

# **FOOD- AND WATERBORNE DISEASES AND ZOOZOSES**

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### 3. Food- and waterborne diseases and zoonoses

- Anthrax
- Botulism
- Brucellosis
- Campylobacteriosis
- Cholera
- Cryptosporidiosis
- Echinococcosis (hydatid disease)
- Shiga toxin/verocytotoxin-producing *Escherichia coli* (STEC/VTEC) infection
- Giardiasis
- Hepatitis A
- Leptospirosis
- Listeriosis
- Noroviruses
- Salmonellosis
- Shigellosis
- Toxoplasmosis (congenital)
- Trichinellosis
- Tularaemia
- Typhoid/paratyphoid fever
- Variant Creutzfeldt–Jakob disease (vCJD)
- Yersiniosis

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- Cholera - 1 billion people drink contaminated water
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# Campylobacteriosis

***Campylobacter*** is a genus of Gram-negative bacteria. *Campylobacter* species are typically spira-shaped and able to move via unipolar or bipolar flagella.

## Etiology:

### The source of infection

The animals such as poultry, cattle, pigs, wild birds and wild mammals.

### Route of transmission

It is usually acquired from eating or drinking contaminated food and water; nevertheless, it can also be caught directly from animals or, rarely, from person to person though contact with infected faeces. Drinking raw or inadequately pasteurised milk has caused outbreaks of campylobacteriosis and cases have also been caused by birds pecking at milk in foil-topped bottles. People have also been infected through drinking from streams when trekking or canoeing. Contact with animals on farm visits and with infected pets, especially puppies, can be a risk factor for children younger than five years of age. Person-to-person spread can happen, although it is unusual, and is most likely from children who have diarrhoea or are not toilet-trained.

### Susceptibility

#### General

### Preventive measures:

There is currently no vaccine against *Campylobacter* infection. Drinking pasteurised milk and chlorinated drinking water is important in preventing contamination. Good hygiene in commercial and domestic kitchens—especially avoiding cross-contamination—is important as is cooking meat properly, especially poultry. Conventional disinfectants are active against *Campylobacteriosis*. Doorstep milk should be protected against birds and it is important to wash hands carefully after contact with faeces, nappies, meat or animals, including on farm visits.

# Salmonellosis

## Etiology:

*Salmonella* bacteria are generally referred to by the term 'salmonellosis' when they are due to *Salmonella* species other than *Salmonella typhi* and *Salmonella paratyphi*.

## The source of infection

Various animals (especially poultry, pigs, cattle, and reptiles) can be sources for *Salmonella*, and humans generally become infected by eating poorly cooked, contaminated food.

## Route of transmission

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

Person-to-person transmission through the faecal-oral route can also occur.

## Susceptibility

General.

## Preventive measures:

Prevention requires control measures at all stages of the food chain, from agricultural production, to processing, manufacturing and preparation of foods in both commercial establishments and at home.

National/regional surveillance systems are important means to detect and respond to salmonellosis and other enteric infections in early stages, and thus to prevent them from further spreading.

# Escherichia coli (E.coli)

Escherichia coli (E.coli) are very common bacteria in the gastrointestinal tract, and part of the normal bacterial flora. However, some E.coli strains are able to produce a toxin that could produce serious infection.

## Etiology:

### The source of infection

The main reservoir of such E.coli strains is grass-feeding animals, cattle in particular. Their meat might become contaminated by faecal matter due to poor processing methods during slaughter, and their faeces might end up contaminating other foods (e.g. milk, vegetables) and water.

### Route of transmission

Transmission of STEC infection mainly occurs through contaminated food or water and contact with animals. Person-to-person transmission is also possible among close contacts (families, childcare centres, nursing homes, etc).

General; However, about 8% of patients (children under five years old and the elderly being the most susceptible) may develop “haemolytic uraemic syndrome” (HUS), characterised by acute kidney failure, bleeding and neurological symptoms. Antibiotic therapy is not helpful (it might even favour HUS development).

### Susceptibility

## Preventive measures:

# Shigellosis

## Etiology:

caused by one of four species of Shigella bacteria: Shigella sonnei, S. flexneri, S. boydii and S. dysenteriae.

## The source of infection

The causative organism is frequently found in water polluted with human feces, and is transmitted via the fecal-oral route. The usual mode of transmission is directly person-to-person hand-to-mouth, in the setting of poor hygiene among children.

## Route of transmission

## Susceptibility

Shigellosis is largely a disease of children, with the highest number of cases reported in children younger than five. Infection occurs most frequently in the summer. People at highest risk include those attending daycare, travellers abroad and men who have sex with men.

## Preventive measures:

Simple precautions can be taken to prevent getting shigellosis: wash hands before handling food and thoroughly cook all food before eating.

Since shigellosis is spread very quickly among children, keeping infected children out of daycare for 24 hours after their symptoms have disappeared, will decrease the occurrence of shigellosis in daycares

# Giardiasis

*Giardia lamblia* (*Giardia intestinalis* and *Giardia duodenalis* are synonyms) is a cyst-producing parasite, able to settle in the human and animal bowel. *Giardia* cysts can survive for extended periods of time in the environment and chlorination of water alone cannot inactivate them.

## Etiology:

### The source of infection

The parasites could cause disease equally in humans and animals such as dogs, cats, cows and sheep. In the environment, major reservoirs of the parasite are contaminated surface waters.

### Route of transmission

A major pathway of disease transmission is personal contact with infected patients or exposure to food or water contaminated by them. Direct person-to-person transmission, again through contact with infected faeces, is the other main source of infection. Foodborne outbreaks have happened, usually linked to infected food handlers or their contacts.

### Susceptibility

An individuals in nursing homes or day-care centres are particularly susceptible to outbreaks.

## Preventive measures:

Normal water treatment processes should be effective in removing *Giardia* cysts from drinking water. Good personal and food hygiene, especially hand washing, are important in preventing the spread of giardiasis, especially in institutions like nurseries or care homes.

There is no vaccine to protect humans against giardiasis, although a vaccine may be available for pets.



# Cholera

Vibrio cholera of serogroups O1 or O139. Vibrios can survive for a long time in coastal waters contaminated by human excreta

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## Etiology:

### The source of infection

Humans.

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### Route of transmission

Consumption of contaminated water and food, especially seafood eaten under-cooked, results in infection.

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### Susceptibility

#### General

#### Preventive measures:

In areas where cholera is more common, improved sanitation and water supplies and food hygiene measures are important in reducing the spread of cholera. Water should be chlorinated or boiled before it is considered safe to drink. Although this is a low risk, travellers to countries where cholera is more common should be aware of the possibility of contracting it and drink only boiled or mineral water.

A vaccine is available that is effective against cholera.

# Typhoid and Paratyphoid Fever

## Etiology:

Salmonella typhi and Salmonella paratyphi

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## The source of infection

Humans are the only reservoir for Salmonella typhi (which is the most serious), whereas Salmonella paratyphi also has animal reservoirs.

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## Route of transmission

Humans can carry the bacteria in the gut for very long times (chronic carriers), and transmit the bacteria to other persons (either directly or via food or water contamination).

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## Susceptibility

### General

#### Preventive measures:

Preventive measures include good personal and food hygiene. An effective vaccine is also available.

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In areas where cholera is more common, improved sanitation and water supplies and food hygiene measures are important in reducing the spread of cholera. Water should be chlorinated or boiled before it is considered safe to drink. Although this is a low risk, travellers to countries where cholera is more common should be aware of the possibility of contracting it and drink only boiled or mineral water.

A vaccine is available that is effective against cholera.

# Anthrax

## Etiology:

The spore-producing bacterium *Bacillus anthracis*. The spores can survive in the environment for decades.

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## The source of infection

Anthrax spores can be found in soil and animals, like cows, can then acquire the infection while grazing.

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## Route of transmission

Humans can catch the spores by eating contaminated or insufficiently cooked meat, through contaminated flies that bite, by having a break in the skin and then being in contact with contaminated animal skins, bones, wool, hair or tusks or by breathing in spores (e.g., in wool sorting, bonemeal or hide processing factories).

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## Susceptibility

General. Those most at risk of cutaneous anthrax are butchers, farmers, vets or people working in the animal hide industry.

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**Preventive measures:** Control measures include the correct disposal of dead animal: disinfection, decontamination and disposal of contaminated materials and decontamination of the environment.

Protective equipment must be used by workers.

Vaccination of exposed animals and humans is required.

# Botulism

## Etiology:

*Clostridium botulinum* is a Gram-positive, rod-shaped, spore-forming bacterium. It is an obligate anaerobe, meaning that oxygen is poisonous to the cells.

## The source of infection

Botulism spores are widespread in the environment and can be found in dust, soil, untreated water and the digestive tracts of animals and fish. Foods that have led to botulism outbreaks have included the following: meat products, such as sausage and cured ham; canned, vacuum-packed, smoked or fermented fish products; vegetables preserved by canning or stored in oil; baked potatoes; honey; and cheese. Many outbreaks have occurred due to home-preserved foods. Intestinal or infant botulism usually takes place after swallowing botulinum spores, sometimes from food, which then produce toxins in the gut. Wound botulism usually happens from inoculating botulinum spores which then grow in the inoculation wound and produce toxins.

## Route of transmission

## Susceptibility

General.

**Preventive measures:** There is no routine vaccination against botulism. Care should be taken when canning food, either commercially or at home, and when preserving fish, meat and vegetables to make sure botulinum is destroyed before storage.

Do not eat food from containers that are obviously bulging (which could be caused by gas from the botulinum) or containers that are damaged. Boiling food for ten minutes before eating it would inactivate the toxin in home-canned foods. Potential botulism cases should get urgent medical response and investigation.

Prevention work with intravenous drug users is also important

# Cryptosporidiosis

## Etiology:

Cryptosporidia are intestinal parasites infecting a variety of animals (e.g. cattle, sheep, rodents, cats and dogs, but also birds, fish and reptiles).

Human infections occur due to *Cryptosporidium parvum*, a species that also affects domestic animals.

*Cryptosporidium* eggs (oocysts) can survive for months in moist soil or water and survive harsh environmental conditions (e.g. heat, cold, droughts) for extended periods of time.

## The source of infection

## Route of transmission

Person-to-person or animal-to-person disease transmission occurs mainly through contaminated water and food..

Everyone is susceptible to the infection but the highest numbers of cases are found in children, with those aged younger than two years at the most risk.

## Preventive measures:

Good quality drinking water, swimming pool hygiene and general hygiene measures are all important in preventing cryptosporidiosis. Good hand-washing, taking care when preparing food and carefully disposing nappies are all important in limiting the spread of infection. People whose immune systems are compromised should avoid contact with animals with diarrhoea and young pets, and avoid swallowing water when swimming. If drinking water supplies are affected, water should be boiled before drinking.

## Susceptibility

# Echinococcosis

The genus *Echinococcus* includes six parasite species.

## Etiology:

### The source of infection

The infection is most often spread from dogs, wolves and foxes but can also come from sheep, goats, cattle, camels and horses.

Infected humans do not excrete eggs.

### Route of transmission

People get echinococcosis by swallowing the eggs of parasites when they eat contaminated food or drink water contaminated with the faeces of animals which have been infected with the tapeworm.

General

### Susceptibility

#### Preventive measures:

Good hygiene measures are important to avoid getting echinococcosis. Vaccines are available for animals to reduce the risk of their spreading the parasite to humans.

# Listeriosis

## Etiology:

*Listeria monocytogenes* is a Gram-positive bacterium. The genus *Listeria* currently contains 10 species; only *L. monocytogenes* is consistently associated with human illness.

## The source of infection

Researchers have found *L. monocytogenes* in at least 37 mammalian species, both domesticated and feral.

## Route of transmission

*L. monocytogenes* has been associated with such foods as raw milk, pasteurized fluid milk, cheese (particularly soft-ripened varieties), ice cream, raw vegetables, fermented raw-meat sausages, raw and cooked poultry, raw meats (of all types), and raw and smoked fish. Its ability to grow at temperatures as low as 0°C permits multiplication in refrigerated foods.

## Susceptibility

Reported cases in Europe are highest among those over 65 and children younger than four.

## Preventive measures:

Pasteurising dairy products is important as the process kills *Listeria*.



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# Toxoplasmosis

## Etiology:

*Toxoplasma gondii* is an obligate intracellular, parasitic protozoan

## The source of infection

Cats are the reservoir of the parasite.

## Route of transmission

They excrete cysts in the environment, able to infect many other animals, and humans can become infected either by ingesting the cysts (by direct contact with cats or through food or water contaminated by cat faeces), or by eating poorly cooked meat containing cysts, especially pork and mutton.

## Susceptibility

Furthermore, pregnant or immunocompromised people are at higher risk of becoming infected or transmitting the parasite to their fetus.

## Preventive measures:

Basic food handling safety practices can prevent or reduce the chances of becoming infected with *T. gondii*, such as washing unwashed fruits and vegetable and avoiding raw or undercooked meat, poultry, and seafood. Other unsafe practices such as drinking unpasteurized milk or untreated water can increase odds of infection. Oocysts in cat feces take at least a day to sporulate and become infectious after they are shed, so disposing of cat litter daily greatly reduces the chances of infectious oocysts being present in litter.

# Variant Creutzfeldt-Jakob disease

## Etiology:

Causative agents of vCJD are prions, composed of misfolded prion proteins (PrP<sup>Sc</sup>), which form aggregates in neurological tissue leading to progressive brain damage and characteristic signs and symptoms of the disease. Prions are stable and relatively resistant to proteases, high temperatures, UV radiation, and commonly used disinfectants.

Cats are the reservoir of the parasite.

## The source of infection

Most reported vCJD cases appear to have been infected through the consumption of bovine meat products contaminated with the agent of BSE. In three cases, reported by the UK, the mode of transmission is thought to be through receipt of blood from an asymptomatic, infected donor.

## Route of transmission

## Susceptibility

vCJD tends to affect younger individuals, with an average age of onset of around 28 years, compared to sporadic CJD, which tends to affect middle-aged and elderly individuals.

## Preventive measures:

# Campylobacteriosis

Campylobacteriosis is a diarrhoeal disease caused by *Campylobacter* bacteria, found in animals such as poultry, cattle, pigs, wild birds and wild mammals.

The most frequent way of getting infected is through the consumption of contaminated food (mainly poultry) or water. Other risk factors include swimming in natural surface-waters and direct contact with infected animals.

After an incubation period of 2–5 days (range 1–10 days) common symptoms are severe abdominal pain, watery and/or bloody diarrhoea and fever. Usually, symptoms last for a few days and the disease is self-limiting but occasionally they will persist and result in hospitalisation. Antimicrobial therapy is seldom needed.

*Campylobacter* infection has been associated with complications such as later joint inflammation (5–10% of cases) and, on rare occasions, Guillain-Barré syndrome (a temporary but severe paralysis that may be total).

As a prophylactic measure, control of *Campylobacter* colonisation in poultry is important, as well as hygienic processing of meat, and the protection and control of private drinking water supplies.

# Campylobacteriosis

***Campylobacter*** is a genus of Gram-negative bacteria. *Campylobacter* species are typically spira-shaped and able to move via unipolar or bipolar flagella.

## Etiology:

### The source of infection

The animals such as poultry, cattle, pigs, wild birds and wild mammals.

### Route of transmission

It is usually acquired from eating or drinking contaminated food and water; nevertheless, it can also be caught directly from animals or, rarely, from person to person though contact with infected faeces. Drinking raw or inadequately pasteurised milk has caused outbreaks of campylobacteriosis and cases have also been caused by birds pecking at milk in foil-topped bottles. People have also been infected through drinking from streams when trekking or canoeing. Contact with animals on farm visits and with infected pets, especially puppies, can be a risk factor for children younger than five years of age. Person-to-person spread can happen, although it is unusual, and is most likely from children who have diarrhoea or are not toilet-trained.

### Susceptibility

#### General

### Preventive measures:

There is currently no vaccine against *Campylobacter* infection. Drinking pasteurised milk and chlorinated drinking water is important in preventing contamination. Good hygiene in commercial and domestic kitchens—especially avoiding cross-contamination—is important as is cooking meat properly, especially poultry. Conventional disinfectants are active against *Campylobacteriosis*. Doorstep milk should be protected against birds and it is important to wash hands carefully after contact with faeces, nappies, meat or animals, including on farm visits.

# Campylobacteriosis

- **Symptoms**

Campylobacter infection can vary from people who have no symptoms at all to those who are severely ill. Most people with symptoms have diarrhoea, abdominal pain and fever. Before these symptoms patients may have fever, headache, malaise and muscle pain. About a quarter of cases have vomiting or blood in their stools.

- **Complications**

Complications include arthritis (inflamed joints), Guillain-Barré Syndrome (which causes weakened muscles), and a type of kidney failure known as haemolytic uraemic syndrome (HUS). Some types of Campylobacter infection can lead to bacteria in the blood, meningitis, infected blood vessels and abscesses. Some types can also lead to more severe disease in people with chronic conditions, like diabetes.

# Campylobacteriosis

- **Diagnosis**

Laboratory tests on stool samples can be used to diagnose Campylobacteriosis, as well as blood tests.

- **Treatment**

Most cases settle after 2–3 days of diarrhoea and 80–90% settle within a week. Most people only need treatment to relieve their symptoms and keeping hydrated is important for those with diarrhoea.

However, some cases can be more prolonged or severe. Antimicrobial therapy to treat Campylobacter is not often needed but is available for severe infections or those particularly at risk.

# Salmonellosis

Salmonellosis is one of the most common and widely distributed foodborne diseases and is caused by the bacteria *salmonella*. It is estimated that tens of millions of human cases occur worldwide every year and the disease results in more than hundred thousand deaths. For *salmonella* species, over 2 500 different strains (called "serotypes" or "serovars") have been identified to date. *salmonella* is a ubiquitous and hardy bacteria that can survive several weeks in a dry environment and several months in water.



# Salmonellosis

## Etiology:

*Salmonella* bacteria are generally referred to by the term 'salmonellosis' when they are due to *Salmonella* species other than *Salmonella typhi* and *Salmonella paratyphi*.

## The source of infection

Various animals (especially poultry, pigs, cattle, and reptiles) can be sources for *Salmonella*, and humans generally become infected by eating poorly cooked, contaminated food.

## Route of transmission

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

Person-to-person transmission through the faecal-oral route can also occur.

## Susceptibility

General.

## Preventive measures:

Prevention requires control measures at all stages of the food chain, from agricultural production, to processing, manufacturing and preparation of foods in both commercial establishments and at home.

National/regional surveillance systems are important means to detect and respond to salmonellosis and other enteric infections in early stages, and thus to prevent them from further spreading.

# Salmonellosis

Diarrhoea-causing *Salmonellae* are present worldwide.

The incubation period and the symptoms depend on the amount of bacteria present in the food, the immune status of the person and the type of *Salmonella*.

In general, 12 to 36 hours after the consumption of contaminated food, a clinical picture characterised by fever, diarrhoea, abdominal pain, nausea and vomiting may appear. Symptoms usually last for a few days. Due to the effects of dehydration, hospital admission may sometimes be required. In the elderly and otherwise weak patients death sometimes occurs. Elderly patients are also more prone to developing severe blood infection. In addition, post-infectious complications, such as reactive joint inflammation occur in about 10% of the cases.

**Table 2.3.13. *Salmonella* serotypes most frequently reported from EU and EEA/EFTA countries and percentage change, 2008–09**

Serotype	2008	2009	Percentage change
Enteritidis	70 936	53 951	-24 %
Typhimurium	27 170	23 990	-12 %
Infantis	1 378	1 632	18 %
Newport	838	788	-6 %
Virchow	935	774	-17 %
Derby	662	675	2 %
Hadar	545	513	-6 %
Saintpaul	444	473	7 %
Kentucky	518	469	-9 %
Stanley	619	456	-26 %

Source: Country reports: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden, Spain, United Kingdom.

# Recommendations for the public and travellers

- Ensure food is properly cooked and still hot when served.
- Avoid raw milk and products made from raw milk. Drink only pasteurized or boiled milk.
- Avoid ice unless it is made from safe water.
- When the safety of drinking water is questionable, boil it or if this is not possible, disinfect it with a reliable, slow-release disinfectant agent (usually available at pharmacies).
- Wash hands thoroughly and frequently using soap, in particular after contact with pets or farm animals, or after having been to the toilet.
- Wash fruits and vegetables carefully, particularly if they are eaten raw. If possible, vegetables and fruits should be peeled.
- When travelling, refer to WHO's brochure *A guide on safe food for travellers*.

# Recommendations for food handlers

- Both professional and domestic food handlers should be vigilant while preparing food and should observe hygienic rules of food preparation.
- Professional food handlers who suffer from fever, diarrhoea, vomiting or visible infected skin lesions should report to their employer immediately.
- **The WHO Five Keys to Safer Food** serve as the basis for educational programmes to train food handlers and educate consumers. They are especially important in preventing food poisoning.
- The Five Keys are:
  - Keep clean.
  - Separate raw and cooked.
  - Cook thoroughly.
  - Keep food at safe temperatures.
  - Use safe water and raw materials.

# Recommendations for producers of fruits and vegetables

- The WHO "**Five keys to growing safer fruits and vegetables**" is an educational manual for rural workers, including small farmers who grow fresh fruits and vegetables for themselves, their families and for sale in local market. It provides them with key practices to prevent microbial contamination of fresh produces during planting, growing, harvesting and storing.
- The five keys practices are:
  - Practice good personal hygiene.
  - Protect fields from animal faecal contamination.
  - Use treated faecal waste.
  - Evaluate and manage risks from irrigation water.
  - Keep harvest and storage equipment clean and dry.

# WHO response

- WHO promotes the strengthening of food safety systems, promoting good manufacturing practices and educating retailers and consumers about appropriate food handling and avoiding contamination. Education of consumers and training of food handlers in safe food handling is one of the most critical means to prevent foodborne illnesses including salmonellosis.
- WHO strengthens and enhances the capacities of national and regional laboratories in the surveillance of *Salmonella*, the other major foodborne pathogens and antimicrobial resistance in *Salmonella* and campylobacter from humans, food and animals through the network called Global Foodborne Infections Network (GFN) .
- WHO's main tool to assist Member States in surveillance, coordination and response to outbreaks is the use of the International Network of Food Safety Authorities (INFOSAN) . which links national authorities in Member States in charge of managing food safety events. This network is managed jointly by FAO and WHO.

# Escherichia coli (E.coli)



Escherichia coli (E.coli) are very common bacteria in the gastrointestinal tract, and part of the normal bacterial flora. However, some E.coli strains are able to produce a toxin that could produce serious infection. The main reservoir of such E.coli strains is grass-feeding animals, cattle in particular. Their meat might become contaminated by faecal matter due to poor processing methods during slaughter, and their faeces might end up contaminating other foods (e.g. milk, vegetables) and water.



# Escherichia coli (E.coli)

Escherichia coli (E.coli) are very common bacteria in the gastrointestinal tract, and part of the normal bacterial flora. However, some E.coli strains are able to produce a toxin that could produce serious infection.

## Etiology:

### The source of infection

The main reservoir of such E.coli strains is grass-feeding animals, cattle in particular. Their meat might become contaminated by faecal matter due to poor processing methods during slaughter, and their faeces might end up contaminating other foods (e.g. milk, vegetables) and water.

### Route of transmission

Transmission of STEC infection mainly occurs through contaminated food or water and contact with animals. Person-to-person transmission is also possible among close contacts (families, childcare centres, nursing homes, etc).

General; However, about 8% of patients (children under five years old and the elderly being the most susceptible) may develop “haemolytic uraemic syndrome” (HUS), characterised by acute kidney failure, bleeding and neurological symptoms. Antibiotic therapy is not helpful (it might even favour HUS development).

### Susceptibility

## Preventive measures:

# Shiga toxin-producing E. coli (STEC)

Shiga toxin-producing E. coli (STEC) is a group of pathogenic Escherichia coli strains capable of producing Shiga toxins, with the potential to cause severe enteric and systemic disease in humans.

The full serotype is usually defined by determining both O and H antigens.

There are around 200 different E. coli O serotypes producing Shiga toxin, of which over 100 have been associated with human disease.

Two major Shiga toxin types (Stx1 and Stx2) have been associated with strains causing human disease. While the serotype O157:H7 is considered as clinically the most important, it is estimated that up to 50% of STEC infections are caused by non-O157 serotypes.

STEC is of public health concern because of the potential for outbreaks and the risk of serious complications.

Haemolytic uremic syndrome (HUS) is considered as the most common cause of acute renal failure in European children. Even if the clinical presentation of non-O157 STEC infections may vary, they can be as virulent as O157:H7 infections.

# Shiga toxin-producing E. coli (STEC)

Transmission of STEC infection mainly occurs through contaminated food or water and contact with animals. Person-to-person transmission is also possible among close contacts (families, childcare centres, nursing homes, etc). A wide variety of food has previously been implicated in outbreaks as suspected sources, including raw (unpasteurised) raw milk and cheese, undercooked beef, a variety of fresh produce (e.g. sprouts, spinach, lettuce), unpasteurised apple cider, etc. Recently an outbreak of STEC O157 infections in Canada and the USA was linked to walnuts, thus new sources continue to be identified. Various types of animals, in particular cattle and other ruminants, can be healthy carriers of human-pathogenic STEC that can be spread to humans through faecal contamination.

# Escherichia coli (E.coli)

The infective dose is very low. The incubation period ranges from three to eight days. The typical presentation of infections with STEC is acute gastroenteritis, often accompanied with mild fever and sometimes vomiting. The typically bloody diarrhoea is in most cases mild and self-limiting and most people recover within five to seven days. Around 15% of children diagnosed with STEC O157 infection develop the severe complication of HUS; this proportion is much lower among adults, and this proportion in outbreaks of non-O157 outbreaks is not well documented. The severity of STEC diarrhoea is determined by several factors, including the E. coli serotype, the type of Shiga toxin produced and other virulence characteristics of the bacteria. The patient's age and the infecting dose also play an important role. Children under the age of 5 years are at higher risk of developing clinical disease when infected, and infants are at increased risk of death from dehydration and septicaemia.

- While the confirmation methods of O157 STEC infection are well established, this is not always the case for infections caused by STEC non-O157 serotypes. Therefore, underreporting of non-O157 STEC infections is very likely, and their importance for clinical disease in humans is insufficiently understood.

# Escherichia coli (E.coli)

The treatment of STEC infections is mainly based on rehydration, while antibiotic treatment is often contraindicated as it may activate Shiga toxin release and therefore cause clinical deterioration with a potential evolution to HUS.

- STEC infections in humans are under epidemiological surveillance in the EU and in 2009 there were 3 573 reported cases of which about half were caused by the STEC O157:H7 serotype.
- Since 2008, eight cases of STEC O104 have been reported in the EU, by Austria (one case in 2010), Belgium (two cases in 2008), Denmark (one case in 2008), Norway (three cases in 2009), and Sweden (one case in 2010); three of these cases were imported. In addition, between 2004 and 2009, Austria and Germany reported some positive findings of STEC O104 in food or animals. However, the suggested outbreak strain of serotype STEC O104:H4 has been rarely reported worldwide.

# Shigellosis

## Epidemiology

- Insufficient data exists, but conservative estimates suggest that *Shigella* causes approximately 90 million cases of severe dysentery annually, with at least 100,000 of these resulting in death, mostly among children in the developing world. *Shigella* also causes approximately 580,000 cases annually among travelers and military personnel from industrialized countries.
- An estimated 18,000 cases of shigellosis occur annually in the United States. Infants, the elderly, and the critically ill are susceptible to the severest symptoms of disease, but all humans are susceptible to some degree. Individuals with acquired immune deficiency syndrome (AIDS) are more frequently infected with *Shigella*. Shigellosis is a more common and serious condition in the developing world; fatality rates of shigellosis epidemics in developing countries can be 5–15%.

# Shigellosis

- *S. sonnei*: Most common symptoms are diarrhoea (which is sometimes bloody), abdominal pain and cramps, and fever. Nausea and/or vomiting, loss of appetite, headache or malaise can also occur.
- *S. flexneri*: Also causes diarrhoea, abdominal pain and cramps, and fever but is often more severe than *S. sonnei* infection. Inflammation and ulceration of the lower part of the bowel is also common and illness can be prolonged and more severe.
- *S. boydii*: Can cause diarrhoeal diseases of varying severity, but mostly are similar to those caused by *S. sonnei*.
- *S. dysenteriae*: This species causes more severe disease than other forms of shigellae with higher death rates. Inflammation and ulceration of the lower part of the bowel occurs in most cases, displaying itself as bloody stools.
-

# Shigellosis

## Etiology:

caused by one of four species of Shigella bacteria: Shigella sonnei, S. flexneri, S. boydii and S. dysenteriae.

## The source of infection

The causative organism is frequently found in water polluted with human feces, and is transmitted via the fecal-oral route. The usual mode of transmission is directly person-to-person hand-to-mouth, in the setting of poor hygiene among children.

## Route of transmission

## Susceptibility

Shigellosis is largely a disease of children, with the highest number of cases reported in children younger than five. Infection occurs most frequently in the summer. People at highest risk include those attending daycare, travellers abroad and men who have sex with men.

## Preventive measures:

Simple precautions can be taken to prevent getting shigellosis: wash hands before handling food and thoroughly cook all food before eating.

Since shigellosis is spread very quickly among children, keeping infected children out of daycare for 24 hours after their symptoms have disappeared, will decrease the occurrence of shigellosis in daycares



# Norovirus infection

- Norovirus cause gastrointestinal illness to humans. Norovirus infection can cause vomiting, diarrhoea, and stomach pain. Less common symptoms are low fever, chills and headache. Vomiting can be sudden and frequent resulting in remarkable fluid loss. Death is rare but remains as a risk especially for elderly or persons with weakened immune system.

Recovery occurs usually in one or two days. The incubation period ranges between 12 and 48 hours. Sometimes, symptoms can be milder and last for a week but no long-term adverse health effects have been reported.

-

# Norovirus infection

- Noroviruses belong to the *Caliciviridae* family and they are well known as causing “winter-vomiting disease” or “stomach-flu” referring to their rapid spread in human populations especially during winter months. Noroviruses are relatively resistant in the environment: they can survive freezing as well as high temperatures (up to 60°C). The viruses survive long periods on different surfaces. Steam cooking of shellfish may allow them to survive. It is important to notice that the viruses can survive in up to 10 ppm chlorine, well in excess of levels routinely present in public drinking water systems (less than 2 ppm).

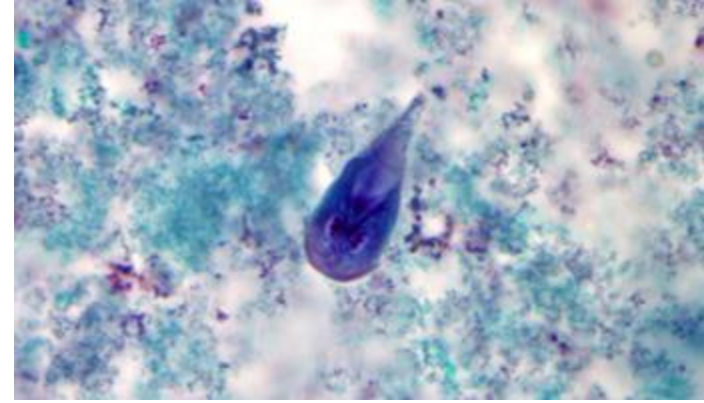
# Norovirus infection

- Noroviruses are highly contagious and 10-100 viral particles may be sufficient to infect an individual. They are transmitted primarily through the faecal-oral route, either by consumption of contaminated food or water, or by spreading directly from person to person. Vomiting creates effectively aerosols with high content of virus particles, which enter the oral mucosa or contaminate surfaces. The virus survives long on different surfaces and thus, environment may serve as a source of new infections. During one single outbreak of norovirus gastroenteritis, several modes of transmission usually occur. Even though the incubation period is relatively short (15-50 h), since the infective dose is very small, and asymptomatic shedding does occur, the origin of the outbreak is often difficult to confirm. For example, initially food or water borne transmission is often followed by secondary person-to-person transmissions to close contacts. Virus shedding usually starts with the onset of symptoms (mainly vomiting and diarrhea) and may continue for 2 weeks after recovery.

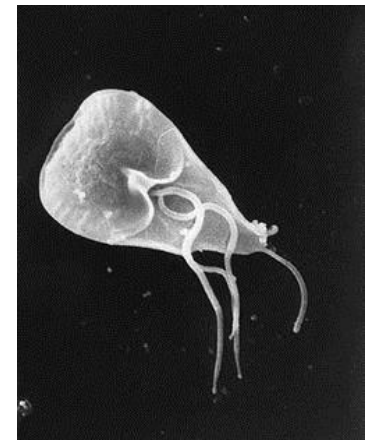
# Norovirus infection

- As the immunity may only last a few months and is strain-specific, and given their genetic variability, infection can happen several times in a lifetime and affects individuals of all ages. Susceptibility to infection is probably genetically determined. According to recent studies, persons of blood group O are at greatest risk for infection. Many different food items have been associated with norovirus outbreaks. Raspberries and oysters have caused several national and international outbreaks. In principle, any food item may become contaminated if handled by infected person or if washed or humidified with contaminated water. Norovirus infections spread effectively from person to person in community settings like hospitals, schools, day care centers and nursing homes. Several outbreaks have been recorded in cruise ships, which provide an ideal closed setting for the spread of infection.

# Giardiasis



*Giardia lamblia* (*Giardia intestinalis* and *Giardia duodenalis* are synonyms) is a cyst-producing parasite, able to settle in the human and animal bowel. The parasites could cause disease equally in humans and animals such as dogs, cats, cows and sheep. In the environment, major reservoirs of the parasite are contaminated surface waters.



# Giardiasis

*Giardia lamblia* (*Giardia intestinalis* and *Giardia duodenalis* are synonyms) is a cyst-producing parasite, able to settle in the human and animal bowel. *Giardia* cysts can survive for extended periods of time in the environment and chlorination of water alone cannot inactivate them.

## Etiology:

### The source of infection

The parasites could cause disease equally in humans and animals such as dogs, cats, cows and sheep. In the environment, major reservoirs of the parasite are contaminated surface waters.

### Route of transmission

A major pathway of disease transmission is personal contact with infected patients or exposure to food or water contaminated by them. Direct person-to-person transmission, again through contact with infected faeces, is the other main source of infection. Foodborne outbreaks have happened, usually linked to infected food handlers or their contacts.

### Susceptibility

An individuals in nursing homes or day-care centres are particularly susceptible to outbreaks.

## Preventive measures:

Normal water treatment processes should be effective in removing *Giardia* cysts from drinking water. Good personal and food hygiene, especially hand washing, are important in preventing the spread of giardiasis, especially in institutions like nurseries or care homes.

There is no vaccine to protect humans against giardiasis, although a vaccine may be available for pets.

# Giardiasis

## Symptoms

People who have swallowed *Giardia* cysts sometimes have no symptoms; this is particularly common in children.

For those who have symptoms, the most common are diarrhoea, malaise, flatulence, foul-smelling and greasy stools, abdominal cramps, bloating, nausea, loss of appetite and weight loss. Prolonged diarrhoea, weight loss and not absorbing nutrients from food passing through the intestines are particular symptoms of giardiasis.

- **Complications**

Symptoms can occasionally be very severe, especially in young children or pregnant women. Symptoms can be acute, chronic—lasting some time—or relapsing, clearing up and then recurring.

# Giardiasis

- **People most at risk**

Most cases happen in children aged 0–4, followed by those aged 5–14 and then adults aged 25–44. Cases happen throughout the year, with slight peaks in spring and autumn. Higher rates of infection are seen in refugees, people living in institutions, travellers abroad, gay men and people whose immune systems are compromised.



# Giardiasis

## **Diagnosis**

Giardiasis can be diagnosed by looking at samples from stools under a microscope and by other laboratory tests.

- **Treatment**

Antimicrobial treatment is available for giardiasis.

# Giardiasis

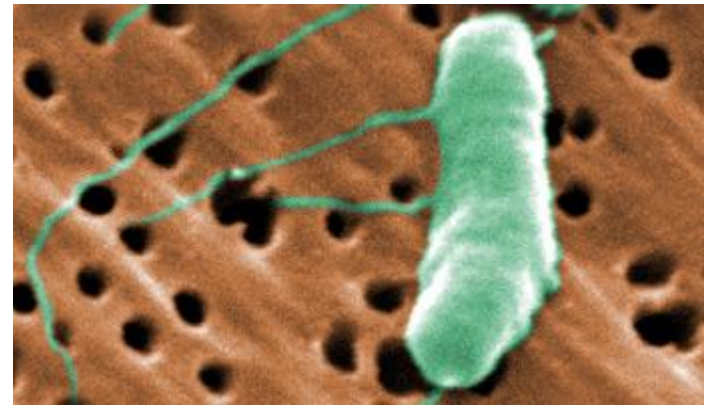
## **How to avoid getting giardiasis**

Normal water treatment processes should be effective in removing *Giardia* cysts from drinking water. Good personal and food hygiene, especially hand washing, are important in preventing the spread of giardiasis, especially in institutions like nurseries or care homes. There is no vaccine to protect humans against giardiasis, although a vaccine may be available for pets.

- **What to do if you have giardiasis**

Food handlers, healthcare workers and affected nursery children should stay at home until 48 hours after their symptoms have ceased in order to avoid spreading the infection.

# Cholera



The illness caused by bacteria called *Vibrio cholerae*. It causes diarrhoea and can lead people to become severely dehydrated very quickly, which can be fatal. It is a major public health problem in many parts of the world and a threat to Europeans travelling to these areas.

Cholera can range in severity from a mild illness which may show no symptoms through to very severe symptoms. The first signs are nausea and discomfort in the abdomen, followed by sudden watery diarrhoea and vomiting. Vomiting tends to disappear after around 12 hours, although the diarrhoea may continue. Cholera often causes people to painlessly loose large amounts of liquid stools – often called “rice water” stools because of their appearance. People with cholera often have extremely painful muscle cramps.

-

# Cholera

Vibrio cholera of serogroups O1 or O139. Vibrios can survive for a long time in coastal waters contaminated by human excreta

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## Etiology:

### The source of infection

Humans.

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### Route of transmission

Consumption of contaminated water and food, especially seafood eaten under-cooked, results in infection.

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### Susceptibility

#### General

#### Preventive measures:

In areas where cholera is more common, improved sanitation and water supplies and food hygiene measures are important in reducing the spread of cholera. Water should be chlorinated or boiled before it is considered safe to drink. Although this is a low risk, travellers to countries where cholera is more common should be aware of the possibility of contracting it and drink only boiled or mineral water.

A vaccine is available that is effective against cholera.

# Cholera

- **Complications**

If cholera is untreated, severe dehydration and “hypovolemic” shock can happen, which leads to symptoms including sunken eyes, wrinkled skin, a very fine and scarcely perceptible pulse, undetectable blood pressure and reduced levels of consciousness. Severe untreated cholera can cause kidney failure and, in 50% of cases, death. In children, a condition called hypoglycaemia (low blood sugar) can occur which can be severe and cause convulsions and coma. In pregnant women, cholera can cause miscarriages and premature birth.

# Cholera

- **Diagnosis**

Cholera can be confirmed by testing a sample of a patient's stools in a laboratory. Rapid tests are also being developed, which do not need to be done in laboratories –. However, where there are outbreaks of large numbers of cases, laboratory tests would not be carried out on all patients and doctors would be able to diagnose patients based on their diarrhoea and vomiting symptoms.

- **Treatment**

As previously mentioned, if cholera is not treated, up to 50% of people who have it can die. However, as long as treatment is given, this is reduced to around 1% of cases. Rapidly rehydrating patients is the most important treatment for cholera. The majority of cases can be rehydrated by drinking Oral Rehydration Salt solution. Severely dehydrated patients will need intravenous fluids and may also be treated with antibiotics. Using anti-diarrhoeal drugs is not recommended in patients with cholera. Infection control measures are important with cholera patients, because the bacteria are highly infectious. Patients in hospital or being cared for at home should be isolated and strict hygiene measures implemented to reduce the risk of spreading the infection.

# Typhoid and Paratyphoid Fever

Typhoid and paratyphoid fevers are systemic diseases. Humans can carry the bacteria in the gut for very long times (chronic carriers), and transmit the bacteria to other persons (either directly or via food or water contamination). After 1-2 weeks incubation period, a disease characterised by high fever, malaise, cough, rash and enlarged spleen develops. Diarrhoea may be present at some stage. When *Salmonella typhi* is the cause, intestinal perforation and haemorrhage may occur. *Salmonella typhi* blood stream infection can also cause infection in all organs. Antibiotic therapy has radically changed the prognosis of typhoid, which, untreated, has a 10% death rate.

# Typhoid and Paratyphoid Fever

## Etiology:

Salmonella typhi and Salmonella paratyphi

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## The source of infection

Humans are the only reservoir for Salmonella typhi (which is the most serious), whereas Salmonella paratyphi also has animal reservoirs.

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## Route of transmission

Humans can carry the bacteria in the gut for very long times (chronic carriers), and transmit the bacteria to other persons (either directly or via food or water contamination).

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## Susceptibility

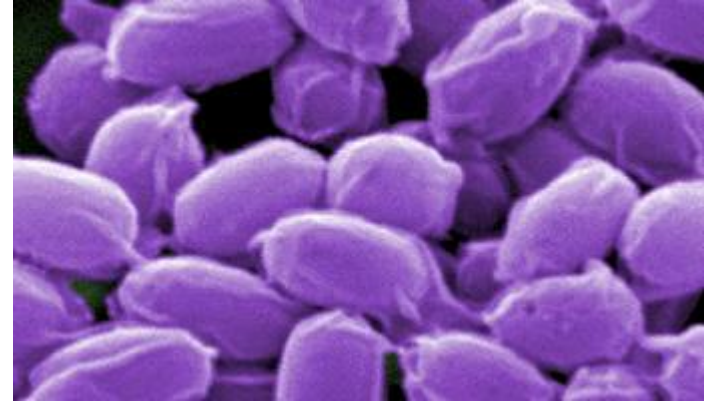
### General

#### Preventive measures:

Preventive measures include good personal and food hygiene. An effective vaccine is also available.



# Antrax



- **Anthrax is...**

...a zoonotic disease that humans can catch from animals. Sources are grass-eating animals, and the spores can survive in the environment for decades. The disease is endemic in several regions of the world, including southern and eastern Europe.

- It causes serious illness.
- It used to be largely occupationally related but has also been used deliberately in bio-terrorist attacks.

# Anthrax

## Etiology:

The spore-producing bacterium *Bacillus anthracis*. The spores can survive in the environment for decades.

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## The source of infection

Anthrax spores can be found in soil and animals, like cows, can then acquire the infection while grazing.

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## Route of transmission

Humans can catch the spores by eating contaminated or insufficiently cooked meat, through contaminated flies that bite, by having a break in the skin and then being in contact with contaminated animal skins, bones, wool, hair or tusks or by breathing in spores (e.g., in wool sorting, bonemeal or hide processing factories).

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## Susceptibility

General. Those most at risk of cutaneous anthrax are butchers, farmers, vets or people working in the animal hide industry.

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**Preventive measures:** Control measures include the correct disposal of dead animal: disinfection, decontamination and disposal of contaminated materials and decontamination of the environment.

Protective equipment must be used by workers.

Vaccination of exposed animals and humans is required.

# Anthrax

The symptoms depend on how the anthrax was acquired by the infected person. Close physical contact with infected livestock or contaminated dead animal products can cause anthrax affecting the skin also known as **cutaneous anthrax**. This is the most common form of the disease.

A small pointed and inflamed elevation appears on the skin, usually on the face, hands or forearms. Over 2–3 days, this ulcerates to become a dry, black, painless scab, surrounded by a ring of small cysts. This is always accompanied by substantial swellings containing fluid, which extend a long way from the scab. The scab dries and falls off within 1–2 weeks, with little scarring. Patients with cutaneous anthrax usually recover, provided they receive prompt treatment with antibiotics.

Swallowing anthrax can cause **gastrointestinal anthrax**, the form most common in children. Gastrointestinal anthrax can affect either the upper throat or the intestines. The form affecting the throat usually starts with a flu-like illness with a high temperature, followed by throat ulcers and a visible swelling of the neck. The form affecting the intestines causes ulcers in the bowel, leading to nausea and vomiting, loss of appetite and high fever with abdominal pain, vomiting blood and bloody diarrhoea.

Anthrax which is breathed in causes **inhalational anthrax**. This illness comes in two phases beginning with non-specific mild fever, malaise, muscle aches, dry cough and chest pain; disorientation is also common. Within 1–6 days, the illness progresses to the second phase with fever, acute shortness of breath, a harsh, grating sound when breathing and blue-tinged skin, rapidly leading to respiratory failure, shock, a drop in body temperature and death, if untreated.

# Anthrax

## Complications

Complications are rare in **cutaneous anthrax** although secondary infections are possible.

**Gastrointestinal and inhalational anthrax** can lead to inflammation of the brain: a flu-like illness, sometimes with an intense headache, rapidly progresses to seizures, delirium and coma, with collapse and sometimes death.

# Anthrax

## Diagnosis

Anthrax can be detected by doing laboratory tests on specimens from an infected person.

## Treatment

Anthrax can be treated with antibiotics. Respiratory support in an intensive care unit (ICU) is likely to be necessary for cases of inhalational anthrax.

## How to avoid getting anthrax

Vaccines are available that protect against anthrax.

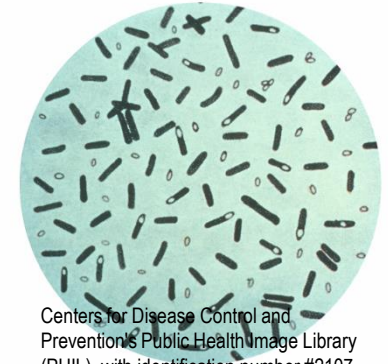
Vaccination is recommended for vets, abattoir workers, those working with animal hides or furs, laboratory workers and armed forces in areas of high risk of exposure. Animals can be vaccinated to prevent them from being infected and passing the spores onto humans.

## Fatal case of anthrax following animal exposure in Bulgaria

On 21 July 2015, Bulgaria reported a fatal case of *B. anthracis* in a 53-year-old breeder of sheep and cows who died on 17 July in Varna after having slaughtered a sick animal.

Further investigations revealed that a meat-processing plant used the contaminated meat. The plant was closed and disinfected and all products were confiscated.

# Botulism



Centers for Disease Control and  
Prevention's Public Health Image Library  
(PHIL), with identification number #2107

- C. botulinum* is responsible for foodborne botulism (ingestion of preformed toxin), infant botulism (intestinal infection with toxin-forming *C. botulinum*), and wound botulism (infection of a wound with *C. botulinum*).
- C. botulinum* produces heat-resistant [endospores](#) that are commonly found in soil and are able to survive under adverse conditions.<sup>1</sup>

Botulism is a serious paralytic illness caused by a nerve toxin produced by the bacterium *Clostridium botulinum*.

There are 3 main kinds of botulism:

- foodborne,
- wound,
- infant.

In each case, bacteria produce a neurotoxin that can cause paralysis, muscle weakness, and other serious symptoms.

The foodborne version occurs when the toxin is pre-formed and ingested in a food product. In wound botulism and in infant botulism, the toxin is produced in situ.

The disease may occur after eating foods containing the toxin or due to development of the spores within the intestine of young children or within wounds.

Food botulism is the dominating form of the disease, and paralytic symptoms generally appear after an incubation period of 12–36 hours (up to several days) after consumption of the toxin-containing food. The symptoms may be very severe, and require intensive-care treatment and the administration of an anti-toxin. Even where these are available, between 5 and 10 % of the patients die.

Due to the extremely high potency of the toxin, botulism is included among the potential bio-terrorist threats. Following laboratory accidents, the toxin has also caused symptoms on inhalation, with a substantially reduced incubation period.

# Botulism

## Etiology:

*Clostridium botulinum* is a Gram-positive, rod-shaped, spore-forming bacterium. It is an obligate anaerobe, meaning that oxygen is poisonous to the cells.

## The source of infection

Botulism spores are widespread in the environment and can be found in dust, soil, untreated water and the digestive tracts of animals and fish. Foods that have led to botulism outbreaks have included the following: meat products, such as sausage and cured ham; canned, vacuum-packed, smoked or fermented fish products; vegetables preserved by canning or stored in oil; baked potatoes; honey; and cheese. Many outbreaks have occurred due to home-preserved foods. Intestinal or infant botulism usually takes place after swallowing botulinum spores, sometimes from food, which then produce toxins in the gut. Wound botulism usually happens from inoculating botulinum spores which then grow in the inoculation wound and produce toxins.

## Route of transmission

## Susceptibility

General.

**Preventive measures:** There is no routine vaccination against botulism. Care should be taken when canning food, either commercially or at home, and when preserving fish, meat and vegetables to make sure botulinum is destroyed before storage.

Do not eat food from containers that are obviously bulging (which could be caused by gas from the botulinum) or containers that are damaged. Boiling food for ten minutes before eating it would inactivate the toxin in home-canned foods. Potential botulism cases should get urgent medical response and investigation.

Prevention work with intravenous drug users is also important



# Botulism

## Symptoms

Intestinal botulism is the commonest form of human botulism in the USA; about 100 cases are reported among infants in the USA annually.

Intestinal botulism occurs rarely in older children and adults [this form has been also referred to as adult colonization botulism.

Intestinal botulism results from colonization and bacterial production of botulinum toxin in the colon.

Swallowing ambient *Clostridium botulinum* spores, which exist worldwide in soil and dust, has been proposed as the principal route of exposure; honey is an avoidable source of some causative spores. Botulism causes paralysis by affecting the nerves which allow the brain to stimulate muscles and part of the central nervous system. It initially affects the nerves in the skull and may cause blurred vision, difficulty swallowing, double vision, stammering or stuttering, vocal disturbance, drooping eyelids, facial weakness and weakness of the tongue. Weakness in the neck and arms follows, after which the respiratory and lower body muscles are affected. Respiratory problems may be severe enough to need ventilation in hospital. Other symptoms may include dry mouth, urinary problems and dysfunction of the stomach, intestines, heart and blood vessels. Patients do not usually have a fever, and have no loss of sensory functions or awareness. Botulism caught from food usually affects the stomach and intestines, causing nausea, vomiting, constipation, diarrhoea and abdominal cramps. Botulism in a wound causes inflammation around the wound, followed by low blood pressure and circulatory collapse. Patients with wound botulism often look and feel quite well before deteriorating dramatically over a few hours.

Babies with botulism may have constipation, lethargy, feeding difficulties, floppy muscles, increased drooling and a weak cry.

Infants can contract botulism through spores, **because their digestive systems produce less acid than adults, acid which would otherwise kill the toxin-producing botulism bacteria.**

Botulism can sometimes be contracted when infants eat contaminated honey, but other than avoiding honey, there's really no way to prevent babies from ingesting botulism.

The vast array of possible spore sources makes it frustrating when talking to parents who want to know how their baby got the disease, she said, because it's impossible to give them a specific source.

Symptoms of botulism can be difficult to spot in the early stages; the baby might simply be more fussy, and they may not be able to suck as well. However, as the disease progresses, the infant will become constipated.

Then, a weakness or paralysis will take hold, from the head, progressing downwards.

The baby's eyelids may droop, and its cry will become weaker, she said. Facial muscles won't work as well.

# Infant botulism

Botulism should be suspected in previously healthy infants aged less than 12 months old who are constipated and who exhibit weakness in sucking, swallowing, or crying; hypotonia [decreased muscle tone]; and progressive bulbar and extremity muscle weakness.

About half of patients require mechanical ventilation during hospitalization.

Lumbar puncture and brain imaging generally yield normal results but can help differentiate among other causes of flaccid weakness.

Although not specifically stated in this post, botulism immune globulin (BIG) is indicated in infants with clinically diagnosed infant botulism, before diagnostic confirmation.

The prompt use of this specific immunoglobulin leads to a significant decrease in both ICU and total hospital stay.

# BOTULISM DURING PREGNANCY

There is not a lot of published information regarding botulism during pregnancy.

2 reports concern botulism during the 3rd trimester.

In one example in the pediatric literature, although the pregnancy was complicated by a placental abruption (early separation of the placenta from the uterus), the infant had no evidence of botulism.

In another, the infant of a substance abuser with wound botulism was delivered at 34 weeks and required several weeks of intensive care; but the report does not state if the infant was indeed affected by botulism.

2 other reports described intoxication during the 2nd trimester. In both, despite the need for respiratory support of the mother, ultrasound examination of the fetus found normal movement and development and resulted in full-term, healthy infants.

A relatively large molecule, botulinum toxin does not seem to passively diffuse across the placenta.

# Botulism

## **Ways to catch botulism**

Botulism spores are widespread in the environment and can be found in dust, soil, untreated water and the digestive tracts of animals and fish. Foods that have led to botulism outbreaks have included the following: meat products, such as sausage and cured ham; canned, vacuum-packed, smoked or fermented fish products; vegetables preserved by canning or stored in oil; baked potatoes; honey; and cheese. Many outbreaks have occurred due to home-preserved foods. Intestinal or infant botulism usually takes place after swallowing botulinum spores, sometimes from food, which then produce toxins in the gut. Wound botulism usually happens from inoculating botulinum spores which then grow in the inoculation wound and produce toxins.

# Botulism

## **People most at risk**

Rates of botulism in the EU are generally low, with around 200 cases each year (0.03 cases per 100 000 people). The highest levels of cases over the past 10 years have been reported from Poland and Lithuania. Wound botulism in intravenous drug users is now the most common type of botulism in some European countries, such as the UK and Ireland. Infant botulism, which is very rare in Europe, usually affects children younger than two, with most being under six months old.

# Botulism

## Diagnosis

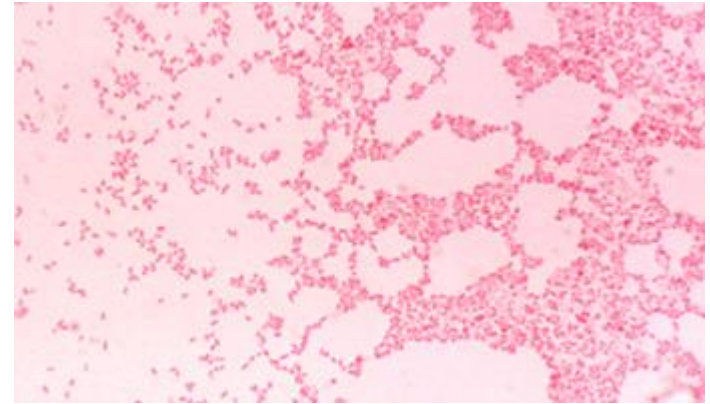
Laboratory tests can detect botulinum toxin in faeces, serum, stomach contents, a swab from a wound or in samples from contaminated food.

- **Treatment**

Patients need to be admitted to hospital for investigation and treatment. **Botulinum antitoxin is available** and reduces the length of illness and fatality rates, but may have serious side effects.

Treatment can be given based on a doctor's diagnosis of symptoms, without waiting for laboratory confirmation. Wound botulism can be treated with antibiotics and surgery to remove dead tissue.

# Brucellosis



Brucellosis is an infection caused by Brucella bacteria. The common reservoirs for Brucella bacteria that may infect humans are cattle, dogs, sheep, goats, and pigs. Brucellosis occurs worldwide but the Mediterranean region has been particularly affected. Humans become infected by direct or indirect contact with animals or with contaminated animal products (including unpasteurised milk and dairy products) or by the inhalation of aerosols.

After an incubation period of five to 60 days, symptoms may appear either acutely or insidiously. Untreated, the disease may become chronic. The various symptoms are both general (fever, weakness, joint pain) and organ-specific (including infections in the brain infection and heart valves). Untreated, brucellosis can lead to death. Prolonged antibiotic treatment is usually effective.



# Brucellosis

## Etiology:

***Brucella*** is a genus of Gram-negative bacteria.

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## The source of infection

Cattle, dogs, sheep, goats, and pigs.

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## Route of transmission

Humans become infected by direct or indirect contact with animals or with contaminated animal products (including unpasteurised milk and dairy products) or by the inhalation of aerosols.

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## Susceptibility

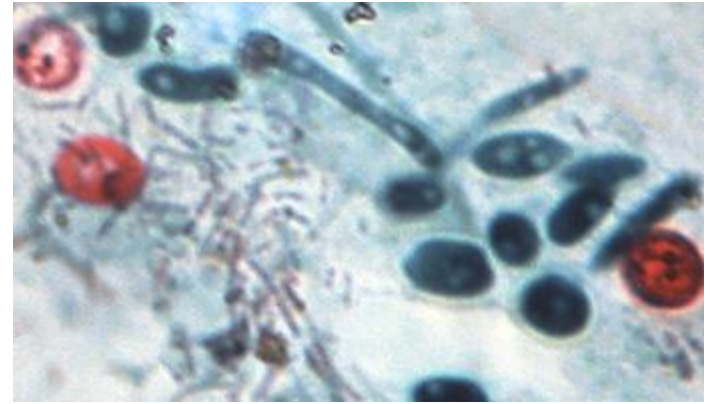
General.

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## Preventive measures:

Control measures include animal vaccination and/or test-and-slaughter of infected animals, as well as pasteurisation of milk and dairy products.

# Cryptosporidiosis



In humans, infections without symptoms are common. Especially healthy individuals, may, after an incubation period averaging one week, get a diarrhoea that spontaneously resolves over a couple of weeks. By contrast, patients with impaired immune system may develop profuse, life-threatening, watery diarrhoea that is very difficult to treat with currently available drugs.

Outbreaks have been reported in hospitals, day-care centres, within households, among bathers (affecting participants in water sports in lakes and swimming pools), and in municipalities with contaminated public water supplies. Water distribution systems are particularly vulnerable to contamination with *Cryptosporidium*, which can survive most disinfection procedures such as chlorination

# Cryptosporidiosis

## Etiology:

Cryptosporidia are intestinal parasites infecting a variety of animals (e.g. cattle, sheep, rodents, cats and dogs, but also birds, fish and reptiles).

Human infections occur due to *Cryptosporidium parvum*, a species that also affects domestic animals.

*Cryptosporidium* eggs (oocysts) can survive for months in moist soil or water and survive harsh environmental conditions (e.g. heat, cold, droughts) for extended periods of time.

## The source of infection

## Route of transmission

Person-to-person or animal-to-person disease transmission occurs mainly through contaminated water and food..

Everyone is susceptible to the infection but the highest numbers of cases are found in children, with those aged younger than two years at the most risk.

## Preventive measures:

Good quality drinking water, swimming pool hygiene and general hygiene measures are all important in preventing cryptosporidiosis. Good hand-washing, taking care when preparing food and carefully disposing nappies are all important in limiting the spread of infection. People whose immune systems are compromised should avoid contact with animals with diarrhoea and young pets, and avoid swallowing water when swimming. If drinking water supplies are affected, water should be boiled before drinking.

## Susceptibility

# Cryptosporidiosis

- **Symptoms**

The most common symptom of cryptosporidiosis is acute, watery diarrhoea. Pain in the abdomen may also occur, along with other symptoms like malaise, headache and fever. The disease is usually self-limiting, but can last up to 14 days and can cause significant weight loss. In humans, the illness can vary in severity from no symptoms at all to those who suffer from persistent diarrhoea, with up to 40% of cases suffering a return of diarrhoea after recovering from the initial illness.

- **Complications**

In children, especially in developing countries, cryptosporidiosis can cause persistent diarrhoea and lead to wasting and stunted growth. People whose immune systems are deficient, including patients with HIV and AIDS, can also develop a more severe and persistent infection.

# Cryptosporidiosis

## Ways to catch cryptosporidiosis

*Cryptosporidium* parasites can be caught by swallowing infected water (either drinking water or through leisure activities), eating contaminated food, direct contact with animals carrying the germs, or passed from person to person by direct contact. Drinking water is a frequent source of infection and causes outbreaks around the world. This occurs where water is contaminated with sewage or waste water overflow, or if there has been a technical failure at a water treatment plant. Person-to-person infection is also common and *Cryptosporidium* can be easily spread in households, nurseries and schools. Changing nappies has been identified as a significant risk factor. In Europe international travel, contact with another case, contact with cattle, use of swimming pools and toileting of children younger than five years have all been shown to be risk factors for contracting cryptosporidiosis.

# Cryptosporidiosis

## **Diagnosis**

Cryptosporidiosis can be confirmed by carrying out laboratory tests on a sample of faeces from an infected patient.

- **Treatment**

In most generally healthy people, treatment may not be necessary for cryptosporidiosis as it is usually self-limiting. As with all illness causing diarrhoea, it is important to monitor patients to make sure they do not become dehydrated. Drugs are available that may be used to treat patients who develop persistent diarrhoea.

# Echinococcosis



Echinococcosis is a zoonotic disease (transmitted from animals to humans) caused by the larval stage (hydatid cyst) of tapeworms. Eggs are excreted in the faeces of infected dogs and foxes and can be ingested by humans either by close contact with these animals or through contaminated food.

- The most common location of cysts is the liver, but cysts may develop in almost any organ, including lungs, kidneys, spleen, nervous tissue, etc, years after the ingestion of the echinococcus eggs. In the case of cystic disease, symptoms usually appear due to the large size of the cysts. Cysts in the lungs invades tissues in a cancer-like fashion and if untreated always leads to death.
- Patients are treated with surgery and the specific anti-helminthic drugs. The disease occurs in areas where dogs have access to animal inner organs, usually of sheep and cattle (intermediate hosts), containing cysts. The lung form is restricted to northern countries, where foxes abound.
- Poor hand hygiene, close contact with infected animals and consumption of undercooked, unwashed food contaminated with echinococcus eggs (e.g. vegetables) are all risk factors.

-

# Echinococcosis

The genus *Echinococcus* includes six parasite species.

## Etiology:

### The source of infection

The infection is most often spread from dogs, wolves and foxes but can also come from sheep, goats, cattle, camels and horses.

Infected humans do not excrete eggs.

### Route of transmission

People get echinococcosis by swallowing the eggs of parasites when they eat contaminated food or drink water contaminated with the faeces of animals which have been infected with the tapeworm.

General

### Susceptibility

#### Preventive measures:

Good hygiene measures are important to avoid getting echinococcosis. Vaccines are available for animals to reduce the risk of their spreading the parasite to humans.



# Echinococcosis

## **Symptoms**

People who are infected with echinococcosis usually do not have any symptoms. Symptoms are usually caused when the cysts formed by the infection restrict or compress other parts of the body. Cysts can also leak and cause secondary bacterial infection in the body, abscesses or immune reactions. People get echinococcosis by swallowing the eggs of parasites after eating contaminated food. The eggs hatch into tapeworms in the person's intestines and these pass through the membranes lining the body and get into the circulation. The tapeworms turn into cysts in the intestines and bowels which can grow and multiply, especially in the liver or lungs. However, it can also spread beyond the liver to any organ including the brain, heart and bones.

- **Complications**

Complications can include various diseases of the liver and the parts of the body around the liver. If cysts leak or rupture, they can cause allergic reactions which are sometimes severe.

# Echinococcosis

## **Ways to catch echinococcosis**

People get echinococcosis by swallowing the eggs of parasites when they eat contaminated food or drink water contaminated with the faeces of animals which have been infected with the tapeworm. The infection is most often spread from dogs, wolves and foxes but can also come from sheep, goats, cattle, camels and horses. Infected humans do not excrete eggs.

- **People most at risk**

The parasites that cause echinococcosis are found all over the world. Studies have shown that the infection tends to more often affect older people rather than children. Dog owners and people who work with sheep, goats or cows can be more at risk.

# Echinococcosis

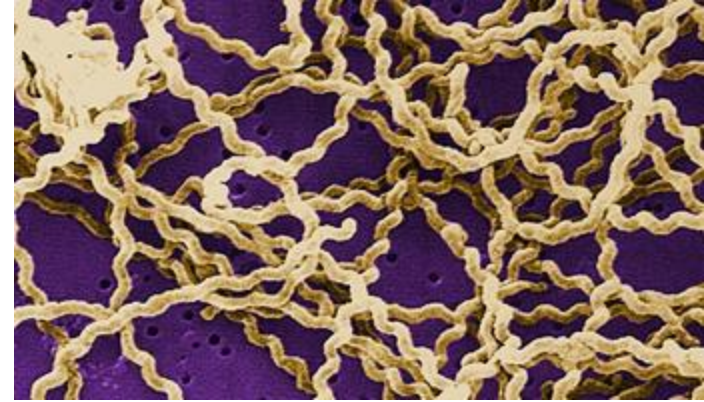
## **Diagnosis**

Most of the time, untreated cysts remain undetected and are often found by chance when other complaints are being investigated. X-rays and ultra-sound scans can detect the cysts caused by echinococcosis and a biopsy can detect the infection.

- **Treatment**

Usually, treatment is only offered to those who are suffering symptoms as a result of the cysts caused by echinococcosis. These can either be treated surgically, by chemotherapy or by using ultrasound scans to guide a doctor to remove the cyst fluid using a needle.

# Leptospirosis



Leptospirosis is a zoonotic disease caused by *Leptospira* bacteria. Although more common in tropical areas of the world, the disease is also present in temperate areas, including Europe. Different species of domestic and wild animals act as maintenance hosts. Humans acquire leptospirosis either from direct contact with the urine of infected animals, or from contact with material contaminated by it, such as water or soil. After exposure, the incubation period ranges between two and 30 days (with an average of 10 days). The clinical presentation is variable. Fever, muscle ache and eye infection are very frequent. Liver, kidney, lung, heart, and more rarely brain involvement and bleeding characterise the most serious clinical presentations. Timely antibiotic treatment is effective, and the death rate is low, but does increase with advancing age and may reach up to 20% or more in complicated cases with severe disease.

- Preventive measures include controlling rodent populations, avoiding contaminated areas and covering cuts and abraded skin when operating in the environment. Immunisation of persons at occupational risk of exposure has been carried out in some countries (Italy, France, Spain).
-

# Leptospirosis

Leptospirosis is caused by spirochatae bacteria belonging to the genus *Leptospira*. 21 species of *Leptospira* have been identified. 13 species cause disease or have been detected in human cases.

## Etiology:

### The source of infection

About 160 mammalian species have been identified as natural carriers of pathogenic leptospire. These include feral, semi-domestic and farm and pet animals as important infection sources.

### Route of transmission

The route of transmission is via broken skin and through mucous membranes of eyes, mouth and nose (consumption, inhalation). Transmission may also occur via sexual contact and mother's milk. In-uterus transmission can lead to reproductive failures such as abortion.

### Susceptibility

The risk of acquiring leptospirosis is associated with contact with animals and thus with occupations such as farmers, veterinarians and sewer workers. Case severity is associated with physical condition and increasing age. Leptospirosis as a recreational disease in travellers is increasing in Western countries.

**Preventive measures:** Prevention and control mainly focus on the identification and reduction of the infection source and the prevention of penetration of leptospire into the accidental host. Prevention of transmission can be achieved by wearing protective clothing.

# Listeriosis

## Etiology:

*Listeria monocytogenes* is a Gram-positive bacterium. The genus *Listeria* currently contains 10 species; only *L. monocytogenes* is consistently associated with human illness.

## The source of infection

Researchers have found *L. monocytogenes* in at least 37 mammalian species, both domesticated and feral.

## Route of transmission

*L. monocytogenes* has been associated with such foods as raw milk, pasteurized fluid milk, cheese (particularly soft-ripened varieties), ice cream, raw vegetables, fermented raw-meat sausages, raw and cooked poultry, raw meats (of all types), and raw and smoked fish. Its ability to grow at temperatures as low as 0°C permits multiplication in refrigerated foods.

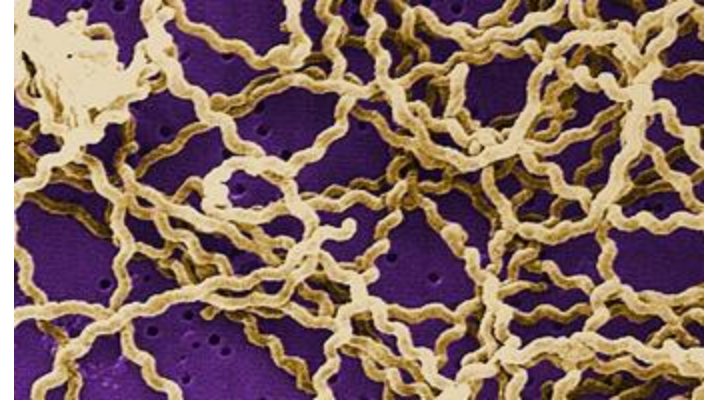
## Susceptibility

Reported cases in Europe are highest among those over 65 and children younger than four.

## Preventive measures:

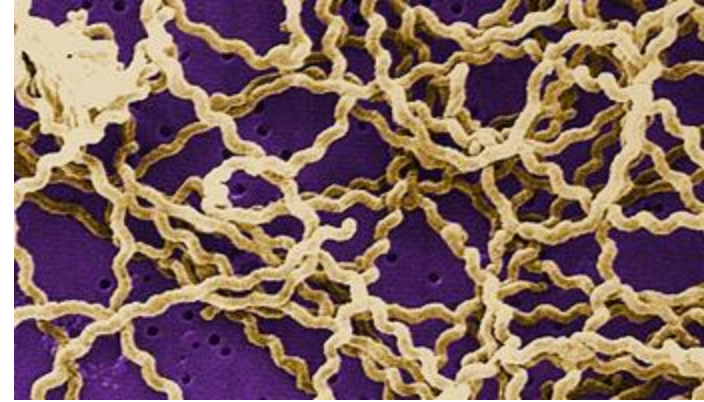
Pasteurising dairy products is important as the process kills *Listeria*.

# Leptospirosis



- **NAME AND NATURE OF INFECTING ORGANISM** Leptospirosis is a zoonosis occurring worldwide, caused by pathogenic spirochaetes of the genus *Leptospira*. Pathogenic leptospire live in the kidneys of a large variety of mammalian species and are excreted into the environment with the urine. Indirect infection through contact with leptospire secreted into the environment is probably the main route of acquiring leptospirosis. Pathogenic leptospire survive longer in a warm and humid environment. Therefore, the disease is particularly prevalent in wet tropical and subtropical regions. The bacterium is sensitive to dry conditions, extreme temperatures and detergents. Currently nearly 300 serovars have been identified, divided into 25 serogroups. Seven main pathogenic species are known.
- Leptospirosis is the most widespread and most prevalent zoonotic disease. The disease is (re-) emerging globally and numerous outbreaks have occurred worldwide during the past decade. In Europe, leptospirosis occurs mainly in the Mediterranean and East European regions.

# Leptospirosis

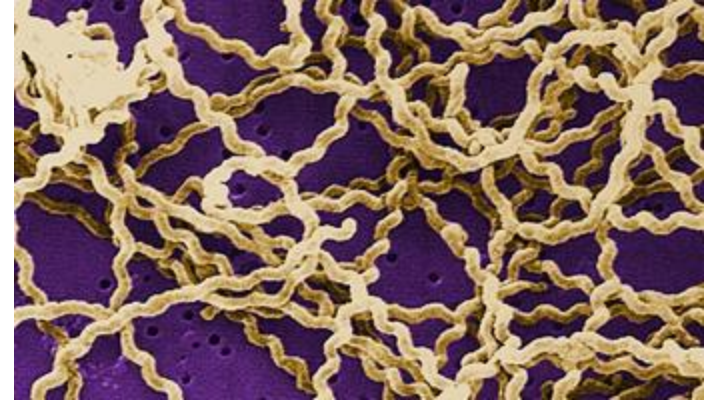


## • 2. CLINICAL FEATURES

- The incubation period varies from 2 to 30 days, with an average of 7–10 days. Leptospirosis varies from mild to severe clinical presentation, and may cause potentially fatal conditions such as Weil's syndrome and the emerging Severe Pulmonary Haemorrhagic Syndrome (SPHS). Generally, leptospirosis is an acute biphasic illness: the first phase (4–9 days) presents with an abrupt onset of a flu-like illness, with a severe headache, chills, muscle aches, and vomiting, while in the second phase the patient develops fever, jaundice, abdominal pain and diarrhoea. In severe cases there may be organ failure. If untreated, recovery may take several months.



# Leptospirosis



- **3. TRANSMISSION**

- **3.1 Reservoir**

- About 160 mammalian species have been identified as natural carriers of pathogenic leptospire. These include feral, semi-domestic and farm and pet animals as important infection sources. The infectious period of natural hosts can be lifelong. Accidental hosts can act as intermediate infection source, and may shed leptospire for days or months.

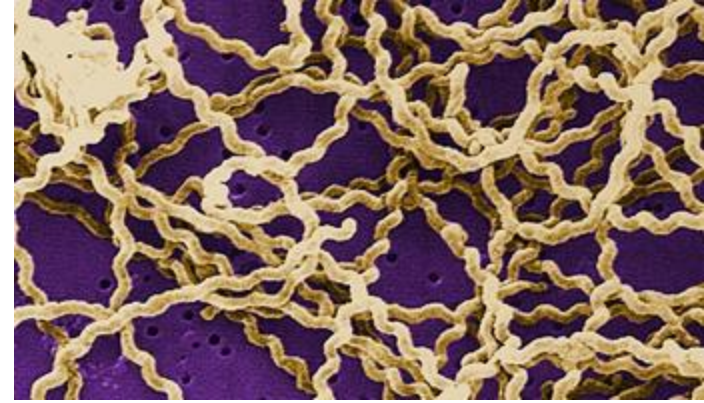
- **3.2 Transmission mode**

- The route of transmission is via broken skin and through mucous membranes of eyes, mouth and nose (consumption, inhalation). Transmission through water-weakened skin is controversial. Transmission may also occur via sexual contact and mother's milk. In-uterus transmission can lead to reproductive failures such as abortion.

- **3.3 Risk groups**

- The risk of acquiring leptospirosis is associated with contact with animals and thus with occupations such as farmers, veterinarians and sewer workers. Case severity is associated with physical condition and increasing age. Leptospirosis as a recreational disease in travellers is increasing in Western countries.

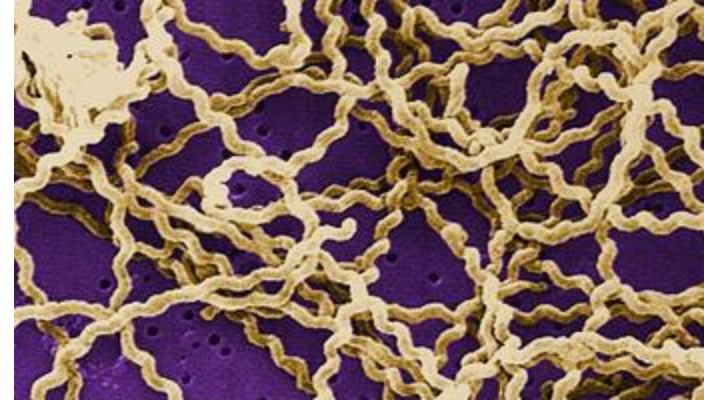
# Leptospirosis



## **. PREVENTION MEASURES**

- Prevention and control mainly focus on the identification and reduction of the infection source and the prevention of penetration of leptospire into the accidental host. Prevention of transmission can be achieved by wearing protective clothing. Prophylactic treatment with doxycycline is protective to some extent. Vaccination is available in a limited number of countries, but currently not considered as a generally applicable option.**
- Improving water and food storage conditions, increasing public awareness about the disease and infection risks, as well as the control of rodents, may reduce the risk of transmission. Infection risk from domestic animals can be reduced by vaccination or treatment of carriers. Both approaches should be combined with herd management. Vaccines are available for cattle, dogs and pigs, and provide a short-term serovar-specific protection.**

# Leptospirosis



## • 5. DIAGNOSIS

• The confirmation of a clinically suspected leptospirosis case is usually done through culturing and the Microscopic Agglutination Test (MAT); both are quite laborious and require well-equipped laboratories with experienced staff. Several rapid tests for humans are currently available, mainly for screening purposes, and results must be confirmed by standard tests.

## • 6. MANAGEMENT AND TREATMENT

• Early diagnosis is critical in the treatment of patients with leptospirosis. In severe cases, high doses of intravenous penicillin are recommended, but Jarish-Herxheimer reactions may occur. In less severe cases, oral antibiotics such as amoxicillin, ampicillin, doxycycline or erythromycin are administered. Third generation cephalosporins and quinolone antibiotics also seem to be effective.

# Listeriosis



- *L. monocytogenes* was not identified as a cause of foodborne illness until 1981, however.
- An outbreak of listeriosis in Halifax, Nova Scotia, involving 41 cases and 18 deaths, mostly in pregnant women and neonates, was epidemiologically linked to the consumption of coleslaw containing cabbage that had been contaminated with *L. monocytogenes*-contaminated sheep manure. Since then, a number of cases of foodborne listeriosis have been reported, and *L. monocytogenes* is now widely recognized as an important hazard in the food industry.

# Listeriosis

## Etiology:

*Listeria monocytogenes* is a Gram-positive bacterium. The genus *Listeria* currently contains 10 species; only *L. monocytogenes* is consistently associated with human illness.

## The source of infection

Researchers have found *L. monocytogenes* in at least 37 mammalian species, both domesticated and feral.

## Route of transmission

*L. monocytogenes* has been associated with such foods as raw milk, pasteurized fluid milk, cheese (particularly soft-ripened varieties), ice cream, raw vegetables, fermented raw-meat sausages, raw and cooked poultry, raw meats (of all types), and raw and smoked fish. Its ability to grow at temperatures as low as 0°C permits multiplication in refrigerated foods.

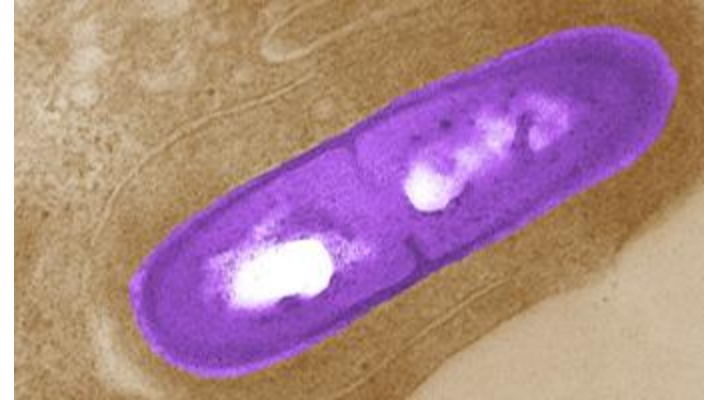
## Susceptibility

Reported cases in Europe are highest among those over 65 and children younger than four.

## Preventive measures:

Pasteurising dairy products is important as the process kills *Listeria*.

# Listeriosis



- **Symptoms**

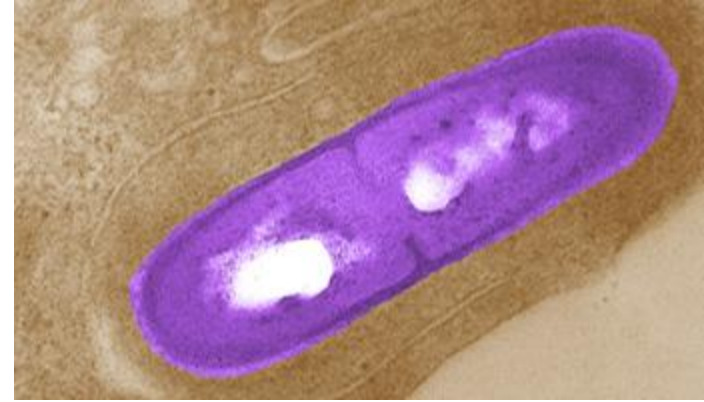
Listeriosis can cause a range of symptoms. Some patients can have no symptoms at all. Previously well, non-pregnant people often get symptoms of acute gastroenteritis—inflammation of the stomach and intestines. This can cause headache, fever, abdominal pain, sleepiness, nausea and diarrhoea. Fatigue, aching muscles, painful joints, vomiting and a sore throat may also occur.

- **Complications**

Listeriosis can also cause serious illness, most often in those with long-term health conditions, the elderly, or people whose immune systems are compromised. Severe symptoms can include the following: blood poisoning; inflammation of the brain and its lining; abscesses; inflammation of the lining of the heart; and infected or inflamed joints.

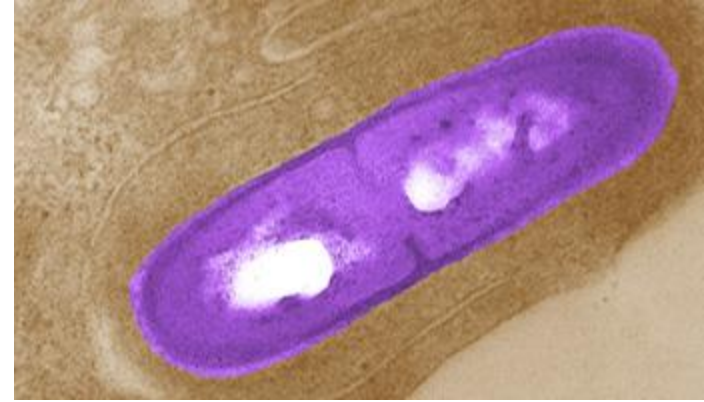
- **Pregnant women** who get the infection may only have mild illness, but can suffer miscarriage, premature delivery or stillbirth. Newborn babies can also suffer from severe symptoms, including meningitis, which can lead to death.

# Listeriosis



- Ways to catch listeriosis  
The bacteria that cause listeriosis are widespread in the environment and can be found in soil, surface water, vegetation and a range of wild and domestic animals. Most humans catch the infection by eating contaminated food. The bacteria can grow at low temperatures and are tolerant of salt and therefore can survive in processed, preserved and refrigerated foods. Foods that have been associated with spreading listeriosis include the following: processed meat and fish, cold meats and hot dogs; dairy products, such as soft cheese, butter and milk, especially if unpasteurised; and pre-prepared salads, sandwiches and salads. Other sources of infection include direct contact from animals or the environment. Pregnant women can pass the infection to their babies during birth or through the placenta.
- People most at risk  
Reported cases in Europe are highest among those over 65 and children younger than four.

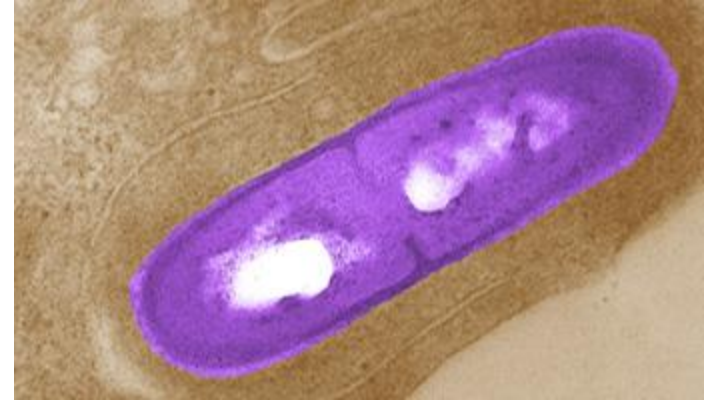
# Listeriosis



- Diagnosis  
Laboratory tests are carried out on samples of blood or cerebrospinal fluid to diagnose the infection. Laboratory tests are also carried out on food and environmental samples to look for *Listeria*.
- Treatment  
Antibiotics can be used to treat patients.



# Listeriosis



- **How to avoid getting listeriosis**  
Pasteurising dairy products is important as the process kills *Listeria*. Cook-chill and ready-to-eat foods should not be stored for too long and should be thoroughly reheated before serving. Raw vegetables, fruits and salads should be thoroughly washed before eating.
- Pregnant women and people whose immune systems are compromised are advised to avoid soft cheeses, pâté and pre-packed salads, contact with pregnant or newborn animals and silage.
- Hand washing is effective at reducing the risk of gastroenteritis from many organisms and may be made even more effective by using antibacterial soap.
- There is no vaccine against listeriosis.

# Toxoplasmosis

is a parasitic disease caused by *Toxoplasma gondii*.

Infections with toxoplasmosis usually cause no symptoms in adult humans. Occasionally there may be a few weeks or months of mild flu-like illness such as muscle aches and tender lymph nodes.

In a small number of people, eye problems may develop. In those with a weak immune system, severe symptoms such as seizures and poor coordination may occur.

# Toxoplasmosis

## Etiology:

*Toxoplasma gondii* is an obligate intracellular, parasitic protozoan

## The source of infection

Cats are the reservoir of the parasite.

## Route of transmission

They excrete cysts in the environment, able to infect many other animals, and humans can become infected either by ingesting the cysts (by direct contact with cats or through food or water contaminated by cat faeces), or by eating poorly cooked meat containing cysts, especially pork and mutton.

## Susceptibility

Furthermore, pregnant or immunocompromised people are at higher risk of becoming infected or transmitting the parasite to their fetus.

## Preventive measures:

Basic food handling safety practices can prevent or reduce the chances of becoming infected with *T. gondii*, such as washing unwashed fruits and vegetable and avoiding raw or undercooked meat, poultry, and seafood. Other unsafe practices such as drinking unpasteurized milk or untreated water can increase odds of infection. Oocysts in cat feces take at least a day to sporulate and become infectious after they are shed, so disposing of cat litter daily greatly reduces the chances of infectious oocysts being present in litter.

# Toxoplasmosis

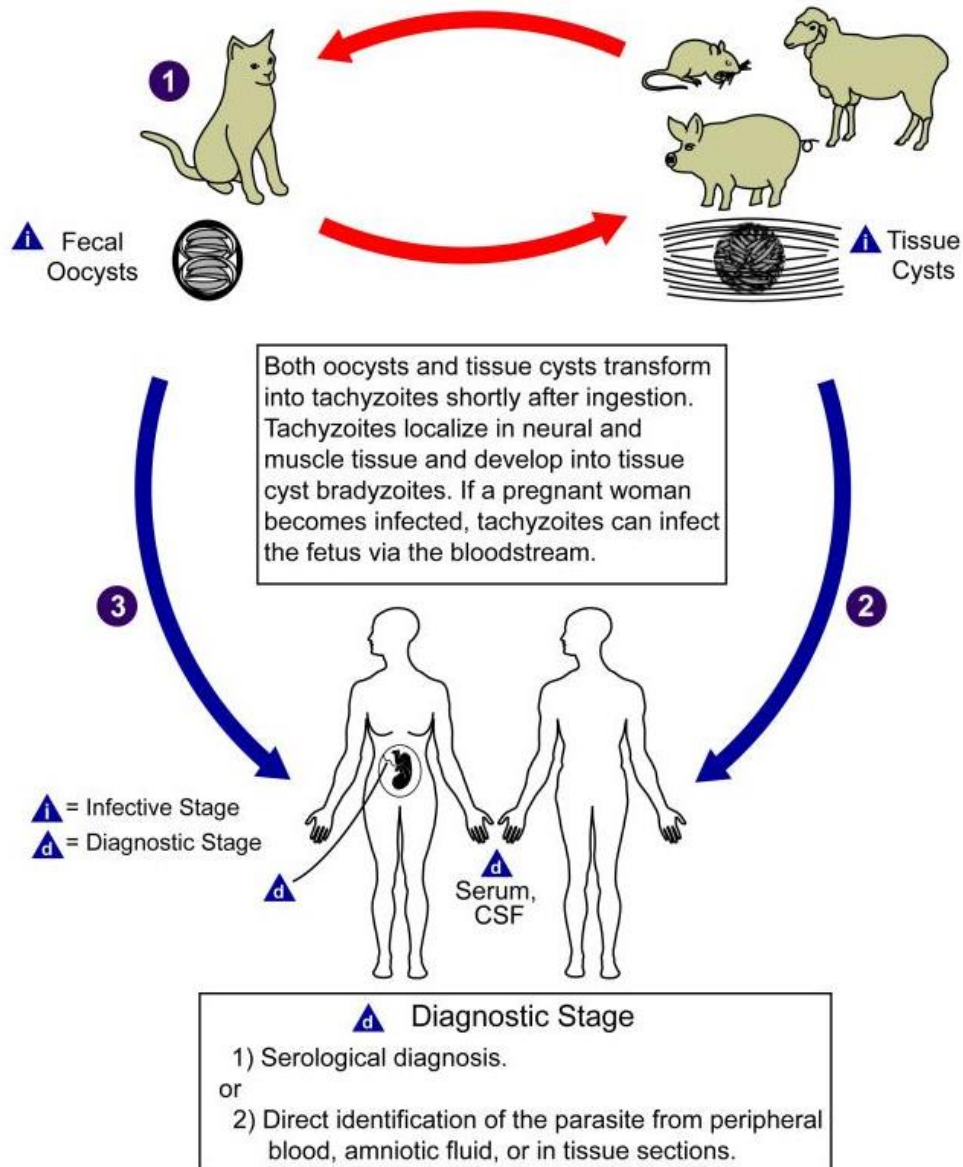
Usually toxoplasmosis goes with no symptoms in humans (and animals), but healthy individuals may experience swollen lymph glands. However, it may also cause life-threatening disease in individuals with impaired immune defence.

During pregnancy the infection can affect the foetus.

Pregnant women, also without symptoms, may transmit the infection to the foetus, which can result in abortion, still-birth, perinatal death (due to disseminated toxoplasmosis), or congenital infection with severe malformation affecting the eyes and the brain. Infection in individuals with impaired immunity tends to seriously affect the central nervous system, but also other organs may be affected. Such patients may require prolonged (sometimes life-long) therapy.

# Toxoplasmosis

(*Toxoplasma gondii*)



# Variant Creutzfeldt-Jakob disease

Variant Creutzfeldt-Jakob disease (vCJD) is a relatively new and rare neurological disease, classified as a Transmissible Spongiform Encephalopathy (TSE). It was first identified in March 1996 in the UK, when 10 cases of a new disease with neurological symptoms were reported and soon associated with the Bovine Spongiform Encephalopathy (BSE), “mad cow”-disease. Patients with vCJD have prominent psychiatric (frequently depression, anxiety and withdrawal) or sensory symptoms and delayed onset of neurologic abnormalities, including ataxia within weeks or months, and dementia and myoclonus late in the illness. The disease always progresses to death. Disease duration is 14 months on average.

# Variant Creutzfeldt-Jakob disease

## Etiology:

Causative agents of vCJD are prions, composed of misfolded prion proteins (PrP<sup>Sc</sup>), which form aggregates in neurological tissue leading to progressive brain damage and characteristic signs and symptoms of the disease. Prions are stable and relatively resistant to proteases, high temperatures, UV radiation, and commonly used disinfectants.

Cats are the reservoir of the parasite.

## The source of infection

Most reported vCJD cases appear to have been infected through the consumption of bovine meat products contaminated with the agent of BSE. In three cases, reported by the UK, the mode of transmission is thought to be through receipt of blood from an asymptomatic, infected donor.

## Route of transmission

## Susceptibility

vCJD tends to affect younger individuals, with an average age of onset of around 28 years, compared to sporadic CJD, which tends to affect middle-aged and elderly individuals.

## Preventive measures: