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10 Module 10: Infectious Diseases for employees working in agriculture

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Tabel of contents

10	Module 10: Infectious Diseases for employees working in agriculture	1
10.1.	Introduction	4
10.1.1	ID Module Structure.....	4
10.1.2	Glossary.....	12
10.2.	Pathogens transmitted through contact with domestic animals.....	12
10.2.1.	Avian and Swine Influenza viruses (zoonotic).....	13
10.2.2.	Chlamydia psittaci (Psittacosis)	14
10.2.3.	Rabies virus	15
10.2.4.	Salmonella spp (Salmonellosis)	15
10.2.5.	Pasteurella infection (Pasteurella multocida).....	16
10.2.6.	Toxoplasma gondii (Toxoplasmosis).....	17
10.2.7.	Bartonella henselae (Cat Scratch Disease).....	18
10.2.8.	Yersinia pestis (Plague)	19
10.2.9.	Echinococcus (Echinococcosis)).....	19
10.2.10.	Brucella spp (Brucellosis)	20
10.2.11.	Coxiella burnettii (Q fever)	22
10.2.12.	Bacillus anthracis (Anthrax).....	23
10.2.13.	Burkholderia mallei (Glanders).....	25
10.3.	Pathogens transmitted through contact with wildlife	26
10.3.1.	Avian Influenza	26
10.3.2.	Psittacosis	26
10.3.3.	Rabies	27

10.3.4.	Tularemia.....	28
10.3.5.	Plague	30
10.3.6.	Leptospirosis	32
10.4.	Food and waterborne diseases	33
10.4.1.	Salmonella (Salmonellosis).....	33
10.4.2.	Shigella (Shigellosis).....	36
10.4.3.	Listeria (Listeriosis)	38
10.4.4.	E. coli	39
10.4.5.	Botulinum Toxin- Botulism.....	41
10.4.6.	Food & Water borne Parasites.....	43
10.4.6.1.	Trichinella.....	43
10.4.6.2.	Giardiasis.....	44
10.4.6.3.	Cyclospora.....	45
10.4.6.4.	Naegleria infection.....	46
10.4.6.5.	Taenia infections.....	47
10.4.6.6.	Entameoba histolytica (Amoebiasis).....	49
10.4.6.7.	Hepatitis A.....	50
10.5.	Pathogens transmitted through contact with the farm environment.....	51
10.5.1.	Vector borne diseases (VBDs).....	51
10.5.1.1.	Malaria	52
10.5.1.2.	Arbo-viral infections.....	53
10.5.1.3.	Plague.....	54
10.5.1.4.	Tick Borne Infections.....	55
10.5.1.5.	Leishmania spp. (Leishmaniasis)	56
10.5.2.	Exposure to pathogens in the dust.....	57
10.5.2.1.	Hanta virus	57
10.5.2.2.	Aspergillus (Aspergillosis).....	59
10.5.2.3.	Bacillus anthracis (Anthrax)	60
10.5.2.4.	Coxiella burnetti (Q Fever).....	60
10.5.2.5.	Brucella spp (Brucellosis)	60
10.5.2.6.	Psittacosis.....	60
10.5.3.	Exposure to pathogens in mud and/or flood water.....	60
10.5.3.1.	Tetanus.....	60
10.5.3.2.	Burkholderia mallei (Meliodosis)	62
10.5.3.3.	Leptospira spp (Leptospirosis)	62
10.5.3.4.	Mosquito borne diseases.....	62
10.5.3.5.	Vibrio infections	62
References.....	63	



10.1. Introduction

Aims of the Module:

- This module aims at providing Occupational Physicians/professionals with a user-friendly education and reference tool focusing on their needs for their everyday work.

Overview of contents:

- The ID module includes an overview of the most common infectious diseases associated with farming, presenting the clinical symptoms, diagnosis and treatment options, as well as prevention and protection advice and public health (PH) key messages for each disease in a 2-page format.
- Efforts were made to include also the public health perspective in each disease outline in order to assist in connecting the two disciplines, especially in this particular area of communicable diseases.

Learning outcomes:

After attending this module occupational physicians will:

- be able to list the most important and more frequent pathogens affecting farmers;
- be able to outline the relevant diseases and the relevant treatment options;
- know about prevention strategies and personal protective measures for each pathogen;
- know key public health issues involved with the particular disease in the event of diagnosis.

Infectious diseases (IDs) are a frequent health problem in the rural population. In particular as regards farmers, their occupation exposes them to various pathogens from prions and viruses to bacteria, fungi and parasites.

The WHO (2010) reported that the most prominent health concerns highlighted as particularly salient to rural areas in the European Region, included exposure to zoonotic infections (diseases of animals which can be transmitted to humans). It also argues that although incidence data of HIV or tuberculosis (TB) are higher in urban areas, people leaving or working in a rural setting might not be as well informed about these issues as people from urban areas. Furthermore, patterns of migration, such as rural-urban and rural-abroad, can potentially have a catalytic effect on vulnerability and disease transmission routes. Not all rural areas across the EU28 have access to clean water and improved sanitation, which leads to incidents of diarrhea infections, typhoid fever and hepatitis A. Another report by the WHO (Kulinkina, Shinee, Herrador, Nygård & Schmoll, 2016) argued that there is limited information about water-related infectious diseases (WRD) outbreak detection, investigation and response in rural small water supply areas and stated that their contribution to the WRD burden is likely underestimated. It included research from the UK which showed that small, private water supplies found in rural areas served approximately 0.5% of the population, but were responsible for 36% of WRD outbreaks, and another study of microbiological water quality in private water supplies which showed that at least 19%, but potentially over 30% of these, are contaminated with *E. coli*.

10.1.1 ID Module Structure

As pathogens and diseases of interest affecting farmers are numerous the ID module will present them in groups according to the most frequent mode of exposure in the farm context, as follows:

- I. Pathogens transmitted through contact with domestic animals,
- II. pathogens transmitted through contact with wildlife,
- III. food and waterborne diseases,
- IV. pathogens transmitted through contact with the farm environment, further categorized:
 - a) vector borne diseases

- b) exposure to pathogens in the dust
- c) exposure to pathogens in mud and/or flood water

An overview of the pathogens and the diseases they cause per type of exposure are presented in the following **Table 1**:

Table 1: pathogens (alphabetically) and relevant mode(s) of exposure of humans in the context of farming

Pathogen/ Disease	Modes of Transmission to Humans						
	Domestic animals or produce	Contact with wildlife	Fomites	Food or water-borne	Exposure to dust	Exposure to mud/flood water	Vector borne
Arboviruses (WNV, Dengue)	X	X	X	X	X	✓	✓
Aspergillus	X	X	X	X	✓	X	X
Bacillus anthracis (anthrax)	✓	X	✓	✓	X	X	X
Borrelia/ Lyme disease	X	X	X	X	X	X	✓ (tick)
Brucella	✓ (cattle)	✓	X	X	X	X	X
Cat scratch	✓	X	X	X	X	X	X
CCHF	X	X	X	X	X	X	✓ (tick)

Pathogen/ Disease	Modes of Transmission to Humans						
	Domestic animals or produce	Contact with wildlife	Fomites	Food or water-borne	Exposure to dust	Exposure to mud/ flood water	Vector borne
Chlamydia psittaci	✓	✓	X	X	✓	X	X
Clostridium botulinum toxin (Botulism)	X	X	X	✓	X	X	X
Clostridium tetani (tetanus)	X	X	✓	X	X	X	X
Cowpox	✓	X	X	X	X	X	X
Coxiella burnetii (Q Fever)	✓	X	✓	X	✓	X	X
E.coli	✓	X	X	✓	X	X	X
Echinococcus	✓ (dogs)	✓ (foxes)	X	✓	X	X	X

Pathogen/ Disease	Modes of Transmission to Humans						
	Domestic animals or produce	Contact with wildlife	Fomites	Food or water-borne	Exposure to dust	Exposure to mud/flood water	Vector borne
Francisella tularensis (tularemia)	✓	✓	X	✓	X	✓	X
Hanta viruses	X	✓ (rats)	X	✓	✓	X	X
Hepatitis A virus	✓	X	X	✓	X	X	X
Influenza viruses	✓ poultry swine	✓ aquatic birds	✓	X	X	X	X
Leishmaniasis	X	X	X	X	X	X	✓ (phlebotomus)
Leptospirosis	X	✓	X	✓	✓	✓	X
Listeria monocytogenes	✓	X	X	✓	X	X	X

Pathogen/ Disease	Modes of Transmission to Humans						
	Domestic animals or produce	Contact with wildlife	Fomites	Food or water-borne	Exposure to dust	Exposure to mud/flood water	Vector borne
Malaria	X	X	X	X	X	X	✓
Melioeidosis	✓	X	X	X	X	✓	X
Orf virus	✓ (sheep)	X	X	X	X	X	X
parasites	✓	X	X	✓	X	X	X
Pasteurella multocida	✓ cats	X	X	X	X	X	X
Prion diseases	✓	X	X	X	X	X	X
Rabies virus	✓	✓	X	X	X	X	X

Pathogen/ Disease	Modes of Transmission to Humans						
	Domestic animals or produce	Contact with wildlife	Fomites	Food or water-borne	Exposure to dust	Exposure to mud/flood water	Vector borne
Salmonella	✓	X	✓	✓	X	✓	X
Shigella	✓	X	X	✓	X	X	X
Staphylococcus	✓ (cats/dogs)	X	±	X	X	X	X
Streptococcus	✓ (cats/dogs)	X	±	X	X	X	X
TB	✓	X	X	X	X	X	X
TBE	X	X	X	X	X	X	✓
Toxoplasma gondii	✓ (cats)	X	X	✓	✓	X	X

Pathogen/ Disease	Modes of Transmission to Humans						
	Domestic animals or produce	Contact with wildlife	Fomites	Food or water-borne	Exposure to dust	Exposure to mud/flood water	Vector borne
Trichinella	X	X	X	✓	X	X	X
Vibrio sp	X	X	X	✓	X	✓	X
Yersinia pestis (plague)	✓	✓	X	X	X	X	X

X = not transmitted via this route, ± = maybe transmitted via this route, ✓ = known to be transmitted via this route

10.1.2 Glossary

Term	Definition
Fatal accident at work	European statistics on accidents at work (ESAW) define fatal accidents at work as ‘those that lead to the death of the victim within one year’.
Non-fatal accident at work	European statistics on accidents at work (ESAW) define non-fatal accidents at work as ‘those that imply at least four full calendar days of absence from work’.
European statistics on accidents at work (ESAW)	Non-fatal and fatal accident at work in the EU collected within the framework of ESAW
The following measurement units used in ESAW data are:	<ul style="list-style-type: none"> - Numbers of accidents. - Percentages of accidents (in relation to different totals and breakdowns). - Incidence rates of accidents: number of accidents per 100,000 workers. - Standardised incidence rates: number of accidents per 100,000 workers adjusted for the relative sizes of economic sectors at EU level. (Eurostat, 2016b).

10.2. Pathogens transmitted through contact with domestic animals

A variety of animals are farmed in Europe from crustaceans to bird species to cattle, horses or small mammals for their fur. Animal farms also come in various sizes and it is common practice for residents of rural areas to keep a small number of animals in their back yard to cover their family's needs for fresh eggs, milk, cheese etc. In 2016 across the EU 28, the livestock population of farm animals was 147 million pigs, 89 million bovine animals, 87 million sheep and 13 million goats. The highest number of pigs was recorded in Spain and Germany (29.2 and 27.4 million respectively), the highest number of bovines was recorded in France (19.0 million) and the highest number of sheep and goats was recorded in the UK and Greece (23.8 and 3.9 million respectively). Nearly 70% (69.1%) of farms in the EU28 are small or very small with regards to their standard output which is between 2.000-8.000EUR. Across the EU28, 74.4% of small very farms and 42.6% of small farms are subsistence households, where their output is mostly self-consumed.

Important **points for occupation history**:

- detailed contact description with specific animal(s),
- description of the activity, duration and frequency of contact,
- condition of the animal, if there is possibility for testing,
- who was exposed and if they can be contacted,
- local veterinarian's contact details.

A comprehensive list of diseases that can be transmitted to humans by their pets is compiled by the CDC, Atlanta in <https://www.cdc.gov/healthypets/diseases/index.html>

Nevertheless for the purpose of this module, we have limited the pathogens considering the most frequently encountered animals.

10.2.1. Avian and Swine Influenza viruses (zoonotic)

<p>Avian influenza (flu), refers to a number of subtypes of influenza type A, (orthomyxovirus) that primarily cause influenza in birds. Migratory aquatic birds are considered the primary reservoir.</p> <p>Swine influenza, refers to virus subtypes circulating in pigs, e.g. A(H1N1), A(H3N2). They may be called variant, A(H3N2)v to distinguish.</p>	WHAT IS AVIAN or SWINE FLU?
<p>Individuals in close contact with birds or pigs are at higher risk. Exposure with sufficient virus to cause infection is usually needed (e.g. during culling, defeathering, preparing birds for cooking, living with the birds etc).</p>	WHO IS AT RISK?
<p>Strains of avian influenza range in severity of illness and contagiousness. Usually these viruses are not well transmitted from person to person, therefore clusters are usually small and often in the same family.</p> <p>Avian flu strains currently (2017) circulating in the EU include H5N8 and H5N6, while internationally H5N1, H7N9 and H9N9 are causing human clusters in China and other areas of the world.</p> <p>Swine influenza cases in humans have also been occasionally reported with varying severity. Attending fairs and petting zoos has been identified as a risk factor.</p> <p>Limited human-to-human transmission happens with zoonotic influenza, while human influenza is transmitted effectively from person to person (airborne, via droplets and fomites).</p>	EPIDEMIOLOGY
<p>Usually 2-5 days (<7 days from exposure)</p>	INCUBATION
<p>Severity of illness is dependent upon the pathogenicity of the strain. Presentation ranges from mild to severe. The most common presentation is with flu-like symptoms, such as fever, cough, sore throat, and myalgia. Conjunctivitis, diarrhea, nausea, vomiting, altered mental status, and pneumonia have also been reported. In some cases patients progress to Acute Respiratory Distress Syndrome (ARDS) and death.</p>	PRESENTATION
<p>Influenza can only be diagnosed by laboratory testing: via molecular testing of a throat swab. Some types or subtypes of influenza can also be diagnosed with a rapid test at the practice setting.</p>	DIAGNOSIS
<p>Supportive care is needed. In addition, a neuraminidase inhibitor, such as oseltamivir or zanamivir, is the recommended treatment, especially if the patient has underlying diseases that increase the risk for bad outcome (e.g. extremes of age, pregnancy, pulmonary or cardiovascular diseases, immune suppression etc), similar as in seasonal influenza.</p>	TREATMENT

<ul style="list-style-type: none"> - Avoid contact with wild birds and feces from wild birds. - Protect household poultry from contact with wild birds, if there is avian flu in the area. - Cook poultry and eggs thoroughly. - Advise on annual seasonal flu immunization to prevent potential coinfection with avian flu. 	<p>PROTECTIVE MEASURES</p>
<ul style="list-style-type: none"> - Cases of human infection with avian or zoonotic influenza are creating the possibility for reassortment of flu viruses, esp. if an avian and a human virus infect the same host. This is one of the main mechanisms of emergence of a new influenza pandemic virus. - A case of human infection needs the collaboration with the local public health service and the veterinary public health (VPH) service or the local veterinarian. One health approach. - If a highly pathogenic virus is detected certain biosecurity measures will be enforced, e.g. culling. OSH guidance for personal protective equipment (PPE) and follow up of persons involved is essential. - Appropriate collection and testing of sick/dead birds or animals will be needed. - Protection of farmed and household poultry from migratory birds is important. 	<p>KEY ACTIONS protecting Public Health</p>
<p>Prognosis is largely dependent on the pathogenicity of the strain. For some strains and in certain settings (e.g. developing countries) the mortality can be as high as 30%, although usually it is closer to the one seen in seasonal influenza (<2-10%).</p>	<p>PROGNOSIS</p>
<ol style="list-style-type: none"> 1. http://www.who.int/influenza/en/ 2. https://www.cdc.gov/flu/avianflu/avian-in-humans.htm 3. https://www.cdc.gov/niosh/topics/h1n1flu/ 4. http://ecdc.europa.eu/en/healthtopics/influenza/Pages/home.aspx 5. https://www.gov.uk/government/publications/avian-influenza-guidance-and-algorithms-for-managing-human-cases 	<p>WHERE CAN I FIND MORE INFO?</p>

10.2.2. Clamydia psittaci (Psittacosis)

<p>Psittacosis is a bacterial infection caused by Clamydia psittaci. Birds are the primary reservoir: parrots, pigeons, poultry, canaries and sea birds.</p>	<p>WHAT IS PSITTACOSIS?</p>
<p>Individuals in close contact with birds are at higher risk of acquiring psittacosis. Exposure is mostly through inhalation of the agent from droppings, feathers, dust. Workers in turkey, geese or duck farms or processing plants, as well as in pigeon lofts have been reported at risk.</p>	<p>WHO IS AT RISK?</p>
<p>The disease occurs sporadically, or small clusters. Outbreaks have been traced to pet stores, aviaries and veterinary offices. Significant under-reporting exists.</p>	<p>EPIDEMIOLOGY</p>

Typically between 5-14 days.	INCUBATION
<p>Patients usually first experience sudden onset of severe headache, fever, chills, rash, myalgia, and cough. Upper and lower respiratory may be involved and imaging will usually show pneumonia.</p> <p>Complications are rare, but serious, and include encephalitis, endocarditis, myocarditis, pericarditis, hepatitis, respiratory failure, reactive arthritis, renal disease, conjunctivitis. Some cases of infection have been fatal, especially in untreated elderly persons.</p>	PRESENTATION
<p>Symptoms are non specific and influenza like.</p> <p>Chest imaging is usually abnormal, consistent with atypical pneumonia.</p> <p>Definitive diagnosis can be made by serology, documenting 4-fold increase of the antibody titer in paired sera 2-3 weeks apart .</p>	DIAGNOSIS
Tetracycline is recommended and macrolides can be used as second-line therapy.	TREATMENT
Avoid contact with birds, or use protective equipment when working with birds or cleaning their cages.	PROTECTIVE/ PREVENTIVE MEASURES
<p>Education of workers on use of protective equipment e.g. face masks</p> <p>Report cases of psittacosis to local public health officials</p> <p>Investigation of potential sources of infection (aviaries, pet shops, farms, plants)</p> <p>Infected birds should be treated or destroyed and their housing areas should be cleaned with a phenolic agent.</p>	KEY ACTIONS protecting Public Health
The majority of Clamydia psittaci infections resolve without any permanent damage. However, complications exist and fatal cases have been reported. (see Presentation)	PROGNOSIS
<p>https://www.cdc.gov/pneumonia/atypical/psittacosis</p> <p>Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA</p>	WHERE CAN I FIND MORE INFO?

10.2.3. Rabies virus

Please refer to 10.3.3

10.2.4. Salmonella spp (Salmonellosis)

Please refer to 10.3.1

10.2.5. Pasteurella infection (*Pasteurella multocida*)

Pasteurella infection is a bacterial infection usually associated with animal bites or scratches of cats, dogs and other animals.	WHAT IS PASTEURELLA?
Individuals in close contact with animals, e.g. veterinarians or vet technicians, farmers etc, children playing with small animals etc	WHO IS AT RISK?
Pasteurella is found in 70-90% of cats, 25-50% of dogs and in other animals. Usually, infection follows a scratch or bite of a cat or dog or other animal. In many cases no animal exposure is reported. Human-to-human transmission has not been documented.	EPIDEMIOLOGY
Typically <24 hours	INCUBATION
Usually as cellulitis at the wound site with swelling, redness, tenderness, and discharge (serous or sanguinopurulent). Regional lymphadenopathy, fever and chills are common. Complications include: septic arthritis, osteomyelitis, tenosynovitis, meningitis, septicemia, endocarditis, respiratory infection, ocular infection.	PRESENTATION
Clinical presentation and history of a bite or scratch is usually enough. Isolation of pasteurella from discharge.	DIAGNOSIS
Thorough irrigation and debridement of bite wounds. Penicilline is the drug of choice, other effective agents are amoxicilline-clavulanate, cephalosporins or fluoroquinolones.	TREATMENT
Education about appropriate contact with animals, especially for children	PROTECTIVE/ PREVENTIVE MEASURES
No specific measures required	KEY ACTIONS protecting Public Health
The majority of pasteurella infections resolve without any permanent damage. However, complications exist and fatal cases have been reported.	PROGNOSIS
American Academy of Pediatrics, Red Book: 2017 Report of the Committee on Infectious Diseases, 30 th Ed. [Pasteurella Infections]	WHERE CAN I FIND MORE INFO?

10.2.6. Toxoplasma gondii (Toxoplasmosis)

<p>Toxoplasmosis is a protozoan parasite infection usually associated with contact with cat feces or eating undercooked meat (esp burgers).</p>	WHAT IS TOXOPLASMOSIS?
<p>Primary infection in pregnant women can result in transplacental congenital infection of the fetus causing significant eye or brain problems (chorioretinitis, hydrocephalus etc). Also immunocompromised persons (e.g. AIDS patients) are at risk for primary infection or reactivation.</p>	WHO IS AT RISK?
<p>Worldwide occurrence, with the felines as the definitive hosts, usually infected by eating infected rodents and birds.</p>	EPIDEMIOLOGY
<p>Approximately 7 days (4-21 days in an outbreak connected to cats, 10-23 days in a foodborne outbreak)</p>	INCUBATION
<p>May be asymptomatic. Otherwise non-specific symptoms of malaise, fever, myalgia and sore throat with cervical lymphadenopathy and hepatosplenomegaly and a macular rash.</p>	PRESENTATION
<p>Serologica test: IgM develops about 2 weeks and IgG 1-2 months after infection, IgA and IgM antibodies may be needed to differentiate new from older infections.</p>	DIAGNOSIS
<p>Most acquired infection do not need specific treatment. Pregnant women and HIV patients need specific treatment (spiramycin, or pyrimethamine & sulfadiazine)</p>	TREATMENT
<p>Education about avoiding undercooked meat, cleaning raw fruits and vegetables appropriately, and handling/cleaning utensils which have come in contact with raw meat. Education about proper hand hygiene: Wash hands frequently and always before eating. Cleaning cat litter boxes should not be done by pregnant women. Cat feces should be disposed appropriately (flushed in a toilet, burned or deeply buried). Keep stay cats away from sandboxes, where children play.</p>	PROTECTIVE/ PREVENTIVE MEASURES
<p>Small outbreaks have been reported (foodborne and connected to inhalation of contaminated dust). Awareness should be maintained in clustered cases, where contact tracing may be needed.</p>	KEY ACTIONS protecting Public Health

<p>Non congenital infections have a good prognosis. Rare complications include myocarditis, pericarditis, pneumonitis, and ocular toxoplasmosis (chorioretinitis).</p>	<p>PROGNOSIS</p>
<ul style="list-style-type: none"> - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Toxoplasmosis] - American Academy of Pediatrics, Red Book: 2017 Report of the Committee on Infectious Diseases, 30th Ed. [Toxoplasma Infections] - Schwartzman, J. & Petersen, E. (2017). Diagnostic testing for toxoplasmosis infection. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 26, 2017) - Guerina, N. (2017). Congenital toxoplasmosis: Clinical features and diagnosis. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 26, 2017.) - Tolentino, M. & Petersen, E. (2017) Toxoplasmosis in immunocompetent hosts. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 26, 2017.) 	<p>WHERE CAN I FIND MORE INFO?</p>

10.2.7. Bartonella henselae (Cat Scratch Disease)

<p>Cat Scratch Disease is a bacterial infection usually associated with scratches of cats, dogs and other animals.</p>	<p>WHAT IS CAT SCRATCH?</p>
<p>Usually, infection follows a scratch, bite or lick of a cat or kitten. Infections in children and young adults are more common.</p>	<p>WHO IS AT RISK?</p>
<p>Bartonella is found worldwide and cats are the main vector, although they are asymptomatic. Fleas may play a role in the transmission.</p>	<p>EPIDEMIOLOGY</p>
<p>Usually within 2 weeks for the primary lesion and 5-50 days to lymphadenopathy</p>	<p>INCUBATION</p>
<p>Usually a primary lesion is noted (papule or pustule) followed by regional lymphadenopathy, and in 30% of patients with fever and mild systemic symptoms. Complications include: encephalopathy, ocular infection, meningitis, hepatitis or liver granuloma, pneumonia, endocarditis.</p>	<p>PRESENTATION</p>
<p>Clinical presentation and history of a bite or scratch is usually enough. Serology, PCR and culture are used.</p>	<p>DIAGNOSIS</p>
<p>Needle aspiration of suppurated lymph nodes may be needed. Antibiotics (azithromycin, erythromycin, ciprofloxacin) are used.</p>	<p>TREATMENT</p>

<ul style="list-style-type: none"> - Education about appropriate contact with animals, esp. for children - Flea control of domestic animals 	PROTECTIVE/ PREVENTIVE MEASURES
Bartonella henselae infections do not have significant public health implications.	KEY ACTIONS protecting Public Health
The majority of cat scratch infections resolve without any permanent damage. However, complications exist esp. in immunocompromised patients.	PROGNOSIS
<ul style="list-style-type: none"> - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Cat Scratch Disease] - American Academy of Pediatrics, Red Book: 2017 Report of the Committee on Infectious Diseases, 30th Ed. [Cat Scratch Disease] 	WHERE CAN I FIND MORE INFO?

10.2.8. Yersinia pestis (Plague)

Please refer to 10.3.5

10.2.9. Echinococcus (Echinococcosis)

Echinococcosis is a parasitic disease, which is caused by Echinococcus granulosus and E. multilocularis. The two parasites differ in geographic distribution and have different definitive hosts.	WHAT IS ECHINOCOC COSIS?
<p>Dogs are the definitive hosts for E. granulosus, while herbivores are intermediate hosts.</p> <p>In the case of E. multilocularis foxes are the definitive hosts and rodents the intermediate. Dogs and cats feeding on contaminated rodents can expose humans.</p> <p>Usually rural populations who come in contact with dog and cat feces, or fecally contaminated fomites, equipment etc.</p>	WHO IS AT RISK?
<ul style="list-style-type: none"> - E. granulosus exists all over the world, however higher incidences are reported from Mediterranean countries. - E. multilocularis is found in central Europe and other countries in the N. Hemisphere 	EPIDEMIOLOGY
12 months to years depending on number and location of cysts	INCUBATION

<p>Cystic echinococcosis presents with symptoms similar to a slow growing tumour. Hydatid cysts can become quite large having a well defined wall and ruptured cysts cause anaphylactoid reactions. Most common organs affected are the liver and lungs, although other organs can be affected.</p> <p>E. multilocularis causes a destructive liver disease, with cysts that are not restricted by a wall but spread like a tumour mass.</p>	<p>PRESENTATION</p>
<p>??????</p>	<p>DIAGNOSIS</p>
<p>Usually surgical excision is needed.</p> <p>For E. multilocularis chemotherapy and anti-helminthic medicines (mebendazole) are also used.</p>	<p>TREATMENT</p>
<ul style="list-style-type: none"> - Potentially contaminated viscera of livestock should be properly disposed. - Treat high risk dogs in high risk areas periodically. - Avoid raw vegetables that may have been contaminated by dog faces. - Practice and teach appropriate hygiene measures for handling food and hand hygiene. 	<p>PREVENTIVE/ PROTECTIVE MEASURES</p>
<p>Echinococcosis cases should be reported to PH authorities, as in collaboration with veterinary services control programmes are implemented.</p>	<p>KEY ACTIONS for Public Health</p>
<p>Surgical excision is usually curative, but it depends on their location, size and number. E. multilocularis can spontaneously cure through calcification of lesions but is often fatal.</p>	<p>PROGNOSIS</p>
<p>Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Echinococcosis due to E. granulosus and Echinococcosis due to E. multilocularis]</p>	<p>WHERE CAN I FIND MORE INFO?</p>

10.2.10. Brucella spp (Brucellosis)

<p>Brucellosis is a bacterial zoonotic disease caused by Brucella, mostly Brucella melitensis, B. abortus, B. suis and B. canis</p>	<p>WHAT IS BRUCELLOSIS?</p>
<p>Farmers, veterinarians, slaughterhouse workers and others in contact with farm animals. The most common route of transmission is via occupational exposure, therefore males are more at risk</p>	<p>HOW IS AT RISK?</p>

<p>Cattle, swine, sheep, goats, dogs, wild animals (boars, deer, elks, camels, coyotes) and newly recognised in marine animals (dolphins, whales, seals etc) are the reservoir.</p> <p>Although found worldwide, Mediterranean and Middle East countries, Africa, central America, India and SE Asia are high risk areas.</p> <p>Exposure occurs through multiple routes:</p> <ul style="list-style-type: none"> - consumption of raw milk and unpasteurised dairy products (esp. soft cheese), - inhalation of the bacteria in the laboratory, the dust from areas contaminated by birth fluids or excreta, in meat processing factories, - accidental inoculation of the animal vaccine strain, - rarely human-to-human transmission. 	EPIDEMIOLOGY
<p>usually 1-2 months (5-60 days)</p>	INCUBATION
<p>Infection can be insidious, usually presenting with intermittent fever with chills, headache, sweats, arthralgia, weight loss and depression.</p> <p>Complications include osteomyelitis and arthritis, orchitis and epididymitis, neurobrucellosis and endocarditis, which is the most severe and sometimes fatal.</p>	PRESENTATION
<p>Brucellosis is diagnosed with a combination of serologic testing, PCR and cultures from blood, bone marrow or other samples.</p>	DIAGNOSIS
<p>The recommended treatment is doxycycline and rifampin or streptomycin for 6 weeks.</p>	TREATMENT
<ul style="list-style-type: none"> - Pasteurise milk and dairy products. - Education of the public, high-risk occupations and hunters on consumption of dairy products and meat, disposal of animal remains and products and good hygiene practices in premises with animals. - Practice good hygiene when dealing with farm animals. - Brucellosis cases should be reported to local public health officials. Foodborne and occupational outbreaks are common and are investigated following “one health” perspective jointly by human and veterinary public health professionals. - <i>Brucella</i> spp is included in the agents with potential for deliberate release due to the low infectious dose (10-100 organisms) and the possibility of exposure via aerosols. - Animal immunization programmes in endemic areas are important to control the disease. 	PREVENTIVE/PROTECTIVE MEASURES KEY ACTIONS for Public Health
<p>Most individuals recover with appropriate treatment. However, there are complications, a chronic form of the disease and the case fatality of untreated cases may be up to 2%.</p>	PROGNOSIS

<ul style="list-style-type: none"> - ECDC: https://ecdc.europa.eu/en/brucellosis - CDC, Atlanta: https://www.cdc.gov/brucellosis/index.html - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Brucellosis] 	WHERE CAN I FIND MORE INFO?
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10.2.11. Coxiella burnetii (Q fever)

<p>Q fever is a bacterial zoonotic disease caused by Coxiella burnetii.</p>	WHAT IS Q FEVER?
<ul style="list-style-type: none"> - Farmers, veterinarians, slaughterhouse workers and others in contact with farm animals. The most common route of transmission is via occupational exposure. - Individuals living or traveling to endemic countries. 	WHO IS AT RISK?
<p>Sheep, goats, cats, dogs, cattle, birds and ticks are reservoirs. The bacteria can be shed in the animal’s milk, urine, feces, or during birthing (placenta etc). Animals can be asymptomatic and shed massive amounts of bacteria. Exposure occurs through multiple routes:</p> <ul style="list-style-type: none"> - inhalation of the bacteria in dust from areas contaminated by birth fluids or excreta, in meat processing factories, in necropsy rooms - consumption of contaminated food, water, or dairy products, - transplacental from mother to embryo, in utero. 	EPIDEMIOLOGY
<p>typically 2-3 weeks (3-30 days)</p>	INCUBATION
<p>Infection can be from non-symptomatic, to mild non-specific or severe. Presentation is variable. Symptomatic patients most commonly present with influenza-like symptoms, including sudden onset of high-grade fever, fatigue, severe headache, cough, and myalgia. Some patients may develop pneumonia and/or hepatitis. Adults and men are more likely to show symptoms as compared to children and women. Complications include meningitis, encephalitis or chronic Q fever, which can manifest as persistent localized infection, such as endocarditis, pericarditis, myocarditis, osteomyelitis, vascular infection.</p>	PRESENTATION
<p>Q fever is diagnosed with serologic testing, PCR and cultures from bone biopsies, cardiac valves, and vascular samples.</p>	DIAGNOSIS
<p>The recommended treatment is doxycycline for non-pregnant adults and children, and trimethoprim-sulfamethoxazole for pregnant women. Fatigue after infection should be treated with supportive care.</p>	TREATMENT

<ul style="list-style-type: none"> - Pasteurise milk and dairy products - Education of high-risk occupations on disinfection, handling and disposal of animal products and good hygiene practices in premises with animals. - Practice good hygiene when dealing with farm animals. 	PROTECTIVE MEASURES
<ul style="list-style-type: none"> - Coxiella is highly resistant to disinfectants and environmental conditions, therefore included in the high-risk agents for deliberate release. - Q fever cases should be reported to local public health officials. Outbreaks have been reported both as occupational exposure as well as in the surrounding geographical areas (airborne transmission downwind). - An inactivated vaccine is used in Australia 	KEY ACTIONS for Public Health
Most individuals fully recover without permanent damage. However, there are complications and Q fever may be fatal.	PROGNOSIS
<ul style="list-style-type: none"> - ECDC: ecdc.europa.eu/en/healthtopics/q_fever/Pages/index.aspx - CDC, Atlanta: www.cdc.gov/qfever/ - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Q Fever] - Raoult, D. (2017). Clinical manifestations and diagnosis of Q fever. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed June 26, 2017) 	WHERE CAN I FIND MORE INFO?

10.2.12. Bacillus anthracis (Anthrax)

Anthrax is a bacterial zoonotic disease caused by Bacillus anthracis.	WHAT IS ANTHRAX?
<ul style="list-style-type: none"> - Farmers, veterinarians, slaughterhouse workers, wool sorters, weavers, workers who process hides (esp. goat hides) or bones, agricultural and wildlife workers. - The most common route of exposure for natural infections is via occupational exposure. 	WHO IS AT RISK?
<p>Cattle, sheep, goats and in general herbivores are reservoirs, usually in sub-Saharan Africa, Central and South America, South and East Europe. Exposure occurs through multiple routes:</p> <ul style="list-style-type: none"> - exposure of a skin lesion to - inhalation of the spores during processing of animal products - consumption of contaminated meat. 	EPIDEMIOLOGY
usually 1-7 days (can extend up to 60 days)	INCUBATION

<p>Infection can present as cutaneous, pulmonary or gastrointestinal anthrax.</p> <ul style="list-style-type: none"> - Cutaneous anthrax refers to a single painless ulcer with significant edema and a black eschar. 95% of natural infection is cutaneous and is usually due to occupational exposure through a skin lysis. Cutaneous anthrax may be complicated with septicaemia. - Pulmonary anthrax usually starts with non specific influenza-like illness, which progresses to respiratory distress, hypoxemia, shock, cyanosis. It is a result of the inhalation of anthrax spores. Hemorrhagic meningitis is a frequent complication, and patients are invariably critically ill. - Gastrointestinal anthrax is the most rare form and results from ingestion of meat from infected animals. Abdominal distress with pain, fever, vomiting and diarrhea can progress to systemic symptoms and septicaemia. 	<p>PRESENTATION</p>
<p>Anthrax is diagnosed with direct smear, serologic testing, PCR and cultures from blood, discharge or lesions.</p> <p>The recommended treatment includes fluoroquinolone, with at least one from penicillins, macrolides, rifampicin, linezolid, doxycycline, aminoglycosides.</p>	<p>DIAGNOSIS</p> <p>TREATMENT</p>
<ul style="list-style-type: none"> - Pasteurise milk and dairy products - Education of high-risk occupations on disinfection, handling and disposal of animal products and good hygiene practices in premises with animals. - Susceptible animals in areas with anthrax transmission should be vaccinated. - Practice good hygiene when dealing with farm animals. - Appropriate ventilation is needed when processing raw animal products. 	<p>PREVENTIVE/ PROTECTIVE MEASURES</p>
<ul style="list-style-type: none"> - Anthrax spores are extremely resistant to disinfectants and environmental conditions. Anthrax is considered a very high-risk agent for deliberate release and has been used to this purpose (2001-USA). - Anthrax cases should be immediately reported to local public health officials. Outbreaks have been reported both as occupational exposure as well as in the surrounding geographical areas (airborne transmission downwind). - Two different anthrax vaccines are used in UK and the USA and in China and Russia. 	<p>KEY ACTIONS for Public Health</p>
<p>All clinical forms of anthrax, but esp. pulmonary anthrax carry significant mortality (cutaneous untreated up to 5-20%, pulmonary >85%, gastrointestinal up to 60%).</p>	<p>PROGNOSIS</p>
<ul style="list-style-type: none"> - ECDC: https://ecdc.europa.eu/en/anthrax - CDC, Atlanta: https://www.cdc.gov/anthrax/index.html - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Anthrax] 	<p>WHERE CAN I FIND MORE INFO?</p>

10.2.13. Burkholderia mallei (Glanders)

<p>Glanders is a bacterial infection, most commonly of horses, caused by <i>Burkholderia mallei</i></p>	<p>WHAT IS GLANDERS?</p>
<p>Veterinarians, horse caretakers, equine butchers, slaughterhouse workers, and other individuals in close contact with horses, mules, and donkeys are at the highest risk.</p> <p>Glanders is endemic in parts of the Middle East, Asia, Africa, Central America, and South America.</p>	<p>WHO IS AT RISK?</p>
<p>Glanders infection in humans is rare. The disease is most commonly spread to humans from close contact with horses, donkeys, and mules, although other domesticated animals can be infected with glanders. <i>Burkholderia mallei</i> is a hardy bacteria that can survive on fomites and transmit disease. It enters the body via open wounds, ingestion, or inhalation.</p>	<p>EPIDEMIOLOGY</p>
<p>Average is 5 days</p>	<p>INCUBATION</p>
<p>Infected patients usually present with fever, chills, myalgia, chest pain, muscle tightness, headache, and photophobia.</p> <p>There are four types of infection:</p> <ul style="list-style-type: none"> - Localized infection results in an ulcer at site of infection and regional lymphadenopathy. If the ulcers rupture, they leak a thick and oily exudate. If the site of infection involves mucous membranes, mucous production increases. Localized infections can disseminate. - Pulmonary infection is the most common form of glandular infection. It causes pneumonia, pulmonary abscesses, and pleural effusion that can be seen with imaging. - Bacteremia is the most serious form of infection. It can present as fever, chills, myalgia, headache, chest pain, rash, lymphadenopathy, cellulitis, cyanosis, jaundice, photophobia, diarrhea, tachycardia, and hepatosplenomegaly. - Chronic infection can cause multiple abscesses and nodules within muscles, skin, lungs, spleen, and/or liver; weight loss; lymphadenopathy; and lymphangitis. 	<p>PRESENTATION</p>
<p><i>Burkholderia mallei</i> can be detected in lesions, lymph nodes, and respiratory exudates.</p>	<p>DIAGNOSIS</p>
<p>Glanders is treated with antibiotics, usually sulfadiazine, but there is no recommended treatment.</p>	<p>TREATMENT</p>
<ul style="list-style-type: none"> - Avoid contact with infected animals. - Isolation of infected individuals. 	<p>PROTECTIVE / PREVENTIVE MEASURES</p>

<ul style="list-style-type: none"> - Contact with Veterinary PH for surveillance of glanders in domesticated animals. - B.mallei is included in the EU list of high threat agents for deliberate release 	KEY ACTIONS for Public Health
<p>Glanders is still deadly even if patients are treated and treatment is extremely long (12-24 months).</p>	PROGNOSIS
<ul style="list-style-type: none"> - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Glanders] - CDC, Atlanta: www.cdc.gov/glanders/index.html - Farcy, Malleus, & Drees. (2015). Glanders. The Center for Food Security & Public Health. Iowa State University. http://www.cfsph.iastate.edu/Factsheets/pdfs/glanders.pdf. 	WHERE CAN I FIND MORE INFO?

10.3. Pathogens transmitted through contact with wildlife

Farmers come in frequent contact with wildlife particularly since they reside in rural areas, some quite remote.

In addition, they may engage more frequently, compared to other population groups, in outdoor occupational or recreational activities which bring them in close contact with wildlife. For example, Lyme disease (Lyme borreliosis, LB) is a bacterial disease which can be transmitted to humans through the bites of infected ticks, which are often found in high-risk areas such as grassy fields, forests or gardens, feeding on small or medium sized mammals or birds. People involved in outdoor activities (e.g. farming, fishing, forestry, camping, collecting mushrooms or berries) are at a high risk of being bitten by a potentially infected tick. It is estimated that more than 65,000 cases are reported in Europe every year.(WHO, 2014)

- World Health Organization Regional Office for Europe, (2014). Factsheet: Lyme borreliosis in Europe. Available online: http://www.euro.who.int/data/assets/pdf_file/0008/246167/Fact-sheet-Lyme-borreliosis-Eng.pdf?ua=1

Important **points for occupation history for the pathogens transmitted through contact with wildlife:**

- detailed contact description with specific animal(s),
- description of the activity, duration and frequency of contact,
- condition of the animal, if there is possibility for its capture and/or testing,
- who was exposed and if they can be contacted.

10.3.1. Avian Influenza

Please refer to 10.2.1

10.3.2. Psittacosis

Please refer to 10.2.2

10.3.3. Rabies

<p>Rabies is a lethal viral zoonotic disease which affects mammals in certain areas of the world.</p>	<p>WHAT IS RABIES?</p>
<ul style="list-style-type: none"> – Children are recognised as particularly high risk group as they tend to play with stray animals, wild or domesticated. – Veterinarians (autopsies on animals who died undiagnosed, work in rabies elimination programmes), other veterinary public health staff, park rangers etc – Hunters and wildlife 	<p>WHO IS AT RISK?</p>
<p>Rabies is transmitted through contact with saliva or nervous tissue of an infected animal. There have been cases of transmission through non-bite exposure, such as through the transplantation of an infected organ or even the inhalation of aerosolized virus. Globally, rabies is most commonly acquired from the bite of an infected dog, although it can be spread by any mammal. Other common reservoirs include also bats, skunks, cats, cattle and jackals.</p> <p>Rabies in wildlife (mainly red foxes) is encountered in many EU countries, but in general not in stray animals. In contrast in developing countries stray animals are a significant risk.</p>	<p>EPIDEMIOLOGY</p>
<p>On average 1-3 months, but it can be longer.</p>	<p>INCUBATION</p>
<p>From the site of infection, the rabies virus moves in a retrograde direction through nerve tissue toward the dorsal root ganglia, spinal cord, and brain. First symptoms resemble an acute flu-like illness and sometimes paresthesias beginning at the site of infection.</p> <p>After 2-10 days, encephalitic or paralytic rabies develops. Most infected patients will develop encephalitic rabies characterized by cerebral dysfunction, hyperactivity, anxiety, confusion, agitation, delirium, hallucinations, insomnia, hydrophobia, aerophobia, and dysphagia. Paralytic rabies is characterized by ascending flaccid paralysis. Coma follows neurologic syndrome. Patients usually die 2 weeks after the onset of coma.</p>	<p>PRESENTATION</p>
<p>Diagnosis can be confirmed using samples from serum, saliva, CSF, or skin for PCR, detection of the virus with immunofluorescent staining (CNS post mortem), or presence of anti-rabies antibodies.</p>	<p>DIAGNOSIS</p>
<p>Rabies is almost invariably fatal for all mammals including humans, once symptoms begin.</p> <p>Post-exposure prophylaxis with anti-rabies vaccines and depending on the case with Rabies immunoglobulin, is the only available prevention measure. Wounds should be immediately cleaned and washed with soap and water for 15 min, as soon as possible after the bite.</p>	<p>TREATMENT</p>

<ul style="list-style-type: none"> – Prophylactic immunization is recommended for high risk professionals e.g. veterinary public health, park rangers, hunters, wildlife keepers etc. – Vaccinate pets and working animals, e.g. shepherd and hunting dogs. – Avoid contact with wild animals. – Prevent pets from contact with wild animals. – Vaccinate and control stray animals. 	PROTECTIVE/PREVENTIVE MEASURES
<ul style="list-style-type: none"> – Educate public on dog behavior and bite prevention, especially for children. – Animal and human rabies cases should be reported immediately to local public health professionals. In the EU countries rabies eliminations programmes are supported by veterinary public health. – Be aware of accessibility of rabies post-exposure prophylaxis in your area of responsibility. 	KEY ACTIONS protecting Public Health
<p>Rabies infection is preventable with the existing post-exposure prophylaxis, provided it is promptly and appropriately delivered. However, if symptoms develop, rabies is almost always fatal.</p>	PROGNOSIS
<ul style="list-style-type: none"> – CDC, Atlanta: www.cdc.gov/rabies/ – WHO: www.who.int/mediacentre/factsheets/fs099/en/ – DeMaria, A. (2016). Clinical manifestations and diagnosis of rabies. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 21, 2017.) – Animal bites and rabies. Health Library. Johns Hopkins Medicine. Accessed June 21, 2017. http://www.hopkinsmedicine.org/healthlibrary/conditions/travel_medicine/animal_bites_and_rabies_85,p00819/ 	WHERE CAN I FIND MORE INFO?

10.3.4. Tularemia

<p>Tularemia is a bacterial infection caused by Francisella tularensis most commonly acquired from lagomorphs (hares, rabbits), ticks.</p>	WHAT IS TULAREMIA?
<p>Occupational hazard for people who work outdoors or with animals, such as farmers, veterinarians, hunters, landscapers, and meat handlers, as well as laboratory workers working with the microorganism.</p>	WHO IS AT RISK?

<p>Infectious dose is extremely low. Humans acquire the infection through exposure to or bite from an infected animal. It is commonly transmitted to humans through a tick bite during summer months, but can also be transmitted by a bite from other arthropods, such as mosquitos, horse flies, fleas, or lice.</p> <p>Rodents, particularly rabbits, muskrats, squirrels, voles, hamsters, and prairie dogs, are also common reservoirs that most commonly cause human infection in hunters or meat handlers.</p> <p>Infection can occur if the bacteria becomes aerosolized and inhaled. This has previously happened when individuals have mowed infected animals.</p> <p>Transmission can also occur through ingestion of contaminated food, especially undercooked meat from infected animals, and water.</p>	EPIDEMIOLOGY
<p>Usually 3-5 days</p>	INCUBATION
<p>Presentation depends on site of infection, and ranges from mild to severe. Patients typically present with fever, chills, headache, and malaise.</p> <p>There are six clinical syndromes according to site of infection:</p> <ul style="list-style-type: none"> – Ulceroglandular tularemia is the most common form of tularemia, usually occurring from the bite of an infected arthropod. It presents as a skin ulcer at the site of infection. Lymphadenopathy is observed near the site of infection. – Glandular tularemia presents as regional lymphadenopathy, similar to ulceroglandular, but without the presence of an ulcer at the site of infection. – Oculoglandular tularemia occurs when bacteria infects the eye. It causes irritation, pain, photophobia, and inflammation of the eye and lymphadenopathy in front of the ear. Upon observation of the eye, patient may have conjunctival erythema with edema and vascular engorgement. – Oropharyngeal tularemia occurs from consumption of contaminated food or water. It causes fever, ulcers of the throat, pharyngitis, tonsillitis, sore throat, and lymphadenopathy in the neck. – Typhoidal tularemia is characterized by febrile illness without lymphadenopathy or pneumonia. Patient may have fever, anorexia, chills, headache, myalgia, sore throat, cough, abdominal pain, and diarrhea. With prolonged illness, patient may present with hepatosplenomegaly. – Pneumonic tularemia is the most serious form of tularemia and is characterized by pulmonary disease. It occurs from the inhalation of Francisella tularensis, causing flu-like symptoms, cough, chest pain, and dyspnea. 	PRESENTATION
<p>Serologic testing and PCR in a specialised laboratory</p>	DIAGNOSIS
<p>Treatment should be administered promptly in suspected cases. Quinolones or Aminoglycosides, such as streptomycin or gentamicin are recommended. Surgery may be needed to drain infected lymph nodes.</p>	TREATMENT

<ul style="list-style-type: none"> – Use protective equipment when handling sick or dead animals. – Avoid mowing over animals. – Thoroughly cook meat. 	PROTECTIVE/ PREVENTIVE MEASURES
<ul style="list-style-type: none"> – <i>F. tularensis</i> belongs to the EU list of high threat agents for deliberate release. Important to be aware of local epidemiology data. – Tularemia cases should be promptly reported and fully investigated in collaboration with public health professionals. 	KEY ACTIONS for Public Health
<p>Complications include sepsis, renal failure, rhabdomyolysis, meningitis, and hepatitis. Some forms of tularemia, particularly pneumonic, can be fatal if left untreated (morbidity up to 30%). With treatment, <i>Francisella tularensis</i> infections usually resolve without any permanent damage.</p>	PROGNOSIS
<ul style="list-style-type: none"> – WHO: www.who.int/topics/tularaemia/en/ – CDC, Atlanta: www.cdc.gov/tularemia/index.html – Penn, R. (2015). Epidemiology, microbiology, and pathogenesis of tularemia. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 21, 2017.) – Penn, R. (2016). Clinical manifestations, diagnosis, and treatment of tularemia. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 21, 2017.) 	WHERE CAN I FIND MORE INFO?

10.3.5. Plague

<p>Plague is a bacteria disease caused by <i>Yersinia pestis</i> commonly transmitted by an infected rodent flea.</p>	WHAT IS PLAGUE?
<p>Hunters, campers, animal handlers and veterinarians are at risk</p>	WHO IS AT RISK?
<p>Rodents are the most important host of <i>Yersinia pestis</i>. Infected fleas are the primary vectors, however, plague can also be transmitted by the bite or scratch of an infected domesticated cat, direct handling of infected animal tissue, inhalation of respiratory secretions from infected animals or persons, consumption of contaminated food, or exposure to the dead body of an infected person.</p>	EPIDEMIOLOGY
<p>Usually 3-7 days</p>	INCUBATION

<p>There are 3 major syndromes associated with plague.</p> <ul style="list-style-type: none"> - Bubonic plague is the most common type of plague. Patients present with sudden onset of fever, chills, weakness, and headache. They may then develop lymphadenopathy and painful buboes, typically in the inguinal region. Without treatment, bubonic plague can lead to sepsis, pneumonia, and meningitis. - Septicemic plague causes febrile and gastrointestinal illness without presence of buboes. Without treatment, septicemic plague can lead to hypotension, disseminated intravascular coagulation, and multiorgan failure. - Pneumonic plague is acquired through the inhalation of <i>Yersinia pestis</i> or occurs secondary to bubonic or septicemic plague. Patients present with sudden onset of dyspnea, high fever, chest pain, and cough. Sputum may be bloody. Pneumonic plague is rare, but deadly. 	PRESENTATION
<p>Definitive diagnosis of plague is made using serologic testing or isolation of <i>Yersinia pestis</i> in culture from a blood, sputum, CSF, or pus sample. Bubonic plague can often be diagnosed by the presence of a bubo.</p>	DIAGNOSIS
<p>Streptomycin or gentamicin is the first line treatment for plague. If aminoglycosides are contraindicated, doxycycline or tetracycline should be administered. Plague, especially pneumonic plague, should be treated immediately. Plague is deadly if left untreated.</p> <p>Patients with pneumonic plague should be treated in isolation. Healthcare workers treating these individuals should wear personal protective equipment.</p>	TREATMENT
<ul style="list-style-type: none"> - Avoid exposure to dead rodents. - Use insect repellent. - Use flea repellent on pets - Post-exposure prophylaxis if infection is suspected. - Healthcare workers should wear personal protective equipment. 	PROTECTIVE/ PREVENTIVE MEASURES
<ul style="list-style-type: none"> - <i>Y. pestis</i> belongs to the EU list of high threat agents for deliberate release. Report suspected cases of plague to health officials immediately. - Isolate patients with pneumonic plague and use strict droplet precautions. - Removal of animal carcasses while wearing personal protective equipment. 	KEY ACTIONS for Public Health
<p>With treatment, the majority of plague cases resolve without any permanent damage, but approximately 10% do result in serious illness and death.</p>	PROGNOSIS
<ul style="list-style-type: none"> - CDC, Atlanta: www.cdc.gov/plague/index.html - WHO: www.who.int/csr/disease/plague/en/ 	WHERE CAN I FIND MORE INFO?

10.3.6. Leptospirosis

<p>Leptospirosis is a bacterial infection caused by <i>Leptospira</i> that is acquired from exposure to urine of infected animals.</p>	<p>WHAT IS LEPTOSPIROSIS?</p>
<p>Infection is an occupational hazard for people who work outdoors or with animals, such as farmers, mine workers, sewer workers, slaughterhouse workers, veterinarians, fish workers, and military personnel. Individuals who engage in recreational water-related activities are also at higher risk of infection. <i>Leptospira</i> is found worldwide, but infection is most common in tropic and temperate climates. Outbreaks have occurred following flooding or other natural disasters.</p>	<p>WHO IS AT RISK?</p>
<p>Humans acquire <i>Leptospira</i> through contact with the urine from infected animals. Infection can occur through skin lesions, mucous membranes, and conjunctivae. Ingestion of contaminated food or water can cause infection, although it is less frequent. <i>Leptospira</i> can infect many different species of animals. The most common reservoirs include rodents, cattle, buffaloes, horses, sheep, goats, pigs, and dogs.</p>	<p>EPIDEMIOLOGY</p>
<p>The average incubation period is 10 days.</p>	<p>INCUBATION</p>
<p>Presentation ranges from mild to severe and may occur in 2 phases. Typically, the first phase is characterized by sudden onset of fever, myalgia, and headache. Patients may experience nausea and vomiting. Some patients recover after the first phase. The presentation of the second phase is more severe and may include muscle tenderness, pharyngitis, hepatomegaly, muscle rigidity, aseptic meningitis, and skin rash. Less common symptoms include arthralgia, bone pain, sore throat, and abdominal pain. Complications include jaundice, renal failure, pulmonary hemorrhage, acute respiratory distress, uveitis, optic neuritis, peripheral neuropathy, myocarditis, and rhabdomyolysis. Conjunctival suffusion is a sign of leptospirosis.</p>	<p>PRESENTATION</p>
<p>Serologic testing, such as microscopic agglutination test, indirect hemagglutination, and ELISA, is the most common method of diagnosis. Treatment should be administered promptly in suspected cases.</p>	<p>DIAGNOSIS</p>
<p>Most cases of leptospirosis are self-limiting, but treatment should be administered to prevent complications. The recommend first-line treatment for mild disease is doxycycline or azithromycin. For hospitalized patients, intravenous penicillin, doxycycline, ceftriaxone, or cefotaxime is recommended.</p>	<p>TREATMENT</p>

<p>Non-typhoidal Salmonella: Salmonella is commonly found in domestic and wild animals. It is spread to humans through the consumption of contaminated food of animal origin, but can also spread between persons via the fecal-oral route. Infection is more common during the summer months.</p> <p>Typhoidal Salmonella: Typhoid fever most common in countries with poor sanitation. It is spread through the consumption of contaminated food and water. Humans are the only reservoir of the Typhi serotype. In endemic countries, it more common in children than adults.</p>	EPIDEMIOLOGY
<p>The incubation period for non-typhoidal Salmonella is usually 8-72 hours after exposure.</p> <p>The incubation period for typhoidal Salmonella usually 5-21 days after exposure.</p>	INCUBATION
<p>Non-typhoidal Salmonella: Salmonellosis usually presents as a nondescript gastroenteritis causing diarrhea, nausea, vomiting, fever, and abdominal cramps. Associated constitutional symptoms include fever, fatigue, malaise, chills, weight loss, and headache. Diarrhea is sometimes bloody. Complications are rare, but include bacteremia that can lead to endocarditis, mycotic aneurysm, and osteomyelitis. Infants are at increased risk of developing meningitis. Adults over 50 are at increased risk of developing endovascular disease, arteritis, and aortitis following bacteremia.</p> <p>Typhoidal Salmonella. Presentations are defined as either non-complicated or complicated. Patients with acute non-complicated disease may present with fever, diarrhea, constipation, headache, malaise, and exanthema. Complicated typhoid fever can cause intestinal perforation, peritonitis, delirium, meningitis, encephalomyelitis, Guillain-Barre, neuritis, and psychosis.</p> <p>The following disease progression has been documented: First, patients present with rising fever, usually accompanied by chills, and bacteremia. Subsequent abdominal pain and exanthema on the trunk and abdomen develop during the second week of infection. In the third week, patients present with hepatosplenomegaly and intestinal bleeding. Complications include septic shock and impaired consciousness. Severe cases can lead to death.</p>	PRESENTATION
<p>Non-typhoidal Salmonella can be diagnosed by stool culture, but is only done if the patient is at increased risk of developing complications or if the illness has not resolved. It takes 48-72 hours to isolate Salmonella from the stool culture. Clinical treatment and management of Salmonella infection usually does not rely on definitive diagnosis.</p> <p>Typhoidal Salmonella is diagnosed by culture. The most sensitive diagnostic test is a bone marrow culture. Less sensitive, but less invasive samples can be taken from blood, stool, urine, macule, or duodenal contents.</p>	DIAGNOSIS

<p>Non-typhoidal Salmonella infections are usually self-limiting, with fever resolving within 72 hours and diarrhea within 10 days. Therefore, most cases go undiagnosed and untreated. Antibiotic treatment is not given to immunocompetent treatment between the ages of 1-50. Antibiotic resistant strains of salmonella are on the rise.</p> <p>Supportive therapy, such as oral rehydration and replenishment of electrolytes, is very important in preventing dehydration.</p> <p>Antibiotic treatment should be considered for the following: those experiencing severe illness, defined as having severe diarrhea (more than 9-10 stools per day), high or persistent fever, or a need for hospitalization; infants; adults over 50; immunocompromised patients; and patients with cardiac, valvular, endovalvular, or joint abnormalities. Fluoroquinolones are the first line treatment. The course of treatment in immunocompetent individuals is usually 3-7 days, but can last months in those who are immunocompromised.</p> <p>Typhoidal Salmonella treatment with antibiotics is very important. Antibiotics should be administered even if symptoms have disappeared. Fluoroquinolones, such as ciprofloxacin, are regarded as the best treatment for typhoid fever. However, many strains have become resistant to fluoroquinolones. For patients infected by fluoroquinolone resistant <i>Salmonella typhi</i>, azithromycin is recommended. For cases that have resulted in severe systemic illness or altered mental status, dexamethasone is recommended. Another course of antibiotics should be administered if patients relapse.</p>	<p>TREATMENT</p>
<p>Non-typhoidal Salmonella: It is important to properly cook food, avoid unpasteurized milk and milk products, clean cooking utensils, and practice good personal hygiene.</p> <p>Farmers should wear dedicated clothing and shoes when out in the barn or fields. This clothing should be removed upon leaving. House pets should not be allowed in the barn.</p> <p>Veterinarians can be used to diagnose and treat infected livestock.</p> <p>Typhoidal Salmonella: Two vaccines are available to protect against the <i>Salmonella typhi</i>: a live attenuated vaccine that is administered orally and an injectable polysaccharide vaccine. These vaccines are recommended for individuals traveling to endemic countries.</p>	<p>PREVENTIVE/ PROTECTIVE MEASURES</p>
<ul style="list-style-type: none"> - Farmers should not use fecal waste as fertilizer and should prevent fecal contamination of fields. Feeders and waterers should be designed to keep manure out. - Farmers should clean tools and equipment appropriately. - Food handlers should be sure to separate raw and cooked foods, cook food thoroughly, store food at safe temperatures, clean cooking utensils, and use clean water. - Provide clean water or build protected water sources in developing countries. - Build sanitary systems for safe disposal of human waste in developing countries. - Educate the public on proper handwashing techniques. 	<p>KEY ACTIONS for Public Health</p>

<p>The most common symptoms of shigellosis are fever, abdominal cramps, tenesmus, anorexia, and diarrhea. Diarrhea is frequent, but low in volume and is often characterized as bloody and/or mucoid. Some patients also present with nausea and vomiting.</p> <p>Complications from shigellosis are rare and can be grouped as intestinal or systemic. Intestinal complications include rectal prolapse, toxic megacolon, intestinal obstruction, and colonic perforation. Systemic complications include bacteremia, leukemoid reaction, metabolic disturbances (hypokalemia, hyponatremia, hypoglycemia), seizures, encephalopathy, reactive arthritis, and hemolytic-uremic syndrome.</p>	PRESENTATION
<p>The preferred method of diagnosis is a stool culture, although Shigella can also be detected from stool samples using PCR. Stool samples are preferred to rectal swabs. Shigella is fastidious; samples should be immediately cultured. All samples should be undergo susceptibility testing to identify the correct treatment due to the increase in antibiotic resistant strains.</p>	DIAGNOSIS
<p>Although Shigella is usually self-limiting, the antibiotic therapy is recommended to shorten the duration of symptoms, prevent complications, and decrease the risk of transmission. Antibiotics should be carefully chosen after a susceptibility test of stool sample. The first line antimicrobial agent currently used is ciprofloxacin. Bismuth subsalicylate may help to relieve gastrointestinal symptoms. Anti-pyretic drugs, such as paracetamol and acetaminophen, can be used to treat fever. Intestinal anti-motility drugs, such as loperamide, should be avoided, as they can prolong the disease. Supportive therapy, such as oral rehydration, is important to prevent dehydration.</p>	TREATMENT
<ul style="list-style-type: none"> – Appropriate hand hygiene is important to prevent all food borne infections. – Due to the increased reports of transmission in men who have sex with men, safe sex is advised and avoidance of sex if one of the partners has or is recovering from diarrhea. – Those who care for individuals with Shigella should properly dispose of diapers and waste in lidded containers and carefully wash hands. – Individuals with shigellosis should wash hands frequently. These patients should not have sex, prepare food for others, or swim in public facilities. 	PREVENTIVE/PROTECTIVE MEASURES
<ul style="list-style-type: none"> – Notify public health authorities of cases of Shigella. – Prevent and control the spread of Shigella in refugee facilities, where poor sanitary conditions and individuals from endemic countries could cause the spread of disease. – Educate the public on proper hand washing techniques. Install hand washing stations, especially near public swimming facilities. 	KEY ACTIONS for Public Health
<p>Without treatment, shigellosis usually resolves within seven days. Most cases resolve without treatment, but antibiotics can be used to treat severe cases, decrease the duration of illness, and help to prevent spread.</p>	PROGNOSIS

<ul style="list-style-type: none"> - http://ecdc.europa.eu/en/healthtopics/shigellosis - www.cdc.gov/shigella - www.who.int/cholera/publications/shigellosis/en/ 	WHERE CAN I FIND MORE INFO?
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10.4.3. Listeria (Listeriosis)

<p>Listeria monocytogenes is a bacteria that most commonly found in soil. It can cause mild gastroenteritis in immunocompetent individuals, but can be very serious in pregnant women and other at-risk groups.</p>	WHAT IS LISTERIA?
<p>Populations most at risk are neonates, immunocompromised patients, older adults, and pregnant women.</p>	WHO IS AT RISK?
<p><i>Listeria</i> is most commonly transmitted to humans through the consumption of contaminated food or water. The bacteria can spread from mother to child by crossing the placenta or at childbirth.</p> <p><i>Listeria</i> most often lives in soil, but is also found in animal feed, feces of humans and animals, water, and dust. Therefore, it can easily contaminate fruits and vegetables. Infection is more common during the summer months. Cutaneous infection has been reported in farmers working with infected livestock.</p>	EPIDEMIOLOGY
<p>The incubation period for <i>Listeria</i> gastroenteritis varies between 6 hours and 10 days, with an average period of 24 hours. The incubation period for invasive listeriosis averages 11 days, but can be as long as 28 days.</p>	INCUBATION
<p>In immunocompetent individuals, <i>Listeria</i> does not usually cause infection. Upon consumption of a high dose of the bacteria, these individuals may present with a nondescript febrile gastroenteritis that is self-limiting and usually resolves within 2 days without treatment. Symptoms include nausea, vomiting, diarrhea, fever, myalgia, arthralgia, headache, and fatigue.</p> <p>Serious complications can arise in at-risk groups. Invasive listeriosis is rare and can be fatal. It can cause sepsis, meningitis, and meningoencephalitis. Although less common, <i>Listeria</i> can also cause brain abscesses and rhombencephalitis.</p> <p>Infection during pregnancy can cause miscarriage, stillbirth, preterm labor, and sepsis or meningitis in the baby.</p>	PRESENTATION
<p>Acute febrile gastroenteritis cause by <i>Listeria</i> is rarely diagnosed.</p> <p>Invasive listeriosis can be diagnosed by a blood or CSF culture.</p> <p>MRI with contrast is used to detect <i>Listeria</i> lesions in the cerebellum, brainstem, and cortex.</p>	DIAGNOSIS

<p>For immunocompetent individuals presenting with febrile gastroenteritis, treatment is not recommended. Supportive therapy, such as oral rehydration, can help prevent dehydration. If symptoms do not resolve, oral ampicillin or trimethoprim-sulfamethoxazole can be administered.</p> <p>First line treatment for invasive listeriosis occurring in at-risk populations is oral ampicillin or trimethoprim-sulfamethoxazole.</p> <p>Infected pregnant women should be given intravenous ampicillin. Asymptomatic pregnant women do not need to be treated, but should be carefully monitored.</p>	<p>TREATMENT</p>
<ul style="list-style-type: none"> - Thoroughly cook meat before consumption. - Thoroughly wash raw vegetables and fruit before consumption. - Thoroughly wash cooking utensils. - Do not consume unpasteurized milk or milk products. Pregnant women should avoid soft cheeses. - Clean refrigerators periodically. - Refrigerate leftovers within two hours. Keep leftovers no longer than four days. Reheat leftovers to 74 degrees Celsius before consuming. - Provide pregnant women with educational materials on how to avoid listeria infection and what to do if infection is suspected. - Educate the public on proper handwashing techniques. Install handwashing stations, especially near public swimming facilities. <p>Without treatment, immunocompetent individuals usually do not experience any symptoms. At risk groups, especially pregnant women, need antibiotic treatment to prevent serious and life threatening complications.</p> <ul style="list-style-type: none"> - WHO: www.who.int/ith/diseases/listeriosis/en/ - ECDC: ecdc.europa.eu/en/healthtopics/listeriosis/Pages/index.aspx - CDC, Atlanta: www.cdc.gov/listeria/index.html 	<p>PREVENTIVE/ PROTECTIVE MEASURES</p> <p>KEY ACTIONS for Public Health</p> <p>PROGNOSIS</p> <p>WHERE CAN I FIND MORE INFO?</p>

10.4.4. E. coli

<p>Escherichia coli (E. coli) are a diverse group of bacteria. Most E. Coli serotypes are harmless and live in the digestive tract of humans and animals. A few serotypes are pathogenic and are a leading cause of diarrhea. The major types are ETEC, EPEC, and EHEC.</p> <p>Enterotoxigenic E. coli (ETEC), also known as travel’s diarrhea, is transmitted through the consumption of contaminated food or water. It is most commonly found in developing countries, especially in children under 2 years old, and usually causes watery diarrhea.</p> <p>Enteropathogenic E. coli (EPEC) causes diarrhea in babies less than 6 months most commonly in developing countries.</p> <p>Enterohemorrhagic E. coli (EHEC) causes bloody diarrhea and can result in severe complications such as hemolytic-uremic syndrome.</p>	<p>WHAT IS E. COLI?</p>
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<p>Children, the elderly, and traveler’s to developing countries.</p>	<p>WHO IS AT RISK?</p>
<p>E. coli is transmitted via the consumption of contaminated food or water and from person to person via the fecal-oral route.</p> <p>ETEC is the most common disease in persons traveling from developed to developing countries. Risk is highest during the first week of travel.</p> <p>EPEC infects babies in developing countries.</p> <p>EHEC mainly comes from cattle. The O157:H7 serotype has been responsible for large outbreaks of diarrhea in North America and Europe. Complications related to infection are most common in children and the elderly.</p>	<p>EPIDEMIOLOGY</p>
<p>ETEC: 1-3 days EHEC: 3-4 days</p> <p>ETEC usually causes watery diarrhea of high volume, abdominal cramps, malaise, and anorexia. Some patients may present with a low fever, nausea, and vomiting. Symptoms typically resolve between 3 and 5 days.</p> <p>EPEC can cause severe diarrhea and vomiting in children.</p> <p>EHEC causes bloody diarrhea, abdominal cramps, and vomiting. Symptoms typically resolve between 5 and 7 days. It can lead to hemolytic-uremic syndrome, which is characterized by polyuria, fatigue, and conjunctival pallor due to anemia.</p>	<p>INCUBATION</p> <p>PRESENTATION</p>
<p>ETEC is usually self-diagnosed and usually does not need a definitive diagnosis in order to treat. Stool samples should only be taken if patient has fever with colitis or upper gastrointestinal symptoms.</p> <p>EPEC is detected from stool samples using a DNA probe or PCR.</p> <p>EHEC diagnosis is important to determine if the serotype is more likely to cause an outbreak, such as the O157:H7 serotype. Stool cultures can be used to confirm the presence of O157:H7.</p>	<p>DIAGNOSIS</p>
<p>ETEC does not require treatment. Supportive therapy, such as oral rehydration and electrolyte replacement, is important to prevent dehydration. Bismuth subsalicylate can help manage symptoms. Chemoprophylaxis includes fluoroquinolone or rifaximin, but is only recommended for patients with underlying medical conditions. Antibiotics, such as fluoroquinolones, can reduce the duration of ETEC, but is only recommended in certain situations due to the increase in antibiotic resistance. Patients can take anti-motility agents, such as loperamide, with antibiotics.</p> <p>EPEC does not require treatment. Supportive therapy, such as oral rehydration and electrolyte replacement, is important to prevent dehydration. Infants should continue to breastfeed/drink formula as much as possible to prevent malnutrition.</p> <p>EHEC does not require treatment. Supportive therapy, such as oral rehydration and electrolyte replacement, is important to prevent dehydration. Antibiotics and antimotility agents are not recommended. If</p>	<p>TREATMENT</p>

<p>hemolytic-uremic syndrome develops, patients should be hospitalized to monitor kidney function and perform dialysis, if needed.</p>	
<ul style="list-style-type: none"> - Wash hands thoroughly after contact with animals or after working in the farm. - Farmers should not use fecal waste as fertilizer and should prevent fecal contamination of fields. Feeders and waterers should be designed to keep manure out. - Farmers should clean tools and equipment appropriately. - Food handlers should be sure to separate raw and cooked foods, cook food thoroughly, store food at safe temperatures, and use clean water. - Careful consumption of food and water when traveling to developing countries. - Thoroughly cook meat before consumption. - Thoroughly wash raw vegetables and fruit before consumption. - Thoroughly wash cooking utensils. - Do not consume unpasteurized milk or milk products. 	<p>PROTECTIVE MEASURES</p>
<ul style="list-style-type: none"> - Educate the public on proper handwashing techniques. Install handwashing stations, especially near public swimming facilities. - Improving the hygiene of slaughtering practices. 	<p>KEY ACTIONS for Public Health</p>
<p>The majority of E. coli infections resolve without any permanent sequelae</p>	<p>PROGNOSIS</p>
<ul style="list-style-type: none"> - CDC, Atlanta: www.cdc.gov/ecoli/general/index.html - WHO: www.who.int/mediacentre/factsheets/fs125/en/ - Wanke, C. (2017) Pathogenic Escheria coli. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 14, 2017.) - Wanke, C. (2017) Travellers' diarrhea: Microbiology, epidemiology, and prevention. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 14, 2017) 	<p>WHERE CAN I FIND MORE INFO?</p>

10.4.5. Botulinum Toxin- Botulism

<p>Botulism is an infection caused by the toxin released from the bacteria Clostridium botulinum. Botulinum toxin is the most toxic substance currently known and it permanently blocks the neuromuscular junction.</p>	<p>WHAT IS BOTULISM?</p>
<ul style="list-style-type: none"> - People who eat home-canned or home-fermented foods are at a higher risk of acquiring foodborne botulism. - Injection drug users (IVDUs) practising “skin-popping” are at risk for wound botulism. - Infants are at risk because their intestinal defenses have not yet developed, to develop infantile botulism. 	<p>WHO IS AT RISK?</p>

<p>The majority of botulism cases are caused by the ingestion of the botulinum toxin (subtypes A-E) or through contact with Clostridium botulinum spores, usually from the inhalation of contaminated dust or soil. Many of these cases occur in infants. Infant botulism has been associated with the ingestion of raw honey.</p> <p>Foodborne botulism typically occurs in isolated events, commonly from the improper canning, fermentation, or preservation of food. Wound botulism cases are most commonly in injection drug users, due to the contamination of the injected drug (usually heroine) with a substance containing C. botulinum spores.</p>	EPIDEMIOLOGY
<p>Foodborne botulism: 12-36 hours Wound botulism: 10 days</p>	INCUBATION
<p>Infected patients develop a progressive neuroparalytic syndrome, without fever or loss of consciousness. They present with fatigue, weakness, and bilateral cranial neuropathies.</p> <p>Foodborne botulism may first present with nausea, vomiting, diarrhea, abdominal pain, and dry mouth with a sore throat. Descending flaccid paralysis manifests with blurred vision, diplopia, nystagmus, ptosis, dysphagia, and dysarthria.</p> <p>Patients with wound botulism present similarly, but lack gastrointestinal symptoms.</p> <p>Death is caused by respiratory failure or infection secondary to paralysis.</p>	PRESENTATION
<p>A thorough patient history is critical in diagnosis.</p> <p>Infant botulism is definitively diagnosed with a stool sample assay.</p> <p>Foodborne botulism is diagnosed with serum analysis for the toxin by bioassay in mice. The toxin can also be isolated for diagnosis from a patient's stool or the suspected foodstuff.</p> <p>Wound botulism must be isolated and cultured from the site of infection. Presumptive diagnosis is made based on electromyogram findings.</p>	DIAGNOSIS
<ul style="list-style-type: none"> - Botulinum antitoxin and hospitalization is immediately required. Equine serum heptavalent botulism antitoxin is used for children over the age of one and adults. It is more effective if administered within 36 hours. - Patients should be carefully monitored for respiratory failure. - In addition to antitoxin, wound botulism should be properly debrided and penicillin should be administered. 	TREATMENT
<ul style="list-style-type: none"> - Educational materials on how to safely can, preserve, and ferment foods at home. - Safe food preparation to inhibit bacterial growth and toxin production. - Infants under one year of age should not consume honey. 	PROTECTIVE/ PREVENTIV MEASURES

<ul style="list-style-type: none"> - Botulism cases should be reported immediately to public health authorities. Contact tracing and cluster investigation may be needed in collaboration with food safety authorities to identify the origin of the infection and the food implicated. In addition, PH authorities need, usually, to mediate for the antitoxin. - Botulinum toxin is included in the list of EU high threat agents for deliberate release. 	KEY ACTIONS for Public Health
<p>Infection usually requires hospitalization for 1-3 months. Complete recovery is expected if infection is diagnosed early and antitoxin is administered immediately. Secondary infection from long term paralysis can lead to complications or death. Botulism is deadly without treatment.</p>	PROGNOSIS
<ul style="list-style-type: none"> - CDC, Atlanta: www.cdc.gov/botulism/index.html - WHO: www.who.int/mediacentre/factsheets/fs270/en/ 	WHERE CAN I FIND MORE INFO?

10.4.6. Food & Water borne Parasites

10.4.6.1. Trichinella

<p>Trichinosis or trichinellosis is a parasitic infection caused by the Trichinella roundworm.</p>	WHAT IS TRICHINOSIS?
<p>No groups are at particular risk of infection.</p>	WHO IS AT RISK?
<p>Trichinosis is most commonly acquired through the consumption of raw or undercooked meat from infected animals, particularly pigs.</p>	EPIDEMIOLOGY
<p>1-2 days (enteral phase) to 2-8 weeks (parenteral phase)</p>	INCUBATION
<p>Trichinosis can present as two distinct clinical phases. The first, or enteral phase, may cause nausea, diarrhea, vomiting, and abdominal pain. After two weeks of infection, patients may present with myalgia, arthralgia, fever, edema of the face and eyes, headache, chills, cough, diarrhea, constipation, and rash. Complications include high fever, meningitis, encephalitis, myocarditis, pneumonia, and pain and difficulty associated with muscle movement, including that of breathing and swallowing. It can be fatal, particularly in patients with myocarditis. The severity of symptoms is directly correlated to the amount of larvae ingested. The infectious dose is low.</p>	PRESENTATION

<p>Trichinosis is typically diagnosed with serologic assays, such as ELISA, indirect immunofluorescence, or latex agglutination. If a definitive diagnosis is needed, a muscle biopsy, particularly from that of affected muscle, can be taken to identify the presence of larvae. Blood tests will reveal eosinophilia and may also show an increase in serum muscle enzymes, such as creatine kinase and lactate dehydrogenase, and hypergammaglobulinemia. ECGs of individuals with myocarditis may show nonspecific ST-T wave changes.</p>	<p>DIAGNOSIS</p>
<p>Trichinosis is usually self-limiting. Therapy is not recommended for mild cases of infection. If a patient is experiencing complications, antiparasitic therapy, such as albendazole or mebendazole, is recommended. Corticosteroids can help to reduce inflammation.</p>	<p>TREATMENT</p>
<p>Cook meat to safe temperatures. If exposure is suspected, post exposure prophylaxis may prevent infection.</p>	<p>PREVENTIVE/PROTECTIVE MEASURES</p>
<p>Education regarding the risk of eating raw or undercooked meat. Improve pig-raising practices and hygiene. Prevent pig exposure to wildlife. Slaughter inspection programs: Testing pig carcasses for parasitic infection.</p>	<p>KEY ACTIONS for Public Health</p>
<p>The majority of Trichinosis infections resolve without any permanent damage.</p>	<p>PROGNOSIS</p>
<p>CDC-Atlanta: https://www.cdc.gov/parasites/trichinellosis/health_professionals/index.html</p>	<p>WHERE CAN I FIND MORE INFO?</p>

10.4.6.2. Giardiasis

<p>Giardia lamblia is a parasitic protozoan that causes giardiasis, a diarrheal illness.</p>	<p>WHAT IS GIARDIASIS?</p>
<p>Those at high risk of Giardia infection are travelers to developing countries, backpackers or campers, infants, children, individuals engaging in oral or anal sex, immunocompromised individuals, and patients with cystic fibrosis.</p>	<p>WHO IS AT RISK?</p>
<p>Giardiasis is acquired through ingestion of contaminated food or water or between persons via the fecal-oral route. It is most common in developing countries. The infectious dose is low. Infection is more common during the summer months. There have been reports of infection through oral and anal sex. Although rare, humans can acquire Giardia from infected animals, such as pets.</p>	<p>EPIDEMIOLOGY</p>
<p>1-2 weeks</p>	<p>INCUBATION</p>

<p>Some individuals infected with giardia are asymptomatic. Symptomatic individuals with acute giardiasis almost always present with diarrhea and malaise. The majority of patients also present with steatorrhea, abdominal cramps, flatulence, nausea, and weight loss. Some patients have vomiting, fever, constipation, and urticarial. Symptoms usually last for 1-2 weeks. Chronic giardiasis occurs when symptoms reappear days or weeks after an acute infection. A major complication includes significant weight loss due to malabsorption. Thus, these patients may experience vitamin A, B12, and folate deficiencies. This is particularly dangerous in children; deficiencies can inhibit growth and development.</p>	PRESENTATION
<p>Giardia infection is diagnosed using antigen detection assays, nucleic acid detection assays, and stool examination.</p>	DIAGNOSIS
<p>Treatment is recommended for Giardia infected patients experiencing symptoms. First line treatment is tinidazole, metronidazole, or nitazoxanide. Supportive therapy, such as oral rehydration and replenishment of electrolytes, is very important in preventing dehydration.</p>	TREATMENT
<ul style="list-style-type: none"> - Frequent and proper handwashing to prevent fecal-oral transmission. - Proper disposal of waste from infected individuals. - Disinfect drinking water when camping or hiking. - Prevent contact with feces during sex . 	PROTECTIVE MEASURES
<ul style="list-style-type: none"> - Educate the public on proper handwashing techniques. - Notify public health authorities in the case of Giardia outbreaks. 	KEY ACTIONS for Public Health
<p>Giardia infections usually resolve without any permanent damage.</p>	PROGNOSIS
<ul style="list-style-type: none"> - CDC, Atlanta: www.cdc.gov/parasites/giardia/diagnosis.html - Leder, K. & Weller, P. (2017). Epidemiology, clinical manifestations, and diagnosis of giardiasis. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 16, 2017.) - Munoz, F. (2017). Treatment and prevention of giardiasis. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 16, 2017.) 	WHERE CAN I FIND MORE INFO?

10.4.6.3. Cyclospora

<p>Cyclosporiasis is an intestinal infection caused by the parasite Cyclospora cayetanensis.</p>	WHAT IS CYCLOSPORA?
<p>Travelers to endemic countries and HIV/AIDS patients are at the highest risk of infection. Children, the elderly, and HIV/AIDS patients are at risk for the most severe presentation of symptoms.</p>	WHO IS AT RISK?
<p>Infection is usually acquired through the ingestion of contaminated food or water, and rarely spreads via the fecal-oral route.</p>	EPIDEMIOLOGY
<p>7 days</p>	INCUBATION

<p>Infection requires a low infectious dose, but may be asymptomatic. Watery diarrhea is the most common symptom, and has been characterized as bloody, mucoid, and explosive. Patients may also present with anorexia, nausea, weight loss, abdominal cramps, flatulence, fever, and fatigue. Children, the elderly, and HIV/AIDS patients may present with more severe symptoms. After treatment, patients may relapse.</p>	<p>PRESENTATION</p>
<p>Cyclosporiasis is diagnosed via the detection of Cyclospora oocytes in a stool sample. PCR analysis of a stool sample can also be used.</p>	<p>DIAGNOSIS</p>
<p>Trimethoprim-sulfamethoxazole is the recommended treatment for cyclosporiasis, although most individuals will recover without treatment. A higher dose and longer course may be needed for HIV/AIDS patients. Supportive therapy, such as oral rehydration, may prevent dehydration.</p>	<p>TREATMENT</p>
<ul style="list-style-type: none"> - Avoid food or water potentially contaminated with human waste. - Thoroughly wash raw vegetables and fruit before consumption. 	<p>PREVENTIVE/ PROTECTIVE MEASURES</p>
<ul style="list-style-type: none"> - Cyclospora has caused a number of large outbreaks in recent years in Europe and the USA, usually connected to fresh fruits or produce watered with human waste - Appropriate disposal of human waste should be implemented and its use as a fertiliser avoided. 	<p>KEY ACTIONS for Public Health</p>
<p>Cyclospora infections usually resolve without any permanent damage.</p>	<p>PROGNOSIS</p>
<ul style="list-style-type: none"> - CDC, Atlanta: www.cdc.gov/parasites/cyclosporiasis/gen_info/faqs.html - Weller, F. & Leder, Karin (2017). Cyclospora infection. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 19, 2017.) 	<p>WHERE CAN I FIND MORE INFO?</p>

10.4.6.4. Naegleria infection

<p>Naegleria fowleri is a free-living amoeba commonly found in freshwater. It can cause primary amebic meningoencephalitis, a rare and fatal disease.</p>	<p>WHAT IS NAEGLERIA?</p>
<p>Individuals most at risk of infection are those who have engaged in water-related activities.</p>	<p>WHO IS AT RISK?</p>
<p>Naegleria fowleri lives in freshwater. Infection is acquired when contaminated water enters through the nose. In most cases, this occurs during recreational water activities. Exposure to Naegleria fowleri is not uncommon, but infection is rare. It cannot be acquired by swallowing contaminated water. The majority of documented cases have occurred in the United States.</p>	<p>EPIDEMIOLOGY</p>
<p>5 -15 days</p>	<p>INCUBATION</p>

<p>In the first stage of the disease, patients present with high fever, frontal headache, photophobia, nausea, and vomiting. The second phase is characterized by neurological involvement, such as stiff neck, seizures, altered mental status, hallucinations, and coma.</p>	<p>PRESENTATION</p>
<p>Naegleria fowleri can be detected in CSF. Naegleria fowleri nucleic acid and antigen can be detected in CSF, biopsy, or tissue specimen. Because of the rarity of the infection, diagnosis is usually post-mortem. In culture it can be detected by direct visualization or by PCR after applying heat to select for the thermophilic Naegleria fowleri.</p> <p>Patient's CSF pressure is high and shows elevated glucose, protein, and white blood cell count.</p>	<p>DIAGNOSIS</p>
<p>There is no standard approach to treating primary amebic meningoencephalitis. In previous cases, Miltefosine has been used as an amebicidal in addition to amphotericin B, rifampin, fluconazole, and azithromycin. It is believed that survivors of Naegleria infection benefitted most from early diagnosis and treatment.</p>	<p>TREATMENT</p>
<ul style="list-style-type: none"> - Individuals should try to limit the amount of freshwater that gets into their nose when engaging in recreational water activities. - Avoid swimming in lakes where infections has been acquired - Swimming pools should have at least 1-2ppm of residual free chlorine. - Avoid wearing contact lenses while swimming. 	<p>PROTECTIVE/ PREVENTIVE MEASURES</p>
<p>Naegleria infected water sources should be reported in order to avoid multiple cases exposed to the same source.</p>	<p>KEY ACTIONS for Public Health</p>
<p>Primary amebic meningoencephalitis is almost always fatal.</p> <ul style="list-style-type: none"> - CDC, Atlanta: www.cdc.gov/parasites/naegleria/index.html - Seas, C. & Bravo, F. (2017). Free-living amebas and Prototheca. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 19, 2017.) - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Naegleriasis] 	<p>PROGNOSIS</p> <p>WHERE CAN I FIND MORE INFO?</p>

10.4.6.5. Taenia infections

<p><i>Taenia saginata and Taenia solium</i> are tapeworm species that infect the intestines.</p>	<p>WHAT IS TAENIA?</p>
<p>Infection is most common in countries or areas where consumption of undercooked beef and pork is common.</p>	<p>WHO IS AT RISK?</p>

<ul style="list-style-type: none"> - Educate the public on proper handwashing techniques. - Pig vaccination campaigns. - Provide clean water or build protected water sources in developing countries. - Build sanitary systems for safe disposal of human waste in developing countries. <p>Taenia infections usually resolve without any permanent damage. Cysticercosis, especially neurocysticercosis, can cause permanent damage and death if not treated.</p>	<p>KEY ACTIONS for Public Health</p> <p>PROGNOSIS</p>
<ul style="list-style-type: none"> - CDC, Atlanta: www.cdc.gov/parasites/taeniasis/index.html, & https://www.cdc.gov/parasites/cysticercosis/index.html - WHO: www.who.int/taeniasis/en/ - Leder, K. & Weller, P. (2017). Intestinal tapeworms. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 20, 2017) - White, A. (2016). Epidemiology, transmission, and prevention of cysticercosis. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 20, 2017) 	<p>WHERE CAN I FIND MORE INFO?</p>

10.4.6.6. Entameoba histolytica (Amoebiasis)

<p>Amoebiasis is a parasitic infection caused by Entameoba histolytica.</p>	<p>WHAT IS AMEBIASIS?</p>
<p>Infection is most common in developing countries or areas in the tropics.</p> <p>Infection is usually acquired through the ingestion of contaminated food or water or from person to person via the fecal-oral route.</p> <p>The incubation period is usually 1-3 weeks after ingestion.</p>	<p>WHO IS AT RISK?</p> <p>EPIDEMIOLOGY</p> <p>INCUBATION</p>
<p>Most cases of amoebiasis are asymptomatic. Symptomatic patients present with diarrhea, stomach pain, and abdominal cramps. Diarrhea may be bloody. The development of colitis may lead to bowel perforation or peritonitis.</p> <p>Rarely, amoebiasis spreads to the liver, lungs, or brain. Infection of the liver may cause the development of liver abscesses. Symptomatic amoebiasis can be fatal.</p>	<p>PRESENTATION</p>
<p>Amoebiasis is diagnosed through the detection of the parasite in stool samples. However, stool samples cannot definitively distinguish Entameoba histolytica from other similar pathogens. For definitive diagnosis, antigen testing of stool, serum, or pus (from a liver abscess) using monoclonal antibodies or serologic assays, particularly indirect hemagglutination, are used.</p>	<p>DIAGNOSIS</p>

<p>Treatment is recommended even if patients are asymptomatic to prevent the risk of further organ infection and spread of disease. Luminal or intraluminal infection should be treated with paromomycin, diiodohydroxyquin, or diloxanide furoate. Invasive infection should be treated with metronidazole or tinidazole.</p>	TREATMENT
<p>Frequent and proper handwashing to prevent fecal-oral transmission. Thoroughly cook meat before consumption.</p>	PREVENTIVE/PROTECTIVE MEASURES
<p>Educate the public on proper handwashing techniques. Provide clean water or build protected water sources in developing countries. Build sanitary systems for safe disposal of human waste in developing countries.</p>	KEY ACTIONS for Public Health
<p>Most infections are asymptomatic and resolve without any permanent damage. However, Entamoeba histolytica is the second leading cause of death due to parasitic infection.</p>	PROGNOSIS
<ul style="list-style-type: none"> - CDC, Atlanta: www.cdc.gov/parasites/amebiasis/general-info.html - Leder, K. & Weller, P. (2016). Intestinal Entamoeba histolytica amebiasis. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 20, 2017.) 	WHERE CAN I FIND MORE INFO?

10.4.6.7. Hepatitis A

<p>Hepatitis A (HAV) is a picornavirus that infects the liver.</p>	WHAT IS HEPATITIS A?
<ul style="list-style-type: none"> - HAV is a common cause of food- and water-borne outbreaks connected to different foodstuff e.g. chives, fruit etc - Travellers to endemic countries, men who have sex with men, drug users, and individuals working with primates. 	WHO IS AT RISK?
<p>HAV is transmitted via the consumption of contaminated food or water and from person via the fecal-oral route. In developed countries, outbreaks are typically due to consumption of contaminated shellfish or vegetables.</p>	EPIDEMIOLOGY
<p>The average incubation period is 28 days.</p>	INCUBATION
<p>HAV is usually self-limiting. It usually presents as sudden onset of fever, fatigue, anorexia, vomiting, abdominal pain, dark urine, pale stools, hepatomegaly, jaundice, and arthralgia. Typically older adults experience more severe symptoms. The majority of infections in children and some in adults are asymptomatic. Complications include cholestatic hepatitis, relapsing hepatitis, and autoimmune hepatitis. The disease does not become chronic.</p>	PRESENTATION

Diagnosis is usually via the presence of IgM anti-HAV antibodies.	DIAGNOSIS
There is no specific treatment for HAV. Vaccination can prevent infection. Infected individuals should consult health care professional about their current medications; medications metabolized by cytochrome P450 system can cause liver damage.	TREATMENT
<ul style="list-style-type: none"> - There is a safe and effective vaccine against HAV, which is included in the National Immunization Programmes of many EU MS. - Frequent and proper hand washing to prevent fecal-oral transmission. 	PREVENTIVE/PROTECTIVE MEASURES
<ul style="list-style-type: none"> - Immunization campaigns, esp. for high risk population groups. - Farmers should not use fecal waste as fertilizer and should prevent fecal contamination of fields. Feeders and waterers should be designed to keep manure out. - Farmers should clean tools and equipment appropriately. - Food handlers should be sure to separate raw and cooked foods, cook food thoroughly, store food at safe temperatures, and use clean water. - Provide clean water or build protected water sources in developing countries. - Build sanitary systems for safe disposal of human waste in developing countries. - Educate the public on proper hand washing techniques. 	KEY ACTIONS for Public Health
<p>The majority of HAV infections resolve without any permanent damage.</p> <ul style="list-style-type: none"> - ECDC-Hepatitis A: https://ecdc.europa.eu/en/hepatitis-a - CDC, Atlanta- Viral Hepatitis: https://www.cdc.gov/hepatitis/index.htm - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Hepatitis, Viral] 	PROGNOSIS WHERE CAN I FIND MORE INFO?

10.5. Pathogens transmitted through contact with the farm environment

This section is devoted to diseases caused by exposure to insects (mosquitoes, ticks etc) in the farm environment, as well as agents, which survive and can be transmitted via inhalation of dust and agents which can be transmitted through contact with mud or flood water.

10.5.1. Vector borne diseases (VBDs)

Vectors are understandably more common in the rural environment. Vector borne diseases (VBDs) are multiple and cause significant morbidity and mortality to humans. They also represent the diseases that are expected to have the highest increase due to climate change, mostly due to the change and expansion of the vector habitat. It is estimated that over the last two decades nearly a third of all recorded events related to emerging infectious diseases were vector-borne.

Farmers and farm workers, even the rural population in general, are exposed proportionally more to vectors through their work and leisure activities. Mosquitoes, ticks, fleas, phlebotomines, filarias etc usually bite unprotected skin or enter through a skin lesion (cut, abrasion etc). Both conditions are common in farm workers and rural populations in general, who are at increased risk to be infected. A short selection of the most important VBDs are presented here.

10.5.1.1. Malaria

<p>Malaria is caused by the parasite Plasmodium, transmitted to humans by the female Anopheles mosquito.</p> <p>Five are the most common species of Plasmodium affecting humans, of which Plasmodium vivax and Plasmodium falciparum are the most frequent.</p>	WHAT IS MALARIA?
<p>Persons at risk include: farmers and their families, farm workers (esp. if migrants), other people living in the farm or working in the farm garden. Although the vector bites other animals it does not cause disease in farm animals (e.g. sheep).</p>	WHO IS AT RISK?
<p>European Union (EU) member states (MS) are malaria free since 2015, although small clusters and sporadic cases of appear in various countries. Some hundreds of imported malaria cases are recorded annually in EU MS mostly in travellers visiting friends and family (VFFs) in malaria endemic countries.</p> <p>P. vivax is prevalent in Asia and South America, while P. falciparum is endemic in Sub-saharan Africa.</p>	EPIDEMIOLOGY
<p>Incubation period differs according to species:</p> <p>P. vivax 12-18 days (usually, although it can be significantly longer) and P. falciparum 7-14 days.</p>	INCUBATION
<p>Malaria presents with nonspecific clinical symptoms. Previously not exposed persons usually have episodes of chills followed by high fever, which resolve with significant sweating and malaise. In addition patients usually have headache, myalgias and arthralgias and sometimes even cough, vomiting or diarrhea. Cyclic pattern of fever may not be recognizable.</p> <p>Persons coming from malaria endemic countries are partially immune and therefore present with mild symptoms often going unrecognized, e.g. low grade fever and headache.</p> <p>Signs: anemia, jaundice, splenomegaly, hepatomegaly.</p>	PRESENTATION
<p>Golden diagnostic standard remains light microscopy, although Rapid Detection Tests (RDTs) have proven valuable field tools for the diagnosis of malaria.</p>	DIAGNOSIS
<p>Depends on the species:</p> <ul style="list-style-type: none"> - <i>P. falciparum</i>: artemisinin combination (3 days) - <i>P. vivax</i>: chloroquine (2 days) or artemisinin (3 days) and primaquine (14 days) 	TREATMENT

<ul style="list-style-type: none"> - Awareness about the disease in the public and mostly in the health professionals should be high. - Advise all persons at risk in vulnerable areas to use mosquito repellents on exposed skin and on clothing, - install window & door screens, - prefer light coloured long-sleeved shirts and pants, - avoid watering plants in the evening, - use mosquito nets for the beds of young infants (<6mos) and pregnant women. 	PROTECTIVE/ PREVENTIVE MEASURES
<ul style="list-style-type: none"> - Malaria belongs to the notifiable diseases in EU countries and should be reported to PH authorities, which may also provide you entomological surveillance information for your area of responsibility. - You may be asked to assist in a focus investigation in the estimated area of exposure of the case. - Persons diagnosed with malaria should be protected from mosquito bites until about 24hrs after starting treatment. 	KEY ACTIONS for Public Health
<p>Appropriate treatment results in full recovery usually within 24hrs of treatment onset.</p> <p>Eradication treatment with primaquine for the hypnozoites of <i>P. vivax</i> is of great importance for public health. Primaquine should be started only if G6PD levels are normal.</p>	PROGNOSIS
<ul style="list-style-type: none"> - ECDC, Malaria: https://ecdc.europa.eu/en/malaria - CDC, Atlanta- Malaria: https://www.cdc.gov/malaria/ - WHO, Malaria: http://www.who.int/malaria/en/ 	WHERE CAN I FIND MORE INFO?

10.5.1.2. Arbo-viral infections

Arthropod borne infections are numerous and are caused by a significant number of viruses, each one transmitted by a specific mosquito species.

Among the emerging vector borne diseases mosquito-transmitted pathogens are a prime concern. In Europe, WNV emerged in the late '90s while more recently autochthonous European cases of Dengue fever and Chikungunya virus infection and outbreaks of malaria, provide firm evidence of the vulnerability of the region to the transmission of these pathogens.

<p>West Nile Virus (WNV) infection, is a viral syndrome transmitted via the common mosquito (<i>Culex</i> spp).</p>	WHAT ARE ARBO-VIRAL INFECTIONS?
<ul style="list-style-type: none"> - Rural populations in general are at a higher risk for contact with infected mosquitoes due to longer exposures, however WNV is also circulating in urban environments. - The elderly are up to 7 times more at risk to develop encephalitis compared to younger patients. Children are most likely to manifest the West Nile Fever syndrome. - Populations living in flooded areas during the spring to fall months are also at risk as flood water is an abundant breeding site for mosquitoes. 	WHO IS AT RISK?

<ul style="list-style-type: none"> - WNV was initially identified in Africa, however it is maintained in nature in a cycle between mosquitoes and migratory birds, which can carry the virus without symptoms. Horses and humans are considered incidental hosts, who cannot transmit it to mosquitoes. - It has emerged in the last 15 years in the USA and Canada and in many EU countries (Romania, Greece, Serbia, Italy, Spain etc) 	EPIDEMIOLOGY
<p>2-14 days</p> <ul style="list-style-type: none"> - WNV infections is mostly asymptomatic (up to 80%). About 15-18% infected persons can exhibit fever, fatigue, myalgia, maculopapular rash, even vomiting and diarrhea. - Neurological symptoms consistent with encephalitis usually present in 1/145-150 infected persons. Some patients may also exhibit polio-like flaccid paralysis. 	INCUBATION PRESENTATION
<p>The virus is detected using serology (IgM) in serum or CSF and PCR or culture.</p>	DIAGNOSIS
<p>No specific treatment or vaccine exist. Supportive therapy is needed.</p> <ul style="list-style-type: none"> - Awareness of the public and health professionals should be high. - Advise all persons at risk in vulnerable areas to use mosquito repellents on exposed skin and on clothing, - Install window & door screens and yellow coloured light in the outside areas, - Prefer light coloured long-sleeved shirts and pants, - Avoid watering plants in the evening. 	TREATMENT PROTECTIVE / PREVENTIVE MEASURES
<ul style="list-style-type: none"> - WNV is a notifiable disease in most EU countries. - Entomological surveillance may be required in the area along with the advised mosquito control programmes - Specific blood safety measures are also recommended in the EU in the areas where WNV in circulating. 	KEY ACTIONS for Public Health
<p>WNV infection usually resolves although long term sequelae are reported in up to 10% of cases. Encephalitis can be fatal especially since patients are elderly and have underlying morbidity.</p>	PROGNOSIS
<ul style="list-style-type: none"> - ECDC- WNV: https://ecdc.europa.eu/en/west-nile-fever - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Arthropodborne Viral Encephalitides] - CDC- Atlanta, WNV: https://www.cdc.gov/westnile/ 	WHERE CAN I FIND MORE INFO?

10.5.1.3. Plague

See Section II.5)

10.5.1.4. Tick Borne Infections

Ticks are second only to mosquitoes for carrying disease to humans. In Europe the main tick-borne diseases include: Tick-borne Encephalitis, Lyme borreliosis, Tick-borne relapsing Fever, Mediterranean Spotted Fever, Crimean-Congo Hemorrhagic Fever (CCHF) and Anaplasmosis. Other tick-borne diseases include Babesiosis, multiple rickettsioses, Ehrlichiosis. Tick-borne disease can be found almost all over Europe with some diseases being more prevalent in certain regions. Three different diseases are included in the following presentation based on their higher frequency in Europe.

<ul style="list-style-type: none"> - Tick-borne Viral Encephalitis (TBE), caused by a number of flaviviruses, of which the most common in Europe is the Central European TBEV, and - Lyme Disease/borreliosis, caused by the spirochete <i>Borrelia burgdorferi</i>, - Crimean- Congo Hemorrhagic Fever (CCHF): is caused by a Bunyavirus. 	WHAT ARE TICK-BORNE INFECTIONS?
<ul style="list-style-type: none"> - Humans are infected through the bite of an infected tick (), therefore populations with occupational or recreational exposure are at a higher risk for contact with infected ticks in rural areas and forests. - TBE & Lyme borreliosis: transmitted via ticks of the genus <i>Ixodes</i> - CCHF: transmitted via the genus <i>Hyalomma</i> 	WHO IS AT RISK?
<ul style="list-style-type: none"> - Central and North European countries report regularly TBE, Lyme borreliosis cases. - CCHF is mainly detected in Turkey, Bulgaria, Northern Greece, and Western Balkans. 	EPIDEMIOLOGY
<ul style="list-style-type: none"> - TBE: 7-14 days - Lyme: usually 7-10 days after tick exposure (3-32 days) - CCHF: usually 3-7 days (1-12 days) 	INCUBATION
<ul style="list-style-type: none"> - TBEV infection may be asymptomatic, but up to 1/4 of cases develop symptoms, usually a biphasic illness: initial influenza-like symptoms are followed by an asymptomatic period and then neurological symptoms like fever, headache, seizures. Patients may also exhibit polio-like flaccid paralysis. - Lyme borreliosis: 70-80% of patients initially present with erythema migrans and early symptoms such as malaise, fatigue, fever, headache, myalgia, migratory arthralgia and lymphadenopathy. In untreated patients these symptoms within weeks or months neurological symptoms may develop including aseptic meningitis, facial neuritis, chorea, ataxia, encephalitis. Cardiac abnormalities may also develop. Symptoms fluctuate and may become chronic. - CCHF: initially presents with fever, malaise, headache and severe myalgia. Petechial rash can also be present and bleeding may develop from mucous membranes. 	PRESENTATION
<ul style="list-style-type: none"> - TBE: The virus is detected using serology (IgM) in serum or CSF and PCR or culture. - Lyme Disease: clinical symptoms plus two stage serology (IgM) and Western immunoblotting. - CCHF: Serology and PCR are used 	DIAGNOSIS

<ul style="list-style-type: none"> - TBE: there is no specific treatment, only supportive care - Lyme borreliosis: - CCHF: supportive care 	TREATMENT
<ul style="list-style-type: none"> - TBE: there is a safe and effective inactivated TBE vaccine. - Increased awareness should be maintained for contact with ticks in rural populations, campers, hikers, hunters etc. Regular check for ticks in humans and animals - Treat shoes, socks and camping equipment with permethrin based insect repellents 	PROTECTIVE / PREVENTIVE MEASURES
<ul style="list-style-type: none"> - CCHF cases should be reported immediately to public health authorities and personal protective measures should be taken to avoid human to human transmission, esp. at the hospital setting. - TBE and Lyme disease are usually notifiable in the countries with higher incidence. 	KEY ACTIONS for Public Health
<ul style="list-style-type: none"> - TBE: Most patients recover but up to 1/3 of patients may suffer long term sequelae. - Lyme borreliosis: doxycycline or amoxicilline should be used according to guidelines. Neuro- disease requires ceftriaxone. - CCHF: case fatality ranges from 2-50% - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Tickborne Viral Encephalitides, Tickborne Viral Hemorrhagic Fevers & Lyme Disease] - CDC- Atlanta: Ticks and Diseases: https://www.cdc.gov/ticks/diseases/index.html - ECDC, TBE: https://ecdc.europa.eu/en/tick-borne-encephalitis/facts/key-messages 	PROGNOSIS WHERE CAN I FIND MORE INFO?

10.5.1.5. Leishmania spp. (Leishmaniasis)

<p>Leishmaniasis is a parasitic disease caused by protozoa of the genus Leishmania. L. major, donovani & tropica are implicated for the cutaneous form in the Eastern hemisphere, while L. donovani and L. infantum are the typical agents in the visceral form.</p>	WHAT IS LEISHMANIASIS?
<p>Humans are infected through the bite of an infected phlebotomine (sandfly), which usually bite from dusk to dawn. Rural populations and forrest workers are at risk together with children and adolescents. Immune-compromised patients may manifest reactivation of the disease</p>	WHO IS AT RISK?
<p>Tropical countries, middle-eastern and central Asian countries are endemic for Leishmania. Infected persons are infectious to sandflies as long as parasites circulate in blood or remain in the skin lesion(s).</p>	EPIDEMIOLOGY
<p>Range from 7 days to 26 months, maybe up to years</p>	INCUBATION
<p>Two distinct clinical presentations are described:</p>	PRESENTATION

<ul style="list-style-type: none"> - cutaneous leishmaniasis: a distinct skin lesion (macule then papule then chronic ulcer). Mucous membranes can be involved and the disease may be severely disfiguring. - visceral leishmaniasis (Kala-azar): fever, hepatosplenomegaly, emaciation, leukopenia, thrombocytopenia. 	
<p>Diagnosis is clinical together with microscopical identification of Leishmania in smears, biopsy specimen, bone marrow, lymph node or blood. Serology and PCR are also used.</p>	DIAGNOSIS
<p>Amphotericine B and pentavalent antimonials are considered the drugs of choice</p> <ul style="list-style-type: none"> - Personal protective measures from insect bites are advisable and increased awareness should be maintained. - Use of bed nets is advisable, may consider also insecticide treated bed nets, which have been proven effective in endemic areas. - Window screens with fine mesh should be used. - Regular residual spraying should be implemented. - Prevention and treatment of leishmaniasis in dogs is also advised, although control of zoonotic foci has not been proven to be effective for the control of human disease. - Leishmania infections should be reported. - Phlebotomine breeding places (rubbish heaps, stone walls, animal houses) should be regularly sprayed. - Consider advising use of bed nets in Increase awareness of hantavirus infections in rural populations, campers, hikers etc 	<p>TREATMENT</p> <p>PROTECTIVE / PREVENTIVE MEASURES</p> <p>KEY ACTIONS for Public Health</p>
<p>Untreated cutaneous form can be severely disfiguring and in the case of visceral form is fatal.</p>	PROGNOSIS
<ul style="list-style-type: none"> - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Leishmaniasis] - CDC- Atlanta, Leishmaniasis: https://www.cdc.gov/parasites/leishmaniasis/index.html 	WHERE CAN I FIND MORE INFO?

10.5.2. Exposure to pathogens in the dust

Several organisms have evolved with the ability to survive in adverse conditions including drought, high temperature etc

Many of those exist in the farm and/or rural environment and pose a health risk to humans not only working in farms but also living downwind from them, as manifested by several detected outbreaks.

10.5.2.1. Hanta virus

<p>Hantaviruses are rodent-borne Bunyaviridae that cause human disease with varying severity.</p>	<p>WHAT IS HANTAVIRUS?</p>
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<p>Those in contact with rodents or rodent excrement. This includes construction workers, cleaners, rural populations, campers, and hunters.</p>	<p>WHO IS AT RISK?</p>
<p>More than 25 viruses are currently known, Seoul virus circulating worldwide, Puumala mostly in Europe, Hantaan mostly in Asia and the Balkans and Dobrava in the Balkans. Hantaviruses are circulating mostly in the Americas. The virus is spread to humans through inhalation of aerosolized particles or contact with rodent feces, urine, or saliva. There is no documented human-to-human transmission or arthropod transmission.</p>	<p>EPIDEMIOLOGY</p>
<p>Average is 2-4 weeks (2 days - 2 months)</p>	<p>INCUBATION</p>
<p>Hantaviruses can cause hemorrhagic fever with renal syndrome or hantavirus pulmonary syndrome.</p> <ul style="list-style-type: none"> - Hemorrhagic fever with renal syndrome first presents with headache, abdominal pain, back pain, chills, fever, nausea, and blurred vision. The syndrome progresses to cause low blood pressure, acute shock, vascular leakage, respiratory failure, and acute kidney failure. It can be fatal. - Hantavirus cardiopulmonary syndrome causes severe respiratory infection. The first symptoms include fever, fatigue, myalgia, nausea, vomiting, and diarrhea. It then progresses to cause cough and shortness of breath as lungs become fluid-filled. Shock, coagulopathy, pulmonary edema, bronchorrhea, and arrhythmias can be fatal. 	<p>PRESENTATION</p>
<p>Diagnosis is a combination of the clinical syndrome and serologic testing, such as immunofluorescent assays or ELISA (IgM).</p>	<p>DIAGNOSIS</p>
<p>Prompt treatment with ribavirin and supportive therapy, with careful fluid and electrolyte management and dialysis, if needed, are usually effective. Supportive therapy, such as respiratory assistance, is recommended for individuals with hantavirus pulmonary syndrome.</p>	<p>TREATMENT</p>
<ul style="list-style-type: none"> - Avoid contact with rodents and rodent excrement. Food should be stored in rodent-proof conditions. - Clean and air out buildings that are not regularly used. - Personal protective equipment (masks) should be worn for cleaning out areas, silos, rooms infested with rodents. Avoid sweeping or vacuuming, rather use wet mops and cloths moistened with disinfectant (e.g. diluted bleach) 	<p>PROTECTIVE / PREVENTIVE MEASURES</p>
<ul style="list-style-type: none"> - Hantavirus infections should be reported as outbreaks in particular sites have been identified. - Increase awareness of hantavirus infections in rural populations, campers, hikers etc. 	<p>KEY ACTIONS for Public Health</p>
<p>Supportive treatment is needed, while mortality is between 5-15%. Puumala virus in Central Europe carries much lower mortality around 1%.</p>	<p>PROGNOSIS</p>

<ul style="list-style-type: none"> - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Hantaviral diseases] - ECDC- Hanta Virus: ecdc.europa.eu/en/hantavirus-infection/facts - CDC- Atlanta, Hanta Virus: www.cdc.gov/hantavirus/index.html - Mustonen, J. (2016) Renal involvement with hantavirus infection (hemorrhagic fever with renal syndrome). In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 26, 2017.) 	WHERE CAN I FIND MORE INFO?
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10.5.2.2. Aspergillus (Aspergillosis)

<p>Aspergillosis is a fungal infection caused by the fungus Aspergillus.</p>	WHAT IS AERGILOSIS?
<p>Aspergillosis most commonly affects immunocompromised individuals or people with lung disease.</p>	WHO IS AT RISK?
<p>Aspergillosis is acquired through the inhalation of Aspergillus spores, which live in the soil. It can be found in both outdoors and indoors. It is ubiquitous in nature, but does not cause infection in most people. Immunocompromised patients are at risk for invasive aspergillosis. Individuals with lung diseases are at risk for allergic aspergillosis.</p>	EPIDEMIOLOGY
<p>Probably 2-30 days</p>	INCUBATION
<p>There are several types of aspergillosis:</p> <ul style="list-style-type: none"> - Allergic bronchopulmonary aspergillosis causes inflammation of the lungs primarily in patients with asthma or cystic fibrosis. Patients present with cough, shortness of breath, wheezing, and sometimes fever. It does not cause infection. - Aspergillus sinusitis causes inflammation of the sinuses. Patients present with runny nose, headache, and congestion. It does not cause infection. - Aspergilloma is a localized infection in the lungs or sinuses. Patients present with cough, hemoptysis, and shortness of breath. - Chronic pulmonary aspergillosis causes weight loss, chest pain, cough, hemoptysis, fatigue, shortness of breath, and fever. - Invasive aspergillosis most commonly occurs in immunocompromised patients. Patients present with fever, chest pain, cough, hemoptysis, and shortness of breath. The most common form is invasive pulmonary aspergillosis. - Cutaneous aspergillosis - If disseminated, aspergillosis spreads to the CNS, it can cause seizures and mycotic aneurysms. 	PRESENTATION
<p>Aspergillus can be detected by culturing samples from sputum, blood, or infected organs; histopathology; galactomannan antigen test; beta-d-glucan assay; PCR; and serologic testing. Diagnosis of cutaneous aspergillosis is confirmed with skin biopsy.</p>	DIAGNOSIS

<p>The recommended first-line treatment for aspergillosis is voriconazole. For those who cannot take voriconazole, amphotericin B or isavuconazole is recommended.</p> <p>The presence of aspergilloma on lung imaging can help diagnose chronic pulmonary aspergillosis</p> <p>Aspergilloma may require surgical resection.</p>	<p>TREATMENT</p>
<ul style="list-style-type: none"> – Those at high risk can take antifungal prophylaxis, and should protect themselves from environmental exposure. 	<p>PROTECTIVE MEASURES</p>
<ul style="list-style-type: none"> – Develop better diagnostic tools in order to better differentiate aspergillosis from other diseases. 	<p>KEY ACTIONS for Public Health</p>
<p>Invasive aspergillosis is rare, but deadly, especially in immunocompromised patients.</p>	<p>PROGNOSIS</p>
<ul style="list-style-type: none"> – CDC, Atlanta- Aspergillosis: https://www.cdc.gov/fungal/diseases/aspergillosis/index.html – Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Aspergillosis] 	<p>WHERE CAN I FIND MORE INFO?</p>

10.5.2.3. Bacillus anthracis (Anthrax)

(see section I).

10.5.2.4. Coxiella burnetti (Q Fever)

(see section I.11)

10.5.2.5. Brucella spp (Brucellosis)

(see section I.10)

10.5.2.6. Psittacosis

(see section I.2)

10.5.3. Exposure to pathogens in mud and/or flood water

During or after flooding incidents individuals are at risk for exposure to a number of pathogens which survive or grow in the flood water and mud. In addition specific risks are reported for persons undertaking clean up operations in houses that have been flooded (e.g. exposure to fungus etc).

10.5.3.1. Tetanus

Refers mostly to the cleanup phase and the possibility of exposure to items hidden in the mud or flood water.

<p>Tetanus is a deadly bacterial infection of the nervous system caused by the toxin released from Clostridium tetani.</p>	<p>WHAT IS TETANUS?</p>
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<p>Those who have not received the tetanus vaccine. It is endemic in developing countries. The bacteria cannot grow in healthy tissue, so those at risk have some kind of injury, infection, or ischemia. Infants of unvaccinated mothers are at risk of infection.</p> <p>In the case of flooding persons involved in the clean up process are at high risk due to the hazard posed by debris in the mud and flood water.</p>	<p>WHO IS AT RISK?</p>
<p>Tetanus is rare in developed countries where the majority of children receive vaccination with tetanus toxoid.</p> <p>Tetanus is endemic in developing countries, where immunization campaigns are lacking. This and some cultural practices especially increases the risk of neonatal tetanus.</p>	<p>EPIDEMIOLOGY</p>
<p>3-21 days</p>	<p>INCUBATION</p>
<p>Generalized tetanus is the most common and severe form of tetanus, causing tonic muscle contractions. Most patients first present with lockjaw. Spasms in other muscle groups, seizures, stiff neck, risus sardonicus, rigid abdomen, apnea, dysphagia, and tachycardia may follow muscle spasms, but patients do not lose consciousness. Therefore, patients experience extreme pain associated with muscle spasms.</p> <p>Patients with localized tetanus have muscle spasms near the site of infection. This usually occurs in individuals with some immunity to the toxin. It can progress to become generalized tetanus.</p> <p>Cephalic tetanus is caused by infection of the face or head, and is characterized by cranial nerve involvement.</p> <p>Neonatal tetanus most commonly occurs as a result of infection of the umbilical stump from mothers with poor immunity. Infants present with risus sardonicus, muscle spasm, and lock jaw, causing refusal to feed.</p> <p>Complications from tetanus infection include laryngospasms, fractures, hypertension, pulmonary embolism, aspiration pneumonia, and death.</p>	<p>PRESENTATION</p>
<p>Diagnosis is made based on clinical findings and patient history.</p>	<p>DIAGNOSIS</p>
<p>Treatment requires hospitalization. Wounds should be properly debrided.</p> <p>If the patient has never received the tetanus vaccine, they should receive active immunization with tetanus toxoid. Passive immunization with human tetanus immune globulin should also be administered to neutralize unbound toxin. Toxoid and immune globulin must be administered at a different sites.</p> <p>If the patient has historically received the tetanus vaccine, but may not be up to date on the booster, the tetanus toxoid booster shot should be administered. Patient does not need immune globulin.</p> <p>Metronidazole or trimethoprim-sulfamethoxazole are the recommended antibiotic therapy.</p> <p>If the infection has compromised breathing, patients may need to be intubated. Benzodiazepines, muscle relaxants, and neuromuscular blocking agents can be used to treat muscle spasms. Labetalol or morphine sulfate can be used for autonomic hyperactivity.</p>	<p>TREATMENT</p>
<ul style="list-style-type: none"> - Get vaccinated and regularly receive booster shots. - Prophylaxis should be administered immediately upon suspected infection. 	<p>PROTECTIVE MEASURES</p>

<ul style="list-style-type: none"> – Immunization campaigns, particularly for children and pregnant women – Some experts warn that focusing on tetanus exposure in flooding is not appropriate use of public health services 	KEY ACTIONS for Public Health
Tetanus is can be fatal without immediate treatment.	PROGNOSIS
<ul style="list-style-type: none"> – CDC: www.cdc.gov/tetanus/index.html – ECDC: www.who.int/immunization/topics/tetanus/en/ – Sexton, D. (2017). Tetanus. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA. (Accessed on June 14, 2017) 	WHERE CAN I FIND MORE INFO?

10.5.3.2. Burkholderia mallei (Meliodosis)

Please refer to 10.2.3

10.5.3.3. Leptospira spp (Leptospirosis)

Please refer to 10.3.6

10.5.3.4. Mosquito borne diseases

Please refer to 10.5

10.5.3.5. Vibrio infections

Vibrio infections (vibriosis) are a group of diseases caused by more than 12 vibrio bacteria that cause human disease, which is not related to cholera (caused by <i>Vibrio cholerae</i>). Among those <i>Vibrio vulnificus</i> infection is more common and connected with exposure to sea or flood water after storms, cyclones etc.	WHAT ARE VIBRIO INFECTIONS?
<ul style="list-style-type: none"> – Persons with chronic liver disease and immunocompromised are at a high risk for severe infection. – Occupational exposure in fishermen or shellfish farm workers is also common. 	WHO IS AT RISK?
Vibrios are found worldwide in brackish or marine environment. Humans are infected through eating raw shellfish (oysters) or after exposure of skin lesions (open skin wounds, abrasions etc) with flood water after storms, cyclones etc during clean up.	EPIDEMIOLOGY
Range from 12 -72 hours after consuming shellfish,	INCUBATION
Vibrio infections can be: <ol style="list-style-type: none"> 1) gastroenteritis with watery diarrhea, abdominal pain and cramping, nausea and vomiting 2) Wound infection: with redness and soft tissue infection 3) primary septicemia with fever, hypotension and shock. 	PRESENTATION
Diagnosis is made through culture of stool, wound discharge or blood	DIAGNOSIS

Supportive care is critical and antibiotics are used for wound infection and septicemia cases. Amputations have been reported.	TREATMENT
Awareness of possible exposures in the clean up after flooding should be maintained. Proper personal protective equipment should be used and hygiene practiced after exposure.	PROTECTIVE / PREVENTIVE MEASURES
<i>Vibrio</i> infections are usually not notifiable, although systems monitoring the growth of <i>Vibrio</i> in certain European sea environments (e.g. Baltic Sea) are in place.	KEY ACTIONS for Public Health
Untreated wound or soft tissue infection or septicaemia can be fatal.	PROGNOSIS
<ul style="list-style-type: none"> - Control of Communicable Diseases Manual, 19th ed, DL Heymann Editor, APHA [Vibrio Infections] - CDC- Atlanta, Vibrio Infections: https://www.cdc.gov/vibrio/index.html 	WHERE CAN I FIND MORE INFO?

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