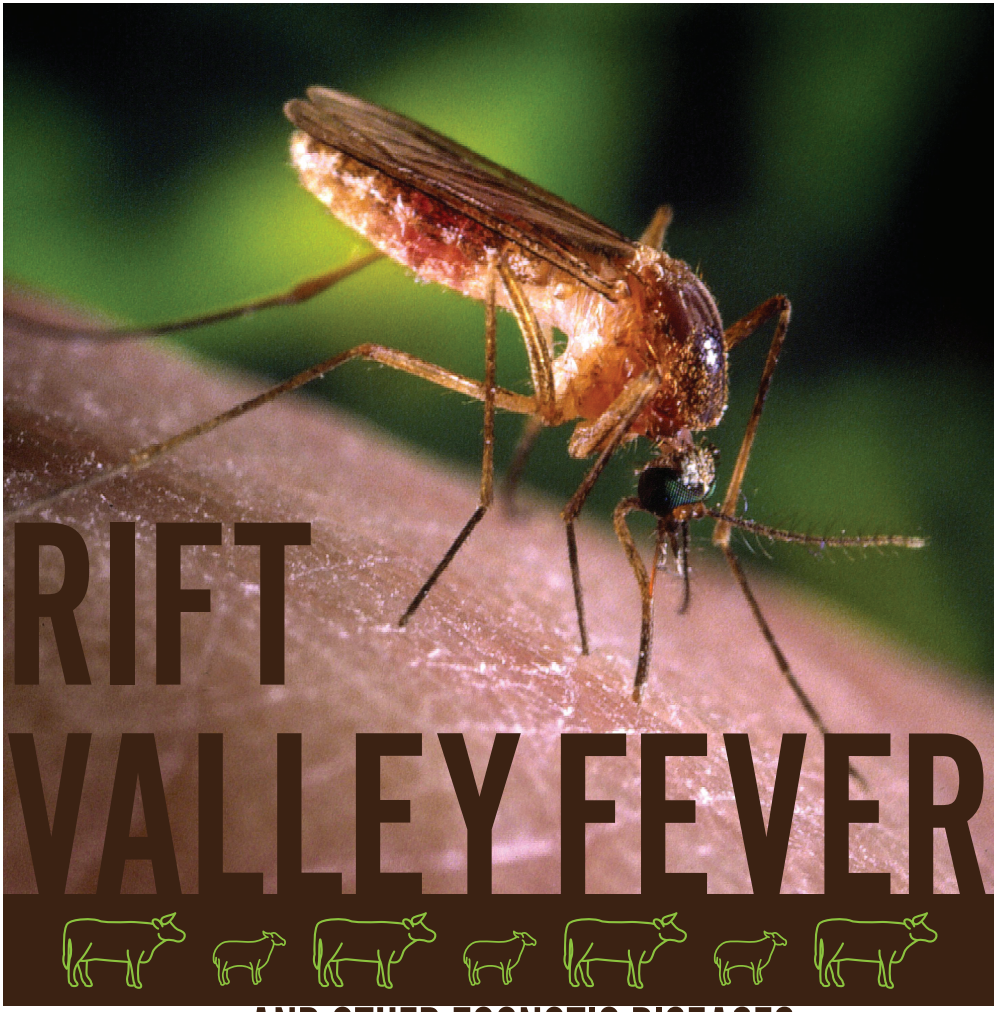

RIFT VALLEY FEVER

AND OTHER ZOONOTIC DISEASES

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

EcoHealth Alliance

Rift Valley Fever and Other Zoonotic Diseases

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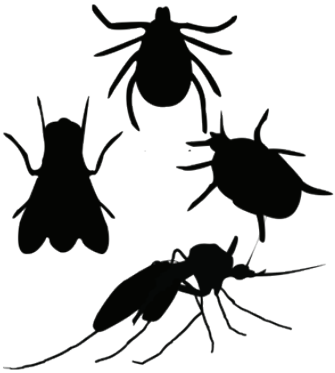
Part I: What are arboviruses?



Examples of arthropods: tick, mite, mosquito, fly.

Arboviruses are viruses which are spread through the bite of arthropods and can cause disease.

A virus cannot live on its own, but needs to be inside a living being -or host- in order to survive, grow, and multiply. Many viruses rely entirely upon biting arthropods -or vectors- to be carried from animal to animal (or people). These viruses are specially equipped to enter and infect both cold-blooded vectors and warm-blooded host animals (or people). These viruses are named ARBOVIRUSES, from the words ARthropod BOrne VIRUSES.

Arthropods that have six legs are called insects and include mosquitoes, flies, midges, sandflies, lice, and fleas. Ticks and mites are arthropods with eight legs. Ticks and some mites and insects can feed on the blood of animals and people. While the arthropod is taking its "blood meal", certain viruses and other germs can move from its saliva into the blood of an animal or human. Such an arthropod is named a vector.

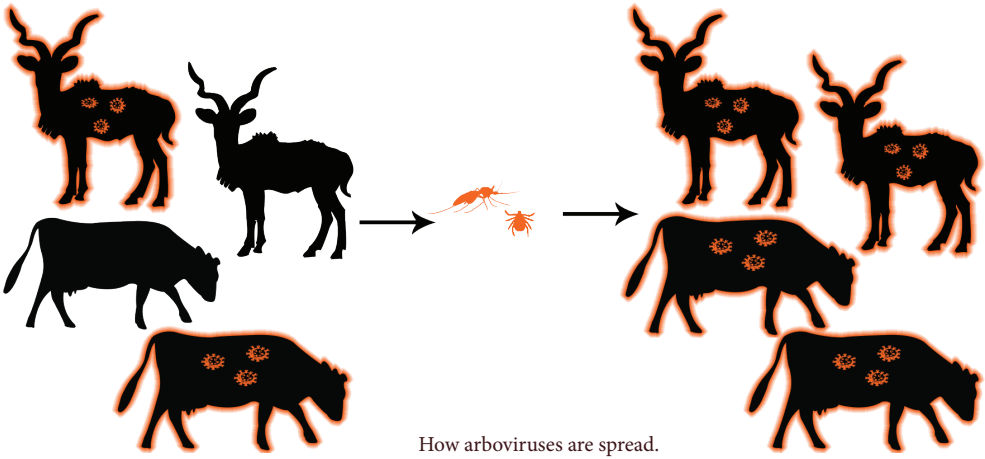
Different vectors prefer to feed on certain host species more than others. For example, some mosquitoes will seek blood from birds, some from a particular kind of mammal or reptile, and others are generalist feeders that will bite any host (birds, mammals or people). Different types of arboviruses have adapted to live in a particular host and vector. Sometimes these arboviruses adapt to infect more than one host and/or vector.

Most viruses have one or more animal hosts. Amplifying host animals can be wild or domestic animals. This enables viruses to increase in number, yet often remain undetected in animals for long periods of time. Whether infected livestock or domestic animals show noticeable signs of disease can vary by species, breed, or age. Animals and people show signs of sickness if they have less defense against that particular virus. Even though the host animals seem to be well, if they are infected, they can serve to spread the virus to more vectors and therefore more hosts, including people.

Vectors spread infection during feeding.

An outbreak occurs when many animals or humans become sick and/or die from the same disease at the same time. Often young animals and exotic breeds will get sicker from infection than adult or native animals. Some animals will act as amplifying hosts of the virus, meaning that there is enough virus in the blood that it can be passed into a different arthropod that is not infected. The infected vector may then go on to bite and feed on more animals, thereby spreading the virus to more animals and arthropods. When infected mosquitoes bite people or animals, the people and/or animals may become sick.

Female mosquitoes bite many animals during their lives and use the blood to produce eggs. As ticks become adults, they can feed on up to three different hosts to lay eggs. Ticks are dependent on host blood for survival, growth and producing eggs. When there are more mosquitoes or ticks present to transmit the virus, the greater the risk is that an animal or person will be bitten by an infected mosquito or tick. For example, after a lot of rain many mosquitoes hatch and more animals are bitten which spreads the virus to more animals and more mosquitoes. Similarly, the more animals or people infected with a particular virus, the higher chance the virus can be spread to other animals and arthropods.



How arboviruses are spread.

Rift Valley, West Nile, Sindbis, chikungunya, and Congo fevers are all caused by arboviruses present in South Africa. The mosquitoes and ticks that spread these viruses, except chikungunya virus, are naturally found in different parts of South Africa. The infections typically occur as outbreaks or single cases in South Africa. Most of these viruses were named after the place where they were first discovered.

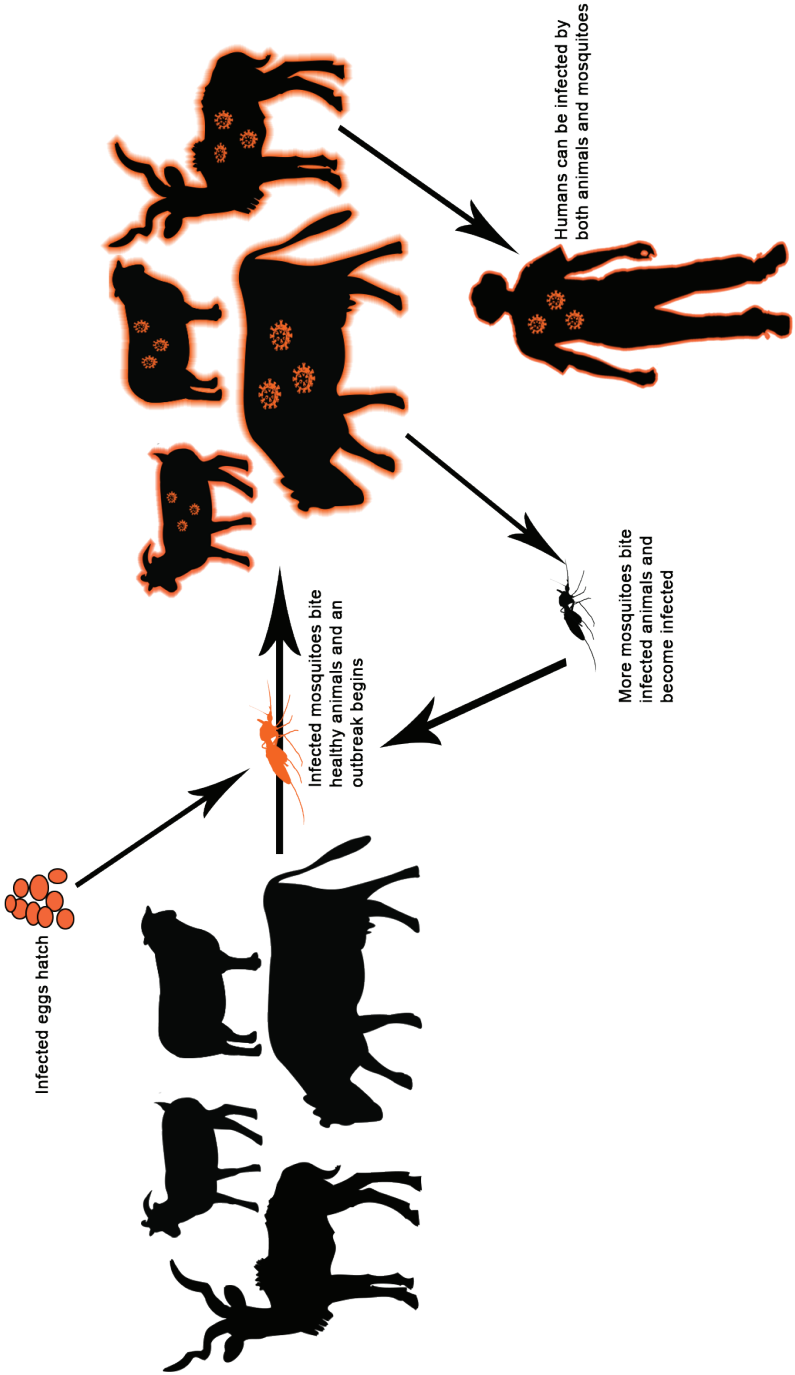
What is Rift Valley Fever?

The Rift Valley fever virus is spread by the bite of certain mosquitoes. The most common hosts affected by Rift Valley fever virus are livestock (cattle, sheep, goats, and camels) and wildlife ruminants (i.e. African buffalo). The virus can persist in the eggs of floodwater mosquitoes for long periods of time. During heavy rains and floods, the eggs hatch and the infected mosquitoes spread the virus to livestock, triggering an outbreak. People may also be affected.

Most animal outbreaks of Rift Valley fever are first noticed because there is a sudden storm of abortions amongst sheep, goats and cattle. Sudden death and sickness can occur in animals of all ages and all three species. Young animals (particularly lambs) of susceptible breeds may all die. Older animals may suffer from a fever and have discharge from the nose and eyes. Other signs include: excessive foul smelling and often bloodstained diarrhoea, stomach pain, extreme physical weakness, jaundice (a yellow discolouration of the skin and the whites of the eyes), and a sudden drop in milk production by dairy cattle. At the same time or shortly after, an influenza-like illness can occur among people working with livestock. Animal or human outbreaks can last for several months.

Different types of vaccines are available for animals and can be applied preventively. The most effective vaccines with the least side effects are live but weakened -or attenuated- vaccines. The Smithburn vaccine, produced in South Africa, has been successfully used to prevent and control the disease. While this inexpensive vaccine does not require boosting, and can protect the livestock for several years, the manufacturer recommends annual revaccination. Although the virus has been weakened in this vaccine, it can still cause harm and therefore it should not be given to very young or gestating livestock. Another live-attenuated vaccine, Clone 13, has been registered in South Africa since 2013. It also is quite protective with fewer side effects and similarly only needs one dose with recommended annual boosting. There is also a totally inactivated vaccine that is safe to use in pregnant or young livestock; however, livestock then require boosters and annual revaccination to remain protected.

People are also easily infected, but usually not through mosquito bites. People typically get Rift Valley fever directly from animals by handling raw meat during slaughtering, butchering or skinning of animals, assisting with animal births, carrying out veterinary procedures, or disposing dead animals. Less common ways for people to be infected from animals include: inoculation (for example by getting a wound from an knife that has infected blood on it or accidental needle-stick when giving injections to the animals), animal fluids coming into contact with broken



The transmission cycle of a Rift Valley fever outbreak.

skin, breathing in aerosols (small droplets of blood or other fluids), and drinking raw (unpasteurised or uncooked) milk. There is no evidence that Rift Valley fever virus can be spread directly from one person to another.

There is no specific treatment for Rift Valley fever in people or animals infected with the disease. Most people recover in a week on their own, with rest, drinking a lot of fluids and taking painkillers to treat the symptoms. However, some people have serious complications and require admission to a hospital where they can receive supportive care for eye problems, inflammation/swelling of the brain, bleeding, and liver damage. A small number of people with the infection may die due to these complications or late recognition of the disease. There are no vaccines to prevent Rift Valley fever in people. To avoid getting Rift Valley fever from animals, overalls, gloves, aprons and goggles should be used when working with the blood, tissues or carcasses of animals.

The best way to prevent and control Rift Valley fever outbreaks is by the vaccination of animals and through surveillance, which is the close monitoring and quick detection of infected animals and people. Monitoring rainfall patterns, for example excessive rainfall, can warn farming communities of possible imminent outbreaks.

Major Rift Valley fever outbreaks have mostly occurred on the inland plateau of South Africa in 1950, 1974, 2008, and 2010-11. Smaller outbreaks have occurred throughout the rest of the country. The most recent outbreak, involving a large number of cases in people (278 cases and 25 deaths), occurred in 2010-11 over the inland plateau and the Cape Provinces.

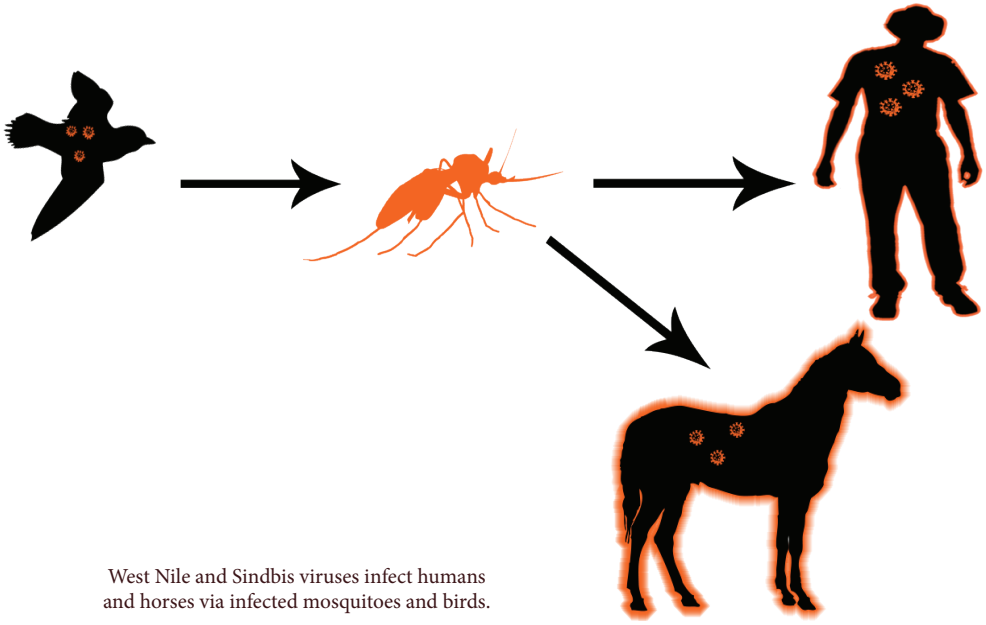
What are West Nile and Sindbis fever?

Both West Nile and Sindbis viruses are bird viruses that are occasionally passed on to people through mosquitoes. Most wild and domestic birds do not show signs of disease while infected with these arboviruses, with the exception of certain species including geese and crows.

Horses are susceptible to West Nile virus. It usually presents with signs like colic, loss of coordination, paralysis, fever, and refusal to eat. Horses can be vaccinated against West Nile virus with a fully licensed vaccine available in South Africa. Sindbis virus is not known to cause disease in animal hosts.

People commonly get infected with West Nile or Sindbis viruses by the bite of an infected mosquito. These viruses are not directly spread through animal-to-person or person-to-person contact. The mosquitoes that carry the virus bite from dusk until dawn, especially during the summer months.

A small percentage of people infected with West Nile virus will develop severe disease, including: high fever, headache, stiff neck, disorientation, coma, quivering, fits, muscle weakness, loss of eyesight, numbness and loss of ability to move or feel anything. These symptoms may last several weeks, and the effects on the nerves and the brain may be permanent. Sindbis fever is characterised by fever, rash, joint and muscle pain, and extreme tiredness. The joint pain can persist for months to years in cases of severe Sindbis fever.



West Nile and Sindbis viruses infect humans and horses via infected mosquitoes and birds.

There is no specific treatment or vaccine for West Nile or Sindbis fever in people. Doctors may treat the symptoms of infected patients, but little more can be done.

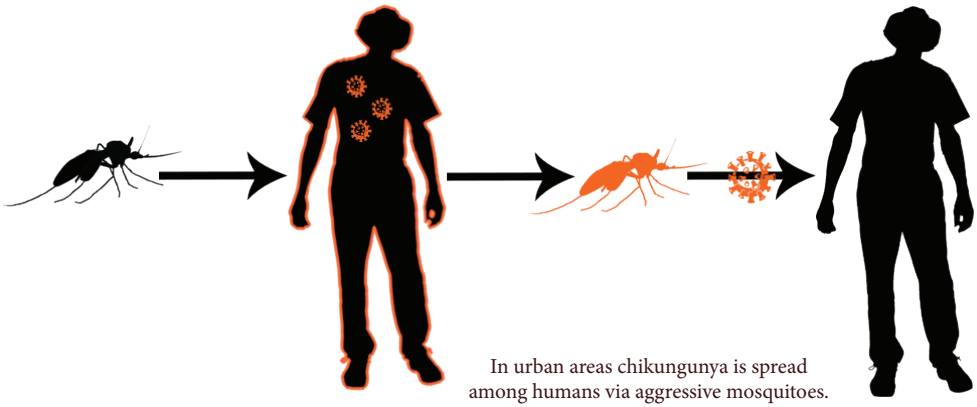
The best way to prevent infection with West Nile and Sindbis virus is to prevent mosquito bites as far as possible. The following are easy ways to prevent mosquito bites and infection: wearing long-sleeved, light coloured clothing; applying mosquito repellent on uncovered skin; reducing time outdoors at night when mosquitoes are most active; avoiding the use of perfumes or fragranced soaps; using door and window screens to prevent mosquitoes getting inside; and removing sources of stagnant water where mosquitoes can breed.

In South Africa, the largest outbreak of West Nile occurred in 1974 with more than ten thousand cases in the Karoo. An outbreak in people and animals also occurred in 1983-84 in the Witwatersrand, affecting hundreds of people. A marked increase in West Nile fever was seen in people in 2010. These outbreaks mainly caused fever with no deaths or severe disease recorded. Every year cases of West Nile fever are reported even though no major outbreaks have occurred recently.

Cases of Sindbis fever are also reported in South Africa every year. It mostly occurs in Gauteng, the Free State and Northern Cape Provinces, and along the Orange River where high temperatures and irrigation for agriculture have created favourable conditions for the mosquito vectors during the summer. Three major outbreaks have been documented in South Africa. In 1974 a large epidemic involving thousands of cases in the Karoo and Northern Cape occurred, likely due to unexpectedly high temperatures and rainfall. Epidemics have also occurred in the Pretoria/Witwatersrand region during 1984 and again in 2010 after a quiet period of nearly 30 years. Sindbis and West Nile fever outbreaks commonly occur at the same time as Rift Valley fever outbreaks.

What is chikungunya fever?

Chikungunya is likely maintained between forest-dwelling mosquitoes and monkeys, baboons and chimpanzees. It is not known to infect livestock or ruminant wildlife. In forested, rural areas cases occasionally occur in people. However, where there are more people living in close quarters in and around cities and towns the virus can be transmitted from mosquitoes to people directly, and back again, causing large outbreaks as in Southeast Asia and Central America. Aggressive mosquitoes that bite mostly during the day, but also at dusk and dawn, are responsible for the spread of chikungunya in these urban areas.



In urban areas chikungunya is spread among humans via aggressive mosquitoes.

Chikungunya comes from the Makonde language (spoken in southern Tanzania and northern Mozambique) words for "to walk bent over," describing the stooped appearance of those suffering from intense joint pain. In addition to severe joint pain or stiffness, it can also cause sudden fever, rash, muscle pain, headache, nausea, and extreme tiredness. Most people fully recover from chikungunya and cannot be infected again. However, the pain may last for weeks or recur months later. In up to 15% of cases, it may become chronic, with the symptoms lasting for years.

There is currently no specific cure or vaccine for chikungunya. Treatment, like with the other arboviruses, is aimed at relieving symptoms.

The easiest and best way to avoid catching chikungunya infection is to prevent mosquito bites in ways similar to those described above for West Nile and Sindbis. Chikungunya is rare in South Africa: only localised small outbreaks have occurred in the Phalaborwa region in Limpopo during 1956, in Ndumo in KwaZulu-Natal in 1964, and in the Mica region in Limpopo in 1975-76. Since those outbreaks, South Africa has reported only a few cases each year.

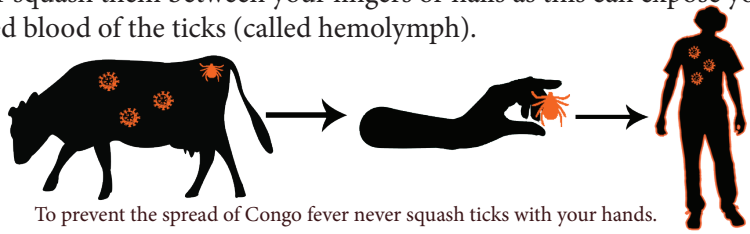
What is Congo fever?

Congo fever (also called Crimean-Congo haemorrhagic fever) is caused by an arbovirus that is spread by the bont-legged tick, the *Hyalomma* found in the central plateau of the Free State, Northern Cape and North West Provinces. Many animals can be infected with the Congo virus, but they do not show noticeable disease, with the exception of ostriches. Controlling ticks on livestock by dipping or pour-on drugs will decrease the exposure risk to people working with them.

Often people are infected directly from tick bites. Sometimes, the virus gets spread to people directly from infected (but not sick) livestock during slaughter. Farmers, abattoir workers, and butchers from inland South Africa are at the highest risk of getting Congo fever. The virus can also be spread from person-to-person when in contact with infected blood or other bodily fluids. People severely affected will develop "haemorrhagic fever" that is characterised by a sudden onset of fever, headache, muscle pain, backache and joint pain, abdominal pain and vomiting, followed by bleeding underneath the skin, from nose or mouth. It is not known whether people can also experience a mild illness with Congo fever because only the severe cases are reported and studied.

People suffering from Congo fever must be cared for in a hospital isolation ward. In the early days of illness, an antiviral treatment (Ribavirin) may be effective. However, as with most arboviruses, the treatment is mainly of the symptoms and management of complications associated with Congo fever.

Regularly checking yourself for ticks if you have been out walking or working near animals can prevent infection. Wear long trousers in tick-risk areas and tuck trousers legs into socks. Remove ticks by grasping their body as close to the skin as possible with a pair of fine-tipped tweezers and pulling straight up with steady pressure. Do not twist the tick while pulling it. Never remove ticks from hooved animals and never squash them between your fingers or nails as this can expose your skin to the infected blood of the ticks (called hemolymph).

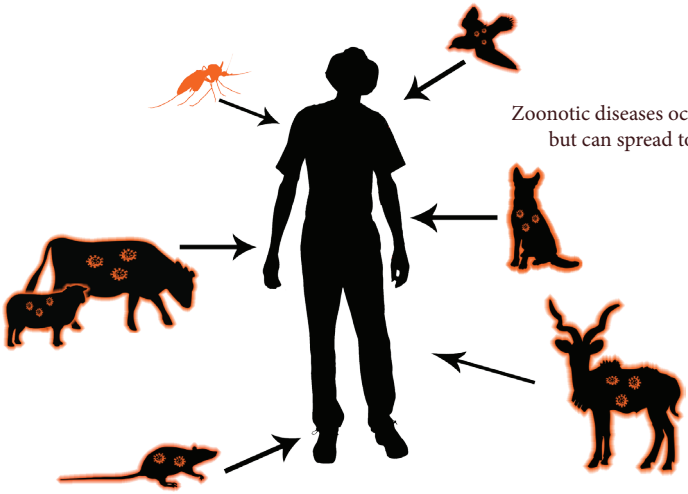


To prevent the spread of Congo fever never squash ticks with your hands.

While there are cases of Congo fever reported in South Africa most years, focal points of direct, animal-to-human spread was recorded in a farm in the Orange Free State in 1984 (5 cases, 1 fatal). A person-to-person outbreak spread at a hospital near Cape Town, Western Cape (8 cases, 2 fatal) in 1984. One larger outbreak occurred in 1996 (17 cases, 1 fatal) at an ostrich abattoir in Oudtshoorn, Western Cape.

Part II: What are zoonotic diseases?

Zoonotic diseases are diseases that usually occur in animals, but can be passed to people. Arboviruses and bacteria, among others, cause zoonotic diseases. Some zoonotic diseases can spread directly to people who do not protect themselves from contact with bodily fluids of infected animals. Farmers, farm and abattoir workers, and veterinary personnel are at higher risk of getting zoonotic diseases. Some zoonotic diseases can continue to spread directly from one person to another person.

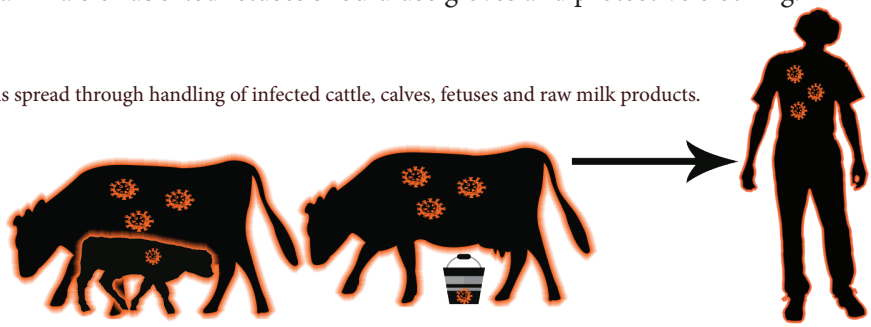


Zoonotic diseases occur in animals but can spread to humans.

What is Brucellosis?

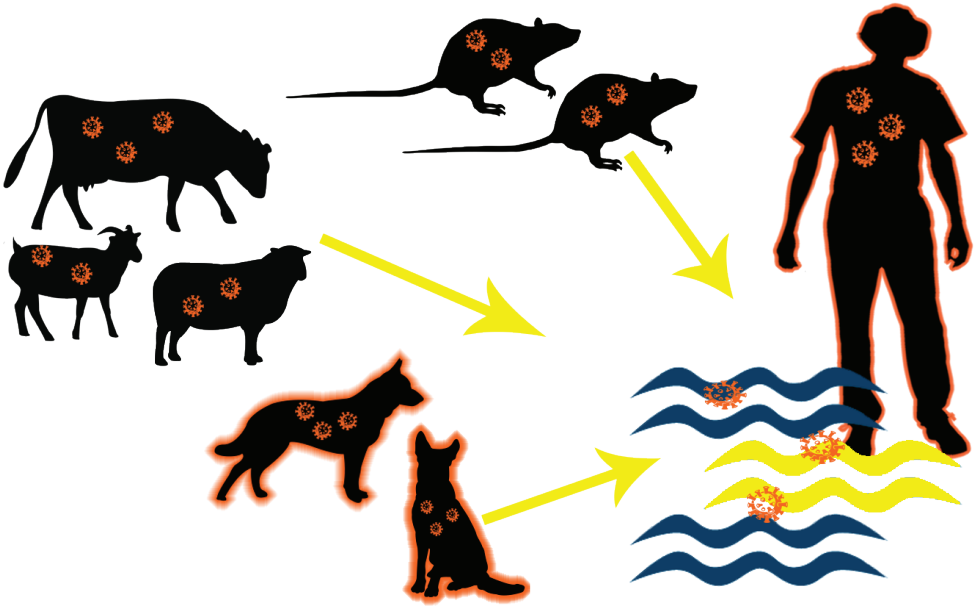
The *Brucella* bacteria cause brucellosis or 'contagious abortion' in cattle and other animals. A vaccine to prevent it is available for cattle, but not for people. Brucellosis can be passed on to people by contact with infected animals or drinking raw, unpasteurised/unboiled milk. In people, brucellosis causes fever, headache, weakness, sweating, chills, muscle aches and joint pain. The symptoms can last a long time if not treated properly. Treatment requires antibiotics for 6 weeks or more. People should only consume pasteurized/boiled milk and those working with infected animals or aborted fetuses should use gloves and protective clothing.

Brucellosis is spread through handling of infected cattle, calves, fetuses and raw milk products.



What is Leptospirosis?

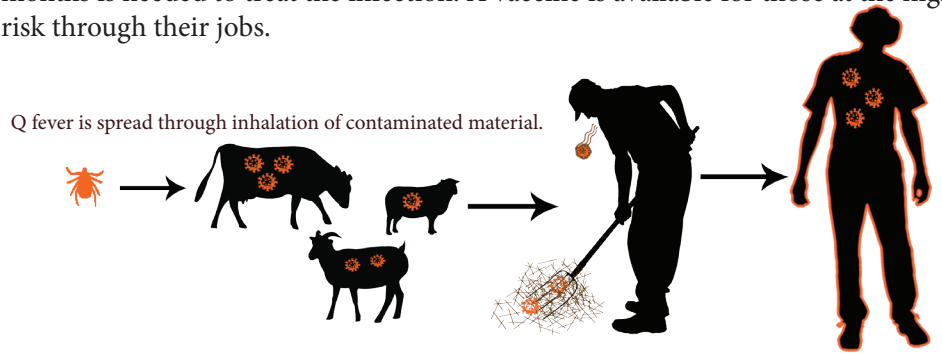
Leptospirosis, caused by the *Leptospira* bacteria, is spread by contact with water, soil or vegetation that was contaminated by the urine of infected animals, especially rats. Animals infected with *Leptospira* can also be sick; they may have fever, loss of appetite, decreased milk production, and sporadic abortions. In people, it causes fever, headache, chills, muscle pains, diarrhoea and skin rash. Sometimes, there can be serious complications, like bleeding, inflammation of the brain and liver or kidney damage. Leptospirosis can be treated with antibiotics. People should avoid swimming or wading in water that might be contaminated. People working with animals should wear protective clothing.



Leptospirosis is transmitted through contaminated water, soil and vegetation.

What is Q fever?

Q (or Query) fever is caused by "*Coxiella*", a bacterial infection, which is spread in animals by ticks, or breathing in contaminated material such as dust or dried waste from infected animals. Most animals will have no signs of sickness, but occasionally may have spontaneous abortions. People are infected in a similar way through breathing dust from the dried waste of infected animals. This means that farmers, abattoir workers and veterinary staff are at the greatest risk. Symptoms of the infection can seem like the flu at first with fever, tiredness, muscle pain, headache and a dry cough. Some people can develop serious complications, such as chest infection (pneumonia), liver or heart damage. A course of antibiotics for several months is needed to treat the infection. A vaccine is available for those at the highest risk through their jobs.



What is Tick bite fever?

Tick bite fever is caused by *Rickettsia* bacteria following the bite of infected bont ticks, *Amblyomma*. These ticks are common in Mpumalanga/Limpopo lowveld and in Kwazulu-Natal and usually feed on cattle and game without causing sickness in them. People that work in rural areas below the escarpment with animals or visit these areas are at greatest risk of infection.

People who have been bitten by an infected tick begin to feel sick with fever, tiredness, headache, muscle aches and pains. A black scab with redness around it -or eschar- is often present at the site of the tick bite, and more than one may appear on the body. In some cases a scattered rash on the trunk of the body, palms of the hands, or soles of the feet can develop. Most cases experience mild to moderate illness, but some people do get severely ill. Complications can include confusion, inflammation and swelling of the brain (encephalitis), chest infection (pneumonia), bleeding, heart problems and organ failure.

The start of the illness can be similar to other infections, so doctors may want to rule out malaria, typhoid or Congo fever. Tick bite fever can be treated with the use of antibiotics.

Part III: Appendix

Glossary

Arthropod: an invertebrate with segmented body, jointed limbs, and usually a shell; includes insects, spiders, ticks, and mites.

Attenuated: a vaccine in which the strength of the virus or bacteria has been reduced while still keeping it alive.

Bacteria: microscopic living organisms, usually one-celled, that can be found everywhere. They can be dangerous, such as when they cause infection, or beneficial, as in the process of fermentation (such as in wine).

Eschar: a hard crust or scab on the skin.

Host: the organism in or on which a germ lives.

Amplifying host: a host in which germs multiply rapidly to high levels, providing an important source of infection for vectors.

Dead-end host: a host from which germs cannot be transmitted to other susceptible hosts.

Outbreak: an increase in the number of disease cases.

Spillover: when an infection spreads from an animal to a person.

Surveillance: continuous monitoring for the occurrence of a disease within a population.

Vector an arthropod (tick, mite, mosquito, fly) capable of spreading a germ.

Arboviruses	Spread	Animal Symptoms	Animal Vaccine	Prevention	Human Symptoms	Onset	Treatment
Rift Valley Fever	Mosquitoes; animal to human via handling of fluids and/or drinking raw milk	Sudden abortions, fever, discharge, diarrhoea, vomiting, weakness, death	Available for animals; human vaccines being tested but not available for use	Use precautions and care when handling animal fluids which may be infected. Avoid mosquito bites by covering exposed skin, applying repellents, reducing time outdoors at night, using door/window screens, removing sources of stagnant water	Fever, headache, malaise, nausea and vomiting, rash, haemorrhage, encephalitis, retinitis; may be fatal	2-14 days	Symptom management
West Nile Fever	Mosquitoes; rarely human to human and only via blood transfusion	Colic, loss of coordination, paralysis, feed refusal, fever, abnormal reaction to aural, visual and tactile stimuli, death	Available for horses; none for humans	Avoid mosquito bites by covering exposed skin, applying repellents, reducing time outdoors at night, using door/window screens, removing sources of stagnant water	Fever, headache, malaise, nausea and vomiting, rash, encephilitis, paralysis	2-14 days	Symptom management
Sindbis Fever	Mosquitoes	n/a	none	Avoid mosquito bites by covering exposed skin, applying repellents, reducing time outdoors at night, using door/window screens, removing sources of stagnant water	Fever, joint pain and stiffness, rash	3-12 days	Symptom management
Chikungunya Fever	Mosquitoes	n/a	none	Avoid mosquito bites by covering exposed skin, applying repellents, reducing time outdoors at night, using door/window screens, removing sources of stagnant water	Arthritis, rash, fever, fatigue, rarely haemorrhage; may be fatal	3-12 days	Symptom management
Congo Fever	Ticks; animal to human via handling of fluids, butchering; human to human	No noticeable disease; occasional mild fever	Available in some countries	Regularly checking for ticks; remove by grasping as close to the skin as possible (do not twist while pulling it off); do not squash ticks	Fever, malaise, weakness, headache, muscle pain, vomiting and diarrhea, rash, haemorrhage; may be fatal	1-12 days	Occasionally antivirals, but usually symptom management

Zoonoses	Spread	Animal Symptoms	Vaccine	Prevention	Human Symptoms	Onset	Treatment
Brucellosis	Animal to human via handling of fluids; drinking raw or unpasteurized milk and milk products	Contagious abortion, reduced milk yield	Available only for animals	Use gloves and protective clothing when working with animals; only consume pasteurized/treated milk	Fever, headaches, weakness, sweating, chills, muscle aches, joint pain/arthritis	5-60 days	Antibiotics
Leptospirosis	Contact with water, soil or vegetation contaminated by infected urine	Fever, anorexia, decreased milk production, soft and flabby udders, sporadic abortions	Available for animals; some limited types available for humans in certain areas	Avoid possibly contaminated water sources; wear protective clothing when working with animals	Fever, headache, chills, muscle pains, diarrhoea, rash; occasional serious complications of meningitis or liver and kidney damage; may be fatal	2-30 days	Antibiotics
Q Fever	Airborne, breathing contaminated tissues, fluids, and dust	No noticeable disease; occasional sporadic abortion	For people with high risk	Limit casual contact with potentially infected animals, properly dispose of infected materials	Fever, chills, headache, malaise, weakness, sweating; severe cases may develop hepatitis or endocarditis	3-30 days	Antibiotics
Tick Bite Fever	Ticks	n/a	none	Regularly checking for ticks; remove by grasping as close to the skin as possible (do not twist while pulling it off); do not squash ticks	Black scab with redness around bite site, fever, tiredness, headache, muscle aches and pains, occasional rash	5-10 days	Antibiotics