

# DISEASES

## FOOD & WATER BORNE DISEASES

### Bacteria

1. Botulism Poisoning - *Clostridium botulinum*
2. *Clostridium perfringens*
3. Campylobacteriosis - *Campylobacter jejuni*
4. Cholera - *Vibrio cholerae*
5. *Vibrio parahaemolyticus*
6. "E. coli" - *Escherichia coli* 0157:H7
7. Shigellosis - *Shigella* sp.
8. Salmonellosis - *Salmonella* sp.
9. Staph Food Poisoning - *Staphylococcus aureus*

### Viruses

1. Hepatitis A
2. Norwalk Virus

### Other Larger Parasites

1. Amoebic Encephalitis - *Acanthamoeba*
2. Galloping Amoeba - *Entamoeba histolytica*
3. Giardiasis - *Giardia lamblia*
4. Cryptosporidiosis - *Cryptosporidium parvum*
5. Trichinosis - *Trichinella spiralis*
6. Taeniasis - *Taenia solium*

## INSECT AND ANIMAL BORNE DISEASES

1. Colorado Tick Fever
2. Encephalitis
3. Hantavirus Pulmonary Syndrome
4. Lyme Disease
5. Plague
6. Rabies
7. Rocky Mountain Spotted Fever
8. Tick Relapsing Fever
9. Tularemia

## QUIZ

# DISEASES

**T**HE LAST THING most people associate with a backcountry experience is the possibility of contracting a disease while enjoying the wilderness. However, the risk of illness is very real, and people need to be aware of diseases that may be present and how to avoid exposure to these diseases. Although there are a number of ways to contract diseases while visiting backcountry areas, experienced travelers prepare for these risks in the same way that they prepare for inclement weather or difficult terrain. People may be exposed to diseases through contact with wild animals, such as bats, skunks, fox, rodents, muskrats, beaver as well as deer and elk. Any of these animals may be carriers of diseases, so it is important to avoid direct contact with wild animals while camping, hiking, hunting, boating, or engaging in other activities.

Backcountry users need to be concerned especially with infectious diseases that can be transmitted from animals to humans or from humans to humans. Diseases that are transmitted from wild and domestic animals to humans are called zoonotic diseases. Many of these diseases are shed by animals through their digestive tracts that may end up in surface waters that are used for recreating and drinking. Other types of diseases may be transmitted to people from improperly handled food and water. It is also possible to get sick from animal bites, insect bites, or having close contact with animals or their burrows.

Diseases may be caused by a variety of microorganisms, such as bacteria, viruses, protozoa and fungi. The following sections review common diseases associated with food water and wildlife. The discussion of each disease includes the cause, stages, prevention and control measures.

## FOOD BORNE & WATER BORNE DISEASES

In the United States the Centers for Disease Control and Prevention estimates that 76 million people become ill with food borne disease resulting in about 325,000 thousand hospitalizations and 5000 deaths each year<sup>(1)</sup>. From 1997 to 1998 the Centers for Disease Control and Prevention reported 4,166 illnesses from contaminated drinking water and recreational water exposure in the United States<sup>(2)</sup>. Nevertheless, most food borne outbreaks go unreported because many food borne illnesses are self-limiting and few seek medical attention. However, groups that may be at a higher risk of becoming seriously ill from a food borne or water borne disease are the elderly, pre-school aged children, pregnant women and immunocompromised individuals. Disease-causing agents are not detectable in food. Food that is contaminated with disease-causing microorganisms and/ or their toxins may look, smell and taste fine. This is one reason that there are so many food borne outbreaks each year in the United States.

A food borne or water borne outbreak is defined by the Centers for Disease Control and Prevention (CDC) as “the occurrence of two or more cases of similar illness resulting from the ingestion of a common food”. When investigating a possible food borne disease outbreak epidemiologists collect information about each individual’s food history, incubation period, signs and symptoms and duration of illness. A food history is important since most food borne diseases take anywhere from several hours to days or even weeks before symptoms may occur. The incubation period is measured from the time contaminated food is consumed to the first signs and symptoms. All of this information assists an epidemiologist in determining what type of organism caused an outbreak. However, in order to identify the cause of a disease with certainty, samples of the incriminated food or water must be taken and analyzed along with stool or sputum samples from sick individuals.



To prevent food and water borne diseases, backcountry users need to decide what types of food to take on a trip, and how food will be stored and prepared. Also, care must be taken when selecting a water purification device. In most cases, food borne and water borne diseases may be prevented by implementing simple water purification procedures and safe food handling methods. These steps are outlined in both the Water Purification and Food Sections provided

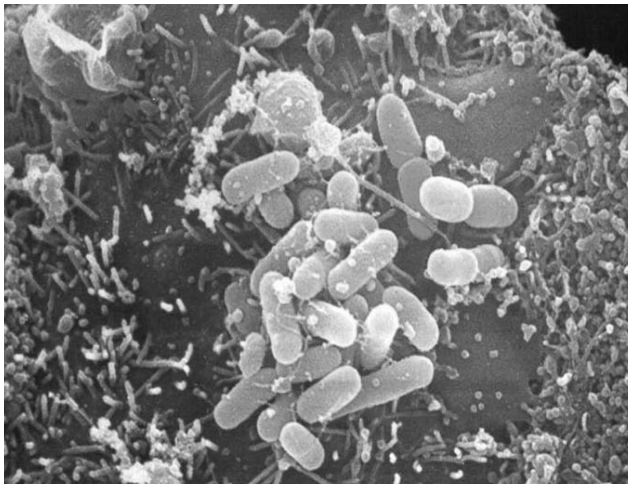
in this manual. The following sections cover the most common water and food borne diseases and provide information about the stages of each disease, how it's transmitted, common sources and steps to prevent disease.

## BACTERIA

Bacteria are single celled organisms that are capable of growing and reproducing without the aid of a host. A single bacterial is invisible to a human eye. Bacteria cells may be round, rod-shaped, or spiral-shaped. Some bacteria are capable of forming spores that protect them from extreme heat and cold conditions. After a bacteria forms a spore it cannot grow or multiply, but once the environment changes and there are food, moisture and ideal temperatures bacteria will come out of their spores and reproduce. More detailed information about bacteria may be found in Appendix A.

### Rod-Shaped Bacteria

Bacteria need moisture, temperature, pH (acidic and basic environment) and food to grow and multiply. All of these conditions are present in potentially



hazardous food. Potentially hazardous food is defined by the Food and Drug Administration as food that can support the growth of disease-causing bacteria. Foods that are potentially hazardous include raw and cooked meat (fish, beef, pork, poultry, sheep, etc.), cooked vegetables, raw sprouts (bean, clover and alfalfa), any type of cut melons, cooked legumes, cooked grains, dairy products, chopped garlic in oil and whole fresh eggs.

Given that all of these foods can support the growth of disease-causing bacteria, they must be held at and cooked to proper temperatures to prevent disease (Proper preparation, cooking and holding procedures are discussed in detail in the Food Section of this manual).

### **Botulism Poisoning** <sup>(3,4)</sup>

#### What is it?

Botulism is a food poisoning that is caused by a bacterium called *Clostridium botulinum*. This bacterium produces a toxin in packaged and canned food, such as canned vegetables and packaged meat products. *Clostridium botulinum* produces that may be destroyed by heat (boiling temperatures).

**Where is it found?**

*Clostridium botulinum* is worldwide and may be found in soil, sediment of lakes and ponds, and in the digestive tract of fish and other animals.

**How is the disease spread?**

Botulism toxin is produced in low acid food if canned food, such as vegetables, meat and fish are improperly packaged and prepared. Hermetically sealed packages and canned food may become contaminated with botulism bacteria if a can is damaged especially on a seam.

Poisoning occurs from eating contaminated food. Only a small amount of contaminated food may result in illness. The disease is not spread from person to person.

Foods that have been associated with food borne botulism outbreaks in the United States are home canned vegetables and low acid fruits, dried whole fish (with intestines), sautéed onions, chopped garlic in oil and baked potatoes.

**Stages of Disease**

The incubation period ranges from 12 to 36 hours. The shorter the incubation period the more severe the disease and the higher the fatality rate.

Once eaten the toxin causes muscle paralysis that progresses throughout the body, starting from the eyes downward. The first signs and symptoms exhibited are blurred or double vision, vomiting and constipation or diarrhea, followed by a dry mouth, difficulty speaking and swallowing, and failure to breathe.

The fatality rate in the United States for botulism poisoning is 5% to 10%. However, for those who survive, recovery is a slow process and may take months.

**Treatment**

Treatment for botulism poisoning is the use of an antitoxin, and respiratory support to prevent hypoxia (oxygen deficiency). Seek care from an emergency room, urgent care center or primary doctor.

**Prevention**

The disease can be avoided by not consuming food from damaged or bulged hermetically sealed cans or packages. Backcountry operators cannot serve “home” canned or hermetically packaged food to guests because home processing is inconsistent and may fail to destroy all botulism spores, therefore increasing the risk of botulism poisoning. Hermetically processed food for

guests must be from an approved commercial source, and in good physical condition. Canned or packaged low acid food, such as vegetables and meats, should be boiled prior to consumption as an extra precaution in case a container has physical damage that is invisible.

Other actions that may be taken include immediate chilling (do not allow the food to sit at “room” temperature) of baked potatoes and other cooked vegetables to 45°F within 4 hours to prevent bacteria like botulism from growing and producing their toxins. Also, opened packages and containers of low acid food must be immediately placed in an ice chest at 45°F or less to prevent bacterial growth.

### ***Clostridium perfringens*<sup>(3,4)</sup>**

#### **What is it?**

The bacterium grows without oxygen in potentially hazardous food and once consumed infects the digestive tract and releases a toxin that results in illness.

#### **Where is it found?**

*Clostridium perfringens* is found in soil, sediment and in the digestive tracts of healthy humans and other animals.

#### **How is the disease spread?**

Food borne illness occurs from improper cooking practices. This bacterium rapidly grows in potentially hazardous food, such as meat, meat products and gravies.

#### **Stages of Disease**

Signs and symptoms usually begin 6 to 24 hours after the food is consumed and lasts for about one to two days. Typical signs and symptoms are abdominal cramps, diarrhea and nausea; vomiting and fever are usually absent. Death is rare in healthy people.

#### **Treatment**

In most cases treatment is not required, but when it is, fluids and electrolyte replacement are given.

#### **Prevention**

The best way to prevent this food borne disease is the proper cooling and reheating of potentially hazardous food, since bacterial spores survive cooking temperatures. To properly cool food, hot food needs to be placed in shallow containers in small quantities so the food is no greater than two inches deep. Hot food must be placed in a cooler immediately so it will cool to 45°F within

4 hours. However, on a backcountry trip cooling food may not be possible, and should be avoided (dispose leftover food).

Additional preventive steps in proper food practices are to rapidly reheat food to 165°F before it is served hot and do not hold food in a cooler at 45°F for longer than 4 days. The latter precaution is necessary because bacteria can grow and multiply at 45°F, and after four days bacterial numbers may be great enough to cause a food borne outbreak.

## ***Campylobacteriosis***<sup>(3,4)</sup>

### **What is it?**

This is an acute zoonotic disease caused by a curved-shaped rod bacterium. This disease-causing bacterium both infects and produces a toxin in the digestive tract. It is believed that this toxin causes diarrhea. This disease is the leading cause of diarrhea in the United States, resulting in 4 to 6 million cases each year.

### **Where is it found?**

Animals that commonly carry this disease include healthy cattle, chickens, birds, puppies, kittens, swine, sheep, rodents and flies. While most of these animals carry the organism in their digestive tracts, flies carry microorganisms externally on their bodies. A fly can spread the disease by picking up microbial “hitch hikers”, on their legs and mouth-parts and deposit these organisms by landing or walking on food and water. The other animals carry this bacteria in their digestive tracts. Other sources of this disease include untreated drinking water, such as water from springs, streams, rivers and lakes, and raw dairy products.

### **How is the disease spread?**

This disease may be spread from animal to human or from human to human. The disease may also be spread from human or animal fecal contamination of food and water, or from consuming improperly cooked poultry products.

*Campylobacter jejuni* occurs everywhere in the world. In fact, this bacterium is the cause of 5% to 14% diarrhea worldwide, especially in children 2 years and younger.

### **Stages of Disease**

The incubation period for this disease is 2 to 5 days, and lasts anywhere from 2 to 10 days. Typical symptoms include watery or sticky diarrhea (which can contain blood), fever, abdominal pain, nausea, headache and muscle pain. The period of communicability (when the disease may be spread from feces)

is the entire duration of the disease, but some infections may have no symptoms. Complications and relapses of this disease are infrequent, and the fatality rate is one in a 1000.

### **Treatment**

Antibiotic treatment is usually not necessary and most individuals are treated with fluids and replacement of lost electrolytes.

### **Prevention**

It is thought that most of the illnesses are caused by eating undercooked poultry. Surveys indicate that 20% to 100% of commercial chickens are contaminated with *Campylobacter*. To prevent this disease, all poultry must be cooked throughout to at least 165°F for 15 seconds to kill this bacterium. It is equally important to sanitize all food contact surfaces after preparation of poultry to prevent cross-contamination to other food.

Good hygienic practices prevent the spread of diseases, such as *Campylobacter*. After handling poultry and poultry products, hands need to be lathered with soap and washed for 20 seconds in 110°F water to remove gross debris and microorganisms.

## **Cholera<sup>(3,4)</sup>**

### **What is it?**

The disease Cholera is a bacterium called *Vibrio cholerae*. Cholera is caused by several different bacterial groups, some cause more severe disease than others. All groups that cause this disease produce a toxin in the digestive tract. It takes about one million bacterial cells to cause disease in an individual.

### **Where is it found?**

Humans are the primary reservoir for this disease; however, “environmental” reservoirs have been identified in association with marine crustaceans including lobsters, shrimps, crabs and barnacles. In the United States, the Gulf of Mexico coast has been identified as an environmental reservoir for this organism.

### **How is the disease spread?**

Transmission is through eating of food or drinking contaminated water with feces or vomitus. While the last outbreaks of Cholera occurred in the United States around 1911, there has been a steady increase of isolated cases in the nation that has been attributed to worldwide travel. Most of these cases have involved bottled water, ice, ice cream, cooked rice, produce and raw or undercooked seafood from polluted waters.



## Stages of Disease

Symptoms usually appear within 2 to 3 days after eating or drinking contaminated food or water. This disease is identified by sudden onset of profuse painless, watery diarrhea (“rice water” stools), nausea and vomiting. This rapid onset of painless watery diarrhea results in rapid dehydration, which may lead to renal failure in severe, untreated cases. The fatality rate for this disease may exceed 50% if the severe disease goes untreated, and is less than 1% if individuals receive proper treatment immediately.

Individuals are contagious when they have signs and symptoms, but some individuals may remain contagious several months after they recover. Someone who appears healthy may be shedding cholera organisms from their feces, which can be transmitted to other people through food or water if this person does not practice good hygienic practices.

## Treatment

The treatment of Cholera is aggressive fluid and electrolyte replacement and treatment of secondary complications from the disease. Anti-microbial treatment is also used by doctors as a supplemental treatment to reduce the numbers of bacteria in the digestive tract, and to shorten the period of communicability.

## Prevention

The best prevention is to obtain water from approved sources or properly treat any surface water so the bacteria are effectively removed. Cholera is primarily associated with poor sanitation, where human sewage contaminates drinking waters and coastal waters. Seafood such as fish and shellfish is also a source, especially if the seafood is eaten raw or undercooked. All seafood served by commercial operators must be obtained from an approved sources, and the Shucker-Packer Interstate Certificate Number must be obtained and kept for at least 90 days for all shellfish. However, “High Risk” individuals may not be served undercooked seafood because of the increased risk of infection and complications. Raw or undercooked seafood cannot be served to “High Risk” customers. However, if guests are not designated as “High Risk”, then raw or undercooked seafood may be prepared and served to them as long as they have been advised of the hazards (Consumer advisory requirements are discussed in the Food Section of this workbook).

## ***Vibrio parahaemolyticus***<sup>(3,4)</sup>

### What is it?

This bacterium causes disease that is less severe than *Vibrio cholerae*. The disease is self-limiting that in that symptoms usually are mild in healthy

individuals. It produces a toxin in the digestive tract similar to Cholera. The infective dose is more than a million bacterial cells.

### **Where is it found?**

Like Cholera, this bacterium is also found in marine coastal environments (in the water during warmer months and in the sediment during colder months).

### **How is the disease spread?**

This organism is more widespread in the United States than Cholera, and outbreaks involve raw or undercooked seafood.

### **Stages of Disease**

Within 12 to 24 hours after consumption of contaminated food or water, symptoms begin with watery diarrhea, abdominal cramps, and sometimes nausea, vomiting, fever and headache. Occasionally, symptoms include bloody or mucoid stools, high fever and high white blood cell count.

The disease is usually very self-limiting and recovery occurs within one to seven days, and death rarely occurs.

Unlike Cholera, this disease is not communicable (not spread from person to person).

### **Treatment**

If treatment is required, it includes fluids and electrolyte replacement.

### **Prevention**

Properly store and cook marine fish and shellfish. Seafood must be stored cold at 45°F or less and cooked thoroughly to 145°F or greater for 15 seconds if the seafood is whole and intact. However, if the seafood is ground it must be cooked to 155°F or greater for 15 seconds, and if the seafood is stuffed it must be cooked to 165°F or greater for 15 seconds.

Care must be taken to prevent cross-contamination when handling raw seafood. Do not store raw seafood immediately over or next to ready-to-eat food (food that is not heated after handling), wash and sanitize all surfaces after preparing raw seafood and thoroughly wash hands after preparation.

Please remember if shellfish is brought on a backcountry trip that the Shucker-Packer Interstate Certificate Number (SPICN) must be kept for at least 90 days after shellfish are purchased. This number indicates where and when shellfish were harvested, which critical information especially if there is an outbreak from shellfish.

Raw or undercooked seafood cannot be served to “High Risk” customers. However, if guests are not designated as “High Risk”, then raw or undercooked seafood may be prepared and served to them as long as they have been advised of the hazards (Consumer advisory requirements are discussed in the Food Section of this workbook).

### ■ **“E. coli” 0157:H7<sup>(3,4)</sup>**

#### **What is it?**

The disease is caused by *Escherichia coli* 0157:H7. Bacteria produce toxins in the digestive tract called. Production of the toxins depends on the presence of certain phage, which are carried by the bacteria. It takes anywhere from 10 to 15 bacterial cells to cause disease in an individual.

#### **Where is it found?**

Cattle are the most likely host, but sheep and humans may carry the disease as well. In addition, there is increasing evidence that North American deer may also carry the disease.

#### **How is the disease spread?**

Disease occurs primarily from ingestion of undercooked beef patties, unpasteurized milk, unpasteurized apple cider, contaminated alfalfa sprouts and person to person transmission. Cases have been reported from contaminated drinking water sources and from swimming in a contaminated lake.

#### **Stages of Disease**

The incubation period range is from 2 to 8 days, and infected individuals are contagious for one week or less however. However, one third of children may remain communicable for up to 3 weeks. The signs and symptoms of the disease include severe abdominal cramps, diarrhea (which is initially watery but becomes grossly bloody) and occasionally vomiting. Fever is either low-grade or absent.

The disease may be mild with recovery in about 8 days. However, up to 7% of all cases can become more severe.

#### **Treatment**

Treatment is mainly fluid and electrolyte replacement.

#### **Prevention**

The primary foods of concern are ground beef, unpasteurized milk and juice and alfalfa sprouts. To prevent illness from ground meat, all ground meat such as beef must be cooked throughout to 155°F or greater for 15 seconds. Care

must also be taken to prevent cross-contamination during preparation, storage and transportation.

Only pasteurized dairy products and juice may be served to backcountry guests, and alfalfa sprouts must be thoroughly washed to remove debris and microbes.

If undercooked ground meat is prepared and served to guests, then they must be advised of the potential hazards, as outlined in the Consumer Advisory portion of the Food Section. However, if a backcountry group is a “high risk” group, then an operator may not serve them undercooked ground meat, alfalfa sprouts or unpasteurized juice or milk.

### ***Shigellosis***<sup>(3,4)</sup>

#### **What is it?**

There are four different species of *Shigella* that cause the disease named Shigellosis. *Shigella* bacteria infect the digestive tract of mainly humans, and in some infections produce a toxin that may damage the intestinal lining.

#### **Where is it found?**

Humans are the primary source of *Shigella*, with monkeys occasionally acting as carriers.

#### **How is the disease spread?**

Primary transmission is the fecal/oral route. Most cases are due to poor hygienic practices, especially the lack of or poor hand washing methods, and water contaminated with human feces.

This disease is responsible for about 600,000 deaths per year worldwide. Most of the deaths involve children 10 years or younger. In the United States Shigellosis accounts for up to 300,000 diarrheal cases per year, and the fatality rate is a function of the health of an individual. The fatality rate can be as high as 20% among high risk groups, such as hospitalized patients.

#### **Stages of Disease**

The signs and symptoms of the disease begin anywhere from 12 to 96 hours after consuming as few as 10 to 100 bacterial cells. The symptoms include fever, nausea, vomiting, abdominal cramps and watery or bloody diarrhea. The disease is usually self-limiting for healthy individuals and recovery occurs anywhere from 4 to 7 days.

Individuals may be contagious up to 4 weeks after symptoms end.

### **Treatment**

For most cases, only fluid and electrolyte replacement is needed. However, for high risk individuals anti-microbial treatment may be prescribed by a physician.

### **Prevention**

To prevent the spread of diseases such as Shigellosis, great care must be taken to wash hands. The following hand washing procedure must be used before preparing food, before purifying water, after toilet duty, or after handling waste:

- Wash exposed hands, wrists and arms for 20 seconds in
- Warm water (110°F) with
- Soap all exposed areas to a lather, then
- Rinse soap off and
- Air dry or dry with a paper towel

It is also important to treat all untreated water by following the steps outlined in the water Purification Section of this manual.

## ***Salmonellosis***<sup>(3,4)</sup>

### **What is it?**

These disease agents cause the disease known as Salmonellosis. There are more than 2,000 different types of *Salmonella*. There is evidence that these bacteria produce a toxin when embedded in the intestinal tract that may contribute to symptoms.

### **Where is it found?**

Animals that are common carriers of the disease include poultry and swine, but also may include cattle, rodents, iguanas, turtles, tortoises, terrapins, dogs, cats and humans.

### **How is the disease spread?**

The majority of the cases result from contaminated food and water, improperly cooked poultry and poultry products, improperly cooked eggs and egg products, improperly pasteurized milk and milk products, improperly sanitized kitchen surfaces and fecal/oral transmission due to improper hand washing.

### **Stages of Disease**

Symptoms usually occur with sudden onset of headache, fever, abdominal cramps, diarrhea, nausea and sometimes vomiting. Most infections with this

organism result in inflammation of the intestines, but in some cases the infection may develop into septicemia (infection of the blood) or localize in a body tissue. Deaths with this disease are uncommon, however, death may be more frequent with high risk groups, such as young children, the elderly, or high risk individuals.

Infected individuals are communicable throughout the acute phases of the disease. However, some may develop into a “carrier” state where no signs and symptoms are exhibited, but the organism still is present for several months, but in rare cases it may last up to a year or longer.

### **Treatment**

Most cases only require fluid and electrolyte replacement, but antibiotic treatment may be prescribed by physicians for high-risk individuals.

### **Prevention**

To prevent disease:

- Wash hands thoroughly before handling or preparing food using the hand washing procedures found in the Food Section of this manual,
- Sanitize kitchen surfaces,
- Store raw poultry or poultry products away from other food,
- Cook eggs and egg products to 145°F for 15 seconds,
- Cook poultry and poultry products to 165°F for 15 seconds,
- Use pasteurized milk and milk products and
- Store potentially hazardous food cold at 45°F or less.

Insects such as flies may also be a source of disease by mechanically transporting disease-causing organisms from feces to food and water. Therefore, toilet facilities must be properly covered when they are not being used to keep flies from accessing waste.

## **Staph Food Poisoning<sup>(3,4)</sup>**

### **What is it?**

Staph food poisoning is caused by a round-shaped bacterium known as *Staphylococcus aureus*. These bacteria produce a toxin as they eat and grow in potentially hazardous food that cannot be destroyed by cooking temperatures. It is this toxin that causes the symptoms of the illness.

### **Where is it found?**

Twenty five percent of the population carries this bacterium in the nose and throat, on hair and on skin of the face and hands. Dairy cattle (especially with infected udders), dogs and fowl also may serve as hosts for this microbe.

### How is the disease spread?

A human carrier introduces the organism to food, and if the food is held at improper temperatures, bacteria produce the heat stable toxin. The toxin cannot be detected in food by smell, taste or sight. Fortunately, this disease cannot be transmitted from human to human.

Foods that this organism commonly grows on include sandwiches, lunchmeat, salami, cooked ham, salad dressings, pastries and custards.

### Stages of Disease

The incubation period ranges from 30 minutes to 8 hours. Food poisoning caused by this organism is characterized by abrupt onset with severe nausea, cramps, vomiting and diarrhea. The intoxication lasts anywhere from one to two days, and deaths are rare.

### Treatment

Patients are treated with fluids and electrolyte replacement.

### Prevention

Education of food handlers is a primary prevention for this disease. Food handlers must follow:

- A strict hand washing regime as described in the Food section of this manual,
- Avoid bare hand contact with ready-to-eat foods, such as lunchmeat, salad dressings, custards and cream-filled pastries,
- Hold potentially hazardous food at proper cold temperatures of 45°F or less and
- Properly chill hot food to 45°F within 4 hours (However, the use of leftovers by backcountry operators is not recommended because of the increased risk of Staph Food Poisoning).

Also, food servers with lesions on their hands, wrists, upper arms, or face need to be restricted and/or excluded from preparing food. It is very important that food handlers wear disposable gloves or use utensils when preparing ready-to-eat foods.

## VIRUSES

Viruses are infectious agents that can be found inside cells (Figure A). They infect a host by attaching to a cell, dissolving a small section of the cell wall and invading the cell through this opening. The virus' single strand of genetic material then acts like a computer programmer and programs the host's cell to make more viruses. The cell eventually becomes filled with viruses and eventually the cell explodes, which allows the new viruses to invade other cells.

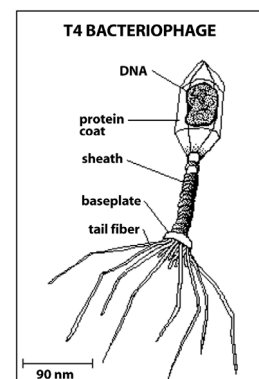


Figure A.

Because all viral diseases are intracellular infections, antibiotics cannot successfully treat viral diseases, since host cells would have to be destroyed in order to destroy the invading viruses.

## **Hepatitis A<sup>(3,4)</sup>**

### **What is it?**

Hepatitis A causes the disease known as Infectious Hepatitis, which is transmitted by the fecal/oral route, that infects the liver.

### **Where is it found?**

Humans are the primary source of Infectious Hepatitis, with chimpanzees acting as a source in rare instances.

### **How is the disease spread?**

Transmission is through the fecal/oral route and contamination of food and water. This is why poor sanitation and over crowded conditions may lead to outbreaks of this disease. Other practices commonly associated with this disease are poor hygienic practices, improper food handling and poor diaper changing practices at day care facilities.

Hepatitis A occurs worldwide, with about 22,700 cases are reported annually in the United States.

### **Stages of Disease**

After an incubation period ranging from 15 to 50 days, onset is usually abrupt, with fever, overall discomfort, loss of appetite, nausea, and abdominal discomfort followed by jaundice (skin turns a yellow color). Only 10 to 100 viral particles are required to cause disease in a person. Most cases resolve within 1 to 2 weeks; however, about 15% of cases can take months to recover. There are a few cases where Hepatitis A may relapse for up to a year. Rarely do people die from this disease, but for high-risk individuals it may be fatal.

People are highly contagious one to two weeks before onset of symptoms and may continue to shed the virus in their feces up to one week after jaundice.

### **Treatment**

Contacts must receive immunization with immunoglobulin within 2 weeks by a physician. However, after symptoms begin there is no specific treatment, just support care.



Hepatitis A vaccine (2 doses) is recommended for persons at high risk for contracting hepatitis A virus, such as children who live in areas that have a high incidence, or individuals who work around human feces.

### **Prevention**

Good sanitation practices are crucial for prevention as well as education for food handlers. It also is essential to:

- Properly treat raw water sources prior to consumption;
- Take care during toilet handling, transportation and clean up;
- Employ proper hand wash procedures as described in the Food section of this manual;
- Cook shellfish to 145°F for 15 minutes and retain the Shucker-Packer Interstate certificate number from the shellfish case for 90 days (However, if raw or undercooked shellfish is served to guests, then backcountry operators must provide a consumer advisory. If the backcountry operator is catering for an identified “high” risk group or individual, then raw or undercooked shellfish may not be served.)

### **Norwalk Virus<sup>(3,4)</sup>**

#### **What is it?**

Norwalk-like Virus infects digestive tracts of humans.

#### **Where is it found?**

Humans constitute the only known carrier for this disease.

#### **How is the disease spread?**

This disease has been identified as the most common cause of non-bacterial gastroenteritis outbreaks in the United States. In the United States most outbreaks are linked to the consumption of raw or undercooked shellfish. Other outbreaks have been associated with fecal contamination of food, drinking water, and recreational water. The disease is transmitted by the fecal/oral route, and it is believed that human to human transmission may occur. The period of communicability occurs during the acute stage of the disease and may last up to 48 hours after diarrhea ends.

#### **Stages of Disease**

This is considered a self-limiting, mild disease that begins after 10 to 50 hours with nausea, vomiting, diarrhea, abdominal pain, muscle aches, headache, overall discomfort and a low grade fever. The symptoms usually last 24 to 48 hours and death from this disease is rare.

## **Treatment**

There is no specific treatment prescribed for this disease, just supportive care that includes fluid and electrolyte replacement.

## **Prevention**

Prevention guidelines are the same as for Hepatitis A, and they include:

- Good hand wash practices during food preparation, which can be found in the Food Section of this manual;
- Proper handling of toilet waste;
- Adequate cooking of shellfish to 145°F for 15 seconds (If shellfish is served undercooked or raw then a consumer advisory must be given to guests, however, if guests are “high” risk then all shellfish must be adequately cooked);
- Proper treatment of drinking water;
- Proper sanitizing of kitchen and equipment surfaces; and
- Proper storage of raw shellfish to prevent cross-contamination to other food

## **OTHER LARGER PARASITES**

Parasites have become a concern with public and recreational water safety. Both *Giardia* and *Cryptosporidium* are leading causes of water borne disease in the United States. Parasites can be found in all types of environments, and are capable of surviving extreme conditions like the North Pole and in hot springs. This is because parasites like *Giardia* and *Cryptosporidium* produce cysts that protect them from extreme environmental conditions. These cysts can even endure normal concentrations of disinfectants, which is why raw water must be filtered.

Parasites can invade humans. Many of these pathogens are able to escape the human immune system, thus, causing an infection that may persist for a long time.

### ***Amoebic Encephalitis*<sup>(3,4)</sup>**

#### **What is it?**

There are several amoebas that can invade the brain. They reach the brain by first entering the nose and then moving up into the brain.

#### **Where is it found?**

These amoebas live in both soil and fresh water.

#### **How is the disease spread?**

These amoebas are found all over the world. They commonly are found in stagnant water, lakes, ponds, hot tubs, spas, natural hot-springs, effluent from

wastewater treatment plants and poorly maintained swimming pool water.

Disease normally occurs during warmer months and may infect healthy individuals that swim in infected waters. The likelihood of infection is increased if water is forced through the nose by diving or swimming underwater.

### **Stages of Disease**

The incubation period for this disease can be 3 to 7 days, or much longer in some cases. Symptoms include sore throat, severe frontal headache, occasional hallucinations, nausea, vomiting, high fever followed by death within 10 days.

### **Treatment**

Although recoveries rarely are documented, there are several prescription drugs that may be used to treat these infections.

### **Prevention**

While visiting the backcountry, avoid swimming or diving in stagnant water, ponds, natural hot-springs, water contaminated with effluent, or lakes where these amoebas have been identified.

## ***Galloping Amoeba*<sup>(3,4)</sup>**

### **What is it?**

The disease is caused by an amoeba called *Entamoeba histolytica*. This parasite has two forms, cysts that are the infective form and a non-cyst form. Infection begins after a cyst found in contaminated water or food is swallowed. Once swallowed, the parasites may secrete toxins into the stomach lining that cause signs and symptoms.

### **Where is it found?**

Humans are the hosts for this disease-causing agent.

### **How is the disease spread?**

This amoeba is found everywhere in the environment, and is transmitted by the fecal/oral route. The disease may be transmitted through contaminated food and water. Amoeba cysts are very resistant to normal concentrations of chlorine that is used for water treatment.

There is a higher prevalence of Amoebiasis in areas with poor sanitation, and there is a higher incidence of this disease in young adults.

### **Stages of Disease**

If symptoms are present, they may include abdominal discomfort, bloody or mucoid diarrhea, fever, and chills. Symptoms mainly are dependent on an individual's health. Unhealthy individuals will have less resistance to this disease than someone who is healthy. In most cases the disease is self-limiting.

Without treatment the disease and symptoms may last for years, and the infected individual will remain contagious during this time.

It only takes one cyst to become infected and the incubation period is commonly 2 to 4 weeks before symptoms appear.

### **Treatment**

Acute Amoebiasis should be treated by a physician.

### **Prevention**

To prevent the spread of this disease, the following guidelines must be followed:

- Provide sanitary disposal of human feces and prevent exposure to feces during toilet set up, removal and disposal.
- Provide proper hand wash set up and employ proper hand wash procedures (as found in the Food section of this manual) before and after handling of toilet facility and equipment.
- Prior to consumption, wash all produce thoroughly in treated water to remove contaminants.
- Treat all "raw" water by using one of the methods provided in the water purification section of this manual.

### ***Giardiasis*<sup>(3,4,6)</sup>**

#### **What is it?**

The disease agent is a parasite that has two forms: the cyst is the infective stage that is excreted in feces, and the non-cyst form is the stage that lives and multiplies in the small intestine of humans. The disease may cause inadequate absorption of fats and fat-soluble vitamins during the infection. The infective form of *Giardia* is resistant to cold temperatures and normal concentrations of disinfectants used to treat water. Therefore, to ensure that cysts are removed from "raw" water, water must be filtered to physically remove the hardy cysts.

#### **Where is it found?**

Humans, as well as other animals such as rats, mice, dogs, cats, beavers, muskrats, gerbils, and mule deer may carry *Giardia* that may infect humans. However, beavers and muskrats are the most likely source for human infections.

Feces from humans and other animals increase the presence of Giardiasis in the environment. This disease may occur if untreated water is consumed from surface water sources like streams, lakes or rivers.

### **How is the disease spread?**

*Giardia* is transmitted via the fecal/oral route through water and food and the disease is frequently spread from person to person as well. *Giardia* sometimes is referred to as “travelers” disease. Large water borne outbreaks have occurred, and illness has been associated with consumption of water from unfiltered surface water sources or shallow wells, and during water recreational activities. According to the World Health Organization, Giardiasis is the most commonly reported water borne disease worldwide.



The disease is more prevalent in young children and infants, but anyone can get the disease if they consume contaminated food or water.

### **Stages of Disease**

Between 50% to 70% of infected individuals show no symptoms, but still can spread the disease. However, people who have symptoms may experience chronic diarrhea, abdominal cramps, bloating, excess gas, pale greasy and foul smelling stools and weight loss. In severe cases the cells of the intestinal lining may become damaged, but in most cases the disease is self-limiting unless individuals are a health risk. Fortunately, deaths due to Giardiasis are rare.

It takes one or more cysts to cause infection, with an average incubation period of 7 to 10 days. Duration of the disease varies from 3 to 4 days, or months depending on the health of the infected individual, but most recover in 1 to 4 weeks without complications. However, some cases become chronic, and are characterized with recurrent, persistent brief episodes of loose foul-smelling stools that can last for months without treatment. The *Giardia* organisms may be spread throughout the entire duration of infection, with or without symptoms. This is probably why the disease is widespread, since many infected individuals do not realize they are infected and may easily spread the disease if they do not practice good hygiene.

### **Treatment**

Giardiasis must be treated by a physician.

### **Prevention**

*Giardia* may be present in any surface water source and, therefore, it is critical that these sources be properly disinfected and filtered to remove cysts. It is equally important to properly handle, transport and dispose of human feces during a backcountry trip. All toilet units and equipment must be stored in

tightly sealed containers and properly disinfected during a trip. Also, backcountry operators must implement proper hand wash procedures (as found in the Food section of this manual) during a trip to prevent the spread of diseases like Giardiasis after using and handling portable toilets and equipment.

## ■ ***Cryptosporidiosis***<sup>(3,4,7)</sup>

### **What is it?**

*Cryptosporidium parvum*, a parasite, is the primary disease-causing agent for humans.

These parasites are extremely resistant to environmental conditions, especially in cold water temperatures, and to normal concentrations of water disinfectants like chlorine and iodine. Symptoms of the disease are caused by the disruption of intestinal absorption and secretion by the protozoan parasite.

### **Where is it found?**

Humans as well as other animals including cattle, sheep, pigs, goats, deer and horses are common sources. These sources contribute to environmental contamination of watersheds, foods and recreational waters.

### **How is the disease spread?**

*Cryptosporidium* is widespread in surface waters and is common worldwide. It is estimated that there are over one million cases annually throughout the world.

Transmission is person to person, or animal to person by the fecal/oral route. However, transmission may occur when human and/or animal feces contaminate food and water sources.

### **Stages of Disease**

An infective dose ranges from 30 to a million oocysts, depending on the individual. Symptoms of the disease occur between 7 to 9 days after parasites are consumed. Signs primarily include profuse watery diarrhea that resolves itself in less than 30 days. However, other symptoms may include fever, anorexia, nausea, abdominal cramps, vomiting, or infection of the respiratory tract. Illness may persist and contribute to death in individuals that have weakened immune systems.

### **Treatment**

Currently, there is no treatment for *Cryptosporidium* other than fluid and electrolyte replacement.

## **Prevention**

Primary prevention includes:

- Proper handling, transportation and disposal of human feces.
- Proper disinfection and filtration of water sources.
- Good personal hygiene for backcountry operators (see hygienic practices in the Food section in this manual)

## ***Trichinosis*<sup>(3,4)</sup>**

### **What is it?**

The disease is caused by a roundworm that is invisible to a human eye. The infection occurs after consumption of undercooked or raw meat from a particular animal, when the roundworms attach to the intestinal wall and lay eggs. After the eggs hatch the larvae move from the intestine and embed in muscle tissues throughout the human body.

### **Where is it found?**

Common sources of Trichinosis include pigs, dogs, cats, horses, rats, bear, walrus and foxes. Infection occurs when raw or undercooked meat from these animals is consumed.

### **How is the disease spread?**

Trichinosis occurs worldwide, and transmission occurs if raw or undercooked meat from infected animals is consumed.

### **Stages of Disease**

The average incubation period for the disease is from 8 to 15 days, and the signs vary in humans depending upon the number of roundworms ingested. The first symptoms that appear are muscle soreness, swollen upper eyelids and fever, followed by orbital pain, retinal hemorrhage, photophobia, sweats, chills, weakness and diarrhea. Death is due to myocardial failure, which is a result of roundworms invading the heart muscle.

### **Treatment**

Infected individuals must be treated by a physician.

### **Prevention**

Primary prevention consists of properly cooking meat from reservoirs of this disease. The proper cooking temperatures for various meats are:

- Whole pork muscle tissue must be cooked throughout to 130°F or greater for at least 15 seconds.
- Ground pork meat or other meat products must be cooked to 155°F or greater for at least 15 seconds.

- Stuffed pork meat or other stuffed meat products must be cooked to 165°F or greater for at least 15 seconds.

Other preventive measures include good hygienic practices and avoidance of cross-contamination. To prevent cross-contamination, raw meat, (such as pork) must be stored away from or below ready-to-eat foods in ice chests or other storage units, and all work surfaces thoroughly sanitized before and after each use.

## INSECT AND ANIMAL BORNE DISEASES

A zoonotic disease is defined as a disease that is transmitted from animals to humans.

Eleven zoonotic diseases are discussed in this section, although many more are known to exist. These eleven diseases were selected because they are the ones to which readers are most likely to become exposed during a backcountry outing.



Zoonotic diseases are transmitted from animals to humans in a variety of ways. Diseases may be transmitted via animal bites, from urine or feces, from direct contact with an infected animal, or from an insect bite if the insect has bitten an infected animal. There are many different insects that may transmit diseases from infected animals to humans. These insects are called vectors. A vector serves as an intermediate host that enables a disease to find its way to

other animals. Insects that “carry” a disease may not be affected by the disease-causing agent. Insects that are common vectors for zoonotic diseases include ticks, fleas, mosquitoes and deer flies.

The following paragraphs provide information about the most commonly encountered zoonotic diseases and their vectors. By learning about the ways these diseases are transmitted, backcountry travelers can minimize their risk of exposure.

### ■ **Colorado Tick Fever**<sup>(4,8,9)</sup>

#### **What is it?**

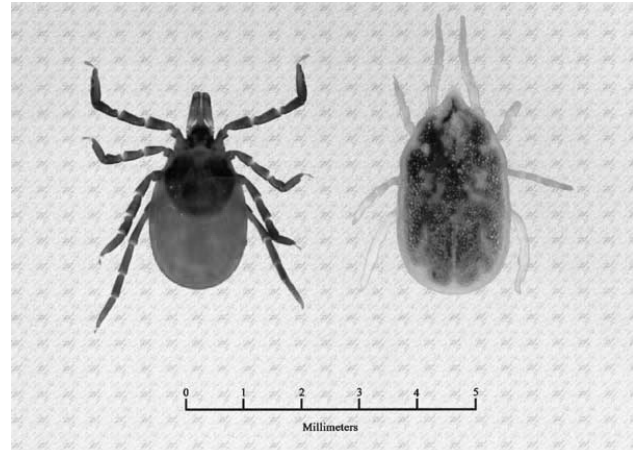
The disease-causing agent is a virus. These viruses are known as arboviruses, which means that the viruses reside in an insect and are transmitted when the



infected insect bites an animal. This is a tick-borne arbovirus and is the only viral disease that is known to be transmitted by ticks.

### **Insect Vector**

The vector for this disease is a tick called *Dermacentor andersoni*. The common name for this tick is the Rocky Mountain wood tick, and it is generally found throughout the western part of the United States and in Canada. This tick inhabits areas with thick brush and an abundance of low-lying vegetation.



An immature tick picks up the virus from an infected animal and carries the virus throughout its life; thus, passing the infective virus to any animal it feeds on.

### **Where is it found?**

The primary sources for Colorado Tick Fever are Golden-Mantle squirrels, chipmunks, pine squirrels, deer mice, porcupines and the Rocky Mountain wood tick.

### **How is the disease spread?**

Colorado Tick Fever is common in mountainous areas above 5,000 feet in elevation in all of the Rocky Mountain States and parts of Canada. Transmission is by the bite of a tick carrying this virus. There is no evidence that this disease is spread from person to person.

### **Stages of Disease**

In three to six days following a tick bite there is sudden onset of fever, headache, pain behind the eyes, severe muscle aches and a rash may occur in a small percentage of cases. The symptoms of this disease occur in two phases. The first phase is the initial onset, which goes away for a brief time, followed by the second phase of fever that lasts 2 to 3 days.

This is considered a moderately severe disease with some cases resulting in encephalitis and myocarditis. However, deaths from this disease are rare.

### **Treatment**

There is no treatment.

## Prevention

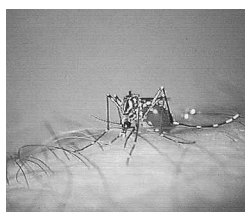
The best prevent to avoid tick bites includes the following:

- Avoid thick, brushy areas during the summer months.
- Wear long sleeves and pants that hang over boots and shoes.
- Check pets for ticks frequently.
- Examine yourself frequently for ticks.
- If ticks are found, remove them immediately and properly. To remove a tick properly, use tweezers to grasp the tick by the mouthparts as close to the skin as possible. Pull the tick straight out with gentle steady pressure. Take care not to squeeze or crush the body of the tick during removal. Wash the bite site with soap and water. Do not use hot matches, cigarettes, fingernail polish, or petroleum jelly to remove ticks as these methods are not effective. It is important to save the tick (preserved in alcohol) for later identification by health officials as it helps assess the risk of disease.

## ■ *Eastern Equine Encephalitis, St. Louis Encephalitis, Western Equine Encephalitis and West Nile Virus*<sup>(16,20,21)</sup>

### What is it?

This disease is caused by an arbovirus, which means that the virus multiplies in a blood-sucking insect like a mosquito and is transmitted by a bite. In nature, arboviruses alternate residence in insect hosts to animal reservoirs.



### Insect Vector

The vectors for Eastern Equine Encephalitis (EEE), Western Equine Encephalitis (WEE), St Louis Encephalitis (SLE) and West Nile Virus (WNV) are mosquitoes. The disease-causing viruses are transmitted by the bite from an infected mosquito.

### Where are they found?

Animal and insect sources for EEE, WEE, SLE and WNV may include birds, rodents, bats, reptiles, amphibians, or mosquitoes.

### How are these diseases spread?

Transmission to humans is from a bite from an infected mosquito. This disease is not spread from person to person.

### Stages of Disease

Eastern Equine Encephalitis (EEE) often causes more severe symptoms than Western Equine Encephalitis (WEE) or St. Louis Encephalitis (SLE). Most people exposed to these viruses have either no symptoms or mild flu-like illness. A small percentage (usually less than 1%) may develop encephalitis, which is characterized by a sudden onset of high fever, headache, meningial

signs, stupor, disorientation, coma, tremors, occasional convulsions and spastic paralysis. Symptoms usually occur between 5 to 15 days after a mosquito bite. The fatality rate for EEE may be from 0.3% to 60% depending on the health and age of the person; whereas, death is uncommon for WEE.

### **Treatment**

There is no specific treatment for either disease, only supportive treatment.

### **Prevention**

The best prevention includes:

- Wearing repellents to prevent mosquito bites.
- Sleeping in a protected area, such as a tent that is properly screened.

## ***Hantavirus Pulmonary Syndrome*<sup>(4,10)</sup>**

### **What is it?**

The disease-causing agent is a virus called Hantavirus. Hantavirus Pulmonary Syndrome was first recognized in 1993 in the Four Corners area of the southwestern part of the United States. The strain of Hantavirus found in the United States is called Sin Nombre Virus, which means virus with no name.

### **Where is it found?**

The primary source for Hantavirus Pulmonary Syndrome (HPS) is the deer mouse, also known the Black-footed deer mouse. However, other species of mice (*Peromyscus maniculatis*), such as the cactus, pinyon and brush mice have been identified as sources for HPS as well. This disease has no known insect vectors.

### **How is the disease spread?**

The disease is transmitted through aerosolization and inhalation of urine, droppings, or saliva from infected mice. Transmission most commonly occurs when cleaning mouse droppings or nests in enclosed areas. The risk is considered to be much lower in open air situations. Avoid sleeping on the ground where there is considerable rodent activity. This disease is not spread from person to person.

### **Stages of Disease**

The first symptoms may appear in a few days to 6 weeks (usually 2 weeks) after inhalation of aerosolized infected mouse urine, droppings, or saliva. The symptoms are flu-like and include



fever, muscle aches, dry-nonproductive coughing, vomiting and abdominal pain (It is interesting to note that the symptoms do not include nasal stuffiness or sore throat). These first symptoms may last 2 to 15 days and are followed by respiratory arrest, which is caused by fluid filling the lungs making it impossible to breath. Death is due to respiratory failure and cardiac shock. The fatality rate is 40% to 50%.

### **Treatment**

There is no specific treatment for HPS, only supportive care.

### **Prevention**

Precautions taken to reduce exposure to this disease during a backcountry trip include:

1. Do not camp next to rodent burrows or nests.
2. Protect food from rodents during a camping trip by storing food in rodent-proof containers.
3. Store garbage in rodent-proof containers during a backcountry trip.
4. Avoid sleeping on the ground to prevent exposure to rodents and their body fluids. If possible, sleep in an enclosure, such as a tent or car, or on a cot off the ground.
5. Avoid camping in a cabin that has evidence of a rodent infestation (presence of droppings and/or nests) unless the cabin is properly cleaned.
6. Proper cleaning of enclosed areas such as a cabin, may include the following:
  - First open all doors and windows to ventilate the enclosed area.
  - Use a disinfectant that destroys viruses, such as household bleach (one part bleach per 9 parts water) on all affected areas.
  - Allow a disinfectant to soak and treat the area for at least 30 minutes.
  - Use gloves and paper towels to “wet” clean the affected areas – NEVER DRY CLEAN! By dry cleaning a rodent infested area, viruses may become aerosolized and inhaled.
  - Dispose contaminated cleaning materials in a garbage bag, tie bag and properly dispose.

## ■ **Lyme Disease<sup>(4,8)</sup>**

### **What is it?**

The disease-causing agent is a bacterium called a *spirochete* because of its spiral-shape.



### **Insect Vector**

Lyme disease is transmitted by a bite from a tick. This tick is commonly known as a blacklegged deer tick.

**Where is it found?**

The primary sources are the blacklegged deer tick and white-footed mice.

**How is the disease spread?**

This disease is common in the United States along the Atlantic coast between Maryland and Massachusetts, and including Wisconsin and Minnesota as well as some areas of California and Oregon.

The disease is transmitted by a bite from an infected tick, and there is evidence indicating that a tick must be attached for 24 hours or longer to transmit the bacterial infection to the animal host.

**Stages of Disease**

Early symptoms occur after an incubation period of 3 to 32 days and include overall discomfort, fatigue, fever, headache, stiff neck, muscle pain and migratory joint pains. However, the most characteristic symptom is a distinctive skin lesion around the tick bite called “erythema migrans”, which has a red spot or patch with a center clearing. After the initial symptoms, other symptoms manifest in several weeks or months that include neurological symptoms, cardiac abnormalities, intermittent episodes of swelling and joint pains.

**Treatment**

Diagnosis and appropriate treatment must be determined by a physician.

**Prevention**

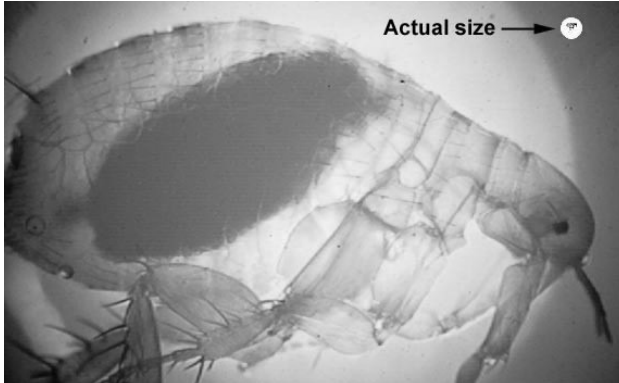
The best prevention to avoid tick bites includes the following:

- Avoid thick, brushy areas during the summer months
- Wear long sleeves and pants that hang over boots and shoes
- Check pets for ticks frequently
- Examine yourself frequently for ticks
- If ticks are found, remove them immediately and properly. To remove a tick properly, use tweezers to grasp the tick by the mouthparts as close to the skin as possible. Pull the tick straight out with gentle steady pressure. Take care not to squeeze or crush the body of the tick during removal. Wash the bite site with soap and water. Do not use hot matches, cigarettes, fingernail polish, or petroleum jelly to remove ticks as these methods are not effective. It is important to save the tick (preserved in alcohol) for later identification by health officials as it helps assess the risk of disease.

## Plague<sup>(4,8)</sup>

### What is it?

Plague is caused by a rod-shaped bacterium *Yersinia pestis*. Known since ancient times, plague has had a great influence on history, characterized by epidemics and pandemics that have decimated human populations all over the world.



### Insect Vector

Plague is transmitted to humans and other animals by bites from infected fleas. Fleas become infected by ingesting the bacteria while feeding on an infected animal.

### Where is it found?

Plague is referred to as “sylvatic” plague, which means the disease has invaded “wild” rodent populations. There are approximately 220 different species of rodents that can harbor plague, but the most common sources for plague include ground squirrels and prairie dogs.

### How is the disease spread?

Plague occurs worldwide, and is transmitted by bites from infected fleas. In the United States, it occurs in the western states. Plague may be transmitted by flea bites or through contact with blood and tissues of infected animals, or through “pneumonic” transmission from sick humans or pets. Pneumonic plague is transmitted from human to human, or from sick animal to human by inhaling droplets from animals or humans that have pneumonic plague.

### Stages of Disease

There are three primary forms of plague, and they include bubonic plague, septicemic plague and pneumonic plague. The most common form of plague is “bubonic” plague. Bubonic plague occurs from 1 to 7 days after a bite of an infected flea. The disease is characterized by a characteristic skin lesion (which occurs around the site of the flea bite), a “bubo” that is a swollen, tender lymph node. Bubos usually affect the lymph nodes located in the inner thigh, groin and under arm regions. Symptoms also include sudden high fever (103°F or 104°F), headache, exhaustion, nausea, vomiting and delirium.

Secondary septicemic and pneumonic plague may occur when the bacterium invades the blood stream and lungs. However, primary pneumonic plague occurs when droplets are inhaled from infected humans or other animals. The onset of pneumonic plague is rapid, and symptoms occur anywhere from 1 to 4 days after exposure. Symptoms of pneumonic plague may include high



fever, headache, difficult breathing and coughing-up blood.

The fatality rate for untreated bubonic plague is 50% to 60%, and the fatality rate for pneumonic plague is greater than 90%. Rapid diagnosis and treatment can reduce these figures noticeably.

### **Treatment**

Diagnosis and treatment must be done by a physician.

### **Prevention**

The best prevention for plague includes the following:

- De-flea pets routinely – consult a veterinarian for advice on flea control
- Use insect repellents especially around pant cuffs, socks and shoes
- Do not camp next to rodent burrows and nests
- Avoid sleeping directly on the ground
- Do not pick up dead or sick rodents
- Wear gloves when field dressing game

## ***Rabies*<sup>(4,9)</sup>**

### **What is it?**

Rabies is caused by a “bullet-shaped” virus. The rabies virus can infect any warm-blooded animal. Once introduced to a human host by an animal host, the virus travels through the nervous system to the brain.

### **Where is it found?**

Common reservoirs include bats, skunks, foxes, coyotes, raccoons and unvaccinated dogs.

### **How is the disease spread?**

Rabies occurs all over the world. The virus is transmitted through a bite of an infected animal. A rabid animal secretes the virus in its saliva.

### **Stages of Disease**

The early stages of the disease include discomfort, anxiety and extreme sensitivity around the bite wound. These symptoms are followed by muscle spasms around the salivary glands that result in hydrophobia (a fear of water), delirium, coma and paralysis that invariably leads to death.



### **Treatment**

Human rabies immune globulin is injected by a physician at the wound site as soon as possible, followed by 2 to 3 doses of the rabies vaccine.

### **Prevention**

The best prevention after exposure includes the following:

- Immediately wash the bite wound with soap and water
- If possible, capture the animal for testing – be careful not to re-expose yourself or others (keep the dead animal chilled to prevent decomposition)
- Contact the local health department as soon as possible
- Seek medical attention immediately

Ways to prevent the spread of rabies from wild animals to pets is to have pets, such as dogs and cats vaccinated for rabies routinely.

## ***Rocky Mountain Spotted Fever*<sup>(4,8)</sup>**

### **What is it?**

The disease-causing agent is a microorganism that occupies a position between viruses and bacteria.

### **Insect Vector**

The vector for Rocky Mountain Spotted Fever is a certain tick species. The vector for this disease in the eastern part of the United States is the American dog, and the western tick is the Rocky Mountain wood tick known.

### **Where is it found?**

Sources for Rocky Mountain Spotted Fever include all stages of the American dog tick and the wood tick, dogs, rodents and other animals.

### **How is the disease spread?**

Rocky Mountain Spotted Fever is common in the United States, parts of Canada, Mexico and parts of South America.

Transmission occurs 4 to 6 hours after a tick has attached itself to a human host, or if the tick is crushed or the feces rubbed into the bite wound.

### **Stages of Disease**

The characteristic symptom for this disease is a rash that appears within 2 to 5 days, usually on wrists, ankles at first, and later spreading all over the body. Other symptoms commonly occur within 2 to 14 days and include moderate to high fever, headache on the front and back of head, intense lower back pain and discomfort. If the infection goes untreated the case fatality rate is 13% to



25%, however, if the disease is properly treated the case fatality rate is reduced to 3% to 5%.

### **Treatment**

Diagnosis and treatment must be done by a physician.

### **Prevention**

The best prevention to avoid tick bites includes the following:

- Avoid thick, brushy areas during the summer months
- Wear long sleeves and pants that hang over boots and shoes
- Check pets for ticks frequently
- Examine yourself frequently for ticks
- If ticks are found, immediately remove them (be careful not to crush them or rub their excrement into the bite wound)

## ***Tick Relapsing Fever<sup>(4,8)</sup>***

### **What is it?**

The disease causing-agent for Tick Relapsing Fever is a bacterial spirochete.

### **Insect Vector**

The vector for this disease is an argasid tick that is also known as a soft tick. These ticks are nocturnal feeders and hide in rodent nests during the day. They do not attach to a host as do “hard” bodied ticks.



### **Where is it found?**

The primary sources are soft ticks and wild rodents.

### **How is the disease spread?**

Tick Relapsing Fever is common in both North and South America, parts of Africa, Spain, Saudi Arabia, Iran and India. The disease is transmitted through a bite from an infected soft tick, or by crushing a tick into a bite wound. Soft ticks come out at night to feed on an animal host and then hide during the day, typically in a rodent nest.

### **Stages of Disease**

The incubation period is 5 to 15 days. The onset of disease begins with a fever that may last 2 to 9 days, subside for 2 to 4 days and reoccur again. This relapsing fever cycle may occur 1 to 10 times. When the bacteria are present in the blood a person will experience fever, then when bacteria leave the blood there is no fever. The symptoms are most severe during the end of the fever period, and 2% to 10% of all untreated cases will lead to death.

## **Treatment**

Diagnosis and treatment must be done by a physician.

## **Prevention**

To prevent Tick Relapsing Fever:

- Rodent proof cabins and treat areas with pesticides where rodent nests are present
- If ticks are found, remove them immediately and properly. To remove a tick properly, use tweezers to grasp the tick by the mouthparts as close to the skin as possible. Pull the tick straight out with gentle steady pressure. Take care not to squeeze or crush the body of the tick during removal. Wash the bite site with soap and water. Do not use hot matches, cigarettes, fingernail polish, or petroleum jelly to remove ticks as these methods are not effective. It is important to save the tick (preserved in alcohol) for later identification by health officials as it helps assess the risk of disease.

## ***Tularemia*<sup>(4,8)</sup>**

### **What is it?**

The primary agent is a disease of rabbits and rodents caused by a bacteria This disease is also known as “rabbit fever” or “deer fly fever”.

### **Where is it found?**

The primary sources for this disease are rabbits, hares, voles, muskrats, beavers and various hard ticks.

### **How is the disease spread?**

Tularemia is found throughout the world and the United States. This disease may be transmitted to humans by a variety of modes. Tularemia may be transmitted from:

- Direct contact with infected blood and tissues from rabbits (cottontails, jacks and snowshoes) and from wild rodents.
- Deer fly and tick bites that are infected with the bacteria.
- Consumption of raw or undercooked infected rabbit or rodent meat.
- Drinking raw water that has not been properly treated.

### **Stages of Disease**

After an incubation period of 1 to 14 days the signs may include fever, headache, chills, weakness and swollen lymph nodes in the armpit, elbow, groin, or neck regions. Also, an open sore or ulcer usually appears on the skin around the site of infection. When treated, Tularemia is rarely fatal.

**Treatment**

Diagnosis and treatment must be done by a physician.

**Prevention**

Prevention includes:

- Wearing gloves when skinning or field dressing rabbits or wild rodents.
- Wearing insect repellents in the backcountry, and avoiding brushy areas where ticks may reside.
- Thoroughly cooking rabbit and wild rodent meat.
- Properly treating all drinking water, as described in the Water Purification section of this manual.

## QUIZ : DISEASES

1. What is a zoonotic disease?
2. Is food borne illness life threatening?
3. What groups of people are considered high risk?
4. What type of food does pathogenic bacteria grow and multiply in?
5. Is cooked rice a potentially hazardous food?
6. How can botulism poisoning be prevented?
7. What types of foods are *Campylobacter* and *Salmonella* associated with, and how can these disease-causing organisms be destroyed?
8. What is the primary prevention of Cholera?
9. What is the primary source of *E. coli* 0157:H7, and how can this disease-causing organism be destroyed?
10. How can the spread of the disease Shigellosis be prevented during food preparation?
11. What is the primary source of *Staphylococcal* food poisoning, and how can this disease be prevented?
12. How can viral food borne diseases be prevented?
13. How is Hepatitis A transmitted?
14. How can the spread of Norwalk-like Virus be prevented?
15. What are the two primary organisms of concern for water borne disease?
16. What disease may be contracted by swimming in stagnant ponds?
17. How can *Giardia* and *Cryptosporidium* cysts and oocysts be effectively removed from water?
18. What is the main preventive measure for Colorado Tick Fever?
19. What is the best prevention for Western Equine Encephalitis, Eastern Equine Encephalitis and West Nile Virus?
20. What is the primary source for Hantavirus in the United States, and how can this disease be prevented?
21. What is the most characteristic symptom of Lyme Disease?
22. What is the insect vector for Plague, and how can this disease be prevented?
23. How is the disease Rabies transmitted, and what steps must be taken after exposure?
24. How are Rocky Mountain Spotted Fever and Tick Relapsing Fever transmitted, and how can these diseases be prevented?
25. What is another name for the disease Tularemia, and how can this disease be prevented?



