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## Yaws

CATEGORY: Diseases and conditions

ANATOMY OR SYSTEM AFFECTED: Bones, joints, musculoskeletal system, skin

ALSO KNOWN AS: Boubas, frambresia tropica, parangi, pian, polypapilloma tropicum, thymiosis, treponematosis

### DEFINITION

Yaws is a chronic infection of the skin, bones, and joints caused by exposure to the bacterium *Treponema pallidum pertenuis*. The bacterium is spread through direct physical contact.

### CAUSES

Yaws is spread by physical contact with another person who is infected with *T. pallidum pertenuis*, principally through exposure to the open sores associated with the disease. Unlike the closely related disease syphilis, yaws is not spread through sexual contact. The bacterium responsible for yaws infections thrives in tropical, humid climates, especially in areas where extreme poverty, overpopulation, unsanitary living conditions, poor physical hygiene, and inadequate medical care are prevalent.

### RISK FACTORS

Indigenous peoples who live in extreme poverty in tropical climates, with unsanitary living conditions, poor physical hygiene, and overcrowded populations are at greatest risk for contracting yaws. Children, particularly age two to fifteen years, are most vulnerable to infection by yaws, but all persons are susceptible. Although massive campaigns by the World Health Organization between 1950 and 1970 largely eradicated yaws worldwide, many pockets of yaws-infected populations still exist, especially among isolated peoples in Indonesia, Africa, Latin America, and the Caribbean. Persons who visit areas where yaws is endemic also risk infection and should ensure that all precautions are taken to reduce exposure.

### SYMPTOMS

Five to eight weeks after initial exposure to the *T. pallidum pertenuis* organism, initial lesions, called mother yaws, form at the site of infection, usually on the legs. The lesions, purple and shaped like raspberries, become large, ulcerative, and itchy, but they heal after about six months. Shortly thereafter, a new manifestation of yaws erupts all over the body that includes very painful lesions on the palms of the hands and soles of the feet, lasting for approximately five years. The final phase of yaws manifests five to ten years later in skin, joint, and bone destruction and disfigurement.

### SCREENING AND DIAGNOSIS

After a physical examination, blood and lesion samples are collected and tested using dark-field microscopy. Blood tests such as rapid plasma reagin will appear positive for all four subspecies of the microbe *T. pallidum*, so close examination of lesion samples is required to identify the spirochete *T. pallidum pertenuis* organism responsible for yaws.

### TREATMENT AND THERAPY

In the early stages of yaws, treatment with long-acting penicillin is effective. Persons who are allergic to penicillin are prescribed erythromycin, chloramphenicol, and tetracycline to successfully eliminate the disease. Late-stage destruction of bones and joints by yaws is largely irreversible, however.

### PREVENTION AND OUTCOMES

Avoiding skin-to-skin contact with sores from those infected with yaws and receiving immediate treatment with penicillin if infected are the best ways to prevent the spread of the disease. Sanitary personal hygiene and living conditions also help prevent yaws.

Mary E. Markland, M.A.

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#### WEB SITES OF INTEREST

*American Society of Tropical Medicine and Hygiene*  
<http://www.astmh.org>

*Neglected Tropical Diseases Coalition*  
<http://www.neglectedtropicaldiseases.org>

*Virtual Museum of Bacteria*  
<http://www.bacteriamuseum.org>

*World Health Organization*  
<http://www.searo.who.int/en/section10.htm>

**See also:** Bacterial infections; Children and infectious disease; Developing countries and infectious disease; Pinta; Skin infections; Syphilis; *Treponema*; Tropical medicine.

## Yellow fever

CATEGORY: Diseases and conditions  
ANATOMY OR SYSTEM AFFECTED: All

#### DEFINITION

Yellow fever is a disease carried by female mosquitoes of two species (*Aedes* and *Haemogogus*). Mosquitoes pass yellow fever to humans through a small amount of saliva when they bite. The species of mosquito that carry yellow fever are native to sub-Saharan Africa and South America.

Yellow fever can cause flulike symptoms, yellowing

of both the skin and the whites of the eyes, and death. Yellow fever is a rare disease in travelers because many people get the vaccine, but it is endemic to impoverished areas because most people cannot afford to get vaccinated or because the vaccines are not available.

#### CAUSES

The yellow fever virus is the cause of yellow fever. The yellow fever virus is transmitted to humans when an infected mosquito bites a person. Yellow fever is not communicable, or contagious, meaning it cannot be passed directly from one person to another.

#### RISK FACTORS

The following factors increase the chance of getting yellow fever: living, working, or traveling in jungle or urban areas with yellow fever, including sub-Saharan Africa (thirty-three countries in Africa have consistent cases of yellow fever); and South America (Bolivia, Brazil, Colombia, Ecuador, and Peru provide greatest risk). Another risk factor is failing to take precautions, including receiving the yellow fever vaccine, reducing contact with mosquitoes (by using sleeping nets, long-sleeved clothing, and screens), and using insect repellents.

#### SYMPTOMS

Yellow fever has two phases: acute and toxic. All persons infected with yellow fever will experience the acute phase. Fifteen percent of people with yellow fever will progress into the toxic phase.

One should not assume that the following symptoms are caused by yellow fever. Many of them also occur with other, less serious illnesses, such as influenza. However, persons who experience any of these symptoms should seek medical attention.

During the acute phase, the symptoms are fever, headache, muscle pain, backache, chills, loss of appetite, and nausea or vomiting (or both). During the toxic phase, the symptoms are high fever; abdominal pain; bleeding from the gums, nose, eyes, or stomach; black vomit (vomit that appears black because of blood content); low blood pressure; liver failure, which may lead to jaundice, or yellowing of the skin and whites of the eyes; kidney failure; confusion; seizure; coma; and death. Approximately 50 percent of toxic-phase patients die.

Yellow fever symptoms appear three to six days after a person is bitten by an infected mosquito. Typi-



*The Aedes aegypti mosquito is a yellow fever vector.* (CDC)

cally, acute phase symptoms will persist for three to four days and then disappear. If an infected person is going to progress into the toxic phase, toxic-phase symptoms will begin within twenty-four hours of the end of the acute phase. When a person recovers from yellow fever, he or she is considered to have lifetime immunity from the disease.

#### SCREENING AND DIAGNOSIS

A doctor will ask about symptoms, medical history, and travel history, and will then perform a physical exam. Blood tests may be ordered to screen for signs of yellow fever in the blood.

#### TREATMENT AND THERAPY

Medications or treatments specifically for yellow fever are not available. However, there are treatments that can be given at a hospital to ease some symptoms of yellow fever. One should keep the body hydrated with fluids containing electrolytes and salts. These fluids may be given orally or may be injected through a vein to prevent dehydration. Cool water or fever-reducing medications (such as acetaminophen, or Tylenol) may be given to reduce fever.

In toxic-phase cases, dialysis may be needed to help the kidneys filter waste. Also, a transfusion may be needed to replace blood cells and clotting agents lost through bleeding.

Fighting yellow fever may cause a person's immune system to become temporarily weak. A weakened immune system cannot guard against bacterial infections as it normally would, so infections occur more easily. Antibiotics may be given to fight bacterial infec-

tions associated with yellow-fever illness. Antibiotics cannot be given to treat yellow fever because yellow fever is caused by a virus, and viruses do not respond to antibiotics.

#### PREVENTION AND OUTCOMES

Vaccination is the best way to prevent yellow fever. However, like any vaccine, it is not for everyone. People with compromised immune systems, the elderly, and women who may be pregnant should not receive the vaccine. If a person lives, works, or travels in areas where yellow fever is common, he or she should ask a doctor if vaccination is recommended.

Persons who cannot receive the vaccine or who would like to reduce their risk of being bitten by a mosquito should take the following precautions: Stay in air-conditioned or well-screened areas, wear long-sleeved clothing and long pants, use sleeping nets, and remove or destroy mosquito-breeding areas. Mosquitoes lay their eggs in standing pools of water, such as the insides of old tires, flower pots, and small puddles. Another preventive measure is to use insect repellents that contain NN-diethyl metatoluamide (DEET) and permethrin on clothes, exposed skin, and bed nets for extra protection.

*Jen Rymaruk; reviewed by David L. Horn, M.D., FACP*

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#### WEB SITES OF INTEREST

*American Society of Tropical Medicine and Hygiene*  
<http://www.astmh.org>

*Centers for Disease Control and Prevention*

<http://www.cdc.gov>

*World Health Organization*

<http://www.who.int>

**See also:** Blood-borne illness and disease; Dengue fever; Developing countries and infectious disease; Eastern equine encephalitis; Encephalitis; Fever; Insect-borne illness and disease; Insecticides and topical repellants; Japanese encephalitis; Malaria; Mosquito-borne viral encephalitis; Mosquitoes and infectious disease; Sleeping nets; Tropical medicine; Vaccines: Types; Vectors and vector control; Viral infections; West Nile virus; Yellow fever vaccine.

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## Yellow fever vaccine

CATEGORY: Prevention

### DEFINITION

The yellow fever vaccine was developed to fight yellow fever, which is an acute infectious disease transmitted by mosquitoes and caused by a flavivirus. Yellow fever remains endemic to parts of South America and in Africa. The reported risk of contracting yellow fever, when in an endemic area, is approximately 1 in 267; of those infected, up to 40 percent will die. No antiviral treatment is effective against the yellow fever virus, so a vaccine was developed to prevent people from contracting the disease. The vaccine is prepared from the 17D strain of the disease, which is live but attenuated (weaker). More than four hundred million doses of yellow fever vaccine have been administered worldwide.

### HISTORY

As was first thought, yellow fever was conclusively identified as a virus rather than as a bacteria in 1928. Max Theiler, a South African-born virologist working at New York's Rockefeller Foundation, developed the yellow fever vaccine in 1937. He initially passed the virus through laboratory mice and found that the weakened form of the virus provided immunity to Rhesus monkeys. During his work with the virus, Theiler contracted yellow fever but survived and consequently developed immunity. Theiler was awarded



*Max Theiler.* (The Nobel Foundation)

the Nobel Prize in Physiology or Medicine in 1951 for developing the yellow fever vaccine.

### ADMINISTRATION

Persons traveling to or planning to live in areas where yellow fever is endemic should receive the vaccine. People routinely exposed to yellow fever virus, such as researchers and laboratory staff, are also encouraged to receive the vaccine. The vaccine, however, is not recommended for newborns younger than four months of age or for women during their first trimester of pregnancy. The yellow fever vaccine is administered in a single injection by a health care professional. Effective protection from the virus begins after ten days and protection lasts a minimum of ten years.

**DOCUMENTATION**

To legally enter some countries, people must carry internationally recognized proof of receiving the yellow fever vaccine. This proof is established with a stamped document, the International Certificate of Vaccination Against Yellow Fever.

**SIDE EFFECTS**

The yellow fever vaccine is safe. As with any drug or vaccine, strict regulations are enforced during its development and manufacturing. Common physical reactions to the vaccine include soreness and tenderness or redness at the site of the injection. Also, a slight headache, low-grade fever, or aching muscles can occur five to ten days after receiving the vaccine.

*April Ingram, B.S.*

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**WEB SITES OF INTEREST**

*American Society of Tropical Medicine and Hygiene*  
<http://www.astmh.org>

*Centers for Disease Control and Prevention, Division of Vector Borne Infectious Diseases*  
<http://www.cdc.gov/ncidod/dvbid>

*World Health Organization: Vaccines, Immunization, and Biologicals*  
<http://www.who.int/vaccines/en/yellowfever.shtml>

**See also:** Blood-borne illness and disease; Dengue fever; Developing countries and infectious disease; Encephalitis; Hemorrhagic fever viral infections; Insect-borne illness and disease; Insecticides and topical repellants; Malaria; Mosquito-borne viral encephalitis; Mosquitoes and infectious disease; Tropical medicine; Vaccines: Types; Vectors and vector control; Viral infections; West Nile virus; Yellow fever.

***Yersinia***

CATEGORY: Pathogen

TRANSMISSION ROUTE: Ingestion, inhalation, skin

**DEFINITION**

Three species of *Yersinia* affect humans, two causing intestinal infections and one causing the plague, an acute, contagious disease.

**Taxonomic Classification for *Yersinia***

**Kingdom:** Bacteria

**Phylum:** Proteobacteria

**Order:** Enterobacteriales

**Family:** Enterobacteriaceae

**Genus:** *Yersinia*

**Species:**

*Y. aldovae*

*Y. aleksiciae*

*Y. bercovieri*

*Y. enterocolitica*

*Y. frederiksenii*

*Y. intermedia*

*Y. kristensenii*

*Y. mollaretii*

*Y. pestis*

*Y. pseudotuberculosis*

*Y. rohdei*

*Y. ruckeri*

**NATURAL HABITAT AND FEATURES**

*Yersinia* bacteria are rod shaped (at times approaching a spherical shape) and are usually 0.5 micrometers ( $\mu\text{m}$ ) in diameter and 1 to 3  $\mu\text{m}$  in length. *Yersinia* are gram-negative. They are motile below 86° Fahrenheit (30° Celsius) with the exception of some

*Y. ruckeri* strains and *Y. pestis*, which is never motile. The optimal temperature for these bacteria is 82° to 86° F (28° to 30° C), although *Y. enterocolitica* is often found in cold climates.

*Yersinia* occur in a variety of habitats, including soil, water, and foods such as dairy products, and are present in birds, animals (especially rodents), and humans. Most species are occasional human pathogens. *Y. ruckerii* causes red mouth in fish; three species (*pestis*, *pseudotuberculosis*, and *enterocolitica*) cause infections in humans and other mammals.

Draft sequencing of the various *Yersinia* species indicates that genes have been horizontally transferred and that virulence determinants have been gained and lost over time. There is a high degree of genetic redundancy among the *Yersinia* species. Later scientific developments have led to the ability to distinguish among the various species with a high degree of accuracy. A close evolutionary relationship exists among the *enterocolitica* clade (descendant) strains. Four species (*bercorieri*, *mollaretii*, *aldovae*, and *ruckerii*) evolved from *Y. enterocolitica*. *Y. pestis* evolved from *Y. pseudotuberculosis* as early as twenty thousand years ago with significant branching; this resulted in a clear split around 6,500 years ago.

#### PATHOGENICITY AND CLINICAL SIGNIFICANCE

Three species of *Yersinia* pose health threats to humans. The three species can be distinguished from each other by laboratory tests and by their symptoms. Most notable is *Y. pestis*, the causative agent of the plague. There have been three plague pandemics, dating from the plague of Justinian in the sixth century. The second, often referred to as the Black Death, first appeared in southern Europe in 1347 and then spread over much of the continent during the next four years. It is estimated that this pandemic killed between 30 and 60 percent of the population of Europe. Plague remained endemic to European society, with periodic epidemics until the early eighteenth century. The third pandemic began in western China in the 1860's, spread to Hong Kong by 1894, and to India, Java, Egypt, and San Francisco by 1900, killing more than one hundred million persons worldwide. Plague remains endemic to some parts of the world, such as Mongolia and the Four Corners region of the United States. The first plague pandemic probably originated in Africa; the later ones came from Asia. Alexander Yersin identified *Y. pestis* as the agent of plague during

the third plague pandemic. Although most scholars credit *Y. pestis* as the causative agent of the first and second plague pandemics, the diagnosis is disputed by some.

Three varieties of plague exist: bubonic, septicemic, and pneumonic. Bubonic is the most common form and is transmitted by infected fleas, which bite humans after having bitten infected rats or other animals. Left untreated, bubonic plague has a mortality rate between 40 and 70 percent.

Septicemic plague arises as a secondary infection from a primary bubonic infection and is generally fatal. Pneumonic plague often occurs as a secondary infection but may also be a primary infection that is spread from human to human through nasal discharge. Untreated, it is fatal.

The incubation period for bubonic usually ranges from two to six days and is followed by the sudden onset of chills, fever, and headache, followed by body ache and possibly diarrhea. Painful swollen lymph glands, often in the groin, are a telltale sign of bubonic plague. Septicemic plague arises from a bubonic infection producing nausea and diarrhea. Buboes are uncommon in septicemic plague. The patient soon becomes moribund, has multiorgan failure, and dies. Pneumonic plague is often secondary to bubonic or septicemic plague, but is also spread human to human. It exhibits sudden-onset fever with chest pain and purulent sputum; death often follows. Often, also, no buboes are present.

*Y. enterocolitica* is the most common form of *Yersinia* pathogen. It produces acute bacterial gastroenteritis that especially affects the young. A food-borne pathogen, it colonizes the small intestine and may exhibit symptoms similar to other intestinal ailments.

*Y. pseudotuberculosis* is also a food-borne pathogen, although it is less common than *Y. enterocolitica*. It often mimics appendicitis and generally does not cause diarrhea. Together, *Y. enterocolitica* and *Y. pseudotuberculosis* cause about seventeen thousand cases of yersiniosis every year.

#### DRUG SUSCEPTIBILITY

Infections from *Y. enterocolitica* and *Y. pseudotuberculosis* are often managed without antimicrobials. Antibiotic regimes, however, may be prescribed for some persons. Ampicillin is prescribed at times for *Y. pseudotuberculosis*, and ciprofloxacin is prescribed for *Y. enterocolitica*.

Early antibiotic treatment is essential for the treatment of plague, as untreated cases often have a high mortality risk. Outside the United States, streptomycin is often prescribed. Gentamicin is comparable or superior to streptomycin and is often used in the treatment of plague. Doxycycline is used for persons who cannot take aminoglycosides. It is also recommended for mass casualties, such as those from an act of bioterrorism. Drug-resistant cases have been reported, however, in Madagascar.

Vaccines have been developed for use against the plague, although no country requires them. Killed whole-cell plague vaccines may cause severe side effects, require a six-month course of vaccination, and are ineffective against pneumonic plague. Largely because of the threat of the use of plague as a biological weapon by terrorists, scientists are working to develop second and third generation vaccines that avoid the problems of the first generation vaccines.

*John M. Theilmann, Ph.D.*

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Orent, Wendy. *Plague*. New York: Free Press, 2004. A useful historical treatment of plague with detailed attention to the biology of the disease.

#### WEB SITES OF INTEREST

*American College of Gastroenterology*  
<http://www.acg.gi.org>

*Center for Biosecurity*  
<http://www.upmc-biosecurity.org>

*Centers for Disease Control and Prevention*  
<http://www.bt.cdc.gov/agent/plague>

*PathoSystems Resource Integration Center*  
<http://www.patricbrc.org>

**See also:** Airborne illness and disease; Arthropod-borne illness and disease; Bacterial infections; Biological weapons; Bioterrorism; Bubonic plague; Contagious diseases; Endemic infections; *Enterobacter*; Fleas and infectious disease; Food-borne illness and disease; Intestinal and stomach infections; Lassa fever; Plague; Rat-bite fever; Respiratory route of transmission; Rodents and infectious disease; Vectors and vector control; *Yersinia pseudotuberculosis*; Yersiniosis; Zoonotic diseases.

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## *Yersinia pseudotuberculosis*

CATEGORY: Diseases and conditions

#### DEFINITION

One of the three main *Yersinia* bacterium species, *Y. pseudotuberculosis* causes an animal-transmitted or food-borne gastroenteritis whose symptoms mimic appendicitis.

Microscopically, *Y. pseudotuberculosis* shows as an ovoid-shaped cell (cocci) that stains gram-negative (red) during a Gram's stain. If cultured from infected persons, it tends to grow slowly and form small, translucent, gray colonies. The cells have multiple flagella that allow them to move rapidly at low temperatures, but at higher temperatures that approximate that of the human body (95 degrees Fahrenheit, or 35 degrees Celsius), the species is nonmotile.

#### CAUSES

Upon introduction to the gastrointestinal tract, the organism invades the wall of the lower small intestine and usually colonizes the lymphatic system

associated with the intestines (causing mesenteric lymphadenitis).

#### RISK FACTORS

*Y. pseudotuberculosis* normally lives in warm-blooded animals. Mammals such as dogs, cats, cattle, horses, rabbits, deer, and rodents, and birds (such as turkeys, geese, ducks, cockatoos, and canaries) can act as reservoirs of this organism. Contact with animals that carry *Y. pseudotuberculosis* can cause zoonotic infections (diseases that are transmitted from animals to humans). Likewise, the consumption of food prepared from animals that harbor the bacterium can cause food-borne infections. Drinking water from wells, streams, or other water sources, including those contaminated with bacterium-containing soil, also can lead to *Y. pseudotuberculosis* infections.

#### SYMPTOMS

The symptoms of *Y. pseudotuberculosis* infection are a triad of abdominal pain in the lower right quadrant, a fever, and sometimes a skin rash, but diarrhea is rather uncommon. Symptoms usually appear five to ten days after infection and can last one to three weeks in healthy persons in the absence of treatment.

In persons with poorly functioning immune systems or with liver disorders that cause excessive blood-iron concentrations, the organism can colonize the blood, leading to sepsis. In such cases, mortality rates exceed 75 percent.

#### SCREENING AND DIAGNOSIS

Because of the location of the abdominal pain, *Y. pseudotuberculosis* gastroenteritis is commonly confused with appendicitis.

#### TREATMENT AND THERAPY

Most *Y. pseudotuberculosis* infections do not require antibiotic treatment, but drug therapy is essential for children or adults with preexisting conditions that makes sepsis likely.

Aminoglycoside antibiotics such as streptomycin sulfate, tobramycin, and gentamicin, can treat *Y. pseudotuberculosis* infections, but the toxicity of these drugs to the kidneys and ears limits their long-term usefulness. Bacterial cell-wall inhibitors such as the beta-lactam antibiotic piperacillin or the third-generation cephalosporin cefotaxime show consistent activity against *Y. pseudotuberculosis*. The bacterial protein-syn-

thesis inhibitor chloramphenicol is effective against *Y. pseudotuberculosis* but should be used only as a last resort because it can damage bone marrow and cause aplastic anemia.

Combinations of antibiotics are also efficacious against *Y. pseudotuberculosis* infections. For example, a combination of cefotaxime and the quinolone antibiotic levofloxacin has effectively treated persons with bacteremia caused by *Y. pseudotuberculosis*.

#### PREVENTION AND OUTCOMES

Prevention involves proper hygiene and food preparation and the avoidance of other sources of infection.

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#### FURTHER READING

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#### WEB SITES OF INTEREST

*American College of Gastroenterology*  
<http://www.acg.gi.org>

*Centers for Disease Control and Prevention*  
<http://www.cdc.gov>

*National Center for Emerging and Zoonotic Infectious Diseases*  
<http://www.cdc.gov/nceid>

**See also:** Appendicitis; Bacteria: Classification and types; Bacterial infections; Bubonic plague; *Enterobacter*; Food-borne illness and disease; Intestinal and

stomach infections; Pathogens; Plague; Respiratory route of transmission; Rodents and infectious disease; Sepsis; Waterborne illness and disease; *Yersinia*; Yersiniosis; Zoonotic diseases.

## Yersiniosis

CATEGORY: Diseases and conditions

ANATOMY OR SYSTEM AFFECTED: Gastrointestinal system, intestines, stomach

### DEFINITION

Yersiniosis is a food-borne infection of the intestines caused by ingesting the bacterium *Yersinia enterocolitica*, which is often in infected pork products and in infected unpasteurized (raw) milk.

### CAUSES

Yersiniosis is principally caused by eating raw or undercooked meat, especially pork, in the form of chitterlings. However, yersiniosis may be spread by processing pork chitterlings before cooking, by not washing hands afterward, and by then disseminating the bacteria through direct physical contact with others. Furthermore, cross-contamination of food may occur by preparing infected pork on the same cutting board as other food prepared in the kitchen. Drinking unpasteurized milk or untreated water that has been infected with the bacterium *Y. enterocolitica* also causes yersiniosis. Touching infected animals or their feces spreads yersiniosis. Rarely, yersiniosis may be transmitted through blood transfusion.

### RISK FACTORS

Anyone may contract yersiniosis by ingesting raw or undercooked meat, particularly pork, but children are at greatest risk for infection by yersiniosis through the drinking of infected unpasteurized milk. Because drinking infected untreated water may also cause yersiniosis, those living in poverty and in developing countries are highly susceptible to the disease caused by unsanitary water conditions. Having a weakened immune system greatly increases potential bacterial infection by yersiniosis. Touching infected animals can also spread yersiniosis, so farmers, veterinarians, and stockyard workers are also vulnerable to infection.

### SYMPTOMS

Symptoms of yersiniosis include abdominal and joint pain, cramps, fever, nausea, diarrhea, and bloody stool. Yersiniosis is sometimes mistaken for appendicitis because both diseases cause severe pain on the right side of the abdomen.

### SCREENING AND DIAGNOSIS

After a physical examination, a stool sample is collected and tested for the presence of *Y. enterocolitica*. However, the bacterium may also be detected by examining the person's throat culture, urine, blood, joint fluid, or bile, confirming an infection of yersiniosis.

### TREATMENT AND THERAPY

Most cases of yersiniosis resolve themselves in one to three weeks; however, severe cases of yersiniosis can reemerge approximately four weeks after infection as severe arthritic joint pain, especially in the wrists, knees, and ankles, with an accompanying skin rash. Antibiotics, particularly doxycycline, are prescribed by a physician for seven to fourteen days to eliminate the disease.

### PREVENTION AND OUTCOMES

Drinking only pasteurized milk and treated water is the primary way to prevent yersiniosis infection. All meat that is ingested, particularly pork chitterlings, should be refrigerated properly and then cooked thoroughly. Anyone involved in the preparation of chitterlings should wear rubber gloves if possible, wash hands often, use a separate cutting board and utensils for the preparation of the pork, and avoid touching one's eyes, nose, or mouth during food preparation. Those who work with animals, such as farmers, veterinarians, and stockyard workers, should wear gloves to avoid being infected by animals, and children should wash hands thoroughly after touching animals at petting zoos or other locations.

Mary E. Markland, M.A.

### FURTHER READING

Hunter, Beatrice. *Infectious Connections: How Short-Term Foodborne Infections Can Lead to Long-Term Health Problems*. Laguna Beach, Calif.: Basic Health, 2009.

Juneja, Vijay, and John Sofos. *Pathogens and Toxins in Foods: Challenges and Interventions*. Washington, D.C.: ASM Press, 2010.

Parker, James. *The Official Patient's Sourcebook on Yersiniosis*. San Diego, Calif.: Icon Health, 2002.

**WEB SITES OF INTEREST**

*Center for Science in the Public Interest: Food Safety*  
<http://cspinet.org/foodsafety>

*U.S. Department of Agriculture, Food Safety and Inspection Service*  
<http://www.fsis.usda.gov>

**See also:** Bacterial infections; Developing countries and infectious disease; Fecal-oral route of transmission; Food-borne illness and disease; Intestinal and stomach infections; *Salmonella*; Waterborne illness and disease; *Yersinia*.