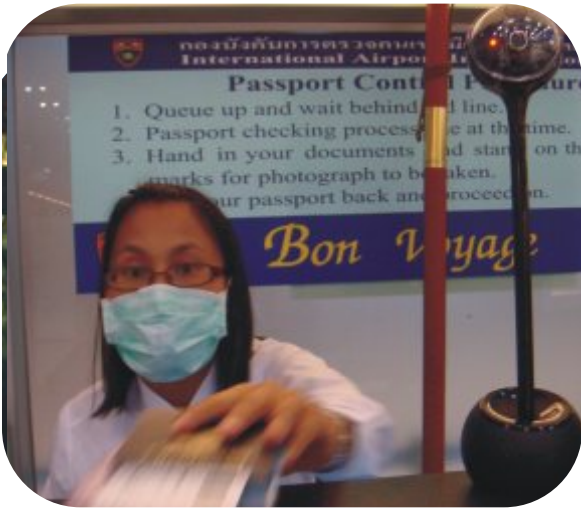


A brief guide to **emerging infectious diseases and zoonoses**



A brief guide to emerging infectious diseases and zoonoses



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Abbreviations

CCHF	Crimean-Congo haemorrhagic fever
EVD	Ebola virus disease
HFMD	hand, foot and mouth disease
HFRS	haemorrhagic fever with renal syndrome (hantavirus)
Hong Kong SAR	China, Hong Kong Special Administrative Region
HPS	hantavirus pulmonary syndrome
JE	Japanese encephalitis
MERS-CoV	Middle East respiratory syndrome coronavirus
NiV	Nipah virus
RVF	Rift Valley fever
SARS	severe acute respiratory syndrome
SARS-CoV	severe acute respiratory syndrome coronavirus
WHO	World Health Organization

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Preface



Emerging infectious diseases (EIDs) pose a significant threat to global health security. Past experience shows that outbreak of these diseases could not only potentially cause large numbers of human deaths as they spread, but also have huge social and economic impact in today's interconnected world. Unfortunately, many of these diseases do not yet have any cure, and health-care providers are also often victim of such diseases. During the past 30 years, more than 30 new organisms have been identified worldwide and many of them have originated at the level of human-animal interface.

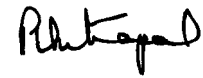
With increasing travel, trade and mobility of people worldwide, emerging infectious diseases can easily cross international borders, moving seamlessly from one population to another. The nature of such diseases and the need for a collective approach has clearly been demonstrated by SARS (severe acute respiratory infections), avian influenza and, more recently, Pandemic (H1N1) 2009. There are also some infectious diseases that have occurred in other parts of the world but have the potential to appear in the WHO South-East Asia Region; for example, Middle East respiratory syndrome coronavirus and Ebola virus disease.

International Health Regulations (2005) provides WHO Member States and the WHO Secretariat with a legally binding framework within which they can address issues of preparedness for, recognition of and response to acute public health risks including EIDs. Member States, WHO and partners are working together to build robust capacity to face the growing threats posed by EIDs.

Effective risk communication and management have a critical role to play to ensure that emerging infectious diseases are recognized early, promptly reported and appropriately managed. Awareness on recognition, prevention and control of EIDs and zoonoses is key at policy, professional and public levels for better preparedness and response during disease outbreaks. This guidebook serves as a valuable document in this regard.

While there are many documents on EIDs, this provides, in one publication, key technical information on EIDs to professionals and others who need such information quickly during an outbreak. Therefore, efforts have been made to ensure that the information provided here is accurate and substantial enough to provide the foundation

for decision-making. At the same time, it is presented in a way that is clearly understood by the general reader. Although this document is prepared for the WHO South-East Asia Region keeping in mind endemic, emerging and re-emerging infectious diseases and zoonoses that are affecting countries in the Region or pose a potential threat to them, I am confident that it is equally important and useful for other WHO regions.



Dr Poonam Khetrpal Singh
Regional Director

Introduction

From severe acute respiratory syndrome (SARS) to avian influenza A(H7N9), the twenty-first century has seen the emergence of many new, high-profile diseases. Such diseases – called emerging infectious diseases – are of serious public health concern. Not only can they cause large numbers of human deaths as they spread, they also have a huge social and economic impact in today's interconnected world. For example, the estimated direct cost of SARS to Canada and Asian countries was US\$ 50 billion ¹. In addition, the impact of emerging infectious diseases is relatively greater in developing countries that have fewer resources. In the past 30 years, more than 30 new infectious diseases have emerged. Asia, unfortunately, is often at the epicentre ^{2,3}.

An emerging infectious disease is one that has appeared and affected a population for the first time, or has existed previously but is rapidly increasing, either in terms of the number of new cases within a population, or its spread to new geographical areas ². Also grouped under emerging infectious diseases are those that have affected a given area in the past, declined or were controlled, but are again being reported in increasing numbers. Sometimes an old disease appears in a new clinical form that may be severe or fatal. These are known as re-emerging diseases, a recent example of which is chikungunya in India.

Many emerging and re-emerging diseases are zoonotic in origin, meaning that the disease has emerged from an animal and crossed the species barrier to infect humans. Approximately 60% of all human infectious diseases recognized so far, and about 75% of emerging infectious diseases that have affected people over the past three decades, have originated from animals ⁴. Several countries in the World Health Organization (WHO) South-East Asia Region have conditions that favour the emergence of such diseases, many of which can be lethal and spread rapidly. Scientific research on 335 emerging diseases between 1940 and 2004 indicated that certain areas of the world are more likely to experience the emergence of new infectious diseases ³. Among these global "hotspots" for emerging infectious diseases are countries related to the Indo-Gangetic Plain and the Mekong River Basin. Nipah virus, Crimean-Congo haemorrhagic fever and avian influenza A(H5N1) are examples of diseases that have recently emerged and have affected the WHO South-East Asia Region.

Many factors precipitate the emergence of new diseases, as they enable infectious agents to evolve into new ecological niches, to reach and adapt to new hosts, and to spread more easily among the new hosts. These factors include urbanization and destruction of natural habitats, leading to humans and animals living in close proximity; climate change and changing ecosystems; changes in populations of reservoir hosts or intermediate insect vectors; and microbial genetic mutation. Consequently, the impact of an emerging disease is difficult to predict but could be significant, as humans may have little or no natural immunity to the disease.

While a strong public health system is a prerequisite to combat outbreaks of emerging infectious diseases, these outbreaks can also significantly disrupt such a system. Therefore, strengthening preparedness, surveillance, risk assessment, risk communication, laboratory facilities and response capacity in the Region are all crucial ⁴. It is equally important to forge partnerships among the animal health, agriculture, forestry and health sectors at national, regional and global levels.

This publication, developed by the WHO Regional Office for South-East Asia, is intended to serve as a resource for information on 26 selected endemic, emerging and re-emerging infectious diseases and zoonoses affecting countries in the Region, or posing a potential threat to the Region. It is hoped it will be particularly useful for non-specialist audiences such as decision-makers, the media and the general public.

Each chapter starts with a general description of the type and severity of the infectious disease and how it is transmitted and spread, followed by an explanation of the risk factors for and symptoms of infection in humans. This is followed by recommendations on prevention, control and treatment. Where available, links to further sources of information are also provided. Readers are invited to consult the glossary at the end of the document for an explanation of the technical terms used in this publication. Guidelines on how to reduce and prevent some infectious diseases in the home and in communities are also highlighted in the annex, entitled "Practical tips for vector control".

Emerging and/or zoonotic viral diseases



Avian influenza

Chikungunya

Crimean-Congo haemorrhagic fever

Dengue

Ebola virus disease

Hantavirus

Hand, foot and mouth disease

Japanese encephalitis

Nipah virus

Novel human coronavirus

Rabies

Rift Valley fever

Viral hepatitis



1 Avian Influenza

(Also known as fowl plague, bird flu)

Brief description

Avian influenza refers to certain viral infections or diseases often seen among wild birds, water fowl and poultry. It is caused by a strain of the influenza virus called "type A". The infection causes a wide spectrum of symptoms in birds but does not normally infect humans. However, certain strains have managed to cross the species barrier and infect humans. Since humans have little or no immunity to such strains, they cause severe respiratory disease (e.g. pneumonia) or death. It has been revealed that the past three pandemics in the world have been due to influenza of avian origin.

There are different types of avian influenza infections reported in humans, depending on the different strains of the avian influenza virus that have crossed the species barrier from birds to humans. The risks, symptoms and treatments for different types of avian influenza may differ.

Geographical distribution

According to the United Nations Food and Agriculture Organization, viruses are thought to be circulating endemically in poultry in Bangladesh, China, Egypt, India, Indonesia and Viet Nam. Sporadic reintroduction into poultry populations is also thought to occur in Cambodia⁵.

Agent

Avian influenza virus subtype A H5N1, H5N6, H6N1, H7N7, H7N9, H9N2, H10N8.

Reservoir

Wild birds, waterfowl and poultry.

Avian influenza A(H5N1):

This was the first avian influenza virus subtype observed to be transmissible to humans directly from infected poultry during a poultry outbreak in China, Hong Kong Special Administrative Region (Hong Kong SAR) in 1997. It then re-emerged in 2003 and 2004 and spread from Asia to Europe and Africa. From 2003 to 2013, of the 649 laboratory-confirmed human cases of A(H5N1) officially reported to WHO from 15 countries, 385 died. Of these, 228 cases (35%) and 181 deaths (47%) were from South-East Asia. Indonesia had the highest number of avian influenza cases in the world. Other countries in the WHO South-East Asia Region reporting human cases at this date were Bangladesh, Myanmar and Thailand⁶.

Today, avian influenza is entrenched in poultry in some countries, resulting in millions of affected and culled chickens, several hundred human cases, and many human deaths. Outbreaks in poultry have seriously impacted livelihoods, food security, the economy and international trade in affected countries.

Human infection

Risk factors

The primary risk factor for human infection appears to be direct or indirect exposure to infected – live or dead – poultry, contaminated environments⁶ and young age. Slaughter, de-feathering, handling carcasses of infected poultry, and preparing poultry for consumption – especially in household settings – are likely to be risk factors⁷.

Mode of transmission

A(H5N1): Infection of humans from poultry is rare, but most likely occurs through direct or indirect contact with sick or dead birds, or contaminated products such as faecal material. Human-to-human infection is even more rare, but is likely to be through a direct respiratory route (e.g. coughing).

Clinical signs and symptoms

A(H5N1): Clinical signs are the rapid onset of flu-like symptoms (fever, chills, body ache, headache, sore throat, dry cough), frequent watery diarrhoea, and progression to severe pneumonia and multi-organ failure.

Avian influenza A(H7N9):

Avian influenza A(H7N9) had previously been isolated only in birds. Bird species known to be susceptible to the virus included quail, geese, pigeons, Muscovy and Pekin ducks. Influenza A(H7N9) virus does not produce clinical signs and symptoms in

chicken. However, in February 2013, human infection with avian influenza A(H7N9) was reported for the first time, from China.

Human infection

Risk factors

Direct or indirect exposure to infected – live or dead – poultry, and environments contaminated by the virus, are the biggest risk factors. Most cases of avian influenza A(H7N9) have occurred in middle-aged and older men⁸.

Mode of transmission

A(H7N9): Live bird markets have been shown to be reservoirs of avian influenza A(H7N9) infection. The main exposures and routes of transmission to humans remain unknown. Information to date suggests that this virus does not transmit easily from human to human, and does not support sustained human-to-human transmission.

Clinical signs and symptoms

A(H7N9): Clinical findings in patients with confirmed H7N9 infection at hospital admission include high fever, cough, shortness of breath, and difficulty in breathing; symptoms can lead to respiratory, kidney as well as multi-organ failure⁸.

For avian influenza A(H5N1) and A(H7N9)

Treatment

Antiviral medicines are effective if used in the early stages. Anyone in the family developing fever after body aches or running nose-like symptoms should contact the nearest health centre or doctor.

Prevention and control

Individuals

- Avoid contact with sick or dying birds, or birds that have died of unknown causes.
- Wash hands with soap and water after contact with sick or dying birds, or with objects that may have been contaminated by the birds, such as soil, cages and eggs.
- Use personal protective equipment such as masks, gloves, etc. while handling suspected cases or while culling or disposing of birds.
- Seek medical advice if exposed to birds suspected of being infected.

- Avoid buying live chickens for home slaughter.
- Cook poultry (including eggs) thoroughly before eating (until the juice runs clear and the meat is not pink).
- Although the source of avian influenza A(H7N9) infection and the mode of transmission are uncertain, people are advised to practise basic hygiene, including hand-washing and proper handling and thorough cooking of raw meats.
- No vaccine for the prevention of A(H7N9) infections is currently available.

Community

- Suspect bird flu if chickens suddenly fall sick and start dying. Immediately report to the local veterinary authorities.
- If bird flu is confirmed, cooperate with the local authorities in culling chickens. Dead chickens should be disposed of safely⁷.
- Do not eat or sell the sick or dead poultry, or share with neighbours.
- Allow poultry manure to decompose for several weeks before applying it to fields.
- During an outbreak of A(H7N9) in 2013, the recommended preventive measures were disinfection, restricted movements, and closure of live-bird markets that were detected positive for this strain.

National/international

- Ban on export of live birds, poultry and poultry products from affected areas.
- Ensure good sanitary practices in markets, especially live bird markets.
- Rapid information sharing between animal and/or agricultural sectors and human health authorities⁹.
- Social mobilization and risk communication targeting high-risk populations in affected areas⁸.



Weblinks with more information:

- www.who.int/mediacentre/factsheets/avian_influenza/en/index.html
- www.who.int/influenza/human_animal_interface/update_20130405/en/index.html
- www.who.int/influenza/human_animal_interface/influenza_h7n9/en/index.html



2 Chikungunya

Brief description

Chikungunya is a viral illness spread by the bite of infected mosquitoes and clinically resembles dengue fever. The name comes from the African Kimakonde language, meaning “that which bends up”, and aptly describes the stooped appearance of sufferers with joint pain due to the disease. Chikungunya was first reported in an outbreak in Africa in 1952.¹⁰ Although chikungunya may cause a long duration of illness, it is rarely life threatening.

In Asia, virus strains were isolated in parts of India, Sri Lanka and Thailand in the 1960s,¹¹ Myanmar and Viet Nam in 1975, and Indonesia in 1982.¹⁰ After more than 20 years, chikungunya is being reported again in India, Indonesia, Maldives and Thailand, and in 2012 cases were reported for the first time from Bhutan. Chikungunya is thus considered a re-emerging disease. Beyond Asia and Africa, cases have recently been reported from north-eastern Italy.

Geographical distribution

Chikungunya has been identified in nearly 40 countries in Asia, Africa, Europe and the Americas.¹¹

Agent

Chikungunya virus, an alphavirus, belongs to the Togaviridae family of arboviruses, i.e. it is primarily spread by mosquitoes.

Vectors

The mosquitoes *Aedes aegypti* and *Aedes albopictus*, which transmit mosquito-borne viruses such as dengue, also transmit chikungunya to humans and can be easily recognized by the black and white stripes/spot markings on their bodies and legs.

They breed in anything that holds clean water including tyres, coconut shells, flower pots, storage jars and cooling systems.

Reservoir

Humans are the main reservoir for this disease in Asia, although monkeys are an important reservoir in Africa.

Human infection

Risk factors

The proximity of mosquito breeding sites to human habitation is a significant risk factor for chikungunya.

Mode of transmission

The disease is transmitted through the bite of female infected mosquitoes. Unlike some other species, these mosquitoes bite throughout daylight hours, although there may be peaks of activity in the early morning and late afternoon.

Clinical signs and symptoms

Incubation period: usually 3–7 days, but can range from 2–12 days.

Typical symptoms are a sudden onset of fever, severe headache, chills, nausea and vomiting, and severe joint pains that may persist for weeks or months. However, symptoms are often mild and the infection may go unrecognized, or be misdiagnosed in areas where dengue occurs. Most patients recover fully, but in some cases joint pain may persist for several months, or even years. Serious complications are not common, but in older people, the disease can contribute to the cause of death.¹²

Treatment

Symptomatic treatment of acute infection for pain and fever with anti-inflammatory drugs usually suffices. Some people develop persistent joint pain after the infection has gone and may require analgesics (pain killers) and long-term anti-inflammatory therapy.

Prevention and control

No vaccine is available. Prevention and control are entirely dependent on taking steps to avoid mosquito bites and eliminate mosquito breeding sites.

To avoid mosquito bites

- Wear long sleeves and full-length clothes to cover the limbs.
- Use mosquito coils, repellents and electric vapour mats during the daytime.
- Use mosquito nets to protect babies, the elderly and those who rest during the day. The effectiveness of such nets can be improved by treating them with an insecticide. Curtains (cloth or bamboo) can also be treated with insecticide and hung at windows or doorways to repel or kill mosquitoes. Mosquitoes get the virus and become infected when they bite people who are sick with chikungunya; therefore, infected persons should also minimize exposure to mosquitoes.

To eliminate breeding sites

The *Aedes* mosquito that transmits chikungunya breeds in a wide variety of containers that are common around human dwellings. These breeding sites can be eliminated by:

- draining water from coolers, tanks, barrels, drums and buckets, animal water troughs, used coconut shells, water storage vessels, plastic food containers, etc.;
- emptying coolers when not in use;
- removing from the house all objects, such as plant saucers, that have collected water;
- cooperating with public health authorities in anti-mosquito measures.



Weblinks with more information:

- www.searo.who.int/entity/emerging_diseases/topics/Chikungunya_FactSheet_Chikungunyafever.pdf
- www.who.int/mediacentre/factsheets/fs327/en/



3

Crimean-Congo haemorrhagic fever

(Also known as tick-borne zoonosis)

Brief description

Crimean-Congo haemorrhagic fever (CCHF) is a viral haemorrhagic fever transmitted by ticks. It can cause severe outbreaks in humans, with high mortality rates,¹³ but is asymptomatic in cattle and ruminants, the amplifying host and reservoir for human infection. The disease was first described in the Crimea in 1944. In 1969 it was recognized that the pathogen causing CCHF was the same as that responsible for an illness identified in 1956 in the Congo, hence the name for the disease.¹⁴ CCHF is endemic in Afghanistan, Iran and Pakistan. The tick responsible for transmission of CCHF is found in countries of the South-East Asia Region but human infection with the virus is rare and has been reported from only one country, India, where an outbreak was reported for the first time in Ahmedabad in January 2011.¹⁵ However, CCHF constitutes a threat to public health services, not only because of its high case-fatality rate (e.g. 10–40% for hospital-acquired infections), but also its potential for epidemic and nosocomial outbreaks, and difficulties in treatment and prevention.¹⁵

Geographical distribution

CCHF has been reported from more than 30 countries in the African, South-East Asia, European and Eastern Mediterranean regions of WHO. Outbreaks usually occur in rural populations during June to September.¹⁶

Agent

The virus that causes CCHF is a *Nairovirus*, which is part of the Bunyaviridae family. All 32 members of the *Nairovirus* genus are transmitted by ticks, but only three viruses are known to cause disease in humans.¹⁴

Vectors

A number of tick genera are capable of becoming infected with and transmitting the CCHF virus, but the most efficient and common vectors for CCHF to animals and humans appear to be members of the *Hyalomma* genus.

Reservoir

A wide range of domestic and wild animals act as carriers of the disease. Ostriches are particularly susceptible and may show a high prevalence of infection in endemic areas. Animals become infected with CCHF from the bite of infected ticks.

Human infection

Risk factors

The majority of cases occur in people working in the livestock industry, such as agricultural workers, slaughterhouse workers and veterinarians since they come in close contact with infected animals. Health-care workers are especially at risk of acquiring infection while providing intensive care to patients and, in the past, infection has been transmitted to surgeons operating on patients who had not yet been diagnosed.

Mode of transmission

Transmission is mainly through direct contact with the blood or tissues of livestock, such as sheep, goats or cattle, but also from tick bites. Human-to-human transmission may occur by exposure to blood and excreta from affected people, for example health-care workers.

Clinical signs and symptoms

Incubation period: usually 1–3 days following a tick bite, or 5–6 days following contact with infected blood or tissues.

There is a sudden onset of high fever and chills, headache, dizziness, and muscle pain. Gastrointestinal signs include abdominal pain, nausea, vomiting and diarrhoea. The face and neck may be flushed and the conjunctiva can be congested. Bleeding from the nose, gums, kidneys, and gastric mucosa are frequent manifestations. Patients who survive experience extreme weakness, sweating, headache and malaise.

Treatment

While antiviral agents have been used to treat CCHF patients, reportedly with some benefit, general supportive therapy is the mainstay of patient management.

Prevention and control

- Insect repellents containing *N,N*-diethyl-m-toluamide, commonly known as DEET, are the most effective repellents for preventing tick bites.
- Wearing gloves and other protective clothing is recommended for livestock workers.
- Individuals should avoid contact with the blood and body fluids of sick livestock or patients.
- Strict adherence to infection-control precautions is very important in health-care settings. Health-care workers who have had contact with tissue or blood from patients with suspected or confirmed CCHF should be followed up with daily temperature and symptom monitoring for at least 14 days after exposure.
- No vaccine exists for human or animal use.
- Public education about the hazards of tick bites and personal protection is essential.



Weblinks with more information:

- www.who.int/mediacentre/factsheets/fs208/en/index.html
- www.who.int/csr/disease/crimean_congoHF/en/index.html
- www.searo.who.int/entity/emerging_diseases/links/CCHF_Fact_Sheet_SEARO.pdf



4

Dengue

(Also known as breakbone fever or, for severe dengue, as dengue haemorrhagic fever or dengue shock syndrome)

Brief description

Dengue is a mosquito-borne viral infection that has become a major international public health concern. It is found in tropical and subtropical climates worldwide, mostly in urban and semi-urban areas.¹⁷ Dengue has shown a 30-fold increase globally over the past five decades. Some 50–100 million new infections are estimated to occur annually in more than 100 endemic countries.¹⁸ Bhutan and Nepal are the most recent countries in South-East Asia to report outbreaks of dengue. The increased burden of dengue is attributed to the expanding geographic distribution of all dengue viruses and their mosquito vectors.

Severe dengue – a potentially lethal complication – was first recognized in the 1950s during dengue epidemics in the Philippines and Thailand. Today, it occurs in most Asian countries and has become a leading cause of hospitalization and death. Globally, an estimated 500 000 people with severe dengue require hospitalization each year, a very large proportion of whom are children. About 2.5% of those affected die.¹⁸

Geographical distribution

Worldwide, usually in tropical and subtropical regions.

Agent

The four distinct but closely related serotypes of dengue virus (DEN-1, DEN-2, DEN-3 and DEN-4) are members of the virus family Flaviviridae.¹⁹

Vectors

The mosquitoes of the *Aedes* genus transmit mosquito-borne viruses such as dengue, and can be easily recognized by the black and white stripes/spot markings on their bodies and legs. They breed in anything that holds clean water including tyres, coconut shells, flower pots, storage jars and cooling systems.

Reservoir

The viruses are maintained in a human–mosquito cycle in tropical urban centres.

Human infection

Risk factors

Dengue is a risk to humans living in tropical and subtropical urban locations in dengue-endemic areas, particularly during the rainy season.

Mode of transmission

Dengue viruses are transmitted to humans through the bite of infective female *Aedes* mosquitoes, which in turn have acquired the virus while feeding on the blood of an infected person. These mosquitoes bite humans during the day.

Clinical signs and symptoms

The average incubation period is 4–6 days after a mosquito bite.

Dengue fever

- Severe, flu-like illness that affects infants, young children and adults, but seldom causes death.
- Infants and young children may have a fever with rash.
- In older children and adults there is usually an abrupt onset with high fever, severe headache, pain behind the eyes, muscle and joint pains, and rash.
- Most people with dengue suffer no significant complications, but some go on to develop severe dengue, or dengue shock syndrome.

Severe dengue

- A potentially deadly complication, which often begins with a sudden rise in temperature accompanied by facial flush and other flu-like symptoms. Fever usually continues for 2–7 days and can be as high as 41 °C.
- Symptoms may include haemorrhagic rash (bleeding into the skin).

- The patient's condition may suddenly deteriorate after a few days of fever: temperature drop, very low blood pressure followed by signs of circulatory failure and a rapid decline into a critical state of shock.

Treatment

There is no specific drug or vaccine available for treatment of dengue. Paracetamol is the drug of choice to bring down fever and alleviate joint pain. Other medicines such as aspirin should be avoided since they can increase the risk of bleeding. Judicious use of intravenous fluids is a very important component of medical support.

Prevention and control

- To prevent mosquitoes from breeding, water should be drained from window air coolers (when not in use), tanks, barrels, drums, buckets, etc. All objects containing water should be drained, removed from the house or discarded.
- In case it is not possible to drain water that has been collected or to cover receptacles fully, use temephos (an insecticide) according to local guidelines to prevent larvae from developing into adults.
- Wear long sleeves and full-length clothes to cover as much of the body as possible.
- Use mosquito repellents according to the instructions.
- Use mosquito coils and electric vapour mats during the daytime to prevent mosquito bites.



Weblinks with more information:

- www.who.int/topics/dengue/en/index.html
- www.wpro.who.int/mvp/Dengue_Strategic_Plan.pdf
- www.who.int/mediacentre/factsheets/fs117/en/
- www.who.int/features/qa/54/en/index.html



5

Ebola virus disease

(Also known as *Ebola haemorrhagic fever*)

Brief description

Ebola virus disease (EVD) is a severe, often fatal illness in humans. EVD outbreaks have a case fatality rate of up to 90%. Ebola first appeared in 1976 in two simultaneous outbreaks, in Nzara, Sudan, and in Yambuku, Democratic Republic of Congo.^{20,21} The latter was in a village situated near the Ebola River, from which the disease takes its name. It has not been reported in humans in the Asia Pacific region as of 31 July 2012. However, with global travel, it is possible that outbreaks in Africa could result in the spread of the virus to Asia.

There are different species of the Ebola virus. Of these, the *Reston ebolavirus* was first discovered in laboratories in Reston, Virginia, United States of America (USA) in 1989 after some quarantined, crab-eating macaque monkeys originating from the Philippines became ill and died. In 2008, a virus identified in pigs was found to be very similar to the virus identified in monkeys imported into the USA. for research from the Philippines in 1989.²²

In 2009, six people tested positive for *Reston ebolavirus* antibodies after contact with sick pigs in the Philippines, but had no significant symptoms. The threat to human health is likely to be low for healthy adults but is unknown for all other population groups. Therefore, the *Reston ebolavirus* is not as great a threat as the other ebolaviruses that are known to be highly pathogenic for humans. However, it is of public health concern in the Asia Pacific region because, although very rare, it is a newly emerging disease in animals and humans.

Currently there is no vaccine or specific treatment for Ebola virus disease.

Geographical distribution

EVD outbreaks occur primarily in remote villages in Central and West Africa, near tropical rainforests. The virus is transmitted to people from wild animals and spreads in the human population through human-to-human transmission.

Since 2008, Reston ebolavirus has been detected during several outbreaks of a deadly disease in pigs in the People's Republic of China and in Philippines, but no illness or death in humans from this species has been reported to date.²¹

Agent

Ebolavirus belongs to the *Filoviridae* family (filovirus). Ebolavirus comprises 5 distinct species:

1. Bundibugyo ebolavirus (BDBV)
2. Zaire ebolavirus (EBOV)
3. Sudan ebolavirus (SUDV)
4. Reston ebolavirus (RESTV)
5. Tai Forest (formerly Côte d'Ivoire ebolavirus)ebolavirus (TAFV)

Four of the five subtypes occur in an animal host native to Africa. BDBV, EBOV, and SUDV have been associated with large EVD outbreaks in Africa, whereas RESTV and TAFV have not. Pathogenicity varies among Ebola viruses, from EBOV, which is highly lethal in humans, to RESTV, which causes disease in pigs and macaques but asymptotically infects humans.

Reservoir

Fruit bats of the *Pteropodidae* family are considered to be the natural host of the Ebola virus. Although non-human primates have been a source of infection for humans, they are not thought to be the reservoir but rather an accidental host like human beings. Since 1994, Ebola outbreaks from the EBOV and TAFV species have been observed in chimpanzees and gorillas.

RESTV has caused severe EVD outbreaks in macaque monkeys (*Macaca fascicularis*) farmed in Philippines and detected in monkeys imported into the USA in 1989, 1990 and 1996, and in monkeys imported to Italy from Philippines in 1992.²¹

A recent study suggests that bats might be a reservoir for Ebola virus in Bangladesh. The study found antibodies against Zaire and Reston ebolaviruses circulating in 3.5% of the 276 bats scientists screened in Bangladesh.²³ Detection of antibodies to Ebola virus infection in Indonesian orangotans suggests the existence of multiple species of filoviruses or unknown filovirus-related viruses in Indonesia, some of which are serologically similar to African ebolaviruses.²⁴

Human infection

Risk factors

Human contact with infected fruit bats or monkeys/apes and the consumption of their raw meat leads to wild-life-to-human transmission of the virus.

Human-to-human transmission is through direct or close contact with infected patients, and particularly through contact with blood and body fluids of an infected patient.

Health-care workers caring for patients with suspected or confirmed Ebola are at risk if proper hospital infection control measures are not in place.

Laboratory personnel handling infected material without proper biosafety measures are also at risk.

Mode of transmission

Ebola is introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals. In Africa, infection has been documented through the handling of infected chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines found ill or dead or in the rainforest.

Ebola then spreads in the community through human-to-human transmission, with infection resulting from direct contact (through broken skin or mucous membranes) with the blood, secretions, organs or other bodily fluids of infected people, and indirect contact with environments contaminated with such fluids.

Burial ceremonies in which mourners have direct contact with the body of the deceased person can also play a role in the transmission of Ebola.

Health-care workers have frequently been infected while treating patients with suspected or confirmed EVD. This has occurred through close contact with patients when infection control precautions are not strictly practiced.

Among workers in contact with monkeys or pigs infected with Reston ebolavirus, several infections have been documented in people who were clinically asymptomatic. Thus, RESTV appears less capable of causing disease in humans than other Ebola species.

Clinical signs and symptoms

EVD is a severe acute viral illness often characterized by the sudden onset of fever, intense weakness, muscle pain, headache and sore throat. This is followed by vomiting, diarrhoea, rash, impaired kidney and liver function, and in some cases, both internal and external bleeding. Laboratory findings include low white blood cell and platelet counts and elevated liver enzymes.

People are infectious as long as their blood and secretions contain the virus. Men who have recovered from the disease can still transmit the virus through their semen for up to 7 weeks after recovery from illness.²¹

Incubation period: 2 to 21 days.

Treatment

Severely ill patients require intensive supportive care. Patients are frequently dehydrated and require oral rehydration with solutions containing electrolytes or intravenous fluids.

No licensed specific treatment is available for use in people or animals.

Prevention and control

There are no vaccines for humans or for animals.

In the absence of effective treatment and a human vaccine, raising awareness of the risk factors for Ebola infection and the protective measures individuals can take is the only way to reduce human infection and death.

Transmission to health-care workers has been reported when appropriate infection control measures have not been observed.

It is not always possible to identify patients with EBV early because initial symptoms may be non-specific. For this reason, it is important that health-care workers apply standard precautions consistently with all patients – regardless of their diagnosis – in all work practices at all times. These include basic hand hygiene, respiratory hygiene, the use of personal protective equipment and safe injection practices.

Samples taken from suspected human and animal Ebola cases for laboratory diagnosis should be handled by trained staff and processed in suitably equipped laboratories.

Individuals

- Suspected animals should be handled with gloves and other appropriate protective clothing.
- Gloves and appropriate personal protective equipment should be worn when taking care of ill patients at home.
- Regular hand washing is required after visiting patients in hospital, as well as after taking care of patients at home.

Community

- Communities affected by Ebola should inform the population about the nature of the disease and about outbreak containment measures, including burial of the dead.
- People who have died from Ebola should be promptly and safely buried.

In regions where RESTV has been reported in pigs:

- Routine cleaning and disinfection of pig or monkey farms (with sodium hypochlorite or other detergents) should be effective in inactivating the virus.
- All animal products (blood, meat and milk) should be thoroughly cooked before eating.
- Educational public health messages should focus on reducing the risk of pig-to-human transmission as a result of unsafe animal husbandry and slaughtering practices, and unsafe consumption of fresh blood, raw milk or animal tissue.



Weblinks with more information:

- <http://www.who.int/mediacentre/factsheets/fs103/en/>
- www.who.int/csr/don/2009_03_31/en/
- www.afro.who.int/en/clusters-a-programmes/dpc/epidemic-a-pandemic-alert-and-response/outbreak-news/4140-ebola-virus-disease-west-africa-situation/
- www.cdc.gov/vhf/ebola/



6

Hantavirus

Brief description

Hantavirus is an emerging viral disease that is spread to humans through rodents. Unlike other Bunyaviridae viruses, hantaviruses are transmitted through inhalation of the virus from infected rodent faeces. Hantaan virus and its related strains (Seoul virus and Puumala virus) cause haemorrhagic fever with renal syndrome (HFRS) in humans.²⁵ Each year, there are 60 000–100 000 cases of HFRS reported worldwide.²⁶ Another variation, hantavirus pulmonary syndrome (HPS), was identified in the United States of America (USA) in 1993 and is caused by at least three different strains of hantavirus.²⁷ Hantavirus syndrome is serious and can be fatal.

Geographical distribution

Hantaviruses are the most widely distributed zoonotic rodent-borne viruses, and can be found in North and South America, Europe, and the Asia-Pacific region, including India, Indonesia, Myanmar, Sri Lanka and Thailand. They occur mostly in the summer dry season.

Agent

Hantaviruses form part of the Bunyaviridae family. Hantaan, Seoul and Thailand hantavirus types are mainly responsible for outbreaks in Asia.

Reservoir

Wild rodents. Each strain of hantavirus possibly has its own rodent reservoir.

Human infection

Risk factors

Certain occupational groups – such as farmers, sweepers and labourers who are likely to have high exposure to infected dust – and those living in rural areas are at higher risk of infection.

Mode of transmission

- Inhalation of the virus in aerosols from urine or faeces of infected rodents, particularly in the dry summer season.
- Human-to-human transmission is uncommon but possible.

Clinical signs and symptoms

Incubation period: usually 2–3 weeks for the renal (kidney) syndrome.

The disease is of two types: HFRS affects the kidney and is more common in Asia, while HPS affects the lungs and is more commonly seen in the Americas.

HFRS: Sudden onset of high fever, chills, and pain in the back, muscles, and abdomen. Profuse bleeding may occur from haemorrhage, and kidney function can also be impaired. Tiny red spots and rashes appear on the face and elsewhere. Bleeding may also be seen from the nose and in the urine. The outcome is fatal in up to 15% of cases.²⁶

HPS: An initial period of general fever, ache and cough is followed by the sudden onset of acute respiratory distress. Headache and abdominal pain, nausea and vomiting also occur in the early stages. Most deaths are associated with respiratory failure and the outcome is fatal in up to 50% of cases.²⁶

Treatment

There are no effective antiviral drugs for the treatment of hantavirus infections. Treatment of patients with HFRS/HPS remains supportive in nature. Treatment of shock syndrome should be provided and if infection is highly suspected, patients should be immediately transferred to an emergency department or intensive care unit for close monitoring and care.

Prevention and control

- Persons cleaning rodent-infested structures in endemic areas should wear protective clothing and avoid inhaling or creating dust/aerosols.
- Rodents should be eliminated from homes and prevented from re-entering.
- Contact with wild rodents should be avoided.

- There should be rodent control at the community level.
- Adventure travellers, backpackers, campers and those with occupational exposure to rodents in countries or areas at risk for hantaviruses should take precautions to exclude rodents from tents or other accommodation and to protect all food from contamination by rodents.



Weblinks with more information:

- www.who.int/ith/diseases/hantavirus/en/
- www.who.int/biologicals/vaccines/haemorrhagic_fever/en/
- www.cdc.gov/hantavirus/hps/
- www.cdc.gov/hantavirus/hfrs/index.html
- www.cdc.gov/hantavirus/hps/history.html



7

Hand, foot and mouth disease

Brief description

Hand, foot and mouth disease (HFMD) is a common viral disease that usually affects children. It is considered an emerging infectious disease in the Asia-Pacific region as outbreaks were reported from 1997 to 2009 in many countries, including Australia, China, Maldives, Malaysia, Singapore, Thailand and Viet Nam.²⁸ Thailand reported an unprecedented number of cases – 8405, with four deaths – between January and August 2011. HFMD is therefore of particular concern in the Region.²⁹

HFMD is often confused with foot-and-mouth disease (FMD), which is a disease of sheep, cattle and swine. The two diseases are caused by different viruses and are not related. Humans do not get the animal disease, and vice versa.³⁰

Geographical distribution

Worldwide, and increasing in the Asia-Pacific region.

Agent

Viruses of the *Enterovirus* genus of the Picornaviridae family. The clinical syndrome/disease may be caused by serotypes of coxsackievirus and enterovirus 71 (EV71). Infection with EV71 is of particular concern as it can cause severe disease in children, sometimes resulting in death.²⁸

Reservoir

Humans are the sole reservoir of coxsackievirus and EV71.

Human infection

Risk factors

Poor hygiene and direct contact with infected patients are risk factors for HFMD. Children under the age of 10 years, and especially those under the age of 5 years, are at the greatest risk of acquiring the infection.²⁸

Mode of transmission

HFMD is highly contagious, and gatherings in places like kindergartens and schools facilitate disease transmission. The virus is transmitted through direct contact with nose and throat discharges, saliva, fluid from blisters, or the stool of infected persons. Patients are infectious during the stage when they have high fever.

Clinical signs and symptoms

Incubation period: 3–7 days.

The disease is usually mild and self-limiting. Typical symptoms are fluid-filled blisters on the hands, feet and inside of the mouth, and/or dehydration due to fever and poor fluid intake. However, certain outbreaks of HFMD due to EV71 have been associated with severe neurological complications such as meningo-encephalitis (inflammation of the brain and meninges) in some children, pneumonia and myocarditis (inflammation of the heart muscle, resembling a heart attack), which have led to significant mortality. Outbreaks of HFMD due to coxsackievirus A16 have not been associated with significant complications or mortality.²⁸

Treatment

Symptomatic and supportive therapy is the mainstay of treatment.

Prevention and control

Individuals

- Wash hands with soap or use alcohol-based hand sanitizers before eating, feeding a baby and preparing feeds.
- Wash hands thoroughly with soap after going to the toilet and after changing nappies.
- Disinfect* dirty surfaces and soiled items including toys.
- Thoroughly clean objects and surfaces (toys, doorknobs, etc.) that may be contaminated.
- Avoid close contact (like kissing and hugging or sharing eating utensils or cups) with people who are infected.³¹

* One of the best and most widely available disinfectants is household bleach. A solution of chlorine bleach can be made by mixing 1 tablespoon of bleach and 4 cups of water.²⁸

Community

- Ensure that good hygiene practices are followed in kindergartens and primary schools.
- Keep sick children away from crowded public places if they show signs of infection.
- Build awareness among parents and teachers about HFMD.



Weblinks with more information:

- www.wpro.who.int/publications/docs/GuidancefortheclinicalmanagementofHFMD.pdf
- www.cdc.gov/Features/HandFootMouthDisease/
- www.cdc.gov/hand-foot-mouth/about/



8

Japanese encephalitis

Brief description

Approximately 60% of the world's population live in regions endemic for Japanese encephalitis (JE). The disease, a mosquito-borne viral infection, causes an estimated 50 000 cases and 10 000 deaths each year over a wide geographic range.³² The case-fatality rate can be as high as 25–30%; of those who survive, 30–50% suffer lasting damage to the central nervous system.³³

Geographical distribution

Mainly in the Asia-Pacific region.

Agent

JE is a member of the *Flavivirus* genus in the family Flaviviridae.

Vector

Mosquitoes belonging to the *Culex tritaeniorhynchus* and *Culex vishnui* groups.

Reservoir

The virus circulates in ardeid birds (herons and egrets). Pigs are amplifying hosts, in that the virus reproduces in pigs and infects mosquitoes that bite them, but does not cause disease.³⁴ Humans become infected as accidental hosts when those mosquitoes bite humans.

Human infection

Risk factors

Children in endemic areas are at risk when involved in outdoor activities during and immediately after the monsoon season, when mosquito numbers are at their highest.

Travellers and expatriates who stay for prolonged periods in rural areas with active JE virus transmission are likely to have a similar risk to the susceptible resident population, i.e. 0.1–2.0 cases per 100 000 per week (5–50 cases per 100 000 children per year).³⁵

Mode of transmission

JE outbreaks usually occur during the rainy season in paddy-growing territories, when there are large areas of stagnant water. Mosquitoes breed in this water, resulting in a much higher likelihood of humans being bitten. Occasionally, outbreaks have been reported in peri-urban or slum areas where scavenging pigs are present and waterlogged conditions exist during the rainy season.³⁶ Infected *Culex* mosquitoes acquire and transmit the virus when they bite animals and humans.

Clinical signs and symptoms

Incubation period: 5–15 days.

Signs and symptoms include the rapid onset of high fever, stiff neck, coma, tremors, and convulsions (especially in infants). Given that they have similar symptoms, JE can be clinically confused with cerebral malaria, meningitis, Chandipura virus, and West Nile virus.

Treatment

There is no specific treatment for JE, but supportive treatment and good nursing care can significantly reduce the number of deaths.

Prevention and control

Mosquito bites can be prevented by wearing clothing that covers the limbs, and the use of insect repellents. Mass immunization of children and pigs with JE vaccine is recommended in endemic areas, as is vaccination for travellers to these areas.



Weblinks with more information:

- www.who.int/water_sanitation_health/diseases/encephalitis/en/
- www.cdc.gov/ncidod/dvbid/jencephalitis/qa.htm
- www.nlm.nih.gov/medlineplus/druginfo/meds/a607019.html
- www.nhs.uk/conditions/japanese-encephalitis/Pages/Introduction.aspx



9

Nipah virus

Brief description

Nipah virus (NiV) was first recognized in 1999 during an outbreak among pig farmers in Malaysia.³⁷ Its name originates from Sungai Nipah, a village in the Malaysian Peninsula where pig farmers became ill with encephalitis. Since then, there have been NiV outbreaks almost every year in South Asia, causing severe disease and death in people and thus making it an emerging disease of serious public health concern.³⁷ The virus infects a wide range of animals and causes severe disease in pigs, and this has resulted in significant economic losses for farmers in Malaysia.

Geographical distribution

Affected countries in the Asia-Pacific region include Bangladesh, India, Malaysia and Singapore.

Agent

Nipah virus belongs to the Paramyxoviridae family.

Reservoir

Fruit bats of the genus *Pteropus* (flying foxes) are the main reservoir. NiV is known to infect pigs, dogs, cats, horses and humans when they consume contaminated food or drink that has been infected by bat secretion (saliva, urine).

Human infection

Risk factors

In Bangladesh, the cultural practice of drinking raw date palm sap is a major risk factor for human infection. Human-to-human transmission of NiV reported in recent outbreaks demonstrates the risk for health-care workers of acquiring the virus from infected patients through contact with infected secretions, excretions, blood or tissues.

Infections documented in several outbreaks in Bangladesh occurred in the absence of any obvious zoonotic source and the virus was thus likely to have been transmitted through sneezing or coughing.³⁸ In Malaysia, NiV infection is associated with close contact with infected pigs;³⁹ the disease is highly contagious among pigs, who act as an intermediate and possibly amplifying host after contact with infected bats or their secretions. Infected bats shed the virus in their secretions such as saliva, urine, semen and excreta, but are symptomless carriers.

Mode of transmission

NiV is transmitted to humans either from animals (contact with urine, saliva or contaminated materials) or from other humans. In Bangladesh, half of the reported cases between 2001 and 2008 were believed to be due to human-to-human transmission.³⁷

Clinical signs and symptoms

Incubation period: 4–21 days.

NiV infection in humans ranges from asymptomatic infection to fatal encephalitis. Infected people initially develop flu-like symptoms of fever, headaches, myalgia (muscle pain), vomiting and sore throat. This can be followed by dizziness, drowsiness, altered consciousness, and neurological signs that indicate acute encephalitis. Some people can also experience atypical pneumonia and acute respiratory distress. Encephalitis and seizures occur in severe cases, progressing to coma within 24–48 hours. Around half the symptomatic cases become fatal (case-fatality range, 40–75%).

Treatment

No vaccine or specific treatment exists for NiV. Intensive supportive care and treatment of symptoms is the main approach to managing the infection in people.

Prevention and control

- Avoid contact with bats and fruit potentially contaminated with bat urine, such as date palm sap.
- Health-care workers should implement standard precautions when caring for patients with suspected or confirmed NiV infection and when handling specimens.^{37,40}
- Wear gloves and protective equipment such as masks when taking care of ill people, and wash hands after visiting anyone sick.



Weblinks with more information:

- www.searo.who.int/entity/emerging_diseases/links/nipah_virus/en/
- www.who.int/csr/disease/nipah/en/



10

Novel human coronavirus

Coronaviruses are a group of viruses which infect humans and animals. They usually cause mild to moderate upper and lower respiratory tract infection, and can sometimes also cause gastroenteritis. Human coronaviruses were first identified in the 1960s and they are believed to cause a significant percentage of all common colds in adults. Novel human coronaviruses have recently been discovered, which have jumped from animals to infect humans, with serious socioeconomic consequences. A highly publicized novel human coronavirus is severe acute respiratory syndrome coronavirus (SARS-CoV). In September 2012, a new coronavirus causing lower-respiratory tract infection in humans was identified in Middle East countries and tentatively referred to as novel coronavirus 2012. This coronavirus is now known as Middle East respiratory syndrome coronavirus (MERS-CoV).⁴¹ A brief description of SARS-CoV and MERS CoV is given below.

SARS-CoV

SARS first appeared in November 2002 in the Guangdong province of southern China.⁴⁷ This area is considered a potential zone of re-emergence of SARS-CoV. It subsequently spread, and an epidemic of SARS affected 26 countries and resulted in more than 8000 cases in 2003.⁴² Since 2004, no known cases of SARS have been reported anywhere in the world.⁴³

Geographical distribution

Outbreaks were reported in China, Hong Kong SAR, Singapore and Viet Nam, and spread to many countries in 2002–2003, notably to Canada.⁴²

Agent

SARS coronavirus (SARS-CoV).

Reservoir

The reservoir was initially thought to be the civet cat but is now believed to be the bat, with the civet cat acting as an intermediate host.

Human infection

Risk factors

SARS is a rare disease. Since 2003, the disease has reappeared four times – three times from laboratory accidents in Singapore and China (Province of Taiwan), and once in southern China. The source of infection remains undetermined, although there is circumstantial evidence of animal-to-human transmission.⁴² The elderly and those with chronic, immunosuppressive diseases are particularly vulnerable.

Mode of transmission

In humans, SARS seems to spread mainly through close person-to-person contact, e.g. by inhaling droplets produced when an infected person coughs or sneezes, and can be transmitted during air travel. It is also possible that the SARS virus spreads in other ways that are not yet known.⁴⁴

The mode of transmission from animal to humans currently remains unknown.

Clinical signs and symptoms

Incubation period: 2–14 days.

The sudden onset of flu-like symptoms may include fever, muscle pain, lethargy, cough and sore throat. Severe cases progress to a respiratory disease and pneumonia that can be fatal.

Treatment

No specific treatment is available. Symptomatic and supportive therapy is required.

Prevention and control

- Isolate suspected cases of SARS.
- Wear gloves and protective clothing when dealing with SARS patients and maintain personal hygiene.
- Follow national and international disease control guidelines.

MERS-CoV

MERS-CoV has not been previously identified in humans. There is very limited information on transmission, severity and clinical impact given the small number of cases reported thus far. Globally, from September 2012 until 31 December 2013, WHO was informed of a total of 177 laboratory-confirmed cases of infection with MERS-CoV, including 74 deaths.⁴⁵

Geographical distribution

As of December 2013, human cases have been reported from 11 countries in the Middle East, north Africa and Europe.⁴⁶ All cases identified had a link to the Middle East. For those cases reported outside the Middle East, the link is either through recent travel to the region or exposure to a patient who acquired infection in the region.

Reservoir

The virus is thought to be of animal origin. The full picture on the source is not yet clear. Strains of MERS-CoV that match human strains have been isolated from camels. Human and camel genetic sequence data demonstrate a close link between the virus found in camels and that found in people. These studies indicate that camels are a likely source of infection in humans.

Human infection

Risk factors

Since it is not yet clear how MERS-CoV is transmitted, it is not possible to identify specific groups at risk. However, individuals at high risk of severe disease include those with diabetes, chronic lung disease, pre-existing renal failure, or a weak immune system. The occurrence of new cases seems to follow a seasonal pattern, with increasing incidence from March to April onwards.⁴⁷

Agent

MERS-CoV.

Mode of transmission

It is not yet known how people become infected with MERS-CoV. More investigation is required into the recent exposures and activities of infected humans.

More than half of all laboratory-confirmed secondary cases have been associated with health-care settings.⁴⁶ These include health-care workers treating MERS-CoV patients, other patients receiving treatment for conditions unrelated to MERS-CoV, and people visiting MERS-CoV patients. The specific types of exposure resulting in transmission in the health-care setting are currently unknown.

Clinical signs and symptoms

Incubation period: 2–10 days.

Patients diagnosed and reported have had respiratory disease as their primary illness. The most common symptoms observed are fever, cough and breathing difficulties. Most patients have had pneumonia. Diarrhoea is commonly reported among the patients and severe complications include kidney failure and acute breathing problems leading to unconsciousness. It is possible that severely immunocompromised patients can present with atypical signs and symptoms.⁴⁸

Treatment

No specific treatment is available.

Prevention and control

It is not possible to give specific advice on prevention of infection as the source of infection and mode of transmission are not yet clear. However, basic hygiene measures include frequent handwashing with soap and clean water, avoiding sick animals, and avoiding food that may be contaminated with animal secretions unless they are properly washed, peeled, or cooked.

MERS-CoV infections that may be acquired in health-care facilities illustrate the need to continue to strengthen infection prevention and control measures. Health-care facilities that provide care for patients with suspected or confirmed MERS-CoV infection should take appropriate measures to decrease the risk of transmission of the virus to other patients, health-care workers and visitors. Infection control guidelines for both home-care settings and health-care facilities can be found on the WHO coronavirus infections webpage (see web links, below). Education and training for infection prevention and control should be provided to all health-care workers and regularly refreshed.



Weblinks with more information:

- www.who.int/csr/disease/coronavirus_infections/en/index.html
- www.who.int/csr/sars/en/
- www.who.int/ith/diseases/sars/en/
- www.who.int/csr/sars/postoutbreak/en/
- www.who.int/features/2003/07/en/
- www.who.int/csr/disease/coronavirus_infections/faq/en/index.html



11

Rabies

(Also known as *lyssa*, or *hydrophobia in humans*)

Brief description

Rabies is a common and preventable viral zoonotic disease; however, it is almost always fatal, and results in 55 000 deaths globally every year. Children are the main victims of rabies. Every year, more than 15 million people worldwide receive post-exposure rabies prophylaxis – i.e. vaccination after exposure to the virus to avert the disease – which is estimated to prevent an additional 327 000 rabies deaths.⁴⁹ Countries in the WHO South-East Asia Region contribute 45% of the global burden of the disease.⁵⁰

Despite substantial advances in the development and availability of efficient measures to control rabies, there has been no significant decrease in rabies incidence in Asia except in a few island countries.

Geographical distribution

Worldwide (except Antarctica), but more than 95% of human deaths occur in Asia and Africa.

Agent

Lyssavirus is a genus of viruses belonging to the family Rhabdoviridae.

Reservoir

Warm-blooded mammals and bats are responsible for maintenance of the virus – urban rabies primarily by dogs, and sylvatic rabies by wild animals.

Human infection

Risk factors

In Asia, more than 4 billion people are at risk of contracting rabies. Of all documented human rabies cases, 94% are due to a rabid dog bite. Human deaths following exposure to mongoose, jackals, foxes, wolves, and other wild carnivore host species are very rare.

Mode of transmission

- People are infected through the skin following a bite or scratch by an infected animal.
- Transmission can also occur when infectious material – usually saliva – comes into direct contact with human mucosa or fresh skin wounds.
- Rabies may be contracted via transplantation of an infected organ such as a cornea.

Clinical signs and symptoms

The incubation period is usually 4–8 weeks, but may extend to several years.

Once clinical symptoms develop in a person who has been bitten by a rabid animal, the disease is almost always fatal. Symptoms appear in phases and include:

- initial pain or a tingling sensation at the site of the bite;
- fear of water (hydrophobia);
- restlessness;
- excess salivation;
- convulsions; and finally
- death.

Treatment

Rapid post-exposure prophylaxis i.e. immediate post-bite treatment, such as vaccination and/or application of rabies immunoglobulin, is very effective in preventing the disease. However, there is no cure for rabies once clinical signs develop.

Prevention and control

Individuals

- Pre-exposure rabies vaccination of high-risk groups such as children, veterinarians, dog handlers and vaccinators is highly recommended. This is a course of three vaccines that must be completed.

- Immediately after a person is bitten by a suspected rabid animal, wash the wound thoroughly with soap and plenty of water. The person should then go to a doctor as soon as possible.
- If prescribed by a medical doctor, the full course of vaccinations for rabies prophylaxis should be taken.
- Pet dogs must be vaccinated according to a veterinarian's advice.

Community

- Mass vaccination of all dogs (pets, community-owned and stray) at the community level. It has been seen that where more than 80% of community dogs are properly vaccinated against rabies, the occurrence of human rabies cases ceases promptly.⁴⁹
- Dog population management through animal birth control (surgical or chemical sterilization) in highly rabies-endemic areas.⁴⁹
- Public awareness and education on rabies prevention and control.
- Proper waste management.

National/international

- International travel of dogs without reliable evidence of rabies vaccination is prohibited in most countries.
- Movement of dogs without a vaccination certificate can also be restricted within a country as a control measure.

World Rabies Day is marked on 29 September every year to increase awareness and understanding of rabies prevention and control.



Weblinks with more information:

- www.searo.who.int/topics/rabies/en/
- www.rabiescontrol.net/assets/files/resources/newsletters/GARCnewsletter26.pdf



12

Rift Valley fever

Brief description

Rift Valley fever (RVF) is a mosquito-borne viral disease first identified in Kenya in 1931.⁵¹ An outbreak of RVF in animals frequently manifests itself as mass mortality among their young, or a wave of unexplained abortions among livestock. Outbreaks usually occur first in animals and then in humans,⁵² particularly in those who work with animals. Heavy rains often precede outbreaks. The total case-fatality rate has varied widely between different epidemics, but overall has been less than 1% in those documented. However, post-infection complications are very high, and can have a severe socioeconomic as well as health impact.

Geographical distribution

RVF is widespread throughout Africa and occasionally reported in Middle East countries. However, there is a potential risk of introduction of RVF in countries in the South-East Asia Region due to livestock movement and trade.

Agent

RVF is caused by the *Phlebovirus*, a member of the Bunyaviridae family.

Reservoir

Infected livestock (sheep, cattle, goats) can have high enough levels of the virus in the bloodstream to infect a variety of mosquito vectors. These amplifying hosts help establish the disease in the environment and can lead to large epizootic epidemics. The virus often enters the bloodstream during early clinical illness in humans.⁵³

Human infection

Risk factors

Currently there is very little risk in the South-East Asia Region. RVF may, however, be introduced through the illegal import of infected animals.

The disease mainly affects persons in certain occupational groups – such as veterinarians, animal handlers and slaughterhouse workers – who are at an increased risk of contracting the virus from an infected animal. Sleeping outdoors at night in areas where outbreaks occur exposes individuals to potentially infected mosquitoes and other insect vectors. Travellers increase their chances of getting the disease when they visit RVF-endemic locations during periods when sporadic cases or epidemics are occurring.⁵⁴

Mode of transmission

- Through the bite of infected mosquitoes or other insects.
- Contact with tissues and body fluids of infected animals during slaughtering or butchering, assisting with animal births, conducting veterinary procedures, or from the disposal of carcasses or fetuses.
- Contact with the aborted material from infected animals.
- Through inoculation; for example, via a wound from an infected knife, contact with broken skin, or inhalation of aerosols produced during the slaughter of infected animals.

Clinical signs and symptoms

Incubation period: 1 week.

Most human cases are relatively mild. Some patients develop severe flu-like symptoms such as sudden onset of chills, muscular and back pain, headache, nausea and fever, which last for a week or more. However, a small percentage of people develop a much more severe form of the disease that manifests as one or more of three distinct syndromes: ocular, meningo-encephalitis and haemorrhagic. Most fatalities occur in patients who develop the haemorrhagic syndrome (internal bleeding).⁵²

Treatment

There is no vaccine or specific treatment for human use. For the most severe cases, the only treatment is general supportive therapy.

Prevention and control

Individuals

- Handle diseased or dead animals carefully using protective clothing.
- Practise good hygiene.

Community

- Prohibit the butchering of diseased animals.
- Encourage public awareness of RVF prevention and control measures.

National/international

- Restrict the trade of livestock products or movement of animals from infected areas.



Weblinks with more information:

- www.searo.who.int/entity/emerging_diseases/Rift_Valley_Fever.pdf
- www.who.int/mediacentre/factsheets/fs207/en/
- www.who.int/csr/disease/riftvalleyfev/en/
- www.who.int/biologicals/vaccines/rift-valley-fever/en/



13

Viral hepatitis

Brief description

Viral hepatitis is an infectious disease causing inflammation of the liver and mainly manifests as yellow discolouration (jaundice) of the skin and the eyes, loss of appetite, nausea, fatigue and abdominal discomfort. It is a complex public health problem as there are five different types of hepatitis virus, namely A, B, C, D and E, which are capable of transmitting through various routes. Viral hepatitis A and E are foodborne and waterborne infections that cause acute illness, whereas viral hepatitis B, C and D are transmitted through various means such as infected blood and blood products, contaminated medical equipment and needles, sexual contact, or mother-to-child transmission. Viral hepatitis B and C are responsible for serious public health problems due to chronic infection, which may lead to liver damage (cirrhosis) and liver cancer. Approximately 70–80% of cases of cirrhosis and liver cancer are associated with hepatitis B and hepatitis C infections.⁵⁵ The prevalence of viral hepatitis B and C coinfection is up to 60% among persons living with HIV infection. Coinfected individuals have more rapid progression of liver disease and a greater probability of developing cirrhosis and liver cancer.⁵⁶ Unlike viral hepatitis B and C, viral hepatitis A infection does not cause chronic liver disease and is rarely fatal.⁵⁷

Geographical distribution

Worldwide.

The magnitude of the impact of various types of viral hepatitis differs from region to region, and is influenced by levels of socioeconomic development and health-care services, availability of safe drinking water, and hygienic and sanitary conditions.

Hepatitis E virus commonly causes an epidemic of jaundice in communities. Viral hepatitis E outbreaks have been documented in most countries of the South-East Asia Region. More than 50% of global deaths from viral hepatitis E occur in the Region.⁵⁵

Overall socioeconomic development, public awareness and availability of vaccine have decreased the burden of viral hepatitis in many countries. However, sporadic cases are reported when individuals travel to high-endemic countries or contaminated food is imported from endemic countries.

Agent

Different types of hepatitis viruses namely hepatitis A virus (HAV), hepatitis B virus (HBV), hepatitis C virus (HCV), hepatitis D virus (HDV) and hepatitis E virus (HEV). Of these, the most common cause of infection is one of four viruses: A, B, C and E.

Reservoir

Humans are considered natural hosts for all types of viral hepatitis. However, phylogenetic analyses show that HEV subgenotypes circulating in human beings and animals in the same area are closely related, supporting zoonotic transmission.⁵⁸

Human infection

Risk factors

Hepatitis A

Drinking unsafe water or eating food from a plate that has not been properly washed; sexual contact with a person infected with HAV; living with or caring for a person infected with HAV.

Hepatitis B

Unsafe blood transfusion; use of non-sterile syringe for injection; repeated haemodialysis; sexual contact with a person infected with HBV; birth from a mother infected with HBV; and working in a health-care facility without proper infection control and blood safety.

Hepatitis C

Unsafe blood transfusion; use of non-sterile syringe for injection; and repeated haemodialysis are known major risk factors. Birth from a mother infected with HCV is also a risk factor.

Hepatitis E

Drinking unsafe water or eating food from a plate that has not been properly washed, and consumption of meat products contaminated with HEV (usually uncooked meat). HEV outbreaks are characteristically associated with a high disease attack rate among pregnant women.

Mode of transmission

Hepatitis A

Eating or drinking water, drinks and food which have been contaminated by stool from an infected person. Close person-to-person contact or sexual contact with a person infected with HAV.

Hepatitis B

Contact with blood, semen or other body fluids contaminated with HBV.

Hepatitis C

Contact with blood contaminated by HCV, primarily through sharing needles or syringes, needle-stick or sharp instrument injuries, tattooing/piercing; sexual contact with a person infected with HCV; or birth from a mother infected with HCV.

Hepatitis E

Primarily faecal-oral route, i.e. consumption of water or food (including uncooked or undercooked meat) contaminated with HEV.

Clinical signs and symptoms

The incubation period and clinical signs and symptoms depend on the type of hepatitis virus.

Viral hepatitis A: 14–28 days.⁵⁷

Viral hepatitis B: usually 45–180 days, average 60–90 days.⁵⁹

Viral hepatitis C: 2 weeks–6 months.⁶⁰

Viral hepatitis E: 3–8 weeks.⁶¹

Symptoms of viral hepatitis range from mild to severe. Typical signs and symptoms of viral hepatitis include:

- jaundice (yellow discolouration of the skin and sclera of the eyes, dark urine and pale stools);
- anorexia (loss of appetite);
- an enlarged, tender liver (hepatomegaly);
- abdominal pain and tenderness;
- nausea and vomiting;
- fever.

Adults have signs and symptoms of illness more often than children in cases of viral hepatitis A, and the severity of disease and mortality increases in older age groups.⁵⁷ Infected children under six years of age do not usually experience noticeable symptoms.

Most people do not experience any symptoms during the acute infection phase of viral hepatitis B. In some people, HBV can also cause a chronic liver infection that can later develop into cirrhosis of the liver or liver cancer.

Following initial infection with viral hepatitis C, approximately 80% of people do not exhibit any symptoms. About 75–85% of newly infected persons develop chronic infection and 60–70% of chronically infected people develop chronic liver disease.

Although viral hepatitis E infection is frequent in children, the disease is mostly asymptomatic or causes a very mild illness without jaundice, and goes undiagnosed.

Treatment

More than 90% of healthy adults who are infected with viral hepatitis B will recover and be completely rid of the virus within six months.

Viral hepatitis C does not always require treatment. Scientific advances have led to the development of new antiviral drugs for hepatitis C, which may be more effective and better tolerated than existing therapies.

As hepatitis E is usually self-limiting, hospitalization is generally not required. However, hospitalization is required for people with severe hepatitis which could lead to liver failure. Hospitalization should also be considered for pregnant women who are infected.

Prevention and control

Preventive action against viral hepatitis varies greatly and depends on the mode of transmission, water quality, hygienic and sanitary conditions, sociocultural behaviour and availability of vaccine.

Hepatitis B control programmes may involve blood screening, injection safety, immunization, public awareness and education on sexual behaviour.

Vaccines against viral hepatitis A and B are available. Hepatitis B vaccine has been included in universal immunization programmes in all countries of the Region. However, vaccination coverage remains low in some countries. Hepatitis A vaccine is available, but it is not yet used as a means of public health protection in the Region.

World Hepatitis Day is held on 28 July every year to increase awareness and understanding of viral hepatitis.



Weblinks with more information:

- www.who.int/features/qa/76/en/index.html
- www.who.int/mediacentre/factsheets/fs328/en/index.html
- www.who.int/mediacentre/factsheets/fs204/en/index.html
- www.who.int/mediacentre/factsheets/fs164/en/index.html
- www.who.int/mediacentre/factsheets/fs280/en/index.html
- www.who.int/csr/disease/hepatitis/global_report/en/index.html
- www.searo.who.int/topics/hepatitis/en/

Emerging and/or zoonotic bacterial diseases



Anthrax

Botulism

Brucellosis

Leptospirosis

Listeriosis

Melioidosis

Plague

Salmonellosis

Scrub typhus

Tularaemia



14

Anthrax

(Also known as woolsorter's disease, splenic fever)

Brief description

Anthrax is a bacterial disease that usually affects herbivorous animals, but outbreaks involving humans are increasingly being reported. An outbreak in Bangladesh in 2010, involving 607 human cases in 3 months, was the biggest outbreak in the country's history.⁶² The disease does not spread from human to human, and most forms are curable when diagnosed early and treated with antibiotics. However, case-fatality estimates for inhalation of anthrax spores, although based on incomplete information, are extremely high (75–100%, even with all possible supportive care, including appropriate antibiotics). The case-fatality rate for cutaneous anthrax, which accounts for the vast majority of cases, is usually low (about 20%, if untreated).⁶³

Geographical distribution

Worldwide. Usually outbreaks are sporadic and small, but outbreaks of epidemic proportion can occur if contaminated animal feed becomes a common source of infection.

Agent

The bacteria *Bacillus anthracis*.

Reservoir

Reservoir hosts include domestic and wild animals such as cattle, buffalo, sheep, goats, pigs and horses.

Human infection

Risk factors

Although *anthrax* spores can live in the soil for many years, anthrax infection in humans is rare. Skin contact with, or inhalation of, aerosolized spores and consumption of undercooked or raw meat or dairy products from infected animals can cause the disease.

Mode of transmission

People can become infected in four main ways: by the cutaneous route, e.g. direct skin contact of anthrax spores with a cut or abrasion; by contact with infected animals or animal products (usually related to occupational exposure); through consumption of undercooked or raw meat or dairy products from infected animals (gastrointestinal form⁶⁴); and by inhaling a large number of anthrax spores suspended in the air (the pulmonary form of anthrax, which is the rarest and most severe).

Clinical signs and symptoms

Incubation period: 1–7 days for the cutaneous form; 12 hours–5 days for the gastrointestinal form; and 1–5 days for the pulmonary form. Clinical symptoms are listed below.

- Cutaneous form: red marks on the exposed area of skin, which swells and forms blisters. The skin tissue then dies, leaving a black central scar. These signs are accompanied by fever and malaise. The vast majority of anthrax cases (up to 95%) are cutaneous.
- Gastrointestinal form: loss of appetite, fever, vomiting and diarrhoea.
- Pulmonary form: fever, cough, difficulty in breathing, respiratory failure and, in severe forms, death within 24 hours.

(Animals exhibit sudden acute illness, high fever, localized swelling, bleeding from natural orifices (nose, mouth, ear, anus), or death. Tonsillitis is seen in pigs, and colic in horses.)

Treatment

Anthrax responds well to antibiotic treatment. Antibiotics must be prescribed and taken with medical advice. Treating the pneumonic form of anthrax is very difficult.

Prevention and control

Individuals

- Avoid examination of (suspected) infected carcasses.
- Dispose of carcasses by deep burial or burning.

Community

- Prevent movement of livestock from affected premises during an outbreak.
- Control dust in industries handling wool or hides.
- Wash and disinfect wool/hair from endemic areas (e.g. with 10% formalin).
- In general, prohibit the use of meat and bone meal as ruminant feed, as these are potential sources of anthrax bacteria.
- Vaccinate livestock in endemic areas.



Weblinks with more information:

- www.who.int/csr/disease/Anthrax/en/
- www.who.int/csr/disease/Anthrax/anthraxfaq/en/
- www.who.int/csr/resources/publications/anthrax/en
- www.who.int/csr/resources/publications/anthrax/WHO_EMZ_ZDI_98_6/en/



15

Botulism

Brief description

Human botulism is a serious but relatively rare paralytic disease, caused by one of the most potent toxins that exist. In recent decades, the disease has been linked to foods such as unrefrigerated home-made salsa, honey, and traditionally prepared salted or fermented fish.⁶⁵ An outbreak of botulism in 2006 in northern Thailand, which affected 152 people without causing any deaths,⁶⁶ was caused by the consumption of home-preserved bamboo shoots at a festive gathering.

Geographical distribution

Worldwide.

Agent

Clostridium botulinum. There are seven recognized types of the toxin that cause botulism, four of which (types A, B, E and, rarely, F) cause human botulism. Types C, D and E also cause illness in mammals, birds and fish.

Reservoir

The bacterium, in the form of spores, is commonly found in soil, aquatic sediment, the intestinal content of herbivores and fish.⁶⁷ Botulism is caused by a toxin produced by this sporulated form. Type E toxin is associated with fish and marine mammals. Infant botulism is associated with the use of contaminated honey in milk formula.

Human infection

Risk factors

Human-to-human transmission of botulism does not occur. Foodborne botulism can occur in all age groups.⁶⁸ The incidence of botulism is low, but all forms are considered

medical emergencies, as the mortality rate is high if treatment is not immediate and appropriate.⁶⁹

Improper home canning of low-acid foods (e.g. asparagus, green beans, beets, corn, fish and meat), as well as improperly stored garlic in oil, chili peppers and tomatoes can lead to foodborne botulism.⁷⁰ Foodborne botulism is especially dangerous and of public health concern, as many people can be poisoned by eating the same contaminated food.

Mode of transmission

There are three kinds of botulism, that occur naturally:⁷⁰

- foodborne botulism (due to ingestion of pre-formed toxins);
- wound botulism (occurs when wounds are infected with *C. botulinum* that secretes the toxin);
- infant botulism (typically in children less than 1 year old, after eating bacterial spores from food that develop into toxins in the intestines).

Clinical signs and symptoms

Incubation period: 4 hours–4 days.

The symptoms described below are not caused by the organism itself, but by the toxin that the bacterium releases.

- Nausea, vomiting, sometimes constipation, followed by toxic effects on the central nervous system (drooping eyelids, blurred or double vision, dizziness, difficulty in swallowing, blurred speech, muscle weakness, respiratory paralysis).

Treatment

Generally, supportive care is the mainstay for treatment of botulism. Prolonged intensive care, mechanical ventilation, and intravenous feeding may be required. Antitoxin administration is indicated as soon as possible after a clinical diagnosis has been made. This does not reverse the effects of the disease, but can prevent further paralysis. Antibiotics are not effective against toxins, but are needed to treat secondary bacterial infections.

Prevention and control

Individuals

- When preserving food at home, use a pressure canner and rigorously follow guides for home canning.
- While preparing food, follow the WHO Five Keys to Safer Food: keep clean; separate raw and cooked food; cook thoroughly; keep food at safe temperatures; use safe water and raw materials.

- Take good care to avoid contamination of food by soil or other sources likely to harbour these bacteria.

Community

- The community should be educated regarding proper preservation of home-made food, especially canning, to destroy spores.



Weblinks with more information:

- www.who.int/mediacentre/factsheets/fs270/en/
- www.who.int/csr/delibepidemics/botulism/en/
- www.who.int/csr/don/2006_03_22a/en/index.html



16

Brucellosis

(Also known as undulant fever, Malta fever, Bang's disease)

Brief description

Brucellosis is one of the world's most widespread zoonoses. The disease affects cattle, sheep, goats, pigs and some other animals. It can be passed to people via direct contact with livestock or through drinking unpasteurized milk from an infected animal. Globally, it is reported that brucellosis causes more than 500 000 infections in humans every year,⁷¹ although the true number of people infected in endemic areas is unknown because of variable reporting. Classically, high fever spikes occur every afternoon, hence the name "undulant" fever.

Geographical distribution

Countries in Asia including China, India, Indonesia and Thailand, and also in South America, the Mediterranean and the Middle East.

Agent

Various types of the *Brucella* species of bacteria exist (*B. abortus*, *B. melitensis*, *B. uis*, *B. canis*). *B. melitensis* is the most virulent and causes the most severe and acute cases of brucellosis. *B. abortus* is associated with mild to moderate sporadic disease that rarely causes complications.

Reservoir

Major reservoirs are cattle and buffalo (*B. abortus*), sheep and goats (*B. melitensis*), swine (*B. suis*) and dogs (*B. canis*). Infection persists throughout the lifetime of the animal.

Human infection

Risk factors

Person-to-person transmission is rare.⁷² People in close contact or working with animals are at greater risk of developing the disease. However, the majority of cases are caused by consuming raw, unpasteurized milk or cheese from infected goats or sheep.⁷³

Mode of transmission

- Direct contact with infected tissues or fluids.
- Ingestion of raw milk or dairy products such as soft cheese.
- Contamination of a fresh wound with infected matter from animals such as blood, urine, aborted fetuses and placenta.
- Accidental needle-stick puncture with *Brucella* B19 vaccine while vaccinating animals.

Clinical signs and symptoms

Incubation period: one week to several months.

Gradual onset of persistent fever, chills, sweating, headache, muscle pain, backache, joint pain, fatigue, weakness and weight loss.

Human brucellosis can cause chronic debilitating illness. Complications may affect any of the organ systems.

Treatment

Medical advice must be sought. There is no vaccine available for humans, but an extended course of antibiotics is recommended.

Prevention and control

Individuals

- Consume only pasteurized or boiled milk and dairy products from cows, sheep, and goats.
- Ensure meat is thoroughly cooked.
- Exercise care in handling and disposal of placenta, discharges and fetuses.

Community

- In regions where the prevalence of brucellosis is high, ensure farmers and slaughterhouse workers are aware of the risks of handling animal tissue, and provide instructions in infection-control practices to minimize risk of exposure.

- Bury discarded animal remains.
- Put in place special precautions for laboratory workers.

(Animal brucellosis is best prevented by careful herd management and hygiene. Vaccination is useful for prevention and control of infection. Eradication can only be achieved by test-and-slaughter combined with effective prevention measures and control of animal movement).



Weblinks with more information:

- www.who.int/csr/resources/publications/Brucellosis.pdf
- www.who.int/zoonoses/diseases/brucellosis/en/
- www.who.int/ith/diseases/brucellosis/en/
- www.cdc.gov/nczved/divisions/dfbmd/diseases/brucellosis/



17

Leptospirosis

(Also known as Weil's disease, rice field worker's disease, rat fever)

Brief description

Leptospirosis is a common, zoonotic, bacterial disease that affects both humans and animals. It is considered an emerging disease as it is increasingly being reported from various parts of the world.⁷⁴ Although curable if treated early, it is often misdiagnosed and can be fatal if left untreated. The number of new cases ranges from 0.1–10 per 100 000 per year globally, although during outbreaks and in high-exposure risk groups, disease incidence may reach over 50 per 100 000.⁷⁵ Case-fatality rates in different parts of the world are reported to range from < 5% to 70%.⁷⁵ In South-East Asia, leptospirosis outbreaks in humans are increasingly being reported during the rainy season in India, Indonesia, Sri Lanka and Thailand. Major outbreaks in the Region have been reported in Jakarta, Indonesia (2003), Mumbai, India (2005) and Kurunegala, Sri Lanka (2008).⁷⁴ Seasonal outbreaks have been reported in northern Thailand and in Gujarat, India following heavy rainfall and flooding.

Geographical distribution

Leptospirosis occurs worldwide, but is most common in tropical and subtropical areas with high rainfall.

Agent

The bacteria *Leptospira interrogans*, of which there are 12 species and over 250 serological variants (serovars).

Reservoir

About 160 mammalian species serve as reservoirs. Rodents were the first recognized carriers of leptospirosis and are a primary source of infection for humans. Rodents

have a prolonged carrier state, i.e. they can shed leptospires throughout their lifespan without showing any clinical symptoms.

Human infection

Risk factors

Agricultural and farm workers (rice-paddy and sugarcane workers for example), as well as those who work outdoors or with animals, are particularly at risk. Leptospirosis is also a recreational hazard for those who swim or wade in contaminated waters. In endemic areas, the number of leptospirosis cases may peak during the rainy season and even reach epidemic proportions in cases of flooding because this causes rodents to move into the city. Other occupational groups at risk include pet shop workers, veterinarians, sewer workers, abattoir workers, meat handlers and the military. The survivors of natural disasters (e.g. flooding) are also at high risk.

Mode of transmission

- Contact with urine or tissues from infected animals, usually rodents.
- Contact with surface water, soil or plants contaminated with the leptospirosis bacteria from the urine of infected animals.
- Via skin abrasions or exposed mucous membranes, the most common entry point for infection.
- Human-to-human transmission is rare.

Clinical signs and symptoms

Incubation period: usually 7–10 days.

The clinical spectrum of the disease ranges from flu-like symptoms to complications involving pneumonia and multiple organ dysfunction syndromes. Headache, muscle pain and conjunctival suffusion can develop with progression to severe jaundice, anuria, kidney failure and even death.

Treatment

Treatment with effective antibiotics should be initiated as soon as the diagnosis of leptospirosis is suspected. Although leptospirosis is curable, it is often misdiagnosed and can be fatal if left untreated. Complications may lead to pneumonia and multi-organ failure.

Prevention and control

The infection source can be controlled by general measures including:

- reduction of animal reservoir populations, such as rats;
- immunization of dogs and livestock;
- removal of rubbish and ensuring areas in and around homes are clean.

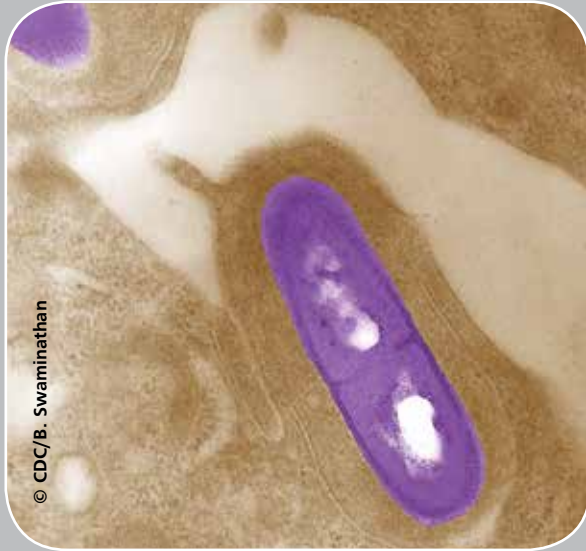
Individuals

- Avoid contact with animal urine, infected animals or an infected environment e.g. waterlogged places where infected animals may have urinated.
- Wear protective clothing and cover wounds with waterproof dressings to reduce the chance of infection if exposure is likely, e.g. occupational or recreational exposure.
- Do not swim in lakes or rivers that might be contaminated with animal urine.
- Drink only safe or boiled water during the rainy season, especially in flood-prone areas.
- Practise good personal hygiene, washing hands before eating and after defecating.
- Consult a physician for prophylactic use of antibiotics during flooding times.
- Protect the water supply from animal contamination.
- Drain wet ground.



Weblinks with more information:

- www.searo.who.int/entity/emerging_diseases/topics/leptospirosis/en/
- www.searo.who.int/entity/emerging_diseases/topics/Communicable_Diseases_Surveillance_and_response_CDS_leptospirosis-Fact_Sheet.pdf
- www.who.int/water_sanitation_health/diseases/leptospirosis/en/
- www.who.int/zoonoses/diseases/leptospirosis/en/
- www.who.int/zoonoses/diseases/lerg/en/
- www.cdc.gov/leptospirosis/pdf/fact-sheet.pdf
- www.cdc.gov/leptospirosis/health_care_workers/



18

Listeriosis

(Also known as circling disease)

Brief description

Listeriosis is a serious bacterial infection and is most commonly caused by eating contaminated food such as unpasteurized dairy products or ready-to-eat foods that have not been hygienically packaged. Changing food habits and new technologies such as refrigeration and vacuum packing of dairy, meat and fish products are contributing factors in the emergence of listeriosis. The overall case-fatality rate among non-pregnant adults is approximately 30%. In pregnant women, infection can lead to miscarriage, stillbirth, premature delivery, or infection of the newborn. The disease is known as "circling disease" in young animals.

Geographical distribution

Worldwide.

Agent

The bacterium *Listeria monocytogenes*.

Reservoir

Listeria monocytogenes mainly occurs in soil, forage, water, mud, livestock food and silage. Animal reservoirs include infected domestic and wild mammals, fowl and humans. Animals can carry the bacterium without appearing ill and can contaminate foods of animal origin such as meat and dairy products.⁷⁶

Human infection

Risk factors

Unlike most other foodborne pathogens, *Listeria* can multiply in refrigerated foods that are contaminated.⁷⁶

Although rare, listeriosis primarily affects older adults, pregnant women, newborns and adults with weakened immune systems.⁷⁶ The disease often intensifies existing debilitating illnesses or conditions such as organ transplantation, diabetes, cirrhosis, renal disease, heart disease, HIV infection, and in persons with malignancies or on corticosteroids. Pregnant women are about 20 times more likely to get listeriosis than other healthy adults.⁷⁶ Babies can be born with listeriosis if their mothers eat contaminated food during pregnancy.

Mode of transmission

- Most human infections follow consumption of foods contaminated with *Listeria monocytogenes* (a variety of raw foods, such as uncooked meats and vegetables, foods that become contaminated after cooking or processing, such as soft cheese, smoked seafood, unpasteurized milk and foods made from unpasteurized milk).⁷⁶
- In neonatal infections, the organism can be transmitted from mother to fetus *in utero*, or during passage through the infected birth canal.⁷⁶

Clinical signs and symptoms

Incubation period: uncertain, but probably a few days to 3 weeks.

Listeriosis can present in different ways depending on the type of infection. Manifestations of listeriosis are host-dependent. In older adults and persons with serious medical conditions, septicaemia (blood poisoning) and meningitis are the most common clinical presentations. Pregnant women may experience a mild, flu-like illness followed by fetal loss, or meningitis in their newborn. People with normal immune systems may experience acute gastroenteritis with high fever.⁷⁶

Treatment

Listeriosis is treatable with antibiotics.

Prevention and control

Individuals

- Keep kitchens and the environment clean and safe.
- Cook meat and poultry thoroughly.
- Store foods safely: use precooked or ready-to-eat food as soon as you can.

- Do not drink raw milk, and do not eat foods that contain unpasteurized milk.
- Pregnant women and individuals with low immunity should avoid ready-to-eat foods (unless heated until steaming hot), smoked fish, or soft cheese made with unpasteurized milk. They should also avoid contact with potentially infectious materials, such as aborted animal fetuses on farms.
- Veterinarians and farmers must take proper precautions in handling aborted fetuses and sick or dead animals, especially sheep that died of encephalitis.

Community

- Assure adequate pasteurization of milk and dairy products and prevent post-pasteurization contamination, which is common in many countries.
- Avoid the use of manure and sludge for vegetable farming.



Weblinks with more information:

- www.searo.who.int/entity/emerging_diseases/topics/leptospirosis/en/
- www.who.int/ith/diseases/listeriosis/en/
- www.cdc.gov/listeria/



19

Melioidosis

(Also known as *Whitmore's disease*)

Brief description

Melioidosis is a common bacterial disease that affects human beings and many species of animals. As humans and animals are increasingly being transported around the world, there are more and more opportunities for melioidosis to spread to new geographical areas. Clinical syndromes vary from region to region. Little is known about the incidence of melioidosis outside of Australia, Malaysia, Singapore and Thailand.⁷⁷ It is unrecognized and underreported in other countries because it requires awareness on the part of clinicians, and the existence of a laboratory capable of identifying the causative organism.

Mortality ranges from 40–75% despite the proper use of antimicrobial therapy.⁷⁸ Fatality rates are greater in persons with underlying disease and in immunosuppressed individuals.

Geographical distribution

Melioidosis is endemic in South-East Asia, China, and parts of Australia.

Agent

The disease is caused by a bacterium called *Burkholderia pseudomallei*.

Reservoir

There is no animal reservoir. *B. pseudomallei* is a bacterium that is widespread in soil and muddy water in endemic areas. It is particularly common in moist clay soils.

Human infection

Risk factors

Most people become infected directly from the environment, e.g. soil. More than 70% of all cases occur in people who already suffer from illnesses that increase the risk of disease,⁷⁹ particularly diabetes or other chronic conditions including thalassaemia, kidney disease, chronic lung disease, cancer and alcoholism, as well as the use of steroids.

Agricultural, laboratory and health-care workers are particularly vulnerable to occupational exposure.

Mode of transmission

- Human-to-human transmission is rare.⁷⁹ People contract the disease through direct contact with contaminated soil and surface waters.
- Infected animals can shed the organism on seeping wounds and, depending on the site of the infection, from other abscesses, nasal secretions, milk, faeces and urine.

Clinical signs and symptoms

Incubation period: 1 day to several months or even years. Some infections do not show symptoms, others result in localized acute or chronic disease, or fatal blood poisoning (septicaemia).

- Abscess of the salivary glands is common among children in some countries.
- Acute localized infection sometimes occurs at the site of inoculation.
- Swelling of regional lymph nodes may occur.
- Lung disease is the most common form of melioidosis. The symptoms usually include fever, coughing, chest pain and, in some cases, coughing up of blood.
- Septicaemia is the most serious form of melioidosis. It is most common in people with pre-existing diseases such as diabetes, cancer and kidney failure. Overwhelming infection can occur, resulting in death from septic shock within 48 hours of generalized symptoms.
- Chronic melioidosis is characterized by abscesses and suppurative lesions (i.e. involving pus), which can occur in a variety of organs.

Treatment

Long-term treatment may be necessary, although antibiotics have variable success in treating *B. pseudomallei*, and many drugs are not successful in eliminating the organism. The bacterium is, however, stated to be susceptible to numerous disinfectants including 1% sodium hypochlorite, 70% ethanol, glutaraldehyde and formaldehyde.⁸⁰

Prevention and control

No vaccine is available.

Individuals

- People with diabetes or other predisposing conditions should take special precautions to avoid skin contact with contaminated soil e.g. use gloves while gardening.
- Skin wounds, including abrasions or burns, should be promptly and thoroughly cleansed.
- Those who perform agricultural work should wear boots, which can prevent infection through the feet and lower legs.
- Health-care workers should use standard contact precautions (mask, gloves, and gown) to help prevent infection.
- Practices such as sniffing open culture plates should be discouraged in a laboratory situation.

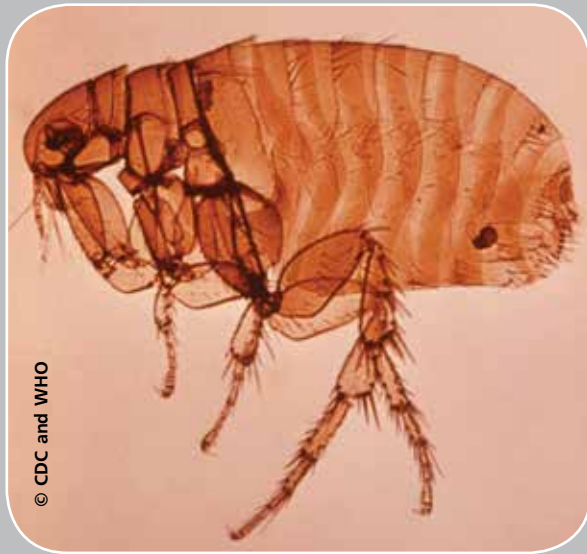
Community

- Chlorination of water supplies decreases the risk of infection.
- Only pasteurized dairy products should be consumed.



Weblinks with more information:

- www.cdc.gov/melioidosis/
- www.cfsph.iastate.edu/Factsheets/pdfs/melioidosis.pdf



20

Plague

(Also known as the Black Death)

Brief description

Plague is a rare, but acute, communicable disease caused by a bacterium and transmitted to man by the bite of infected rat fleas. It is primarily a disease of rodents, and humans are affected incidentally. Plague has been responsible for widespread pandemics, with up to 200 million deaths, since the beginning of humanity; approximately half of these occurred in Asia and Africa, and the other half in Europe.⁸¹ Plague continues to be a life-threatening disease unless detected and treated early. Following the reappearance of the disease during the 1990s in several countries, plague was categorized as a re-emerging disease, and remains of great significance under the International Health Regulations (2005), as plague outbreak may constitute a public health emergency of international concern.⁸² A total of 11 479 cases of human plague and 772 deaths were reported by 14 countries in Africa, the Americas and Asia from 2004 to 2008.⁸¹

Mortality depends on the type of plague: bubonic plague is fatal in about 50–75% of untreated cases, but perhaps 10–15% when treated. Septicaemic plague is almost always fatal, but perhaps 40% fatal with treatment. Pneumonic plague is fatal if not treated within 18–24 hours of infection.

Geographical distribution

Plague is endemic in many countries in Africa, the Americas and Asia, where it is maintained through flea–wild rodent–flea cycles. Contact of infected wild rodents with domestic rats may initiate an urban cycle of spread. In the WHO South-East Asia Region, endemic foci are found in India, Indonesia and Myanmar.⁸¹

Agent

The plague bacillus, *Yersinia pestis*.

Vector

Many species of fleas can act as vectors for *Y. pestis*, but the rat flea is the most important vector for the plague bacterium.

Reservoir

Rodents are the natural and maintenance hosts of plague. At least 220 species of rodents are known to be infected with plague bacillus.⁸¹ Domestic rodents are prone to both the infection and the disease, hence the phenomenon known as “rat fall”. The marmot is a primary carrier of the plague bacillus in many Asian countries. Marmots are the only creatures besides humans who can pass pneumonic plague from one to another under normal circumstances. Dogs may become infected without showing any sign of illness and act as sentinel animals.

Human infection

Risk factors

All ages and both sexes are susceptible to plague. Humans are at risk when they come into contact with rats in the same habitat. When the pneumonic form develops, transmission of plague becomes more efficient through the inhalation of aerosols.

Geographical, meteorological and climatic factors, ecological changes created by natural disasters, as well as the degree of social advancement (type of buildings, amount of overcrowding, forms of sewerage, degree of sanitation), the activities of shipping and other forms of transport, all affect the distribution of the rodents and insects that act as potential reservoirs and carriers of *Y. pestis*. Sociocultural factors, certain occupations and lifestyles such as hunting, cat ownership, sleeping on floors, religious myths and beliefs, are also among factors that increase the risk of exposure.

Mode of transmission

Plague can be transmitted indirectly or directly.

Indirect transmission

- Bite from an infected flea (bubonic plague): bubonic and septicaemic plague do not spread from person to person.

Direct transmission

- From a plague-infected rodent or animal while handling infected animals or carcasses.
- Human-to-human spread (pneumonic plague).
- Direct contact with droplets contaminated with sputum.

- Contact with an animal with pneumonic plague, which occurs when *Y. pestis* infects the lungs or when the infected animal coughs near another animal.
- If a cat develops pneumonic plague, it becomes a source of infection for people through aerosol transmission.
- During a laboratory accident.

Clinical signs and symptoms

Incubation period: bubonic plague, 2–6 days; pneumonic plague, 1–4 days.

Infected persons usually start showing flu-like symptoms such as sudden onset of fever, chills, head and body aches, weakness, and vomiting and nausea. Clinical plague infection manifests itself in three forms depending on the route of infection.

- Bubonic (through flea bites): fever, swollen lymph nodes (buboes) and signs of meningitis.
- Septicaemic (directly through bloodstream): fever without a rash, circulatory collapse, and sometimes a haemorrhagic rash.
- Pneumonic (the most virulent and least common form, due to infection of the lungs): fever, respiratory tract disease, bright red sputum.

*(Camels, domestic cats, susceptible rodents, and lagomorphs (hares and rabbits) may become ill and die suddenly in endemic areas. Cats are severely affected by *Y. pestis* infection).*

Treatment

Rapid diagnosis and treatment is essential to reduce complications and fatality. Patients should be isolated and treated with antibiotics.

Prevention and control

Prophylactic (preventive) antibiotics.

Individuals

- Immunization among high-risk groups offers partial protection.

Community

- Controlling rodents and their fleas around places where people live, work, and play is very important in preventing human disease.
- Effective environmental sanitation.
- Public health education.

Vaccination

- Plague vaccines were once widely used but did not prove to prevent plague outbreaks effectively. Vaccines are not recommended for immediate protection in outbreak situations.



Weblinks with more information:

- www.who.int/csr/disease/plague/en/index.html
- www.searo.who.int/entity/emerging_diseases/documents/ISBN_9789_92_9022_376_4/en/
- www.cdc.gov/plague/



21

Salmonellosis

Brief description

Salmonellosis is one of the most common and widely distributed foodborne diseases. It constitutes a major public health burden and represents a significant cost in many countries. It is estimated that tens of millions of human cases occur worldwide every year and the disease results in more than 100 000 deaths.⁸³ Although outbreaks of salmonellosis have been reported for decades, it is considered an emerging disease because it has recently increased in incidence in many continents. Since the beginning of the 1990s, strains of salmonella that are resistant to a range of antimicrobials have emerged and threaten to become a serious public health problem.⁸³

Geographical distribution

Worldwide. Most animals are susceptible to infection.

Agent

Bacteria of the *Salmonella* species (*S. typhimurium*, *S. enteritidis* and more than 2500 known types or serotypes).⁸³

Reservoir

Poultry (main reservoir), domestic and wild animals.

Human infection

Risk factors

Children are the most likely to get salmonellosis; the rate of diagnosed infections in children under five is higher than in all other age groups. Groups at greatest risk for severe or complicated disease are infants, the elderly, and persons with compromised

immune systems. Most people recover without treatment. However, in the very young and the elderly, and in cases when the bacteria enter the bloodstream, antibiotic therapy may be needed.

Mode of transmission

Salmonellosis is generally contracted through the consumption of raw or improperly cooked food of animal origin (mainly meat, poultry, eggs and milk), although many other foods, including green vegetables contaminated from manure, have been implicated in its transmission.

Clinical signs and symptoms

Incubation period: 6–36 hours, but may be up to 72 hours. Most infections remain subclinical.

- Symptoms include diarrhoea, vomiting and low-grade fever.
- Symptoms can progress to dehydration, extreme exhaustion and sometimes death, especially in the very young or very old.
- Persons with diarrhoea usually recover completely, although it may be several months before their bowel habits are entirely normal. A small number of persons with *Salmonella* develop reactive arthritis (pain in their joints, irritation of the eyes, and painful urination). This can last for months or years, and can lead to chronic arthritis which is difficult to treat.

Treatment

Salmonella infections usually resolve in 5–7 days and often do not require treatment other than oral fluids. Persons with severe diarrhoea may require rehydration with intravenous fluids. Antibiotics are not usually necessary unless the infection spreads from the intestines. The occurrence of resistance to antimicrobial agents used for growth promotion indicates that resistance will also emerge following the introduction of antimicrobials for growth promotion.⁸⁴

Prevention and control

- Cook poultry and eggs thoroughly. Do not consume partially cooked eggs with runny yolks and do not consume meat that is red or pink after cooking unless convinced of the fresh and safe source of the products.
- Practice good personal hygiene and safe food-handling techniques.
- Wash hands with soap and clean water before eating or cooking, and after using the lavatory.
- Control rodents and prevent wild birds from mingling with poultry on farms.
- *Salmonella* testing should be conducted in poultry breeding farms.

- Milk should be pasteurized or boiled before consumption.
- Food handlers and the public should be educated on the risks of salmonellosis infection.



Weblinks with more information:

- www.who.int/mediacentre/factsheets/fs139/en/
- www.cdc.gov/salmonella/general/index.html



22

Scrub typhus

(Also known as *tsutsugamushi disease*)

Brief description

Scrub typhus is a bacterial disease that is spread through trombiculid (“chigger”) mites. Rodents are usually infected, while humans are accidental hosts. The term “scrub” is used because of the type of vegetation (terrain between woods and clearings) that harbours the vector. However, the name can be deceptive as endemic areas can also be sandy, semi-arid and mountain deserts.

Dreaded in the pre-antibiotic era, scrub typhus either incapacitated or caused the deaths of over 36 000 soldiers in the Far East during the Second World War; they were infected through chigger bites as they moved through forests.⁸⁵ In recent years, scrub typhus has re-emerged in India with outbreaks reported in 2003 to 2011, in Maldives since 2000, and in Thailand.¹⁰¹ Scrub typhus is probably one of the most underdiagnosed and underreported febrile illnesses requiring hospitalization in the Region.⁸⁶

Although the precise incidence of the disease is unknown, an estimated 1 billion people are at risk for scrub typhus and an estimated 1 million cases occur annually. The case-fatality rate in untreated cases varies from 1– 60% according to area, strain of infectious agent, and previous exposure to the disease; it is consistently higher among older people.⁸⁷

Geographical distribution

Scrub typhus is endemic to a part of the world known as the “tsutsugamushi triangle”, extending from northern Japan and the far-eastern Russian Federation to northern Australia and Pakistan. This includes Bhutan, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka and Thailand.

Agent

Orientia tsutsugamushi, which has five major serotypes.

Reservoir

Chigger mites act as the primary reservoirs for *O. tsutsugamushi*.

Human infection

Risk factors

Scrub typhus is essentially an occupational disease among rural residents in the Asia-Pacific region. An increase in the prevalence of scrub typhus has been reported from some Asian countries, which coincides with urbanization of rural areas.

Mode of transmission

Scrub typhus is transmitted to humans and rodents by some species of chigger mites (*Leptotrombidium deliense* and others). The mite is very small (0.2–0.4mm) and can only be seen through a microscope or magnifying glass.

Clinical signs and symptoms

Incubation period: 5–20 days (average 10–12 days) after the initial bite.

- The chigger bite is painless and may be noticed as a transient localized itch, often found on the groin, armpits, genitalia or neck.
- A scab is often seen at the site of the bite.
- Sudden shaking chills, fever, severe headache, infection of the mucous of the conjunctiva and swelling of the lymph nodes are also seen.
- A spotted rash on the trunk may be present.
- There may be muscle or gastrointestinal pain.
- Complications may include pneumonia and myocarditis.

Treatment

Scrub typhus is treatable with antibiotics.

Prevention and control

Individuals

- In endemic areas, wear full-length clothing, socks and shoes. Avoid walking barefoot.
- Apply, as necessary, insect repellents containing dibutyl phthalate, benzyl benzoate, diethyltoluamide, and other substances to the skin and clothing to prevent chigger bites.
- Do not sit or lie on bare ground or grass; use a suitable groundsheet or other ground cover.
- Clear vegetation and do chemical treatment of the soil to help break the cycle of transmission.

Community

- Rapid case identification by health-care workers can help provide prompt treatment.
- Public education on case recognition and personal protection will help in the identification and prompt treatment of cases.
- Rodent control and improved living conditions will help prevent spread of the disease.



Weblinks with more information:

- www.who.int/csr/resources/publications/surveillance/WHO_CDS_CSR_ISR_99_2_EN/en/
- www.searo.who.int/entity/emerging_diseases/CDS_faq_Scrub_Typhus.pdf



23

Tularaemia

(Also known as rabbit fever)

Brief description

Tularaemia is caused by the bacterium *Francisella tularensis*, which is found in animals, especially rabbits, hares and rodents. Many species, including humans, are susceptible to infection.

Francisella tularensis is one of the most infectious bacteria known and it is, therefore, considered as a potential biological weapon. Even small doses of these bacteria (10–50 bacteria) have the potential to cause severe disease. The organism is capable of surviving for weeks at low temperatures in water, moist soil, or decaying plant and animal matter.

Geographical distribution

Tularaemia is endemic in many parts of the world including North America, Eastern Europe, China, Japan and Scandinavia. It has been reported from Thailand.⁸⁸

Agent

Francisella tularensis. Currently there are four recognized subspecies *F. tularensis* (*F. tularensis*, *F. holarctica*, *F. mediasiatica*, and *F. novicida*).⁸⁹

A clinical diagnosis of *Francisella* infection is highly nonspecific, and it seems that the underlying disease with immunosuppression is an important factor to contracting the disease. Clinicians should be aware of tularaemia associated with handling of sick pet animals.

Reservoir

Rabbits, hares and rodents are natural reservoirs and often die in large numbers during outbreaks.

Human infection

Humans can acquire tularaemia when they come in contact with infected animals.

Risk factors

An underlying disease that suppresses immunity is an important factor for contracting tularaemia. Hunters, pet owners and farmers are high-risk groups for exposure to infection.

Mode of transmission

Humans acquire tularaemia when they come into contact with infected animals or are bitten by ticks, deerfly or other insects that feed on infected animals. Tularaemia may be spread through inhalation of dried animal matter, skinning or dressing killed animals, or drinking water contaminated by animal carcasses. There is no direct human-to-human transmission.

Clinical signs and symptoms

Incubation period: 3–5 days (range 1–14 days)

Tularaemia is characterized by a sudden onset of high fever, headache, muscle and joint pains and swollen, painful lymph nodes. Fever, headache and body aches resemble other diseases. Slow healing sores and lesions develop at the entry site of bacteria. The organism may spread widely, causing major organs to fail. Pneumonia is common after inhalation. In humans, tularaemia is observed in six distinct clinical syndromes depending on the route of exposure: ulceroglandular (the most common form), glandular, typhoidal (fever without localizing signs), oculoglandular (infection of the eye), oropharyngeal, and pneumonia.⁹⁰

Treatment

Tularaemia is treated with intramuscular injection of antibiotics. If untreated, tularaemia causes prolonged fever and fatigue and is often fatal.

Prevention and control

Since tularaemia is an emerging disease and it can be fatal in humans, it does have a public health significance. Educating clinicians, health workers and the general public on recognition, prevention and control of tularaemia is important. Public should be educated to:

- use universal precautions in direct handling of pet animals that are exhibiting signs and symptoms of illness;
- use gloves when skinning or handling animals, especially rabbits;
- cook the meat of wild rabbits and rodents thoroughly;
- avoid tick-infested areas or use tick repellents.
- No tularaemia vaccine is currently available.



Weblinks with more information:

- www.who.int/csr/deliberedemics/tularaemia/en/index.html
- www.cdc.gov/Tularemia

Emerging and/or zoonotic parasitic diseases



Taeniasis/cysticercosis

Toxoplasmosis

Trichinellosis



24

Taeniasis/ cysticercosis

Brief description

The most important tapeworms for humans are *Taenia saginata* and *Taenia solium*. The tapeworm lives in the intestine of humans and the adult stage is known as taeniasis. These humans shed the proglottids containing the eggs in their faeces. The eggs are ingested by cattle (*T. saginata*) or pigs (*T. solium*), where a cysticercus develops in the muscle; this larval stage of tapeworm is known as cysticercosis. Encystment of larvae can occur in the brain, which is known as neurocysticercosis and is one of the main causes of epilepsy in many developing countries.

T. solium has significant public health importance as it causes human cysticercosis, which affects sensitive organs like the brain and eyes, and is difficult to treat. There is a general misconception that human cysticercosis is reported only in pig-raising or pork-eating communities; however, it has also been reported among vegetarian populations, as it is transmitted through food/vegetables contaminated by human faeces.

Geographical distribution

T. solium and *T. saginata* are distributed worldwide. *T. saginata* can be found worldwide in countries where cattle and buffaloes are raised for human consumption; *T. solium* where pigs are raised for human consumption. The distribution of cysticercosis coincides with the distribution of *T. solium*. More than 80% of the world's 50 million people who are affected by epilepsy live in low-income and lower-middle-income countries, many of which are endemic for *T. solium* infections in people and pigs.⁹¹ Human cysticercosis has been reported from India, Indonesia, Nepal and other countries of the Asia-Pacific region.

Agent

T. solium (pork tapeworm) and *T. saginata* (beef tapeworm). *T. solium* is responsible for human cysticercosis.

Reservoir

Cattle and buffaloes for beef tapeworm and pigs for pork tapeworm.

Human infection

Risk factors

Taeniasis and cysticercosis are parasitic infections related to pig husbandry practice, and poor hygiene and sanitation. Taeniasis is reported in countries where open defecation is common and scavenging pigs are found in the community. Other important risk factors may be lack of meat inspection, and consumption of raw or undercooked meat.

Mode of transmission

Humans acquire the infection by ingestion of raw beef/pork containing the cysticercus. Humans are the final host for both *T. saginata* and *T. solium*, but humans can also be the intermediate host for *T. solium*. The great majority of *T. saginata* and *T. solium* carriers are unaware of their infection, as these tapeworms did not kill their host. However carriers of *T. solium* carry a substantial risk of acquiring cysticercosis by faeco-oral autoinfection and members of their households are also at increased risk.

Clinical signs and symptoms

Incubation period: For taeniasis (adult worm): 6–8 weeks after ingestion of contaminated pork infected with larvae (cysticerci). For human cysticercosis (larval stage): variable, and infected people may remain asymptomatic for years.

Persons who have the tapeworms *T. saginata* and *T. solium* in their intestine may not notice the existence of the tapeworm unless there are multiple adult worms. Intermittent faecal shedding of proglottids (segments), gastrointestinal discomfort, nausea, diarrhoea, loss of appetite and loss of weight may be observed.

The clinical signs and symptoms of human cysticercosis depend on the location and number of larvae in brain, eye or other organs. Seizures, headaches, learning difficulties and convulsions are symptoms of neurocysticercosis. Cysticercosis of other tissues is almost always asymptomatic.

Treatment

Taeniasis is easily treated with praziquantel or niclosamide. Treating human cysticercosis is difficult with varying success and may include long courses with anthelmintics, as well as supporting therapy with corticosteroids and/or anti-epileptic drugs, and possibly surgery.

Prevention and control

Taeniasis and cysticercosis are neglected disease problems in endemic countries. Integrated multidimensional activities are required for the prevention and control of this problem. The following public health interventions are needed:

- meat inspection;
- public awareness and health education;
- thorough cooking of meat;
- improved hygienic practices;
- adequate water and sanitation (elimination of open defecation);
- improved pig-farming practices.

Easy access to treatment should be provided to infected individuals and people who are in close contact with pigs.

In 2009, WHO issued guidance that focused on an integrated approach that targets both taeniasis and cysticercosis. This includes large-scale preventive chemotherapy in humans, and treatment and vaccination of pigs.



Weblinks with more information:

- www.who.int/zoonoses/diseases/taeniasis/en/
- www.who.int/mediacentre/factsheets/fs376/en/index.html



25

Toxoplasmosis

Brief description

Toxoplasmosis is an infection caused by a parasitic protozoan, usually transmitted from animals to humans. It can have severe consequences in pregnant women and individuals with a compromised immune system.

Geographical distribution

Worldwide.

Agent

The protozoa *Toxoplasma gondii*.

Reservoir

Cats and other felines. Intermediate hosts include most species of birds and mammals. Cats become infected by eating these small birds and mammals and then passing oocysts in their faeces, which are infective to humans.

Human infection

Risk factors

Toxoplasmosis is very common: up to 95% of some populations across the world have been infected with *Toxoplasma*.⁹² Infection is often highest in areas that have hot, humid climates and low altitudes.

Persons with weakened immune systems may experience severe symptoms if infected with *Toxoplasma*. If a woman is infected prior to pregnancy, she will have developed

immunity that will protect the child. However, if a woman is infected with *Toxoplasma* during or just before pregnancy, she can pass the infection to her unborn baby.⁹³

Mode of transmission

Foodborne transmission

- Ingestion of undercooked, contaminated meat.
- Eating without washing hands thoroughly, after accidentally or unknowingly handling contaminated food.
- Eating food contaminated by knives, utensils and cutting boards, and food that has had contact with raw, contaminated meat.
- Drinking water or milk contaminated with *Toxoplasma gondii*.

Mother-to-child (congenital) transmission

- Mother-to-child (congenital) transmission or mother-to-fetus through the placenta.

Animal-to-human (zoonotic) transmission

- Accidentally swallowing the parasite through contact with cat faeces that contain *Toxoplasma*, such as while cleaning cat litter.
- Accidentally ingesting contaminated soil (for example by not washing hands after gardening or eating unwashed fruit or vegetables from a garden).
- Consuming food or water contaminated with cat faeces.

Clinical signs and symptoms

Incubation period: 5–23 days. Primary infections may not produce symptoms. The disease can affect the brain, lung, heart, eyes and/or liver. Symptoms in otherwise healthy people include:

- fever;
- mild flu-like symptoms;
- enlarged lymph nodes in the head and neck;
- muscle pain;
- pneumonia;
- central nervous system disturbances;
- complications of eyesight;
- other systemic diseases.

Infection during pregnancy can result in inflammation of an area behind the retina (chorioretinitis) in the fetus, fluid in the fetal brain (hydrocephaly) or fetal death.

The consequences of infection are more serious in mother-to-child (congenital) transmission. The case-fatality rate and number of complications are high during the last trimester of pregnancy, but lower during early trimesters. Damage to the unborn child is more severe and pregnancy can result in miscarriage, stillbirth, or a child born with signs of toxoplasmosis, e.g. abnormal enlargement or smallness of the head. Infants infected before birth often show no symptoms at birth, but develop them later in life with potential vision loss, mental disability and seizures. Toxoplasmosis contracted during infancy may lead to permanent disabilities such as poor sight, hearing loss or learning disorders.

(Symptoms in animals are usually subclinical, although abortion is common in sheep and pigs).

Treatment

Those without symptoms typically do not need treatment. On the advice of health-care providers, different medications are available for those with clinical signs.

Prevention and control

Individuals

- Wear gloves while gardening or doing anything outdoors that involves handling soil or a sandbox.
- Wash hands well with soap and water after outdoor activities.
- Do not touch cats or cat litter during pregnancy.
- Change litter boxes daily.
- Cook all meat thoroughly.

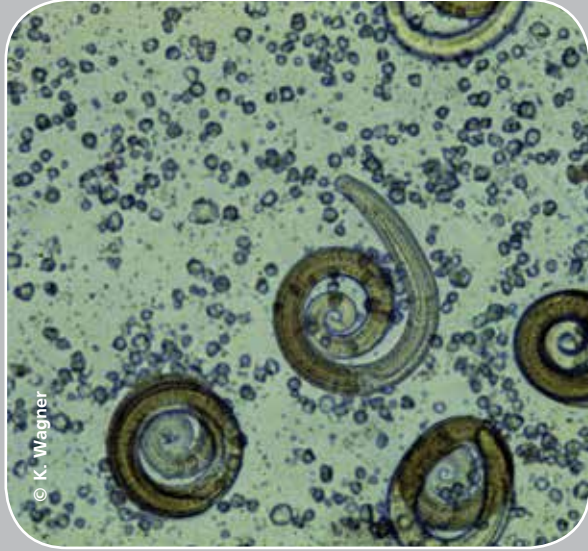
Community

- Cover any sandboxes when not in use to keep cats from defecating in them.
- Prevent entry of cats and kittens to water reservoirs and other water sources.



Weblinks with more information:

- www.cdc.gov/parasites/toxoplasmosis/gen_info/index.html
- whqlibdoc.who.int/hq/1993/WHO_CDS_VPH_93.114.pdf
- www.dpd.cdc.gov/dpdx/html/frames/S-Z/Toxoplasmosis/body_Toxoplasmosis_page1.htm#Causal%20Agent



26

Trichinellosis

(Also known as trichinosis)

Brief description

Trichinellosis is a rare zoonosis caused by roundworms. Humans and domestic and wild animals can be infected and become carriers of the parasites. Trichinellosis has been reported from Bhutan, India, Indonesia and Thailand.^{94,95}

Geographical distribution

Trichinella species occur worldwide, most frequently in regions with temperate climates, including mountainous regions in South-East Asia.

Agent

Trichinella spiralis: *Trichinella* larvae are encysted in muscle tissue of meat from domestic or wild animals.

Reservoir

Wild boar, domestic pigs, bears, rodents and horses.

Human infection

Risk factors

People acquire trichinellosis by consuming raw or undercooked meat infected with the *Trichinella* parasite, particularly from wild game (e.g. boar) or pork. Indeed, cultural factors such as traditional dishes based on raw or undercooked meat or meat-derived products play an important role in how the disease is contracted and spread. Even tasting very small amounts of undercooked meat during preparation or cooking puts a person at risk for infection.

Mode of transmission

Consumption of raw or undercooked meat.

Clinical signs and symptoms

Incubation period: 1–2 weeks.

Intestinal invasion can be accompanied by gastrointestinal symptoms (diarrhoea, abdominal pain, nausea, vomiting). Larval migration into muscle tissues (one week after infection) can cause uneasiness, eyelid or facial oedema (fluid retention), conjunctivitis, fever-associated chills, muscle pain and itchy skin. Occasional life-threatening manifestations include heart failure, pneumonia or encephalitis. Cardiovascular complaints represent the most important complications of trichinellosis and are particularly evident in the moderate and severe courses of the disease.

Suspicion of trichinellosis is based on the consumption of raw or undercooked pork and resulting clinical symptoms, and can be confirmed by specific diagnostic tests including antibody detection, muscle biopsy and microscopy.

Treatment

Anthelmintics and steroids, applied only at the early stage of infection, are effective. There is no specific treatment for the disease once the larvae have invaded the muscles.

Prevention and control

Individuals

- Eat thoroughly cooked meat, i.e. until the juice runs clear and the meat is not pink.
- Freeze pork less than 6 inches (15 cm) thick for 20 days at -15°C .

Community

- Educate consumers about the risk of consumption of raw or undercooked meat and meat products from both domestic pigs and wild boar.
- Do not feed pigs with game meat scraps.
- Ensure rigorous meat inspection and hygienic pig production.



Weblinks with more information:

- wwwnc.cdc.gov/eid/article/17/12/pdfs/11-0896.pdf
- www.dpd.cdc.gov/dpdx/html/PDF_Files/MedLetter/Trichinellosis.pdf
- www.trichinella.org/pdf/Trichinella_Overview.pdf
- www.cdc.gov/parasites/trichinellosis/cmr.asm.org/content/22/1/127.full
- www.ncbi.nlm.nih.gov/pmc/articles/PMC2634638/

Glossary

<i>Acute</i>	Relating to a disease or condition with a rapid onset and a short, severe course.
<i>Aerosol</i>	A suspension of fine solid or liquid particles in a gas, usually air.
<i>Amplifying host</i>	A host (e.g. a pig) in which the level of pathogen can become high enough for a vector (e.g. a mosquito) to become infectious.
<i>Antitoxin</i>	A particular kind of antibody that is produced by the body in response to the presence of a toxin or toxoid.
<i>Anuria</i>	Complete suppression of urine formation by the kidney.
<i>Asymptomatic</i>	A carrier for a disease or infection that experiences no symptoms.
<i>Atypical</i>	Not conforming to the normal form or type.
<i>Case-fatality rate</i>	The number of deaths caused by a disease relative to the total number of diagnosed cases.
<i>Chronic</i>	Relating to a disease of slow progress and long duration.
<i>Conjunctiva</i>	The delicate membrane lining the eyelids and covering the eyeball.
<i>Cutaneous</i>	Relating to the skin.
<i>Emerging infectious disease</i>	A new disease that is affecting a population for the first time, or an existing disease that is rapidly spreading geographically or affecting an increasing number of people.
<i>Encephalitis</i>	Inflammation of the brain.
<i>Endemic</i>	A disease that is usually prevalent in a population or geographical area.
<i>Endocarditis</i>	Inflammation of the inner lining of the heart.
<i>Epidemic</i>	When significantly more cases of disease than normal occur in a population.
<i>Epizootic</i>	An epidemic outbreak of an infectious disease in an animal population.
<i>Gastrointestinal</i>	Relating to the alimentary tract comprising the stomach and intestines.
<i>Herbivorous</i>	An animal that feeds only on grass and other plants.

<i>Immunocompromised /immunosuppressed</i>	Where the immune defence system of an individual is weaker than normal or suppressed. This can result from certain diseases (e.g. HIV, lymphoma) or from certain drugs. The opposite is immunocompetent, i.e. when the body is able to produce a normal immune response following exposure to an antigen.
<i>Incubation period</i>	The time interval between acquiring an infection and the onset of the signs or symptoms of the disease.
<i>Inoculation</i>	The introduction of pathogenic microorganisms, injective material, serum, or other substances into tissues of living organisms, e.g. humans.
<i>Intermediate host</i>	A host in which a parasite undergoes a stage in its development.
<i>Jaundice</i>	Yellowish discoloration of the whites of the eyes, skin, and mucous membranes caused by deposition of bile salts in these tissues. Also called icterus.
<i>Meningitis</i>	Inflammation of the membranes surrounding the brain.
<i>Nosocomial</i>	Acquired or occurring in a hospital.
<i>Opportunistic</i>	Opportunistic infections take advantage of a weakened immune system, and can cause devastating illnesses.
<i>Pandemic</i>	Simply put, a pandemic is an outbreak of disease that has spread to many countries, often across continents or worldwide.
<i>Parotid abscess</i>	A build-up of pus and infected material in a salivary gland surrounding the jaw.
<i>Pathogen</i>	A pathogen is an infectious agent (a germ) that is capable of causing disease in a human, animal or plant host. Different pathogen classes include viruses, bacteria, fungi and prions.
<i>Pneumonic</i>	Affecting the lungs.
<i>Prevalence/incidence</i>	The prevalence of a disease is the number of cases in a defined population at a specified point in time, while its incidence is the number of new cases in a given period in a population.
<i>Primary infection</i>	A time when the body has no innate defence against the organism because it is the first time it is exposed to the pathogen.
<i>Prophylaxis</i>	Any measure that protects against or prevents disease. Post-exposure prophylaxis is given after exposure to protect against or prevent the development of the disease, e.g. antibiotics or rabies vaccination after a bite from a suspected animal. Pre-exposure prophylaxis is undertaken before disease exposure, e.g. meningitis vaccination.

<i>Pulmonary</i>	Relating to the lungs.
<i>Re-emerging disease</i>	A disease that is increasing in prevalence in an area where it was previously absent or controlled.
<i>Reservoir</i>	A group (e.g. animal, human, insect) in which a disease is maintained without causing serious illness to the infected members.
<i>Ruminant</i>	An animal that has a stomach with four complete cavities, and characteristically regurgitates undigested food and chews when at rest. Includes cattle, sheep, goats and deer.
<i>Septicaemia</i>	The medical term for blood poisoning, in which pathogens have invaded the bloodstream and circulate throughout the body.
<i>Serum</i>	The clear, protein-rich liquid that separates out when blood coagulates.
<i>Subclinical infection</i>	An infection with no detectable symptom. This may occur in an early stage of the infection with signs and symptoms appearing later, or the symptoms may never appear.
<i>Tissues</i>	Groups of cells with a common structure and function, e.g. skin.
<i>Toxin</i>	A poisonous substance produced by living cells or organisms that is capable of causing disease when introduced into body tissues.
<i>Vector</i>	A carrier, typically an insect, that transfers an infectious agent from one host to another.
<i>Virulent</i>	Used to describe an agent that is extremely infectious, malignant or poisonous.
<i>WHO South-East Asia Region</i>	WHO Member States are divided geographically into six regions. The South-East Asia Region comprises the nations of Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste. The WHO Regional Office for South-East Asia is located in New Delhi, India.
<i>Zoonotic/zoonosis</i>	These terms refer to diseases that are transferable between animals and humans, and vice versa.

Annex: Practical tips for vector control

1. Individual and household protection

- Clothing that minimizes skin exposure affords some protection from the bites of vectors and is encouraged, particularly during outbreaks. Note that some mosquitoes are most infective during daylight hours.
- Repellents may be applied to exposed skin or to clothing. The use of repellents must be in strict accordance with label instructions.
- Insecticide-treated mosquito nets afford good protection for those who sleep during the day (e.g. infants, the bedridden and night-shift workers).
- Where indoor biting occurs, household insecticide aerosol products, mosquito coils or other insecticide vaporizers may also reduce biting activity.
- Household fixtures such as window and door screens and air-conditioning can also reduce biting activity.
- Initiatives to reduce the sources of infection in homes and the community, i.e. environmental management, comprise:
 - **environmental modification** – long-lasting physical transformations to reduce vector larval habitats, such as installation of a reliable piped water supply to communities, including household connections.
 - **environmental manipulation** – temporary changes to vector habitats involving the management of “essential” containers, such as frequent emptying and cleaning by scrubbing of water-storage vessels, flower vases and desert room coolers; cleaning of gutters; sheltering stored tyres from rainfall; recycling or proper disposal of discarded containers and tyres; management of plants that collect water in the leaves close to homes.
 - **changes to human habitation or behaviour** – actions to reduce human–vector contact, such as installing mosquito screening on windows, doors and other entry points, and using mosquito nets while sleeping.
 - **other measures** – mosquito-proofing of water-storage containers; management of solid waste; street cleaning; and the cleaning of building structures.

2. Chemical control

- Larvicides
- Adulticides
- Residual treatment
- Space sprays.

Safe use of insecticides

All pesticides are toxic to some degree. Safety precautions for their use – care in handling, safe work practices for those who apply them, and appropriate field application – should be followed. WHO has published specific guidelines on use of insecticides, safety procedures, quality control and testing.⁹⁶

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Emerging infectious diseases (EIDs) are serious public health threats, globally as well as in the WHO South-East Asia Region. An emerging infectious disease is one that either has appeared and affected a population for the first time, or has existed previously but is rapidly spreading, either in terms of the number of people getting infected, or to new geographical areas. Many EIDs are zoonotic in origin, which means that the disease has emerged from an animal and crossed the species barrier to infect humans. Nipah virus, Crimean-Congo haemorrhagic fever and avian influenza A(H5N1) are examples of diseases that have recently emerged and have affected the WHO South-East Asia Region. Often humans may have little or no natural immunity to EIDs, so their impact, on health, society and the economy, are difficult to predict.

This publication, developed by the WHO Regional Office for South-East Asia, is intended to serve as a reading source of key facts for non-technical persons who are interested in public health, such as policy-makers, non-health officials, media persons as well as the general public. It contains key information on 26 selected endemic, emerging and re-emerging infectious diseases and zoonoses affecting countries in the Region, or posing a potential threat to the Region. Each chapter starts with a general description of the type and severity of the infectious disease and how it is transmitted and spread, followed by an explanation of the risk factors for and symptoms of infection in humans. This is followed by recommendations on prevention, control and treatment. A glossary helps clarify technical terms, while for those interested in more information on a selected topic, references for further reading are also provided.



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