach—even kidney failure. Of the patients that progress to this stage, 50% die within 14 days; the remainder recover.

Is there yellow fever in the United States?

Yellow fever has been eradicated in the United States.

How is yellow fever treated?

As it is a viral disease, there is no specific treatment for yellow fever. Patients may receive supportive care such as rehydration and antibiotics for secondary infections.

Is there a vaccine for yellow fever?

Yes, a highly effective and safe vaccine is available for children over nine months old and adults. It confers immunity against the yellow fever virus for ten years. Unfortunately this vaccine is not available for the majority of the people who need it in developing countries. In the few countries that have been able to institute mass vaccination programs, yellow fever has been eradicated.

I'm traveling to an area where there is yellow fever. How can I protect myself?

You may be required to present proof of yellow fever vaccination prior to entering the country you're visiting. For more information, visit the U.S. Centers for Disease Control and Prevention online, <http://wwwn.cdc.gov/travel/default.aspx>

Additionally, you should take measures to prevent mosquito bites. Insect Shield® Repellent Apparel is proven and registered to repel mosquitoes—as well as ticks, ants, flies and chiggers. The U.S. Environmental Protection Agency (EPA) requires extensive effectiveness data to prove a product's ability to repel insects. Many species and varieties of these insects have been tested, including those that carry dangerous diseases such as yellow fever. Travelers across the globe have experienced the benefits of wearing Insect Shield apparel in areas where insect-borne diseases are endemic.

Zika virus

Fact sheet WHO organization

Updated February 2016

Key facts

- Zika virus disease is caused by a virus transmitted by *Aedes* mosquitoes.
 - People with Zika virus disease usually have symptoms that can include mild fever, skin rashes, conjunctivitis, muscle and joint pain, malaise or headache. These symptoms normally last for 2-7 days.
 - There is no specific treatment or vaccine currently available.
 - The best form of prevention is protection against mosquito bites.
 - The virus is known to circulate in Africa, the Americas, Asia and the Pacific.
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Introduction

Zika virus is an emerging mosquito-borne virus that was first identified in Uganda in 1947 in rhesus monkeys through a monitoring network of sylvatic yellow fever. It was subsequently identified in humans in 1952 in Uganda and the United Republic of Tanzania. Outbreaks of Zika virus disease have been recorded in Africa, the Americas, Asia and the Pacific.

- Genre: Flavivirus
- Vector: *Aedes* mosquitoes (which usually bite during the morning and late afternoon/evening hours)
- Reservoir: Unknown

Signs and Symptoms

The incubation period (the time from exposure to symptoms) of Zika virus disease is not clear, but is likely to be a few days. The symptoms are similar to other arbovirus infections such as dengue, and include fever, skin rashes, conjunctivitis, muscle and joint pain, malaise, and headache. These symptoms are usually mild and last for 2-7 days.

Potential complications of Zika virus disease

During large outbreaks in French Polynesia and Brazil in 2013 and 2015 respectively, national health authorities reported potential neurological and auto-immune complications of Zika virus disease. Recently in Brazil, local health authorities have observed an increase in Guillain-Barré syndrome which coincided with Zika virus infections in the general public, as well as an increase in babies born with microcephaly in northeast Brazil. Agencies investigating the Zika outbreaks are finding an increasing body of evidence about the link between Zika virus and microcephaly. However, more investigation is needed to better understand the relationship between microcephaly in babies and the Zika virus. Other potential causes are also being investigated.

Transmission

Zika virus is transmitted to people through the bite of an infected mosquito from the *Aedes* genus, mainly *Aedes aegypti* in tropical regions. This is the same mosquito that transmits dengue, chikungunya and yellow fever.

Zika virus disease outbreaks were reported for the first time from the Pacific in 2007 and 2013 (Yap and French Polynesia, respectively), and in 2015 from the Americas (Brazil and Colombia) and Africa (Cape Verde). In addition, more than 13 countries in the Americas have reported sporadic Zika virus infections indicating rapid geographic expansion of Zika virus.

Diagnosis

Infection with Zika virus may be suspected based on symptoms and recent history (e.g. residence or travel to an area where Zika virus is known to be present). Zika virus diagnosis can only be confirmed by laboratory testing for the presence of Zika virus RNA in the blood or other body fluids, such as urine or saliva.

Prevention

Mosquitoes and their breeding sites pose a significant risk factor for Zika virus infection. Prevention and control relies on reducing mosquitoes through source reduction (removal and modification of breeding sites) and reducing contact between mosquitoes and people.

This can be done by using insect repellent; wearing clothes (preferably light-coloured) that cover as much of the body as possible; using physical barriers such as screens, closed doors and windows; and sleeping under mosquito nets. It is also important to empty, clean or cover containers that can hold water such as buckets, flower pots or tyres, so that places where mosquitoes can breed are removed.

Special attention and help should be given to those who may not be able to protect themselves adequately, such as young children, the sick or elderly.

During outbreaks, health authorities may advise that spraying of insecticides be carried out. Insecticides recommended by the WHO Pesticide Evaluation Scheme may also be used as larvicides to treat relatively large water containers.

Travellers should take the basic precautions described above to protect themselves from mosquito bites.

Treatment

Zika virus disease is usually relatively mild and requires no specific treatment. People sick with Zika virus should get plenty of rest, drink enough fluids, and treat pain and fever with common medicines. If symptoms worsen, they should seek medical care and advice. There is currently no vaccine available.

WHO response

WHO is supporting countries to control Zika virus disease through:

- Define and prioritize research into Zika virus disease by convening experts and partners.
- Enhance surveillance of Zika virus and potential complications.
- Strengthen capacity in risk communication to help countries meet their commitments under the International Health Regulations.

- Provide training on clinical management, diagnosis and vector control including through a number of WHO Collaborating Centres.
- Strengthen the capacity of laboratories to detect the virus.
- Support health authorities to implement vector control strategies aimed at reducing *Aedes* mosquito populations such as providing larvicide to treat standing water sites that cannot be treated in other ways, such as cleaning, emptying, and covering them.
- Prepare recommendations for clinical care and follow-up of people with Zika virus, in collaboration with experts and other health agencies.