**SALMONELLA PARATYPHI INFECTION**
*(Salmonella Paratyphi A, Salmonella Paratyphi B [tartrate negative], Salmonella Paratyphi C, paratyphoid fever)*

**REPORTING INFORMATION:**
- **Class B:** Report by the end of the next business day after the case or suspected case presents and/or a positive laboratory result to the local public health department where the patient resides. If the patient residence is unknown, report to the local public health department in which the reporting healthcare provider or laboratory is located.
- **Reporting Form(s) and/or Mechanism:**
  - The Ohio Disease Reporting System (ODRS) should be used to report cases and lab findings to the Ohio Department of Health (ODH). For healthcare providers without access to ODRS, the *Ohio Confidential Reportable Disease form* (HEA 3334) may be used.
  - The *Typhoid and Paratyphoid Fever Surveillance Report form* (CDC 52.5) is available for use to assist in local health department disease investigation. Information collected from the form should be entered into ODRS and the form should be faxed to ODH’s Bureau of Infectious Diseases at (614) 564-2456 or uploaded to the Administration section of ODRS.
  - The *Ohio Enteric Case Investigation Form* may be useful in local health department follow-up of cases who do not report a history of travel to countries where paratyphoid fever is endemic. Do not send this report to ODH; information collected from the form should be entered into ODRS where fields are available, and the form should be uploaded in the Administration section of ODRS.
- **Key fields for ODRS reporting include:** import status (whether the infection was travel-associated or Ohio-acquired), date of illness onset and travel details entered into the Travel History.

**AGENT**
*Salmonella enterica* serotypes Paratyphi A, Paratyphi B (tartrate negative) and Paratyphi C are the agents of *Salmonella* Paratyphi infections.

**Infectious Dose:** A low infectious dose (<10³ organisms) can cause disease.

**CASE DEFINITION**

**Clinical Description**
Infections caused by *Salmonella enterica* serotypes Paratyphi A, B (tartrate negative) and C are often characterized by insidious onset of sustained fever, headache, malaise, anorexia, relative bradycardia, constipation or diarrhea and non-productive cough. However, mild and atypical infections may occur. Carriage of S. Paratyphi A, B (tartrate negative) and C may be prolonged.

**Clinical Criteria**
An illness characterized by one or more of the following:
- Fever
- Diarrhea
- Abdominal cramps
- Constipation
- Anorexia
- Relative bradycardia
**Laboratory Criteria for Diagnosis**

**Presumptive laboratory evidence:** Detection of S. Paratyphi A, B (tartrate negative) or C in a clinical specimen using a culture-independent diagnostic test (CIDT).

**Confirmatory laboratory evidence:** Isolation of S. Paratyphi A, B (tartrate negative) or C from a clinical specimen.

Note: Serologic testing (i.e., detection of antibodies to S. Paratyphi A, B or C) should not be utilized for case classification.

**Epidemiologic Linkage**

- Epidemiological linkage to a confirmed S. Paratyphi infection case, OR
- Epidemiological linkage to a probable S. Paratyphi infection case with laboratory evidence, OR
- Member of a risk group as defined by public health authorities during an outbreak.

**Case Classification**

**Probable:**
- A clinically compatible illness in a person with presumptive laboratory evidence.
- A clinically compatible illness in a person with an epidemiological linkage.

**Confirmed:** A person with confirmatory laboratory evidence of infection.

**Criteria to Distinguish a New Case from an Existing Case**

A new case should be created when either:

- A positive laboratory result is received more than 365 days after the most recent positive laboratory result associated with a previously reported case in the same person or
- Two or more different serotypes are identified in one or more specimens from the same person.

**Comments**

Persons with isolation of *Salmonella* serotype Paratyphi B (tartrate positive) from a clinical specimen should be categorized as a salmonellosis case.

Several serological tests have been developed to detect antibodies to S. Paratyphi A, B and C. However, no current serological test is sufficiently sensitive or specific to replace culture-based tests for the identification of S. Paratyphi infections. Whether public health follow-up for positive serologic testing is conducted and how is at the discretion of the jurisdiction. The percentage of persons with S. Paratyphi A, B (tartrate negative) or C infections that become chronic carriers is not known.

Differentiating whether a person is a chronic carrier or is experiencing a new infection often relies on a variety factors including advanced laboratory testing (e.g., whole genome sequencing [WGS]) to compare the isolate from the previous infection to the new isolate. While these methodologies can provide detailed information about the genetic make-up of the organisms, there is still significant variability in how two organisms can be defined as different. Given the potential for inconsistent application of the label “different” across jurisdictions, this case definition does not exclude persons with a previously reported S. Paratyphi Infection case from being counted as a new case.
if the subsequent positive laboratory result is more than 365 days from the most recent positive laboratory result associated with the existing case.

SIGNS AND SYMPTOMS
Infection caused by *Salmonella enterica* serotypes Paratyphi A, B (tartrate negative) and C are often characterized by the insidious onset of sustained fever, marked headache and malaise. Some patients may also experience anorexia, relative bradycardia, splenomegaly, a non-productive cough early in illness or rose-colored spots on the trunk. Constipation is more common than diarrhea in adults. Symptoms range from a mild gastrointestinal illness with low-grade fever to severe illness with multiple complications. Asymptomatic infections occur, particularly in areas where *S. Paratyphi* is endemic.

Case-fatality rates are below 1% with prompt antimicrobial treatment but are higher for those with altered mental status and other neurologic complications. Patients may experience a relapse depending on the antimicrobial treatment used, but symptoms are generally milder than the initial clinical illness.

[See also the *Salmonellosis* and *Salmonella Typhi Infection* chapters.]

DIAGNOSIS
*Salmonella* Paratyphi infection is diagnosed by isolating the organism from blood, stool, bone marrow, bile or other body fluid. Serology tests are not useful for diagnosis.

Most hospital laboratories can identify *Salmonella*, but few, if any, are likely to have the ability to identify *Salmonella* serotypes Paratyphi A, Paratyphi B (tartrate negative) and Paratyphi C. ODH Laboratory performs testing for *Salmonella*, including the Paratyphi serotypes. In some circumstances, testing of cases and contacts can be done at the ODH Laboratory without charge. To obtain the fee exemption and to arrange for receipt of the stool transport kit, contact the ODH Bureau of Infectious Diseases at (614) 995-5599.

Clinical laboratories are asked to send all *Salmonella* isolates as well as specimens that test positive for *Salmonella* via culture-independent diagnostic testing (CIDT) to ODH Laboratory for serotyping and other molecular analysis. If testing is to be performed at ODH Laboratory, use Cary Blair transport medium and include the ODH Laboratory Microbiology Specimen Submission Form (HEA 2530) with the specimen.

EPIDEMIOLOGY
Source
Humans are the reservoir for *Salmonella* Paratyphi bacteria.

Susceptibility
All individuals are at risk for infection and developing disease. Those traveling to areas where the disease is endemic are at greatest risk for infection.

Occurrence
*Salmonella* Paratyphi infections are most common in the developing world. Most cases diagnosed in the United States and other industrialized nations are acquired during travel to endemic areas such as India, Bangladesh and Pakistan. Paratyphoid infections can occur sporadically or in outbreaks. Among the three serotypes, Paratyphi A is the most common, Paratyphi B is less common, and Paratyphi C is very rare.
Mode of Transmission
Ingestion of food and water contaminated by the feces or urine of symptomatic people or carriers is the most common way *Salmonella Paratyphi* is transmitted. Important vehicles in resource-limited countries include shellfish harvested from sewage-contaminated beds, raw fruit and vegetables, frozen fruit, contaminated milk/milk products (usually contaminated by unwashed hands) and untreated drinking water. Flies may transfer the pathogen to foods, where the bacteria can multiply to infective doses. Sexual transmission of *Salmonella Typhi* from asymptomatic carriers has been documented and is likely possible for *Salmonella Paratyphi* as well.

Period of Communicability
Humans are infectious while they are excreting bacteria, which is usually from the first week throughout their recovery (approximately 1-2 weeks). Although less common than *Salmonella Typhi* infections, people can become chronic carriers following *Salmonella Paratyphi* infection and serve as a source of infection to others.

Incubation Period
1-10 days.

PUBLIC HEALTH MANAGEMENT

Case Investigation
All cases should be contacted to obtain demographic and epidemiologic data, particularly a thorough travel history. It is recommended that all cases, regardless of their occupation, have 3 stool specimens tested for *Salmonella Paratyphi* serotypes. Three consecutive negative specimens are generally sufficient to rule out carriage. See Isolation and Follow-Up Specimens, below, for additional information.

Treatment
Antibiotic treatment is usually indicated. Treatment should be based on the antibiotic susceptibility of the patient’s culture. Resistance to fluoroquinolones and azithromycin has been observed, particularly in those infected with *Salmonella Paratyphi A*.

Isolation and Follow-Up Specimens
Ohio Administrative Code 3701-3-13 (U) states:
“Salmonellosis: A person with salmonellosis who attends a child care center or works in a sensitive occupation shall be excluded from the child care center or work in the sensitive occupation and may return when the following conditions are met:
1) The child may return to the child care center after diarrhea has ceased.
2) A person may return to work in a sensitive occupation after diarrhea has ceased and after two consecutive follow-up stool specimens are negative for *Salmonella*.
3) A person who is a food handler may return to work after diarrhea has ceased and after two consecutive follow-up stool specimens are negative for *Salmonella*.”

Obtain the first stool specimen at least 48 hours after completion of antibiotic therapy. Obtain the remaining specimens at least 24 hours apart. If one or more of the first three follow-up specimens are positive, space subsequent specimens at one-week intervals until a maximum of eight weeks after onset of illness. After eight weeks, obtain follow-up specimens at one-month intervals for up to one year.

The initial isolate identifying the case as paratyphoid fever is often from a blood culture. Regardless of the source of the initial isolate, follow-up cultures should always be from stool.
ODH has developed an instructional video for patients submitting stool specimens that may be helpful to ensure specimens are collected appropriately and safely.

Although only those employed in sensitive occupations such as food handling are required to prove clearance of infection through 2 consecutive negative stool specimens, it is recommended that all who have been diagnosed with *Salmonella* Paratyphi infections be screened and have 3 consecutive negative stool specimens to ensure they do not become chronic carriers following infection.

**Public Health Significance**
High. Identification of a case not acquired through travel indicates a possible outbreak and a risk of infection to others in the community. This situation warrants a thorough public health investigation into the case’s restaurant and other food consumption history.

**Contacts**
All household members and close contacts should be tested for *Salmonella* Paratyphi infection, regardless of their symptoms or occupation.

**Prevention and Control**
Sanitary disposal of human waste, hand washing, fly control and provision of safe food and drinking water are important in the prevention and control of *Salmonella* Paratyphi infection.

**Food Handlers**
Symptomatic persons shall be excluded from work. As detailed in Isolation above, food handlers may only return to work when asymptomatic and when two consecutive follow-up stool specimens are negative for *Salmonella*.

Food Service Operation rules also pertain to this situation. Salmonellosis is a disease which can be transmitted through food. Persons infected with a disease that is communicable by food are not permitted to work as a food handler. For additional information, refer to the [OAC Chapter 3717-1-02.1](https://codes.ohio.gov) (Ohio Uniform Food Safety Code Management and Personnel: Employee Health).

**Healthcare Workers, Child Care Workers and Children Who Attend Child Care Centers**
Symptomatic persons shall be excluded from work. As detailed in Isolation above, children who attend child care centers and persons who work in sensitive occupations may return when asymptomatic, provided their duties do not include food handling. It is further recommended that healthcare workers, child care workers and children who attend child care centers be excluded until two consecutive follow-up stool specimens are negative for *Salmonella*.

**Child Care Center Outbreak Control**
Whenever a case of *Salmonella* Paratyphi infection has been identified in a child care center attendee or worker, **all** staff and children in the same classroom as the case should be cultured for *Salmonella*. Arrangements to have this testing done at ODH Laboratory can be made by contacting the ODH Bureau of Infectious Diseases at (614) 995-5599.

**Vaccination**
There is no vaccine or preventive drug currently available.
Environmental Health Investigation
For cases acquired domestically, an environmental health assessment at each place where food was purchased is warranted. Screening of all food handlers should be considered to identify an asymptomatic carrier.
What is paratyphoid fever?
Paratyphoid fever is a life-threatening illness caused by the bacterium *Salmonella* Paratyphi. Paratyphoid fever is not common in the United States, Canada, Western Europe, Australia or Japan, but it is common in many other countries. It affects an estimated 5 million people worldwide each year. In the United States, about 90 people are diagnosed with paratyphoid fever each year, most often after traveling outside of the United States.

How is paratyphoid fever spread?
People who are actively ill with paratyphoid fever and people who are carriers of *Salmonella* Paratyphi bacteria can both spread the bacteria to other people. Carriers are people who have recovered from paratyphoid fever but continue to carry the bacteria. About 1 in 20 people remain carriers after they've recovered. Both groups of people shed (excrete) *Salmonella* Paratyphi in their feces (poop).

Paratyphoid fever is more common in areas of the world where water is more likely to be contaminated with sewage.

You can get paratyphoid fever if:
- You eat food or drink a beverage that has been touched by a person who is shedding *Salmonella* Paratyphi and who has not washed his/her hands thoroughly after going to the bathroom.
- Sewage contaminated with *Salmonella* Paratyphi gets into water you drink.
- Sewage contaminated with *Salmonella* Paratyphi gets into water used to rinse food you eat raw.

Can paratyphoid fever be prevented?
Yes. Paratyphoid fever can be prevented. If you are planning to travel outside the United States, you should find out how to avoid getting sick from food and drinks:

- **Hot food → Usually safe**
  High heat kills the germs that cause paratyphoid fever, so food that is cooked thoroughly is usually safe as long as it is served steaming hot. Be careful of food that is cooked and allowed to sit at warm or room temperatures, such as on a buffet. It could become contaminated again.
- **Dry or packaged food → Usually safe**
  Most germs require moisture to grow, so food that is dry, such as bread or potato chips, is usually safe. Food from factory-sealed containers, such as canned tuna or packaged crackers, is safe as long as it was not opened and handled by another person.
- **Raw food → Can be risky**
  Raw food should generally be avoided. Raw fruits or vegetables may be safe if you can peel them yourself or wash them in safe (bottled or disinfected) water. Steer clear of platters of cut-up fruit or vegetables. (Did you see the hands that cut them? Can you be sure those hands were clean?) Salads are especially problematic because shredded or finely cut vegetables offer a lot of surface area for germs to grow on. Also avoid fresh salsas or other condiments made from raw fruits or vegetables. Raw meat or seafood may contain germs; this includes raw meat that is “cooked” with citrus juice, vinegar or other acidic liquid (such as ceviche, a dish of raw seafood marinated in citrus juice).
• Street food → Can be risky
  Street vendors in developing countries may not be held to the same hygiene standards as restaurants (which may be low to begin with), so eat food from street vendors with caution. If you choose to eat street food, apply the same rules as to other food; for example, if you watch something come straight off the grill (cooked and steaming hot), it's more likely to be safe.

• Bushmeat → Can be risky
  Bushmeat refers to local wild game and generally include animals not typically eaten in the United States, such as bats, monkeys or rodents. Bushmeat can be a source of animal-origin diseases, such as Ebola or SARS, and is best avoided.

• Bottled or canned drinks → Usually safe
  Drinks from factory-sealed bottles or cans are safe; however, dishonest vendors in some countries may sell tap water in bottles that are “sealed” with a drop of glue to mimic the factory seal. Carbonated drinks, such as sodas or sparkling water, are safest since the bubbles indicate that the bottle was sealed at the factory. If drinking directly from a can, wipe off the lip of the can before your mouth comes into contact with it.

• Hot drinks → Usually safe
  Hot coffee or tea should be safe if it is served steaming hot. It's okay to let it cool before you drink it, but be wary of coffee or tea that is served only warm or at room temperature. Be careful about adding things that may be contaminated (cream, lemon) to your hot drinks (sugar should be fine; see “Dry food” above).

• Milk → Usually safe
  Pasteurized milk from a sealed bottle should be okay, but watch out for milk in open containers (such as pitchers) that may have been sitting at room temperature. This includes the cream you put in your coffee or tea. People who are pregnant or have weakened immune systems should stay away from unpasteurized milk and dairy products (cheese, yogurt).

• Alcohol → Usually safe
  The alcohol content of most liquors is sufficient to kill germs; however, stick to the guidelines above when choosing mixers and avoid drinks “on the rocks” (see “Ice” below). The alcohol content of beer and wine is probably not high enough to kill germs, but if it came from a sealed bottle or can, it should be okay.

• Tap water → Can be risky
  In most developing countries, tap water should probably not be drunk, even in cities. This includes swallowing water when showering or brushing your teeth. In some areas, it may be advisable to brush your teeth with bottled water. Tap water can be disinfected by boiling, filtering or chemically treating it (for example with chlorine).

• Fountain drinks → Can be risky
  Sodas from a fountain are made by carbonating water and mixing it with flavored syrup. Since the water most likely came from the tap, these sodas are best avoided. Similarly, juice from a fountain is most likely juice concentrate mixed with tap water and should be avoided.

• Ice → Can be risky
  Avoid ice in developing countries; it was likely made with tap water.

• Freshly squeezed juice → Can be risky
  If you washed the fruit in safe water and squeezed the juice yourself, drink up. Juice that was squeezed by unknown hands may be risky. The same goes for ice pops and other treats that are made from freshly squeezed juice.
Can animals spread paratyphoid fever to people?
No. *Salmonella* Paratyphi bacteria live only in humans. Animals can spread other kinds of *Salmonella* to humans, so it’s important to wash your hands after contact with animals, their feces (poop) or places where animals live, feed or roam.

What happens when someone ingests *Salmonella* Paratyphi?
When someone consumes a food or drink contaminated with *Salmonella* Paratyphi, the bacteria can multiply and spread into the bloodstream, causing paratyphoid fever.

What are the symptoms of paratyphoid fever?
People with paratyphoid fever usually have a sustained fever (one that doesn’t come and go) that can be as high as 103°F-104°F. Other symptoms include weakness, stomach pain, headache, diarrhea or constipation and loss of appetite. Some people with paratyphoid fever develop a rash of flat, rose-colored spots.

What do you do if you think you have paratyphoid fever?
The only way to know for sure if an illness is paratyphoid fever is to have a sample of blood or stool (poop) tested for *Salmonella* Paratyphi. If you have a high fever and feel very ill, see a doctor immediately. If you are traveling outside the United States, you can usually call the U.S. consulate for a list of recommended doctors.

How is paratyphoid fever treated?
Paratyphoid fever is treated with antibiotics. Resistance to antibiotics is increasing in the bacteria that cause paratyphoid fever. When bacteria are resistant to antibiotics, the bacteria are not killed and their growth is not stopped. To help guide treatment, your doctor may order special tests to see if your type of *Salmonella* is antibiotic-resistant.

People who do not get treatment can continue to have fever for weeks or months and can develop complications. As many as 30% of people who do not get treatment die from complications of the infection.

If you are being treated for paratyphoid fever, it is important to do the following:
- Keep taking antibiotics for as long as the doctor has recommended.
- Wash your hands carefully with soap and water after using the bathroom, and do not prepare or serve food for other people. This will lower the chance that you will pass the bacteria on to someone else.
- Have your doctor test your stool (poop) to be sure no *Salmonella* Paratyphi bacteria remain in your body.

For more information, please visit these websites:
- CDC Typhoid Fever and Paratyphoid Fever: [www.cdc.gov/typhoid-fever](http://www.cdc.gov/typhoid-fever)