

Zoonoses

Diseases transmitted from animals to humans



Agrodok 46

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This publication is sponsored by: ICCO

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First edition: 2008

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Printed by: Digigrafi, Wageningen, the Netherlands

ISBN Agromisa: 978-90-8573-105-4

ISBN CTA: 978-92-9081-395-8

Foreword

Zoonoses are infectious diseases – including parasitic infections – that can be transmitted from animals to humans. Zoonoses pose a significant threat to human health, especially when humans and animals live close together and when humans are in contact with animal products. Examples are: rabies, bovine tuberculosis and many diarrhoeal diseases.

This Agrodok has been written for people who live and work with animals or animal products, to arouse awareness among its readers of the significance of zoonoses to human health. It provides information about the prevention of these diseases in humans and in animals, explaining the causes, the transmission and how to protect against them. The focus is on developing countries and on rural and urban situations.

Acknowledgement

As one of the authors and final editor I thank the co authors, peer readers, the illustrators and the Agromisa team for their support to get this publication realized.

Speaking for the others, we hope that the information of this publication will give a better understanding of zoonoses and what measures people can take.

Wageningen, July 2008

Mariska Leeftang

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1 Introduction

1.1 Healthy animals, healthy people!

A herd or flock will be of benefit to its owners if it is healthy, because healthy animals grow faster and produce more food and more draught power. Some animal diseases and parasites may not only make the animals ill, they can be a threat to humans as well. These diseases are called zoonotic diseases or zoonoses.

When animals fall ill, the owner has a problem because many owners depend on their animals for income. If a sick donkey cannot pull the cart to bring fruits to the market, there will be no income (for the family). If sick chickens stop laying eggs, there will be no eggs to sell. And without any money, how can sick animals be treated or replaced if they die?

Some animal diseases can spread to other animals making the problems even bigger. Worse still, the disease can also spread to humans.

In recent years, much publicity has been focused on mad cow disease (BSE) and avian influenza (AI). While these zoonoses are described as serious threats to human health, many other zoonoses cause more deaths among people (especially in developing countries) and get far less attention. Rabies, for example, kills around 55,000 people worldwide each year, while in comparison BSE killed (only) 139 people between 1996 and 2002. Human deaths due to avian influenza have amounted to no more than 200 worldwide (Source: WHO Fact Sheets, 2007). Many of these zoonoses can be entirely prevented (though not easily!).

Our information in this Agrodok is on Zoonoses, focusing on the prevention of zoonoses in humans (and not in animals). However, to prevent these diseases from occurring in humans, you will also – as far as possible – need to prevent them occurring in animals.

2 General information on zoonoses

2.1 What are zoonoses?

The definition we use here for zoonoses (or zoonotic diseases) is as follows:

Infectious diseases that can be transmitted between animals and humans, and may give problems in humans but not necessarily in animals.

Infectious diseases are caused by pathogenic microbes (viruses, bacteria) or by parasites (worms, protozoans). The microbe or parasite infects the animal or human and causes disease.

Microbes and parasites can be found in different places in the body, depending on the disease. Some live in the intestines and others in organs. Microbes and parasites can also be present in the urine, blood, faeces and saliva. For instance, when you cough, small droplets of saliva can be projected through the air to anyone in the immediate vicinity, and if you are ill, the microbes in your saliva can infect people. Diseases that cause diarrhoea are another example.

An animal may be a carrier of a specific microbe or parasite. This means it carries the microbe or parasite but is not ill. Still, the animal can spread microbes like salmonella, for instance, via its excreta.

Infectious diseases caused by zoonoses are specific: they are not restricted to one animal species or solely to humans, and can cross over from animals to humans and vice versa (action known as transmission). More information about the different routes by which zoonoses can be transmitted from animals to humans can be found in Section 3.1.

Some zoonoses cause no signs of disease in animals. An example is porcine cysticercosis (see Section 6.6). Cysticercosis is caused by the young form (larva) of the pig tapeworm. In humans, cysticercosis may

cause epileptic fits or large nodules under the skin, while the infected pig will show no signs or symptoms of the disease, except for some vesicles on the tongue.

Some well-known diseases are commonly thought to be zoonotic, whereas they are not. For example, classical (CSF) and African swine fever (ASF) do NOT cause illness in humans. The same goes for Foot and Mouth Disease (FMD).

Box 1: Different concepts of health and disease

What is a healthy person? When is someone ill? These questions are answered differently in different parts of the world. In other words: 'health' and 'disease' are strongly culturally and socially influenced. In many societies diseases are even believed to be punishment from the gods or caused by 'black magic'.

Some preventive measures may be difficult to implement in a community simply because they require a new way of thinking or new habits. And changing habits is extremely difficult.

In this book we concentrate on diseases that can be spread by infection with microbes and parasites.

2.2 Why is knowledge of zoonoses important?

Knowledge of zoonoses is of importance to people who live in close contact with animals and to those who work with animals or animal products. Most zoonoses can be prevented by simple measures like vaccination of animals or by proper heating of food, for example. Prevention of zoonoses will improve the health of animals, the income of their owners, and the health of people.

Most zoonotic diseases occur in developing countries and in poor rural communities. Prevention of zoonoses in animals and humans can be a tool in the fight against poverty!

Box 2: Zoonoses and the World Health Organization

In 2005, the World Health Organization organized a meeting about zoonotic diseases because governments, non-governmental organizations and donors often overlook them. These institutions need to prioritize their efforts and focus on the control of 'the big three' – human tuberculosis, malaria and HIV/AIDS. Especially in poor agricultural communities, 'neglected' zoonoses have a major impact on the well being of people. The document issued after the meeting states: "These diseases play a key role in perpetuating poverty" and "zoonoses control can be a cost-effective opportunity for poverty alleviation."

Source: The Control of Neglected Zoonotic Diseases: a route to poverty alleviation: report of a joint WHO/DFID-AHP meeting.
ISBN 92 4 159430 6.

3 How people get infected: transmission and risk factors

3.1 Routes of transmission

Microbes and parasites can be transmitted from animals to humans and vice versa in many different ways:

- 1 Via direct contact between man and animal
- 2 Indirectly via food of animal origin
- 3 Indirectly via water and soil
- 4 Indirectly via insects, ticks, or rats/mice

Transmission via direct contact between humans and animals

Direct contact occurs when human skin comes into contact with the skin of the animal. This happens, for example, when you wash or milk an animal or when you vaccinate animals.

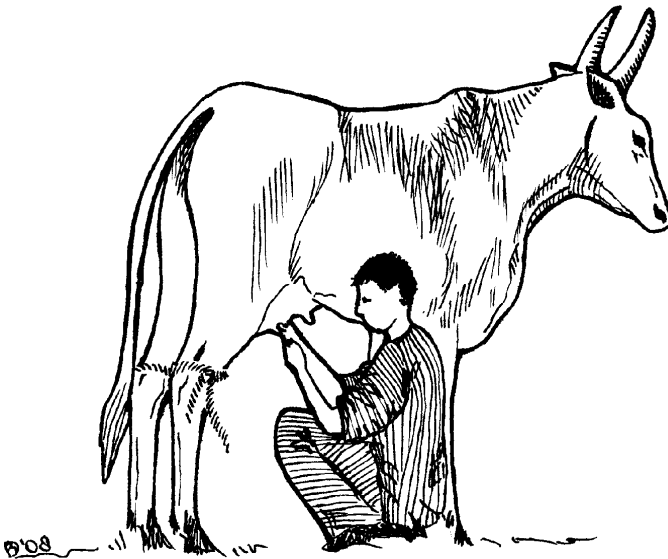


Figure 1: Example of direct contact: milking.

An example is ringworm, which is a fungus (not a worm) that can be present in the skin of humans and animals. If you lay your cheek against the cow when you are milking, it will give the fungus the opportunity to invade your skin via this direct contact. If infected, red circles caused by the ringworm will appear on the area of contact (skin of cheek) a few days later. See Table 1 for other examples of zoonoses that can be transmitted by direct contact.

Direct contact may also occur through touching dung or droppings of animals (faeces), as well as urine and saliva. If a dog has rabies, for example, the rabies-virus is present in the saliva of the dog. When a rabid dog bites or licks a person, this person gets infected with the virus in the saliva of the dog. See also Section 6.9 for rabies.

Another example of a zoonosis through direct contact is brucellosis, which can cause abortion* or stillbirth in animals. The microbes are often present in birth fluids, so a person coming into contact with it when assisting the animal, for instance, can get the microbes on their hands, face or mouth and can become infected with brucellosis. Pregnant women may abort when infected with brucellosis. Men infected with brucellosis can develop Malta fever. See also Section 6.4 for brucellosis.

Table 1: Some major zoonotic diseases and ways of transmission via direct contact.

| Type of direct contact | Disease | Extra information |
|--------------------------------|-----------------|--|
| Biting / scratching | Rabies | Causes paralysis in all animals and in humans. Can also be transmitted when saliva drips on the skin of someone. |
| Petting*, handling or brushing | Ec-thyma/orf | Causes blisters in sheep/goats/humans |
| | Ringworm | Causes red circles on the skin of animals and humans |
| | Scabies | Causes severe itching in animals and humans. Animal scabies does not survive for long on humans. |
| Touching birth fluids | Brucellosis | May cause abortion |
| Touching sick or dead birds | Avian influenza | Is often deadly in poultry (but not in other birds) and is sometimes deadly in humans |

Indirect transmission via food of animal origin

Zoonoses that are transmitted via food of animal origin (milk, cheese, meat, eggs, honey) are called food-borne zoonoses. They can be transmitted to humans via consumption or by touching the meat, organs, milk, blood, wool or eggs of animals carrying the diseases. People working with animals to make these products have a greater risk of contracting a zoonosis.

Honey

Honey is good for energy and general resistance. If applied very thinly on wounds it can improve healing. Because of certain microbes (clostridia) sometimes present in honey, it is safest not to give it to babies under one year of age and very young children that are ill.

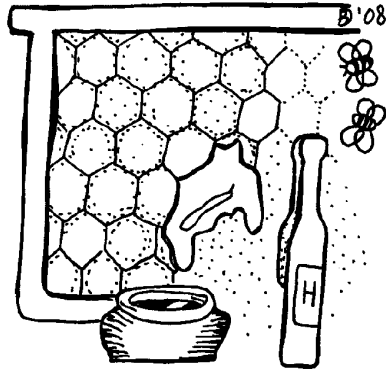


Figure 2: Honey may contain certain microbes and is therefore not safe for very small children

Salmonellosis

Another example of a food-borne disease is salmonellosis, caused by salmonella bacteria. These bacteria are found naturally in the intestines of some humans and some animals (especially poultry and swine). When animals, for example poultry, are slaughtered, the content of the intestines may contaminate the meat with salmonella microbes. Eggs from an infected chicken can also become contaminated. Humans eating these eggs or meat may become infected with salmonella and they get salmonellosis, which causes diarrhoea and can be fatal for young, old or weak people. Heating can kill the bacteria, so there is no danger of infection provided you cook meat well and boil eggs for more than five minutes or fry them properly (so that the egg white is really white). See Table 2 for other examples of zoonosis that can be spread via food.

Table 2: Some major food-borne zoonotic diseases and how they are transmitted.

| Type of food | Disease | Some extra information |
|--|-----------------------------|---|
| Meat | Toxoplasmosis | In raw pork or mutton. |
| | Trichinellosis | In pork. |
| | Cysticercosis and Tapeworms | Tapeworms from pork are dangerous; tapeworms from beef are not dangerous. |
| | Anthrax | The intestinal form of anthrax is caused by eating the meat of animals that died from anthrax. |
| | Sarcocystosis* | Causes various symptoms: slight headache, painful muscle swelling, influenza-like symptoms. |
| | Campylobacter | Present in raw meat |
| Raw Milk and dairy products (fresh cheese) | Brucellosis | Gives influenza-like symptoms when transmitted via milk. See also Table 1. |
| | Tuberculosis | Bovine tuberculosis affects the stomach and intestines. |
| Eggs | Salmonellosis | Present in raw eggs; may be deadly to very young, old or weak people. |
| Fish and sea-food | Fish liver flukes | In fresh water fish and snails, mainly in southeast Asia. They cause chronic and painful infections in the liver and bile duct. |
| Honey | Botulism | Especially a problem for babies. |

Some zoonotic diseases can also be transmitted via food that is not of animal origin, such as vegetables and fruits that are eaten without prior cooking. It also means that drinking water can be a source of infection too.

Examples:

- When plants such as lettuce are irrigated with water contaminated with human excrement containing parasites, cysticercosis – in particular – can occur.
- People eating lettuce that has been fertilised with cow manure containing *E. coli* O157 bacteria (also called VTEC) can become infected with these bacteria.
- The Nipah virus can be transmitted through droppings of bats. People who eat fruit contaminated with bat-droppings could get Nipah.

Indirect transmission via the environment

Here we talk about microbes or parasites that are not directly transmitted from animals to humans. Instead, they are transmitted from ani-

mals (or animal products) first to water, soil, household equipment or garden tools, and thence to humans.

For example, those who work on the land can be contaminated with residues of animal excrement that contain parasites or pathogenic microbes. To prevent this, it is essential that you wash your hands with soap after working on the land, before preparing food and before eating. Likewise, it is necessary to fry or cook vegetables before eating them.

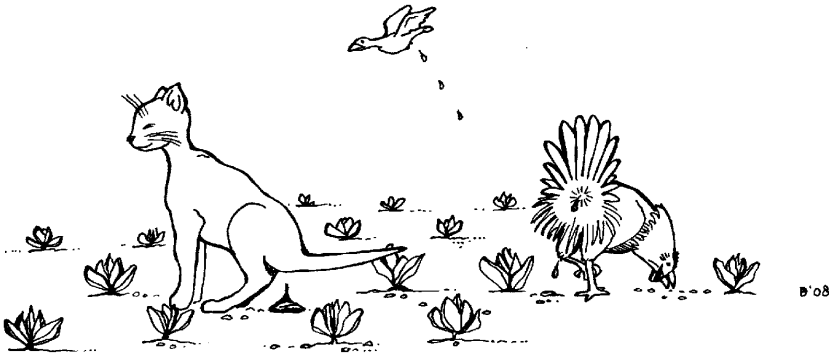


Figure 3: Animals droppings on agricultural land

Another example is raw chicken meat that may contain *Salmonella* or *Campylobacter* microbes. People are exposed to the risk of becoming infected when they eat cooked food that has been cut or prepared on the same plate used for raw chicken, which could be infected.

Examples of microbes that can be in dirty soil are: larva migrans, listeria and toxoplasma (see Section 6.11). *Leptospira* can be found in the urine of rodents. Dirty wells with dead rats in it are notorious for causing leptospirosis (see Section 6.8). Examples of other waterborne zoonoses are explained in the text in Box 3.

Box 3: Faecal contamination of water

Faecal contamination is contamination of water by excrement, dung. Microbes contaminate water when animals or humans defecate in the water. Some examples are:

- *Campylobacter*: is a bacterium mainly found in bird and pig droppings. It causes stomachaches, diarrhoea and sometimes muscle pain.
- *Salmonella*: is a bacterium living in the intestines of animals and humans. Sources of infection are raw (poultry) meat and raw eggs. Water can also be contaminated. It causes diarrhoea, which can sometimes be fatal.
- *E. coli*: is a bacterium living in most intestines. A form of *E. coli* is called H7:O175 or VTEC. This *E. coli* causes kidney disease and severe illness. Children under 5 years may die from it.

Prevention

- 1 Prevent water from becoming contaminated: If you use a lake or river for drinking water, make sure that ruminants and pigs do not walk in the water and defecate there. Water deep in the ground is cleaner than water in rivers or from roofs of houses after rain. Use a pump to get drinking water from a well that has a cover so that excrements of humans and animals cannot fall into the well.
- 2 Prevent people from drinking contaminated water or get rid of the contamination: Boil drinking water and drink it shortly after you boil it, because if you let it stand too long it may become contaminated again.

Indirect transmission via insects, ticks or other creatures

In this case, a so-called vector is needed for transmission, for example ticks and mosquitoes as shown in Table 3. For example, when a tsetse fly bites an animal carrying sleeping sickness microbes, these microbes are transmitted to the fly. Then, when the fly bites a human the microbes enter the bloodstream of this human causing sleeping sickness.

Diseases spread by insects from person to person, without an animal reservoir are NOT called zoonoses (for example malaria).

Table 3: Some major zoonotic diseases and transmission via insects, ticks and other animals

| Vector | Disease | Some extra info |
|---------------|---|---|
| Mosquitoes | Equine encephalitis* | Western and eastern equine encephalitis (WEE and EEE) occur in North America. Venezuelan encephalitis is found in South and Central America. In severe cases brain problems occur that can cause paralysis. |
| | Rift Valley Fever, Yellow fever, Dengue | Rift Valley fever, Yellow fever and Dengue are all hemorrhagic fevers (HF). All HF begin with fever, muscle pain and fatigue. Sometimes there is a second phase with severe bleeding (haemorrhage). |
| | Japanese encephalitis | Pigs and birds are reservoirs; not only present in Japan, but in whole southeast Asia. |
| | West Nile Virus | Mainly in North America. |
| Sand fly | Leishmaniasis | There are several forms of Leishmaniasis and not all of them are zoonoses. |
| Vinchuca | Chagas' Disease | The vinchuca is a kind of beetle. Symptoms vary from nothing to very severe illness. |
| Fleas | Pest / Plague | Has caused major epidemics in the past; is now only present in certain areas of the world. |
| Tsetse fly | Sleeping sickness | Animals do not get ill from human sleeping sickness, but they can be a reservoir*. |

A vector not mentioned in Table 3 is the tick. Ticks are small insects with an oval body, a head and eight legs. There are around 800 sorts of ticks which all feed on blood. Toxins or microbes in the tick's saliva are transmitted through the bite into the human or animal blood stream and can cause disease.

Examples of tick-borne zoonoses are Lyme disease (found in Europe and North America), tick-bite fever (has different names in different parts of the world) Q-fever and Crimean-Congo hemorrhagic fever (mainly in Africa).

Ticks not only transmit zoonotic diseases they also transmit other animal diseases such as East Coast fever, babesiosis and 'heart water disease' in cattle, which cause major problems and economic losses.

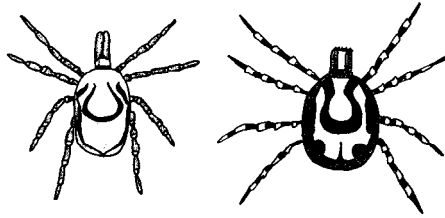


Figure 4: Two types of ticks that can be carriers of many different (zoonotic) diseases: Ixodes ticks (left, also called 'bont tick') and Amblyomma ticks. Amblyomma ticks (right) mostly sit on the udder and under the tail of animals, while Ixodes ticks can be found on the whole body of animals and humans. The ticks in the figure are enlarged; normally they are half a centimetre in size, at most.



Figure 5: Small pair of curved forceps or tweezers made of metal. The middle section is movable and can be moved back and forth to open and close the tweezers.

Box 4: How to remove ticks from humans?

The best way to prevent tick-borne zoonoses in humans is to prevent ticks from biting. This can be done by being properly dressed (cover arms and legs) or by using repellents*. If you find a tick on your body you must remove it as quickly as possible. Be careful! If you squeeze the tick too much, it can inject its saliva into your body before you get it out of your skin and so it can infect you anyway.

Use a small pair of curved forceps or tweezers (There is one specially designed for the purpose, see Figure 5). Grasp the tick firmly with the tweezers as close to the skin as possible. Pull the tick gently from your skin. Twisting or turning is not necessary. After removal, check whether there are no parts of the tick left. If these parts are difficult to remove ask a medical worker to do it.

3.2 People at risk

Some people run more risk of becoming infected with zoonoses than others. They can be divided into three main groups as follows:

- 1 Professional contacts: farmers, butchers, veterinarians or others whose work brings them into intensive contact with animals or animal-products
- 2 Young children, elderly, and HIV infected persons, more vulnerable due to a less effective immune system
- 3 Pregnant women

Please see Section 5.3, which is about prevention and contains advice on how these persons can protect themselves against zoonoses.

Professional contacts

If you work with animals or animal products (professional contacts) you should be aware of the specific zoonotic risks you may encounter while you work. And it is important if you get ill that you tell the medical personnel in the hospital that you work with animals or animal products. You could take this book with you to make clear that some diseases can be transmitted from carcasses to butchers, for example. Examples of people whose occupations place them at greater risk are:

- Veterinarians and vaccinators
- Butchers and meat inspectors
- Milkers and milk inspectors
- Inseminators
- Farmers and people who work with livestock
- Tanners, people who work with leather
- People who work with crude wool



Figure 6: A woman wearing protective clothing has less risk of an infection while milking a camel.

Examples of specific zoonotic risks for these professional contacts are: anthrax, brucellosis, tetanus and rabies.

People with a weak immune system

Everyone should be aware of the vulnerability of these persons whose immune system is not capable of fighting diseases. They include:

- Young children: because their immune system is not yet fully developed
- Very old people: high age results in a weaker immune system
- Malnourished people: the immune system does not function well if certain vitamins are lacking or people are not getting enough food
- People with diseases affecting the immune system, such as HIV/AIDS or leukaemia.

These people and their carers need to be aware of the risk of getting ill from many diseases. Salmonellosis is one example of a disease that gives some people diarrhoea or no problems at all, but can kill people with a weakened immune system.

Pregnant women

Pregnant women should take care of their own health and that of their unborn child. A foetus is very vulnerable and the immune system of a pregnant woman does not work as optimally as that of a non-pregnant woman. Examples of zoonoses that pregnant women should worry about are toxoplasmosis, listeriosis and brucellosis (see Chapter 6).

3.3 More Risk factors

Risk factors are those factors that increase the risk of getting infected by a zoonosis. Apart from occupations (see above), these can be habits, things we do, environmental features and the like. Examples of risk factors are:

- Poor hygiene
- Travelling
- Hunting
- Certain eating habits
- Poor meat inspection
- Poor slaughter hygiene
- Water management
- Stray dogs
- Markets with live animals

Poor hygiene

Hygiene literally means ‘keeping yourself clean’: by washing hands, using latrines for the purpose of urinating or defecating, and keeping the kitchen clean. Many diseases can be transmitted: from (unwashed) hands to other persons or to the mouth; or from contaminated meat to the mouth. Examples

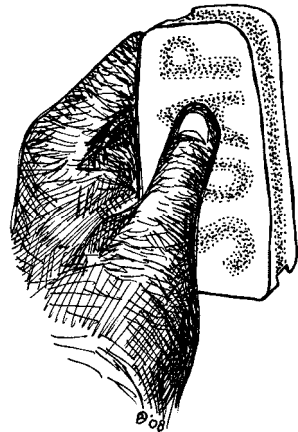


Figure 7: Wash hands with soap

are echinococcosis, salmonellosis and cysticercosis. Some diseases have been virtually eradicated from so-called western countries, because after these countries began building latrines and providing clean water.

Human behaviour such as travelling, eating habits or hunting

People who travel are confronted with all kinds of diseases that are not present in their home surroundings, therefore their immune systems are not prepared to deal with these diseases (see also the text in Box 8 about vaccination in Section 5.2). Eating habits are risk factors as well: the risk of getting salmonellosis from eating raw eggs is greater than from eating well boiled eggs. Hunting, furthermore, brings one into contact with wild animals that can carry many different diseases and parasites.

Meat inspection and slaughter hygiene

Through meat inspection the meat from healthy animals can be differentiated from the meat of sick animals. Detectable diseases in meat include: echinococcosis, cysticercosis and bovine tuberculosis. Some diseases like toxoplasmosis in pig meat, for example, cannot be detected in meat, likewise salmonellosis in pig or poultry meat. Therefore, the health of animals should be checked when still alive. When animals are slaughtered, it is very important that this is done as hygienically as possible and in a cool place as well. If you keep everything clean, the healthy meat can stay uninfected. Cool places are important because bacteria grow fast in temperatures above 10° C.

Poor water management

An example of a disease that can be transmitted via water is leptospirosis. The water of a well can become infected if it is not protected from livestock that could drink or urinate into it or if small (infected) animals are able to fall into the well and cannot get out again. Many microbes thrive in stagnant water or moist environments.

Other risk factors

Stray dogs carry a risk of rabies. Markets where lots of live and dead birds are sold side by side are places exposed to the risk of avian influenza. The dead birds could have died from avian influenza and the microbes can then spread to the living birds. Fruit orchards where bats live can harbour the Nipah* virus. Poverty and lack of education are risk factors as well. Many people do not know that hand washing helps to prevent diarrhoeal diseases. And, persons with little money may choose to buy cheaper (but less well inspected) meat.

4 The impact of zoonoses on daily life

4.1 The role of poverty

Poverty is an important factor governing the risk of zoonotic diseases in rural and urban areas. Poverty can increase exposure to such infections and reduces the chances of getting rid of diseases. Poor communities are often trapped in a never-ending cycle known as ‘the devil’s circle of poverty’.

Poor people are more likely to suffer from zoonotic diseases for several reasons:

- Poor education: if you do not know that certain diseases exist, you will be less motivated to prevent them.
- Poor sanitary conditions: lack of knowledge and lack of money to build good sanitary systems.
- Cheaper animals are often less healthy animals. Cheaper meat is never the healthiest meat and often has not been inspected, therefore, it has a greater risk of harbouring microbes that can make you ill.
- Poor veterinary and public health services: lack of veterinary services worsens the situation in rural communities for those who cannot pay for private services.
- Poor people are often less well nourished and less healthy and are more susceptible to infectious disease in general and zoonoses in particular.
- Lack of money to set up a good health system for both animals and humans.

Many zoonoses cause disabling diseases in humans. A sick or disabled person cannot work as much or as well as a healthy person, hence will not earn enough money to buy proper food or healthy livestock. Unhealthy livestock produce less food. The result is less food to eat and less food to sell – less income again and not enough money to buy

medicines or to pay for proper education or healthy livestock... The big challenge is to break out of this circle through simple and low-cost methods and means.

4.2 Importance of zoonoses in rural areas

The main difference between rural livestock keeping and urban livestock keeping is experienced in accessibility to health services, affecting both humans and animals. The more remote the area the less access there is to public health care and veterinary care.

Close contact between domestic animals and humans is a characteristic of rural settings. Animals kept for food production in these areas have an economic value as well: animals can be sold and they can be a source of security. It is this close association that makes zoonotic diseases so vitally important in rural areas.

In general, three types of animal raising and keeping can be found in rural areas:

- 1 Pastoralists and herders
- 2 A more sedentary, small-scale system
- 3 Commercial, large-scale animal production.

Each system has its own advantages and disadvantages with regard to the risk of zoonotic diseases. An advantage of a large-scale system is that diseases are easier to keep out of the stable, whereas in small-scale systems there is more interaction between the animals and the outside world. The disadvantage is that when one animal is infected the disease can spread rapidly through a large-scale farm, because of the many animals living in close proximity under one roof. In this situation, small-scale systems have the advantage: fewer animals living close together so the chance that a sick animal infects another animal is relatively small. Detection is also easier.

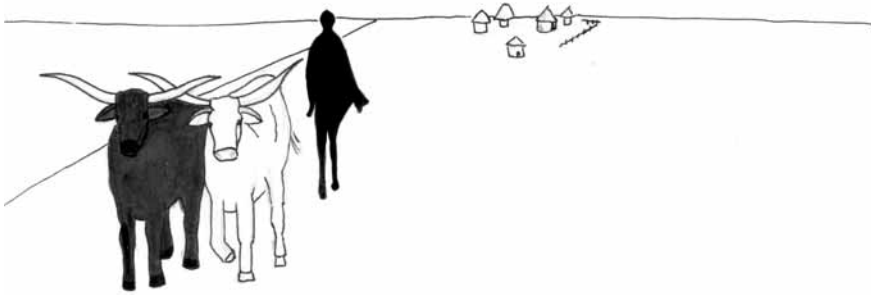


Figure 8: Herder with cows

Box 5: 'Bad' meat

People in poor rural communities often eat infected meat or meat from animals that are found dead.

A study in Ghana showed that 240 out of 250 interviewed cattle owners, butchers and consumers knew about anthrax and the signs of the disease. But none of them knew that the microbe that causes anthrax could be transmitted from dead cows to humans. 225 persons knew that eating meat from cattle that had died from 'unnatural causes' could be fatal to humans. Still, 25 persons thought that there was no risk at all, and although 42 persons thought there was a risk, they felt that anthrax could be prevented by eating certain herbs (which is not the case). Moreover, beef is expensive and a good source of protein, so people find it wasteful not to eat the meat.

Source: Human behavioural factors implicated in outbreaks of human anthrax in the Tamale municipality of northern Ghana. Opare C, Nsiire A, Awumbilla B, Akanmori BD. Acta Trop. 2000; 76:49-52.

Other factors that can enhance the occurrence of zoonotic diseases in rural areas include the following:

- 1 There is a far greater likelihood of contact between livestock and wildlife in rural areas. Some zoonoses can live in both livestock and wildlife, which makes it difficult to get rid of these diseases. An example of one such zoonosis is trypanosomiasis or sleeping sickness in cattle.
- 2 Civil unrest and insecurity can increase movement of people and their animals as they flee and return to their areas of habitation.

3 Certain development programmes promote inappropriate livestock production systems affecting pastoralists, for instance, who are often forced to settle instead of leading their usual nomadic life. They are not accustomed to the new situation and to the risks a sedentary life brings to their animals.

The importance of zoonotic diseases in rural areas extends beyond the realm of public health. Apart from causing human disease and mortality, they affect the agricultural production and social structures of a community. Zoonotic diseases decrease the availability of food creating local and international trade barriers.

- Besides animal production, livestock keepers in rural areas often need their animals for other activities, such as an ox for ploughing or a donkey to take fruits to the market. A sick animal is of no use.
- Zoonotic diseases have a negative effect on animal production. Animals that carry a disease will give less milk, grow slower, stay smaller and lay fewer eggs. See Section 1.1.
- Countries may set up trade restrictions for countries affected by a known zoonosis.
- The economic impact of zoonotic diseases is based on the economic value of the animals as well as the social well being of the rural communities.
- Zoonotic diseases also result in increased costs for controlling outbreaks.

Although zoonotic diseases are mentioned in the annual reports of ministries of health and livestock in many developing countries, they are rarely prioritized compared to other notable human and animal diseases like malaria and rinderpest.

4.3 Zoonoses in urban areas

All over the world and especially in developing countries cities keep cropping up and growing bigger and bigger. People migrate from rural areas to cities in search of work and a better life for themselves and

their families. Having been used to keeping animals, people from rural areas tend to keep animals in cities too: urban livestock keeping. The animals can be sold and provide an easy cash return for school fees, health treatments and so forth. Keeping livestock, therefore, is a safety net especially for the poor. Kitchen waste and crop residues from markets is fed to the animals.

All kinds of animal species are kept in cities, ranging from guinea pigs (in Peru, for example) to poultry and ducks, pigs and small ruminants and even dairy cattle. Animals are not only kept for consumption, in some places horses and donkeys play an important part in providing transportation.

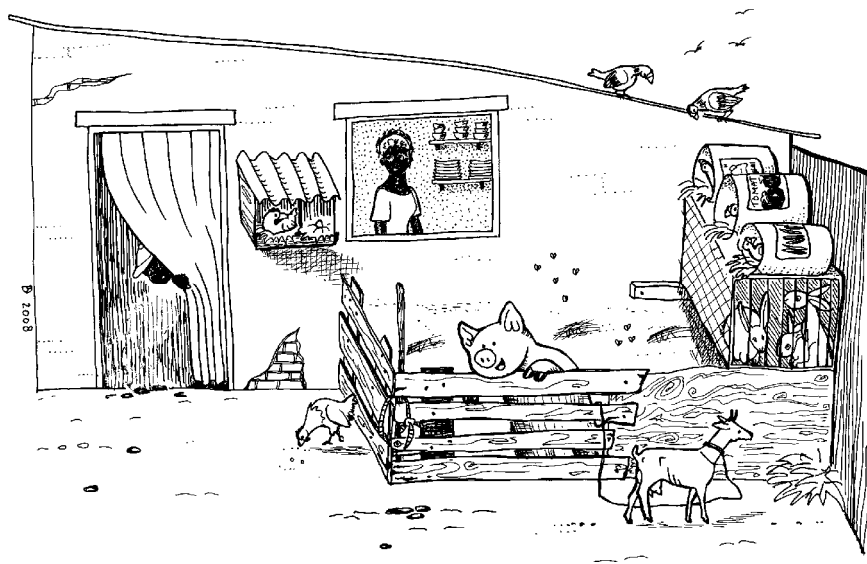


Figure 9: Backyard stable in the city. Small houses, stables and cage situated together.

Public health hazards

The main public health hazards in urban areas relate to:

- 1 Close contact with (sick) animals
- 2 The market situation

3 Poor hygiene

4 Presence of insects and vermin.

Close contacts

Megacities develop with large, often uncontrollable slums, where people and animals live close together allowing easy transmission of zoonoses from animals to humans. Animals in these slums are often seen feeding on waste dumps, which is not animal feed. These animals will produce less and are more likely to get ill. Worse still, these waste dumps may contain toxic substances, which can be detrimental to the health of those consuming the meat or milk from these animals. Competition for scarce water resources and animal waste contamination of these water resources also pose serious threats to public health.

Markets

When cities grow so does the number of urban consumers. More consumers mean more opportunities to sell animals and their products. In developing countries, live animals are generally transported to and sold in wet-markets. The presence of large numbers of living animals in one place increases the risk of spread of diseases among the animals and – in the case of zoonotic diseases – to humans as well.



Figure 10: Man selling dead and live chickens in a marketplace

Poor hygiene

Usually, live animals are bought and taken home for slaughter. This so-called backyard slaughtering is conducted without any health inspection. The risk of you buying a sick animal at the market is considerable and you could easily slaughter an animal without ever knowing that it was sick. Consequently, you may end up becoming infected and ill.

The risk of disease transmission from animal to humans (zoonoses) needs careful consideration. Food products derived from animals held under unhygienic conditions increase the risk of food-borne diseases, especially if the food products have not been pasteurized (milk), heated or cooked.

Presence of insects and vermin

Microbes can be transmitted directly from animals to humans through contact or secretions and faeces. Microbes can also be carried by insects (flies, tsetse flies and mosquitoes) or other vectors (bedbugs, ticks, etc). Unhygienic conditions, especially the absence of clean water or the lack of proper sewage systems can foster the presence of vermin (mice and rats) and therefore also the risk of disease.

Box 6: Of rats and fleas

Plague is a disease that starts with flu-like symptoms, but can turn out to be deadly as well. A typical symptom is the swelling of lymph nodes, which can be felt and seen as painful bumps under the skin (bubonic plague). Without treatment around half of the patients die. It is most often transmitted via the bite of infected fleas.

Plague is still present in the district of Lushoto, Tanzania. To reduce the plague outbreaks in the region, many measures were taken: education, medication and control of rats. But it did not work.

Investigators found that these strategies did not take into account the fact that the risk was greater to children and women who slept on the floor: bitten more often by infected fleas. And most families kept dogs in their homes, which were also carriers of plague. Moreover, the people did not know how to get rid of rats and how to treat the plague. All these factors have made it really difficult to eradicate plague thus far (2008).

Source: Kilonzo et al: Preliminary observations on factors responsible for long persistence and continued outbreaks of plague in Lushoto district, Tanzania. In: Acta Trop. 1997.

Animals that are not kept for production: pets

Besides production animals, dogs and cats are kept in both developing and developed countries. Often these animals are kept unrestricted and unsupervised, without adequate care and vaccinations. Rabies is the most important zoonosis transmitted especially through dog bites. Streets and parks in many cities in developed countries are polluted with dog faeces, posing major problems for city councils. Apart from dogs and cats, inexperienced owners often also keep exotic animals. These animals need to be kept under stringent hygienic conditions to prevent transmission of zoonotic diseases to their handlers (such as salmonella and parasitic diseases in reptiles). Pets appear to be taking over an important emotional function in the ever-increasing individualizing societies.

4.4 The role of wildlife and vermin or pests

As mentioned before, wildlife can be a source of disease. There is no problem as long as there is no contact with humans, or animals living together with humans. But there are many situations in which contact between wild animals and humans or domestic animals occurs.

Rats and mice are wild animals that live very close to people. These animals eat scraps of food left by humans or their animals. For example, they eat paper in a paper factory, grain left by horses and hay left by the cows. Pest animals are a kind of link between wild and domestic animals. They move into houses and stables and live in woods and bushes as well. The relationship between humans, domestic animals, wild animals and pest animals is illustrated in Figure 11.

Rats and mice can be controlled using pesticides and by simply keeping the house and environment clean and free from food and feed scraps. Wild animals cannot be controlled. It is impossible to know where they go and with which animals they come into contact. And it is not easy to know whether wild animals are carrying a certain disease or if the animal is ill. So the disease can spread among the group

of wild animals and be transmitted to domestic animals without anyone noticing it. Wild animals, furthermore, do not get vaccinated.

The diseases that countries want to get rid of could still be prevalent among the wild animals of the countries. Wild animals can travel over borders as well. Migrating birds are a particular example, flying all over the world carrying their diseases with them.

To kill all the wildlife to get rid of diseases is no option. So, we have to find ways to prevent diseases from wild animals spreading to domestic animals or humans. Plague is a good example of a zoonosis that can be prevented successfully. But mostly, prevention is very difficult to accomplish, especially when the links between the animal disease and the disease in humans is not known or recognized. An example is described in Box 7.

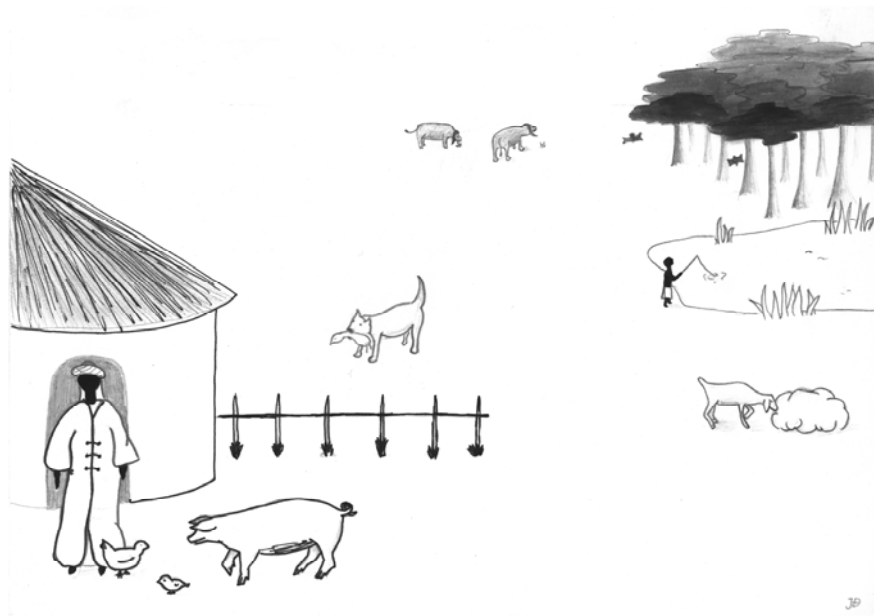


Figure 11: Humans, domestic animals and wildlife are in contact with each other, directly or indirectly.

Box 7: Echinococcosis or hydatid disease

More cases of echinococcosis were reported from within the Tibetan pastoralist community, a few years after people started to use fences to keep their sheep and goats together. This was the result of overgrazing of land, because overgrazing attracted more vermin, like rats and small rabbits. These animals are a reservoir of echinococcosis. Possibly, slaughter offal of sheep and goats containing cysts was fed to the dogs as well, and the dogs had probably never been treated for tapeworms. See also Section 6.7.

Source: Wang et al. Fenced pasture: a possible risk factor for human alveolar echinococcosis in Tibetan pastoralist communities of Sichuan, China. In *Acta Tropica*, 2004.

5 How to prevent occurrence of zoonotic diseases

5.1 Levels of preventing zoonosis

Adequate measures can be taken to prevent zoonotic diseases that are broadspread or even worldwide, but can also be taken locally, for example in your own house or on your own farm. The level at which prevention is possible is shown in Table 1. This chapter provides some practical advice for each level and ends with advice for the particular risk groups mentioned in Section 3.2.

The main objective of prevention of zoonoses is to:

- 1 Prevent animals from becoming infected: if they are not infected, they can produce better, they cannot infect other animals and they cannot infect people.
- 2 Prevent humans from becoming infected: if they are not infected, they will not get ill and they will not infect animals or other humans.

Some preventive measures will prevent animals from becoming infected, while others will prevent humans from becoming infected. Other preventive measurements protect both humans and animals. Here, we will only focus on animal level and farm/community level.

Table 4: Levels of preventing zoonosis

| Level: | Focus: |
|-----------------------|--|
| Animal level | Making sure that animals do not get infected; reducing the risk of infection as far as possible |
| Farm/Community level | Preventing zoonoses from transmission between animals and humans |
| Region/National level | Preventing zoonoses spreading from region to region or from country to country |
| Global level | Worldwide transport (through the air and over water) makes it possible for disease to spread from one part of the globe to another: implementing border closure to prevent entry of animals and animal products from countries in which certain diseases are present |

5.2 Prevention at animal level

Source: 'Where there is no vet'

To prevent animals from becoming infected the first thing one should know is that diseases are contracted and spread:

- From animal to animal by contact
- By animals coming in contact with contaminated materials (bedding, feed bowls, human clothing)
- Through the air (airborne)
- From the mother when an animal is born
- Via food and water
- By insects
- Through mating

Owners should ensure that healthy animals are not in close contact with sick animals. It is important to keep separate towels, blankets, saddles, feed bowls and other equipment for the healthy and the sick animals. Ringworm, for example, is a skin disease that spreads very easily when the saddle or rope that was used for an infected animal is also used for a healthy animal.

Another measure to prevent animals from becoming infected is to use mosquito repellents in the stables.

Making use of artificial insemination can prevent diseases that spread through mating. Artificial insemination stations are likely to check the sperm of the male animal for diseases before they give it to a female animal. For instance, if the sperm is infected with the zoonosis brucellosis, it will not be used.

There is a category of animals that makes prevention difficult: carrier animals. Carrier animals are animals that are not yet ill, or they may never get ill, because their immune system is able to keep the infection low. They look healthy although they are infected with microbes or parasites, which they could transmit to other animals.

Some practical advice to prevent infection of the animals:

- Give animals clean food and water; put the drinking bowls and hay racks so high up that dung and urine cannot fall into the food and water.
- Remove faeces from animal enclosures frequently (at least once a day).
- Do not keep animals overcrowded. Too many animals in a group can lead to fighting, more wounds (and more chance of infections of these wounds) and too close contact.
- Vaccinate animals against the important diseases in your region. Consult your veterinarian about this!
- Be careful with carcasses; bury or burn the dead animals. When an animal suddenly dies, always suspect anthrax.
- Keep animals in clean, dry places. Move enclosures and stables regularly and keep them clean, to avoid build up of diseases in one place.
- Make sure that the air in the stables is well ventilated. Ventilation removes the damp. Many microbes need damp to survive in the environment and to grow and multiply.
- Do not mix healthy animals with animals that are not healthy. If you purchase a new animal and you are not sure if it is healthy, keep it separate from the herd for a few weeks and check the animal for diseases.
- Work together with other farmers and with disease control programmes. More information about these programmes is available on the website of the Food and Agricultural Organization of the United Nations (FAO: www.fao.org) and on the website of the Office International des Epizooties (OIE: www.oie.int).

Box 8: Vaccination

Vaccination prevents humans and animals from becoming ill. Vaccines do not cure diseases! Vaccination sometimes prevents the diseases from spreading from animal to animal.

How does vaccination work? If you get infected with a microbe, for example the influenza virus, then your immune system (blood cells) will fight the virus. This will take some time and you will get ill, but your immune system has a memory function. If in a few weeks later the same sort of flu virus enters your body, then your immune system will recognize it immediately and will be able to fight it faster than the last time. This time you will not get ill or only slightly ill.

Vaccines work the same way. Vaccines are weakened or dead microbes or parts of parasites. Your body can easily fight them, but it also builds up defence for a next time, when a 'real' microbe or parasite enters your body.

But...

- Vaccines only work if they have been stored well and prepared well.
- Vaccines only work when administered at the right time and, sometimes, at the right age.
- Sick or weak animals must NOT be vaccinated!
- Vaccines should be given by people who are trained to do so and who know what they are doing.
- Do not use vaccines that have passed the expiry date.
- The frequency of human and animal vaccination depends on the disease.

It is therefore important that you ask your local veterinarian or animal health worker for advice!

More information can be requested from the veterinary information service of the DIO Foundation: vis@dio.nl or by mail: V.I.S. / DIO, Yalelaan 1, 3584 CL, Utrecht, The Netherlands.

5.3 Prevention at farm and community level

The first step in prevention of zoonoses is to prevent animals from becoming infected. But sometimes it still happens that a zoonosis infects animals. You then will have to prevent spread of the microbe from animals to humans. How you can prevent each of the discussed zoonosis from infecting people is explained in the text boxes in this book.

But there is a slight problem... Most zoonoses cause no clear symptoms in animals. Often you will only see symptoms that look very much like the symptoms of another disease, such as influenza. Or the animal 'is just not itself'. It is a bit slower, does not grow very well,

and may seem to be a bit weaker. In this case it may be another disease and not a zoonosis, but it may also be indeed a zoonosis! So it is important to be careful when an animal gets sick. Be aware that it can be a zoonosis.

Box 9: Traditional prevention

In certain areas in Bolivia, cysticercosis (from the pig tapeworm) is very common. In these regions, women who are specialized in diagnosing the cysts in of pig's tongues check every pig before it is sold. This influences the price of the pigs (healthy pigs are more expensive than pigs with cysts). This method of control is neither thorough nor certain; sometimes the women miss an infected pig. But this traditional system can be a starting point for further control measures.

Preventive measures

The ability to prevent infection from animals to humans depends very much on cultural habits and knowledge. But in general it can be said that hygiene plays an important role in prevention. Hygiene is everything that keeps you healthy. Good hygiene practice in your home applies to:

- Food hygiene (cooking of food, safe disposal of food waste)
- Personal hygiene (including hand washing)
- General hygiene (surface cleaning, laundry etc.)
- Home health care (taking care of wounds, for example)
- Control of wastewater and rainwater
- Care of domestic animals and pets
- Control of insects

In countries where there is clean water, personal hygiene can be achieved by: washing your hands after you have been to the toilet; keeping the toilet covered and clean; washing your hands before you eat; and washing vegetables and fruits before eating them. All this will help prevent many diseases.

Control of insects means cleaning food scraps that may attract flies and using insect repellents and mosquito netting. Personal protection

against flies and mosquitoes includes wearing clothing with full-length trousers and long sleeves.

In countries where clean water is unusual and where the sanitary standards are lower, the following can still be done:

- Boil water before you drink it.
- See if you can build a latrine and use it.
- If you have no latrine, do not defecate near the house and make sure you bury your faeces.
- Do not put your fingers in your mouth without first washing your hands.

The hygienic measures above reduce the risk of infections in general, not only the risk of zoonotic infections. With regard to animals, the following additional measures should be taken:

- Make sure that animals cannot eat the faeces of humans.
- Pets are best fed and kept outside of the kitchen.
- If an animal becomes ill, contact your veterinarian.
- Keep animal food separate from human food.

Extra care should be taken of risk groups: young children, old people, pregnant women and people who are already sick or weakened. This means that these risk groups should in no case eat meat or eggs that are not properly cooked; they should not drink water or milk that is not boiled; and they should not eat cheese made from raw milk.

If you work with animals or animal products, here are some extra measures that should be taken:

- Make sure that you know the risks that apply to your occupation. For example, if you are a tanner, make sure that you know the risks to you from tanning and handling skins.
- Wear protective clothing (overalls, a sturdy overcoat, rubber boots, gloves), so that your skin is not in direct contact with the animals or animal products.
- Make sure that this protective clothing is different from the clothes you wear at home. Do not wear your work-clothes at home, because

if you do so you could bring microbes from your work to your home.

- Launder your protective clothing when dirty. Do this at work or let it be done by a professional laundry.
- Do not eat or drink in areas where animals, animal waste or animal products are present. So do not drink your beer next to a carcass in the slaughterhouse!
- Report all suspected sick animals as soon as possible to your veterinary service, so that protective steps may be taken.
- If you seek medical help for yourself, always remember to tell the doctor that you work with animals or animal products.
- Avoid touching your face and mouth with your hands while you are working.
- Wash your hands before you go home.
- Make sure that a first aid kit is available in case of emergencies.
- Disinfect equipment when you finish your job.
- Keep visitors out as much as possible! Or make sure that they wear protective clothing and boots too.

Please be aware that none of these measures guarantee that you will never get ill any more! But they will reduce the chances of getting infected with an infectious disease.

6 Examples of zoonoses

This chapter contains information about twelve zoonoses we have selected, because: they may cause serious illness in people; they are very common; or there has been a lot of attention surrounding this disease recently or in the past. In the text, we have tried to provide information on the incidence of the specific zoonoses: in which regions they occur and how often. Because exact data on the occurrence of these diseases is difficult to provide for every region, we advise you to contact your local veterinary service.

Table 5: Zoonoses highlighted in this Chapter

| Zoonosis | Section |
|--|-------------|
| Anthrax | 6.1 |
| Avian Influenza | 6.2 |
| Bovine tuberculosis | 6.3 |
| Brucellosis | 6.4 |
| Cysticercosis | 6.5 |
| Chagas' disease | 6.6 |
| Echinococcosis | 6.7 |
| Influenza: see avian influenza | 6.2 |
| Leptospirosis | 6.8 |
| Rabies | 6.9 |
| Sleeping sickness | 6.10 |
| Tapeworms: see Echinococcosis or Cysticercosis | 6.7 and 6.5 |
| Toxoplasmosis | 6.11 |
| Trypanosomiasis: see sleeping sickness | 6.9 |
| Tuberculosis: see bovine tuberculosis | 6.3 |
| Viral Hemorrhagic Fevers | 6.12 |
| Yellow Fever | 6.13 |

6.1 Anthrax

Anthrax is also called carbúncu or splenic fever. It used to be a global disease, but many countries have succeeded in eradicating it. The disease is prevalent in East Asia, West and Central Africa, Madagascar and Central America. And, due to breakdown of veterinary services,

the incidence of anthrax is increasing again worldwide, for example in Eastern Europe.

Transmission and symptoms in humans

There are three forms affecting humans:

- 1 The cutaneous form or skin form is the commonest form and is transmitted via the skin by touch from the carcass, blood, wool, bones or skin of an animal that died of anthrax. It causes vesicles in the skin that are only slightly painful and black in colour. Without treatment, one out of five infected people die.
- 2 The respiratory form is caused by inhalation when working with leathers and wools in a closed atmosphere. At the onset it seems like a common respiratory infection, but days later it becomes more serious and may even cause death.
- 3 The intestinal form can be contracted from eating the meat or drinking the blood of an animal affected by this disease. The symptoms of the disease are violent, expressed by vomiting and bloody diarrhoea. Some 25 to 75 % of the patients die.

Symptoms in animals

Anthrax can affect all animals, domestic and wild. Animals become infected when they drink contaminated water or eat contaminated grass from a spot near where a carcass with anthrax lies exposed. In animals we can also see three forms:

- 1 The peracute form progresses rapidly! The owner mostly only finds a dead animal and suspects that it died from poisoning or lightning. As the blood does not coagulate normally, it is possible that the blood in and around the nose, mouth, vulva and anus is black in colour. The carcass does not become rigid.
- 2 The acute and sub-acute form exhibits the following symptoms: fever, nervousness, difficulties with breathing and walking, convulsions (fits) and death. The blood is not always observed to be black.
- 3 The chronic form develops somewhat slower, with a swollen tongue and bloody foam from the mouth, but the animal soon dies because it cannot breathe.

Prevention

- Any animal that dies suddenly is suspicious of being infected with anthrax: do **not** do an autopsy on an animal that has died suspiciously or has blood oozing out of its natural openings (it can be dangerous)!!
- Avoid letting wild dogs and animals open the carcass;
- Destroy the carcass as rapidly as possible (by burning or to burying with caustic lime).
- Do not eat meat or blood from an animal that died of an unknown disease.
- Be aware of small skin injuries and take care of personal hygiene.
- Ventilate and use proper working clothes in places where products of animal origin are handled, especially leathers and wool.
- Groups of people, who by their work are at serious risk, can be vaccinated.
- Vaccinate cattle and goats annually in regions where anthrax is common.

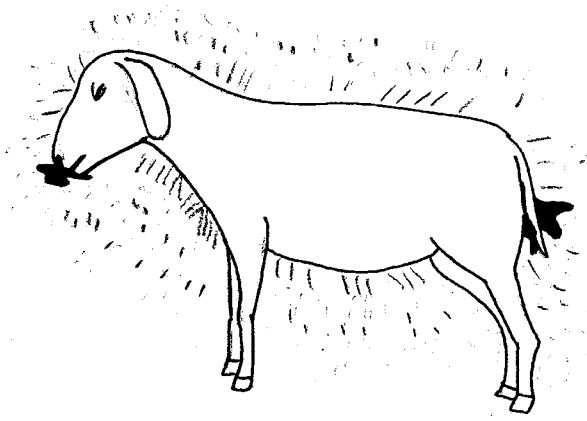


Figure 12: Animal that died from anthrax with black blood from nose, mouth, vulva and anus

6.2 Avian Influenza

Avian or bird influenza is a disease that mainly affects poultry. Wild birds can also be infected but normally have no symptoms. Avian influenza can also affect humans, pigs, horses and many other animals. Although all influenzas are related, the type of influenza that infects one animal species usually does not affect another animal species. However, there are exceptions.

When humans get infected with avian influenza the symptoms are red eyes and those accompanying a (common) flu-like illness, which is mostly very mild. In chickens, one of the alarming symptoms is the sudden death of many chickens in a short space of time. But the disease may also occur without causing symptoms, or with only fatigue, diarrhoea and respiratory problems.

A certain type of influenza, called H5:N1, is the cause of the current avian influenza-epidemic. This type can also cause severe pneumonia in humans, which luckily seldom happens. However, there is a very real chance that people who get the disease will die.

Transmission: how do people get this disease?

Transmission occurs via direct contact with live and dead birds that have been infected, especially wild waterbirds and poultry. Humans can get infected through contact with the faeces and blood of infected birds.

Prevention

Do not touch birds if there is a hint of suspicion of avian influenza, for example, when you find many dead birds together. By touching these animals, you could spread the disease to chickens. Note: avian influenza in poultry cannot be cured. If avian influenza is alerted in your region, keep your poultry inside and make sure that they cannot come into contact with wild birds and other poultry.

Vaccination against avian influenza in poultry is possible. Ask a veterinarian about this.

Challenges

Why is there so much to-do about avian influenza in humans?

At this moment, poultry owners should be aware of the fact that they can get seriously ill from chickens with avian flu. The main problem is the fear that this influenza virus may mutate (change) and then become extremely dangerous to people. Authorities are afraid that such a dangerous influenza could kill millions of people all over the world. On the other hand, there is no real evidence that this will ever happen. We just don't know.

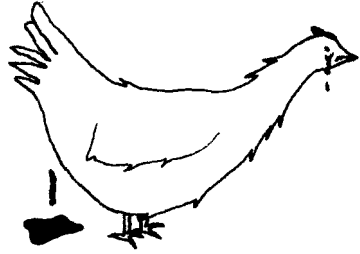


Figure 13: Chicken with symptoms of avian flu. The chicken has diarrhoea and runny eyes.

6.3 Bovine tuberculosis

There are three types of tuberculosis in humans: human tuberculosis, bovine tuberculosis and avian/porcine tuberculosis. Most cases of tuberculosis in humans are human tuberculosis and this is not a zoonosis. The other two are zoonoses, of which bovine tuberculosis is the most significant.

Symptoms in humans

Bovine tuberculosis most often affects weak or debilitated people. Thus, patients with immunodeficiency (for example patients with AIDS) run a greater risk of contracting the disease. The disease causes abscesses of different sizes that appear in the lungs, which in time can become hardened. Sometimes it can invade other organs of the body. It is a chronic disease. The patient coughs a lot, has pain in the chest, fatigue and sometimes dies. The treatment based on antibiotics is lengthy and expensive.

Transmission: how do people get this disease?

People get bovine tuberculosis through consumption of raw (uncooked) milk and other dairy products made from raw milk. It can sometimes be transmitted through the air (airborne), for example, when humans and cattle live together in the same tent or house.

Symptoms in animals

Mycotuberculosis bovis is a cattle disease. It is a chronic disease of the lungs. Transmission between cows is airborne. Other species, like cats and dogs, can become infected by consuming raw milk, but they have natural resistance and do not transmit the disease to people.

Prevention

- Boil all milk before consumption.
- Vaccinate newborn children with tuberculin vaccine.
- Meat inspection and inspection of carcasses: cows with tuberculosis have tubercles (small bumps) in their lungs, intestines and other body parts.
- People with a chronic cough should be referred to a medical centre for tuberculin testing, X-rays and, if necessary, proper treatment.
- Test cattle with the tuberculin test and if the test says that the animals are infected with tuberculosis, kill these animals. In some countries there is a certificate-system where tuberculosis-free herds get a certificate. It is then necessary to prevent people with tuberculosis from working with cows, because through them the cattle can become sensitized to the tuberculin test.

6.4 Brucellosis

Brucellosis, a disease that has spread worldwide, has different names: infectious abortion and Bang disease in animals; and undulant fever or Malta fever in humans.

Brucellosis in humans

People get brucellosis through direct contact with ill animals and by touching aborted foetuses, placentas, secretions, birth channels and

excrements. Brucellosis can also be contracted from drinking uncooked milk or eating cheese made from raw milk.

Some persons infected with the Brucella bacteria do not have any symptoms at all. Sometimes you will see acute fever, chills, insomnia, sexual impotence, generalized constipation, pains and sometimes nervousness and depression. These symptoms are easily confused with the symptoms of malaria, and therefore people may not think that raw milk has made them ill. In humans brucellosis can also cause abortion!

Brucellosis in animals

Animals can become infected when they lick or eat the foetus, placenta or liquids from an animal that has aborted, and from eating the hay where a dead foetus had lain. A female animal can also get brucellosis when she mates with a male animal that is infected. Brucellosis can be even be transmitted via artificial insemination.

The main symptom in all animals is abortion, often combined with retention of the placenta, a lower milk production, mastitis and infertility:

- In cattle, abortion occurs from the 5th month of gestation.
- In goats and ewes the main symptom is abortion in the 3rd or 4th month.
- In pigs, abortions occur in the second half of gestation. Besides abortion, brucellosis may also cause abscesses in pigs.
- In horses and dogs, abortion is rare. Cats are resistant to brucellosis.

Prevention

- Boil milk before drinking it. Some people say that acidity also kills the brucellosis bacterium, but this is not certain.
- Veterinarians, cattle dealers and slaughterhouse workers should use protective clothing (mainly gloves) and have regular medical check-ups. Vaccines exist for people who are at high risk.
- In case of an abortion: separate the animal, bury the foetus and placenta and burn the grass/straw where the animal has aborted.

- Vaccination of young female animals is recommended if there is much brucellosis around. Contact your veterinary services for vaccination. There is no vaccine for pigs.
- In countries where brucellosis is not common, control of the disease is done by testing cattle and eliminating cattle with positive test results.

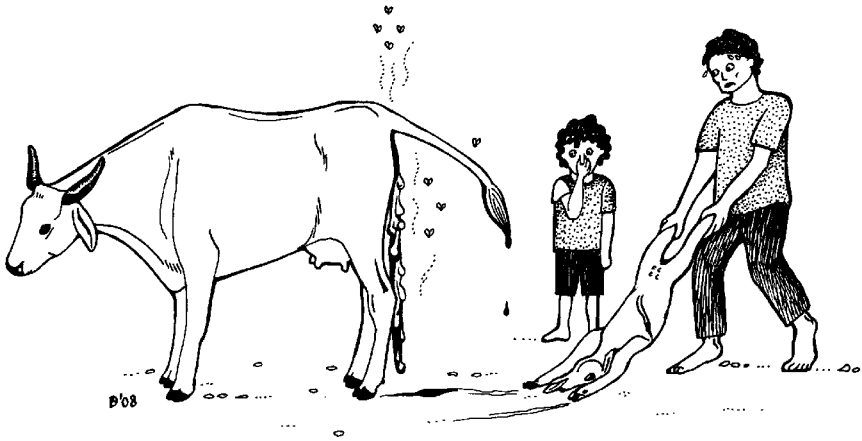


Figure 14: Cow showing a stillborn foetus and placenta.

6.5 Chagas' disease

Chagas' disease, or American Trypanosomiasis is only seen in the Americas. The symptoms it causes are slightly different to those of African sleeping sickness and it is easier to cure. Prevention of American and African trypanosomiasis is the same. Chagas' disease is transmitted to humans by an insect (beetle-like) that is 2 centimetres in length called Triatomíneo, better known as 'vinchuca'.

Symptoms in humans

Chagas' disease is a chronic disease caused by the bite of the vinchuca and it can take years before symptoms appear. The disease starts with fever or other non-specific signs. Specific is the Romaña's sign: oe-

dema (swelling) of the eyelids and eye infections. Heart problems can also occur.

Extra Prevention

Clean the cages of chickens and guinea pigs every week and try to get rid of the insects using smoke. A person bitten by a vinchuca should go to a doctor to have a blood check. There are special medicines to completely eliminate the parasite, but only shortly after the bite.

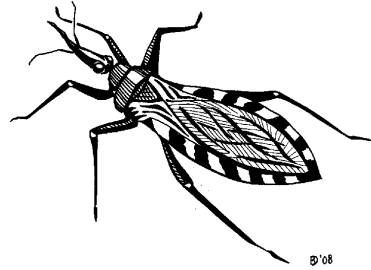


Figure 15: The vinchuca

6.6 Tapeworms and Cysticercosis

Tapeworms live in intestines of humans and animals and can measure up to 10 metres! Tapeworms are made up of a lot of small segments, called proglottids. These segments become detached and are excreted with the faeces. They look like rice grains. Each segment contains more than 10,000 eggs. If humans or animals ingest those eggs, the eggs hatch and the young worms migrate through the body (especially the muscles) of the animal or human. They form cysts in muscles and organs. If you have tapeworms in your intestines, it is called taeniasis; if you have cysts, then it is called cysticercosis.

The three types of tapeworms of significance to humans are:

- 1 The pig tapeworm (is called *Taenia solium*): this is a tapeworm in humans and forms cysts in pigs and in humans
- 2 The bovine tapeworm (is called *Taenia saginata*): this is a tapeworm in humans and forms cysts only in cattle
- 3 The fox tapeworm and the dog tapeworm both cause echinococcosis. See Section 6.7.

Porcine cysticercosis poses a serious problem to public health in regions where pigs are kept in the same place as where people defecate.

This is especially so where there are no latrines and where there are open rubbish dumps. In Latin America, the pig tapeworm is also called 'triquiná'. But this is in fact the real name of a totally different zoonotic worm (*Trichinella*). Switching of names makes prevention more difficult, because you are never really sure what people mean.

Symptoms in cattle and pigs

Generally, there are no clinical symptoms in cattle or in pigs. Cows can get infected by eating grass that contains tapeworm eggs. This has to do with the people who defecate in open fields. Pigs get mostly infected when they directly eat human excreta. There are no medicines that can kill the cysts in the cow or pig. The cysts in pigs can sometimes be detected when they are alive, by inspection of the tongue. The cysts are white, round vesicles measuring between 0.5 to 1 centimetre in diameter.

Transmission: how do people get this disease?

The growth and reproduction cycle of tapeworms is as follows:

- Once in the human intestines, the adult tapeworm lays eggs there.
- The eggs are expelled with the faeces and are eaten by cattle or pigs.
- The eggs hatch in the cow or pig.
- The larvae (from the eggs) grow and form cysts (vesicles or round holes) in the muscles.
- When humans eat raw or badly cooked meat (= muscles), the larvae wake up and grow into adult worms again.

So, the tapeworms need the animals to hatch from the eggs and to grow. This cycle sometimes goes wrong in the case of pig tapeworms, when the larvae eaten by humans get confused and migrate through the human body to form cysts in different parts. It can happen that they form cysts in the human brain or liver.

Symptoms in humans caused by the tapeworms

The symptoms of tapeworms are less serious than the symptoms caused by the cysticercus; only sometimes causing stomach aches, diarrhoea, poor appetite and malaise.

Symptoms in humans caused by cysticercosis

The pig tapeworm is the tapeworm that causes cysticercosis in humans. Cysts can be present in all parts of the body. These cysts may become so large that in the end they will become life threatening, but mostly this will not happen. Cysticercus in muscles does not display many clinical symptoms, but when cysts grow in the brain you can get neurocysticercosis. Then the symptoms are severe headaches and epilepsy.

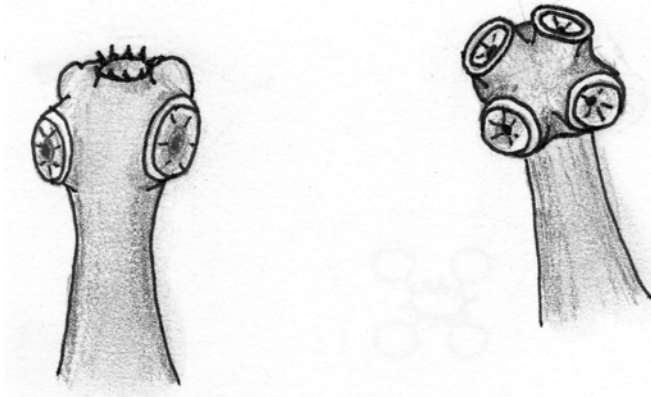


Figure 16: Left: the head of Taenia solium , the pig tapeworm, under a microscope. Right: the head of Taenia saginata, the bovine tapeworm, under a microscope. Both heads are enlarged approximately 100 times.*

Prevention

The main problem is cysticercosis, caused by the pig tapeworm. To prevent cysticercosis, it is important to interrupt the infectious cycle between humans and pigs.

- Educate people about cysticercosis and the lifecycle of the tapeworm. People must be made aware of the fact that if they defecate in a place where pigs can come, they contribute to the infection of other people.
- Promote the use of latrines.
- Wash hands after defecating and before cooking or eating. This aspect is especially important for children.
- When there are white pieces like grains of rice in the faeces, an antiparasiticum must be administered to all members of the family.
- Cook pig meat very well.
- Inspection of pig meat. The traditional control in markets and fairs is insufficient; more and better control is needed.
- Keep pigs in a stable.

These measures also prevent taeniasis from cattle: use latrines, keep animals in a stable or a field with a fence around it and observe strict meat control (of pork and beef) in slaughterhouses.

Do not buy meat if you are not sure whether is free from cysts!

Table 6: The differences between porcine and bovine tapeworms

| Taenia solium | Taenia saginata |
|--|---|
| <ul style="list-style-type: none"> - Lifecycle in humans and pigs - Forms cysts in pigs AND humans - Proglottids are not active: they are passively excreted with the faeces - Pig cysticercosis is dangerous! | <ul style="list-style-type: none"> - Lifecycle in humans and cattle - Forms cysts in cattle - Proglottids are active: they creep out of the anus*, also without faeces - Cattle tapeworms are annoying, but not dangerous |

6.7 Echinococcosis

Echinococcosis is caused by tapeworms from foxes, wolves and dogs. It is also called hydatidosis. The disease is present globally and is especially a problem in rural communities.

How do people get the disease

These tapeworms live in the intestines of dog-like animals. They produce eggs that are excreted with the faeces. When a susceptible animal (cattle, sheep, pigs, mice, humans) accidentally ingests the eggs, the eggs will hatch in the intestines of the animal or person. After hatching, the larvae can move to different organs where they will start to grow as cysts (hydatids). When a carnivore eats the infected animal, the larvae develop into adult tapeworms in the intestines of the carnivore.

Symptoms in humans

The adult parasites do not cause disease. The larva, however, can be dangerous. Symptoms depend on where the cyst is, often in the liver and/or lungs. Cysts grow slowly and may not show any signs for up to 20 years before becoming large enough to be visible as an abdominal swelling, or starting to cause problems by pushing on different organs. Death often occurs from this extreme compression of vital organs. Symptoms of liver cysts can include jaundice, abdominal pain and vomiting. Pulmonary cysts give rise to respiratory problems. Brain cysts may cause headaches and seizures (fits). The only curative treatment of cysts is surgical removal, but this is not always possible.

Prevention

Eradication of this disease is very difficult and very costly. A rich country like Australia, for example, tried for ten years to get rid of echinococcosis but failed, because wildlife (dingoes, small rabbits and rodents) is a reservoir for echinococcosis. People have to prevent the disease from occurring by paying attention to the following:

- Routine deworming of domestic dogs and cats
- Not giving the remains of sheep and cattle to domestic animals
- Not allowing animals in the slaughterhouse other than those for slaughter
- Preventing domestic animals from wandering and straying
- Handling wild carnivores with care and always washing hands after handling

- Carefully washing or cooking before eating all wild fruits or vegetables picked directly from the ground.

There are no vaccines.

6.8 Leptospirosis

Leptospirosis is a zoonosis that lurks in water, soil and foods contaminated by urine of infected animals, especially cattle, rats and pigs. Other names for leptospirosis are: fever of the rice fields, fever of the cane plantations, *enfermedad de los porqueros* (Spanish) and Weil's disease.

The disease can become especially problematic after heavy floods. In the past, this was what happened in parts of Ecuador, Cuba and Nicaragua where many cases of leptospirosis occurred after floods.

Symptoms in animals

The disease mainly affects cattle, dogs, rats and mice, and has a wide range of symptoms, though in some cases no symptoms at all. In cows it can cause mastitis, abortion, infertility and bloody urine. Dogs can become seriously ill with fever and infected kidneys.

Symptoms in humans

The symptoms vary much and can even be absent. In general two clinical types are distinguishable:

- (1) Icteric leptospirosis, the more serious of the two: produces fevers, flu-like symptoms and yellowish skin. The kidneys can fail.
- (2) Anicteric leptospirosis is less severe, though people can die of it! The symptoms are similar to influenza. The patient usually recovers in a month. This form is the commonest.

Prevention

- Avoid contact with the urine of animals.
- Pay attention to personal hygiene and use a separate set of clothes when working with animals.

- The leptospira bacteria that cause leptospirosis will die in the sun, so you can hang out your working clothes in the sun for a day.
- Drain low land as best as possible.
- Control rats and mice.
- Avoid swimming, bathing or washing in fresh water that might be contaminated by the urine of animals.
- Appropriate vaccination for pigs, cattle and dogs.

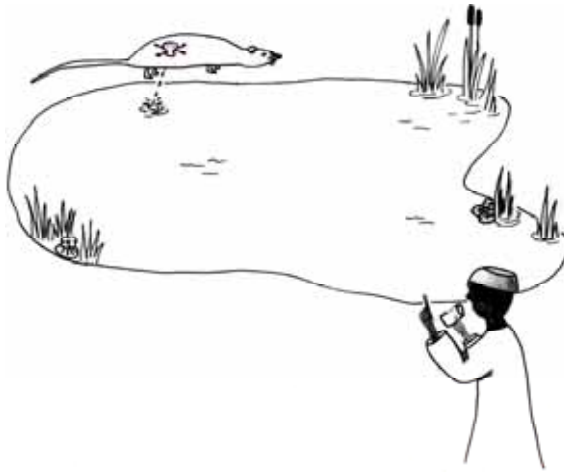


Figure 17: People drinking water from a source that may contain leptospira from the urine of rats run the risk of getting seriously ill.

6.9 Rabies

Rabies, or rage, is one of the most important and dangerous zoonoses! It is present in almost all countries over the world and as much in the cities as in rural areas.

Transmission: how do animals and people get infected?

Rabies is transmitted by the bite of a rabid animal, mostly a dog. Be especially aware of stray dogs! In rural parts of Latin America, vampire bats are dangerous as they are also able to transmit rabies. In some countries, especially in Africa, jackals, mongoose and other wild animals can transmit the disease; skunks and raccoons in the USA.

Symptoms in humans and animals

The symptoms are more or less the same in both humans and animals. They may occur after 10 days, but it can also take up to 10 months to appear, depending on the location of the bite. If the bite was near the head, this period will be closer to ten days, whereas if the bite was in a foot, for example, it could take longer.

The first symptoms are anxiety and pain around the bite wound. People also mention headache. Soon the person will not be able to tolerate light and sound and will start salivating profusely. The disease will cause spasms, paralysis and difficulties with swallowing, which is why the disease is also called ‘water fear’ as the person – although very thirsty – is unable to drink.



Figure 18: Saliva dripping from a rabid dog.

In animals, the symptoms are more or less the same. Dogs and cats exhibit ‘furious rabies’: the animals have the same symptoms as mentioned above, but also become nervous, excited and aggressive. Ruminants and horses exhibit a more quiet form, ‘dumb rabies’: the animals become very timid and shy and not excitable at all. The dumb form can also affect dogs, which is then extra dangerous because people do not recognize it as rabies.

Once a person or animal has symptoms, there is no treatment and the only outcome is death!

Prevention

- Do not touch any animal with nervous symptoms and changes of character, and do not pick up a fallen vampire bat.
- After a bite:
 - 1 Catch and lock up the dog.
 - 2 Wash the person’s wound with abundant water and soap!

- 3 Go to a health centre to start anti-rabies vaccine treatment. If the dog responsible for the bite remains healthy for the duration of 5 days after the bite, the treatment can be stopped.

Some countries have an eradication programme, meaning vaccination programmes for humans and animals, and birth control for stray dogs. In countries where vampire bats play a role, a monitoring system can be set up to control rabies in these bats.

6.10 Sleeping sickness

Sleeping sickness or African trypanosomiasis is a disease that affects humans. Wild and domestic animals (particularly antelopes, buffalo and cattle) can also be infected with a subspecies, but they do not get symptoms. Sleeping sickness only occurs in sub-Saharan Africa. Another human form of trypanosomiasis occurs in the Americas and is known as Chagas' disease (see Section 6.5).

How do people get Sleeping sickness?

The disease is transmitted by the tsetse fly.

Symptoms in humans

First there is redness, pain, and swelling at the site of the fly bite, but this is often ignored. The disease starts with fever, weakness, headaches, joint pain and itching. A characteristic symptom is a nut-sized bump in the neck, behind and below the ear (Winterbottom's sign). In a later phase, involvement of the brain produces the more characteristic signs of the disease: confusion and unpredictable mood changes. The person is unable to sleep at night and fall asleep during daytime, which gives the disease its name. Without treatment, the disease is fatal.

There are two forms of sleeping sickness:

- 1 In central and western Africa (Gambian form), where the first phase can last for months or years without any manifestation of symptoms, suddenly starting in the second phase.

- 2 In southern and eastern Africa (Rhodesian form), where the illness develops in a few weeks and the two phases are evident.

Prevention

Avoid contact with the tsetse fly:

- Wear thick protective clothing. Tsetse can be quite aggressive and bite through thin fabrics.
- Wear khaki or olive coloured clothing, because tsetse is attracted to bright and very dark colours.
- Use mosquito nets.
- Avoid places where the tsetse lives (vegetation along watercourses extending to vast areas of wooded savannah).
- Try to improve the construction of the houses: preferably plaster walls and ceilings and do not use hollow canes to build a house.
- Repellents do not work on tsetse flies. Medicines that work are hard to come by.

6.11 Toxoplasmosis

Toxoplasmosis is a very common parasitic disease both in the western world and in developing countries. A microbe, a protozoan that has a complex life cycle, causes it. Toxoplasmosis is especially dangerous to pregnant women and the foetus.

Transmission: how do people get this disease?

The cat plays a fundamental role in the infectious cycle. Cats become infected with the parasite when they eat wild mice or birds, after which the faeces of the cat will soon contain eggs that are infectious to other animals or humans. Flies, mice and cockroaches can transport the eggs to the kitchen and the rest of the house. Humans get infected most commonly by eating raw or inadequately cooked meat of pigs and sheep that have been in contact with cats.

Symptoms in humans

Toxoplasmosis generally produces no symptoms. Infected humans sometimes have fever, pneumonia, heart problems and brain damage,

especially those with a weak immune system. In pregnant women, the infection can affect the eyes and the brain of the foetus. The child can be born with hydrocephalus (commonly known as ‘water on the brain’ caused by excess fluid in the brain), epilepsy, deafness or can be retarded.

Symptoms in animals

Infected cats, dogs, goats, pigs, horses, cattle, rabbits, guinea pigs and wild animals generally have no symptoms. The infection in sheep, on the other hand, can be the cause of abortion, nervous symptoms and eye problems.

Prevention

- Protect food against flies, cockroaches and mice.
- Wash your hands after handling raw meat and avoid eating raw or insufficiently cooked meat. This is especially important for pregnant women.
- Wash hands after touching soil where cats might have defecated.

6.12 Viral Hemorrhagic Fevers

Hemorrhagic fevers are rare but deadly diseases that are caused by a virus. Examples are Crimean-Congo hemorrhagic fever, Ebola hemorrhagic fever, Marburg hemorrhagic fever, Rift Valley fever, Nipah fever, Yellow fever and Lassa fever. Yellow fever is further explained in Section 6.13 as an example of hemorrhagic fever.

How do people get these diseases?

Mosquitoes or ticks transmit most hemorrhagic fevers. Nipah fever is transmitted by bats and pigs; Lassa fever by rodents. Ebola and Marburg can also spread from person to person (but are extremely rare diseases).

Symptoms in humans

Fever and bleeding are the symptoms in humans and is the reason why they are called hemorrhagic fevers. Most patients die from shock, coma, seizures and sometimes kidney failure.

Prevention

There is no cure for these diseases, so prevention is important. Vaccines exist only for yellow fever. For the other diseases, control of rodents, ticks and mosquitoes is vitally important. Clear away rodent nests and make sure that they cannot enter your house. Use insect repellents, mosquito nets, window screens and wear clothing that covers arms and legs

6.13 Yellow Fever

Yellow fever is a disease that affects monkeys and humans, called 'black vomit' in some areas. The disease is found in tropical areas of South America and Africa. There is no explanation as to why the disease does not occur in tropical Asia, despite favourable conditions. Transmission of yellow fever occurs mainly during the rainy season, in moist savannah zones.

How do people get yellow fever?

Yellow fever is transmitted to humans and monkeys by the bite of infected mosquitoes. These mosquitoes are different from those carrying malaria and, most important of all, they are daytime biters. So general precautions to avoid mosquito bites should be followed. These include wearing light-coloured clothing with full-length trousers and long sleeves, using insect repellent on exposed skin and mosquito nets.

Symptoms in humans and animals (monkeys)

Symptoms can appear 3-6 days after infection. They include fever, headache, muscle pain, loss of appetite, abdominal pain and jaundice. After 3-4 days, the general condition normally improves and most individuals will recover. But in some cases a high fever returns within 24 hours when the infection has taken a turn for the worse. If this hap-

pens, the sick person becomes very tired and bleeding from the mouth and nose can occur. It is difficult to distinguish from other diseases, especially in the early stages of the disease. The symptoms in monkeys are the same as in humans.

Prevention

Vaccination is the single most important measure for preventing yellow fever. But there are also groups of people who cannot be vaccinated, because it would be too dangerous. They are: infants under 9 months of age, pregnant women, persons with AIDS and those hypersensitive to eggs (because the vaccine contains egg white).

7 Challenges

In this chapter we list problems that people or governments encounter when they want to get rid of zoonoses and give some solutions as well.

Identification of disease in animals

Most zoonoses produce no clear symptoms in animals. The animals may not have any symptoms at all while infected and while able to spread the disease to humans and other animals. This makes awareness of these diseases in animals difficult. There are however a few symptoms that should really sound all alarms:

- Sudden death of an animal (especially cattle). This can be the result of lightning, but you should really consider the possibility of anthrax! So: do not touch nor eat animals that died without any obvious cause! Always call your local vet, if possible.
- Abortion. Some zoonoses, like brucellosis, cause animals as well as humans to abort. Make sure that pregnant women do not touch the fluids of an aborted animal. They should not touch the dead fetus either!

Identification of zoonoses in humans

The signs and symptoms of zoonoses in humans are often similar to other (ordinary) diseases, like flu. Medical persons may not recognize a disease as zoonosis and, especially in remote areas, medical practitioners may be less qualified to do so.

Cooperation between veterinarians and medical doctors

The medical world and veterinary world often exist as separate entities. Medical persons may cure humans that are ill from a zoonosis, but they often do not know how to prevent zoonotic diseases from occurring. Prevention of zoonotic diseases is best done through veterinarians: educating people about animal health, vaccination of animals and so forth. But neither the medical professionals nor the veterinary professionals feel really responsible for taking care of good preventive

programmes. This may change if the medical professionals and veterinarians would cooperate more.

Globalization

Globalization is seen as one of the most challenging issues when it comes to the prevention of zoonoses. People can travel from one side of the world to the other without any check on whether they are carrying diseases. Control measures that avoid worldwide spread of diseases are very costly and are not affordable for many countries.

'New' zoonoses

'New' zoonoses have emerged during the past few decades. We put 'new' between quotes because these emerging zoonoses are not always completely new diseases. Avian influenza, for example, already exists and is a well-known disease. What is new about the recent outbreaks is that avian influenza caused human deaths and that there is a possibility that this virus may cause a new worldwide influenza epidemic. Other examples of emerging zoonoses are BSE (Bovine Spongiform Encephalopathy) and SARS, which have raised much public awareness. People fear that new diseases and new zoonoses can emerge any moment. At least it shows that there is still a lot we do not know.

Prioritization

Medical organizations need to prioritize their goals. Eradication or control of diseases like human tuberculosis, malaria and HIV/AIDS are currently given much higher priority than any other infectious disease, including zoonoses. This results in a lack of (financial) resources for research on zoonoses and for preventive measures against zoonoses. Zoonoses that do get attention are those that are a (possible) threat to the richer countries in North America and Europe.

Lack of knowledge

Knowledge about zoonoses is lacking in many ways. Livestock owners and pet owners, for instance, often do not know about the existence of zoonoses. Or if they are aware of zoonoses they are not sure

about what a zoonosis is and what is not. We hope that this book will fill in the gaps and provide the owners and providers of animals with the relevant information. Knowledge is also lacking among researchers, veterinarians and medical doctors who do not exactly know where and how often zoonoses occur. For example, to medical professionals, bovine tuberculosis is not an issue, because they see human tuberculosis as a much bigger problem. Veterinarians on the other hand focus especially on bovine tuberculosis and say that it is a major threat to humans in African countries. But because there is no exact data on bovine tuberculosis we do not know how significant it really is. Exact data is only available on 'new' emerging zoonoses and three of the 'older' zoonotic diseases (echinococcosis, trypanosomiasis and rabies).

Resistance to change

Attempts to get rid of a certain disease by preventive measures are often difficult. People do not like to change their habits or beliefs. This goes for almost everyone, no matter where (also applicable to western countries). Development programmes will not succeed if they do not listen to the people they want to help. If people believe that a curse has made them ill, it will be extremely difficult to tell them that their disease is due to a bacterium or a virus that they cannot see.

Box 10: Maya practices

Mayan views are very different from western views: they use concepts of 'wind' and 'bad wind' if they speak about health and disease. It is therefore very hard to explain the existence of bacteria and microbes to Mayan people. An educational organization in southern Mexico used the concept of 'wind' to explain how diseases are transmitted and this concept is now successfully used in health campaigns.

Preventive measures have an added dimension of difficulty. If people are ill and are given medicines that make them better, then the relationship between medicine and getting better is clear. If people who are not ill are asked to change their eating habits while they continue to remain healthy, then the relationship between changing eating habits and remaining healthy is not so clear.

Appendix 1: Zoonoses grouped by host animal

Not all existing zoonoses are listed here. This list only gives you the most important zoonoses and their host animals. See ‘Further reading’ for titles of books and websites that will give you more information.

| Scientific name/ Popular name | Host animal | Description |
|--|----------------------|---|
| Acariasis/ Scabies, Mange | All animals | Also called scabies. It is caused by mites and transmitted via direct contact. It causes itching. Zoonotic acariasis (mites that are transmitted from animals to humans) lasts only a few weeks, because the mites cannot survive longer on human skin. |
| Anthrax/ Splenic fever | Ruminants | Present in East Asia, West and Central Africa, Madagascar and Central America. If an animal suddenly dies and the blood does not clot, then suspect anthrax. Do not touch the carcass then! |
| Brucellosis/ Infectious abortion, Bang's animal abortion | Ruminants | Brucellosis is an important cause of abortion. Symptoms look like malaria-symptoms. |
| Campylobacter/- | Poultry | Campylobacter is a bacterium mainly found in bird and pig droppings. It causes stomachaches, diarrhoea and sometimes muscle pain. |
| Chagas' disease/ American Trypanosomiasis | Dogs and cats | Chagas' disease is transmitted by a sort of beetle, called 'vinchuca'. Symptoms vary from nothing to very severe illness. |
| Contagious ecthyma/ Orf | Small ruminants | Orf causes blisters and ulcers. Lambs often die because they stop drinking: the blisters around their mouth are very painful. People get blisters and ulcers on their hands and fingers, but they get better within a week or so without treatment. |
| Cysticercosis / Taeniasis | Pigs and cattle | If you have tapeworms in your intestines, it is called taeniasis; if you have cysts, then it is called cysticercosis. The pig-cysts are the most dangerous. They can cause epileptic seizures. |
| Dermatophytosis/ Ringworm | All domestic animals | Also known as ringworm. It is a fungal disease that causes round lesions on the skin, either red (in people with light skin color) or light brown (in people with dark skin color). It is a harmless disease, but may cause permanent hairless places on the head when it is not treated. Ringworm can be treated with antifungal drugs. Transmission via direct contact. |

| Scientific name/ Popular name | Host animal | Description |
|---|---|--|
| Echinococcosis/ Hydatidosis | Rats and mice, dogs and wildlife | Echinococcosis is caused by tapeworms from foxes, wolves and dogs. Cysts grow slowly and give problems because of their size (suppress other organs) or localization (cysts in brains give seizures). |
| Erysipeloid, Erysipelothrix/ Swine erysipelas, Fish-handler's disease | Pigs and fish | In pigs, this disease causes red squares on the skin. In people, it causes a bright red, hot, swollen, shiny patch on the skin. But it can also cause fatigue and fever. |
| Hantaviral disease | Rodents (mice and rats) | Is transmitted by dust particles in the air in places where many rodents are. It is also transmitted via biting. You will get better without treatment. |
| Hemorrhagic fevers | Wildlife | Hemorrhagic fevers are rare but deadly diseases that are caused by a virus. Examples are Crimean-Congo hemorrhagic fever, Ebola hemorrhagic fever, Marburg hemorrhagic fever, Rift Valley fever, Nipah fever, Yellow fever and Lassa fever. |
| Influenza/Flu | Poultry and pigs | A certain type of influenza, called H5:N1, is the cause of the current avian influenza-epidemic. This type can also cause severe pneumonia in humans, which luckily seldom happens. |
| Larva migrans | Dogs and cats | There are two types of larva migrans: cutaneous larva migrans and visceral larva migrans. These are caused by worms that migrate through the skin (cutaneous form) or the body (visceral form). The worms are transmitted via faeces of animals, mainly cats and dogs. |
| Leishmaniasis | Dogs and cats | This disease is transmitted by sandflies that go from animals (mainly dogs) to people. Symptoms vary from mild disease to big ulcers or severe fever. To prevent leishmaniasis, you have to prevent the sandflies from biting you (wear longsleeves, long trousers and use bednets). |
| Leptospirosis/ Weil's disease | Cattle and wild rodents (rats and mice) | The disease can become especially problematic after heavy floods. Icteric leptospirosis is the most serious form in humans. It produces fevers, flu-like symptoms and yellowish skin. The kidneys can fail. Dogs usually become seriously ill with fever and infected kidneys. |
| Listeriosis | Small ruminants | Listeriosis is transmitted via raw milk and raw cheese. It causes flu-like symptoms. In pregnant women, it can cause abortion. |
| Plague/ Bubonic plague, Black death | Rats | The plague is only present in a few regions in the world. It is transmitted by rats and rat fleas. |
| Q fever/- | Ruminants | Gives flu-like symptoms, but can sometimes cause liver problems and chronic heart failure. It is caused by a bacterium and can be cured with antibiotics. |

| Scientific name/ Popular name | Host animal | Description |
|---|-------------------------------|---|
| Rabies/ Rage, hydrophobia | Dogs and cats | Transmitted when a rabid dog bites. Try to get treatment as soon as you are bitten. Once a person or animal has symptoms, there is no treatment and the only outcome is death! |
| Salmonellosis | Poultry | Salmonella is a bacterium living in the intestines of animals and humans. Sources of infection are raw (poultry) meat and raw eggs. Water can also be contaminated. It causes diarrhoea, which can sometimes be fatal. |
| Toxoplasmosis | Pigs, dogs and cats | Toxoplasmosis generally produces no symptoms. Infected humans sometimes have fever, pneumonia, heart problems and brain damage, especially those with a weak immune system. In pregnant women, the infection can affect the eyes and the brain of the foetus. |
| Trichinellosis/ Trichinosis | Pigs | It is caused by eating raw or undercooked meat of animals infected with the larvae of a species of worm called Trichinella. It causes mild disease with flu-like symptoms, but may also cause death. Trichinosis is prevented by cooking the meat. |
| Tuberculosis, bovine | Ruminants | Weak or debilitated people have more chance of getting bovine tuberculosis than healthy people. The disease causes abscesses of different sizes that appear in the lungs, which in time can become hardened. |
| Tularemia/ Rabbit fever, Deer-fly fever, Ohara fever, Francis disease | Rodents, rabbits and wildlife | Tularemia causes fever, headaches, diarrhea, muscle pain, pneumonia. It can be fatal. It is transmitted by insects and ticks, by handling infected carcasses and by drinking contaminated water. |
| Venezolean Equine Encephalomyelitis | Horses | Transmitted by mosquitoes. This disease occurs in South America. Horses may suddenly die or show nervous system disorders. Healthy adult humans get high fevers and headaches. People with a weakened immune system can become severely ill or die. |
| Yellow fever/ Yellow jack, Black Vomit, American Plague | Wildlife | Yellow fever is transmitted to humans and monkeys by the bite of infected mosquitoes. It can be prevented by vaccination. |

Further reading

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Krauss H. et al: **Zoonoses. Infectious Diseases Transmissible from Animals to Humans**. 3rd Ed. Washington, ASM Press 2003. ISBN 1-55581-236-8.

Report of the joint meeting of WHO, DFID-AHP, FAO and OIE, September 2005: **The control of neglected zoonotic diseases – a route to poverty alleviation**. Can be found on:

http://www.who.int/zoonoses/Report_Sept06.pdf

Printed copies can be ordered from the WHO Bookshop, which offers discounts on orders from developing countries (of which we have only found an e-mail address: bookorders@who.int).

Report of the International Scientific Forum on Home Hygiene, 2006: **Home Hygiene in Developing Countries. Prevention of infection in the home and the peri-domestic setting. A training resource on hygiene for teachers, community nurses, community workers and health professionals in developing countries** By Sally F. Bloomfield and Kumar J. Nath. Can be found on

http://www.wash-cc.org/pdf/news/IFH_training_resource_full.pdf

Hardcopies can possibly be requested at IRC in the Netherlands. Address: P.O. Box 2869, 2601 CW Delft, The Netherlands.

Strickland G, Thomas, et al. **Hunter's Tropical Medicine and Emerging Infectious Diseases**. 8 ed. Philadelphia, W.B.Saunders Co.2000, ISBN 0-7216-6223-4

The website of the World Health Organization provides a huge amount of information about zoonoses. Information can be found on the following pages:

<http://www.who.int/topics/zoonoses/en/>

<http://www.who.int/zoonoses/resources/en/>

A bit more difficult to search in, but also containing much information, are the Veterinary Public Health pages of the website of the Food and Agricultural Organization (FAO):

<http://www.fao.org/ag/againfo/programmes/en/A6.html>

Other websites of interest include:

The Website of the Center for Disease Control and Prevention at:

<http://www.cdc.gov/ncidod/dpd/animals.htm>

Diseases from Animals at:

<http://www.diseasesforanimals.org>

The school of Veterinary Medicine (University of Wisconsin) has an interesting online tutorial on Zoonotic Diseases which can be followed at:

<http://www.vetmed.wisc.edu/pbs/zoonoses>

Useful addresses

DIO

Foundation for veterinary medicine for development cooperation

The DIO foundation gives support and advice in the field of animal health and production to the poorer people of the world, irrespective of country of origin, beliefs or political interests. The main tool in our efforts is the Veterinary Information Service (V.I.S.), which is free to our target group. Furthermore, we try to help by giving advice on animal diseases and other veterinary issues.

Our motto is: healthy animals, healthy people!

Yalelaan 1, 3584 CL, Utrecht, The Netherlands

E: dio@dio.nl ; W: www.dio.nl

ICTTD: Integrated Consortium on Ticks and Tick-borne Diseases

ICTTD project created a zoonosis working group, developing a database on zoonotic tick-borne pathogens occurring in the Tropics and Subtropics. A newsletter is published three times a year by the ICTTD and contains the latest information on publications concerning ticks and tick-borne diseases. Electronic copies are freely available online.

Contact: Utrecht Centre for Tick-borne Diseases

Faculty of Veterinary Medicine, Utrecht University

Visiting address: Yalelaan 1, 3584 CL Utrecht, The Netherlands.

T: +31-30-253 4882, F: +31-30-253 2333

E: tropicalticks@vet.uu.nl, W: www.ICTDD.nl

ILEIA

ILEIA, the Centre for Information on Low External Input and Sustainable Agriculture promotes exchange of information for small scale farmers in the South through identifying promising technologies involving no or only marginal external inputs, but building on local knowledge and traditional technologies and the involvement of the farmers themselves in development. Information about these technologies is exchanged mainly through the LEISA Magazine. All articles accessible on-line.

Contact: ILEIA, Zuidsingel 16, 3811 HA Amersfoort, The Netherlands
T: +31(0)33-4673870, F: +31(0)33-4632410
E: ileia@ileia.nl, W: www.ileia.info

Glossary

| | |
|-------------------------|--|
| Abortion | The expulsion of a foetus from the uterus. The result is called a miscarriage. |
| Amniotic or birth fluid | The fluid in which the unborn baby or animal floats in the womb of its mother. |
| Bacteria | Very small organisms invisible to the naked eye that can cause disease. Antibiotics can kill bacteria, but if antibiotics are not properly used the bacteria can become resistant. |
| Bovine | Pertains to cattle |
| Encephalitis | Inflammation of the brains |
| Faeces | human excreta; dung, droppings or excrements/excreta from animals |
| Fungus | Family of moulds and mushrooms. Can sometimes be seen as fluffy green or white coating on bread, corn or hay. |
| Heartwater disease | Heartwater is one of the most important diseases of livestock in Africa. Symptoms include fever, diarrhoea, strange walking. The animals die after approximately one week. |
| Immune system | Defence system of the body against all invaders and diseases. |
| Infectious cycle | A cycle that certain parasites follow to become infectious and to be able to multiply. |
| Larva migrans | Caused by the larvae of worms. Cutaneous larva migrans: worm creeping under the skin, causing itching; ocular larva migrans: worm can be seen in the eye; visceral larva migrans: larvae of the worms of cats and dogs that migrate through the whole body (no or vague symptoms). |
| Listeriosis | rarely affects humans, but can be a problem for pregnant women and may cause abortion. Is present in raw cheese, for example. |

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|---------------|---|
| Microbes | Small organisms that are microscopic because they can only be seen through a microscope, which can be bacteria, viruses or protozoans. |
| Mortality | Death or death rate |
| Pathogenic | An organism (commonly called a germ) that can cause disease in humans, animals and plants |
| Parasites | These are small animals and may be found living on or inside animals and humans and include: worms, ticks, lice and fleas. |
| Peracute | Extremely sudden: mostly sudden death. One moment the animal is healthy and the next moment it falls dead. |
| Porcine | Pertaining to the pig |
| Protozoans | Parasites that are as small as one cell and cannot be seen with the naked eye. |
| Repellent | Substance that is used to keep vermin, mosquitoes etc. away like DEET. |
| Reservoir | Any person, animal, plant, soil or substance in which a microbe or parasite normally lives and multiplies. Mostly, the microbes or parasites do not harm the reservoir and the reservoir serves as a source from which other individuals can be infected. Wildlife, for example, is a reservoir for echinococcosis. |
| Sarcocystosis | Caused by a parasite that is in meat. Disease in humans is rare. Symptoms are muscle ache and muscle swelling (the muscular form) or abdominal pain, nausea, diarrhea and vomiting (intestinal form). |
| Stillborn | baby or baby-animal born dead |
| Vector | a vector is an organism that does not cause disease itself but which transmits infection by conveying pathogens from one host to another |
| Wet-markets | Markets where living animals are sold |