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 patient residence is unknown, report to the local public health department in which the reporting health care provider or laboratory is located.

- Reporting Form(s) and/or Mechanism:
  - The Ohio Disease Reporting System (ODRS) should be used to report lab findings to the Ohio Department of Health (ODH). For healthcare providers without access to ODRS, you may use the Ohio Confidential Reportable Disease form (HEA 3334).
  - CDC 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 typhoid 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 module.

AGENT

*Salmonella enterica* serotype Typhi is the agent of *Salmonella* Typhi infections. (Note: this organism is different from *Salmonella enterica* serotype Typhimurium).

**Infectious dose:** A low infectious dose (<10^3 organisms) can cause disease.

CASE DEFINITION

**Clinical Description**
Infections caused by *Salmonella enterica* serotype Typhi are often characterized by insidious onset of sustained fever, headache, malaise, anorexia, relative bradycardia, constipation or diarrhea and non-productive cough. However, many mild and atypical infections occur. Carriage of S. Typhi 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. Typhi in a clinical specimen using a culture-independent diagnostic test (CIDT).
Confirmatory laboratory evidence: Isolation of S. Typhi from a clinical specimen.

Note: Serologic testing (i.e., detection of antibodies to S. Typhi) should not be utilized for case classification.

Epidemiological Linkage
- Epidemiological linkage to a confirmed S. Typhi infection case, OR
- Epidemiological linkage to a probable S. Typhi 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 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.

Comments
Several serological tests have been developed to detect antibodies to S. Typhi. However, no current serological test is sufficiently sensitive or specific to replace culture-based tests for the identification of S. Typhi infections. Whether public health follow-up for positive serological testing is conducted and how is at the discretion of the jurisdiction.

It is estimated that approximately 2%-5% of persons infected with S. Typhi become intestinal carriers who continue to shed S. Typhi for more than one year. These people are typically referred to as chronic carriers.

Differentiating whether a person is a chronic carrier or is experiencing a new infection often relies on a variety of 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. Typhi 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
A febrile illness with headache, malaise, anorexia, weakness, stomach pain, headache and non-productive cough. Flat, rose-colored spots on the trunk appear in 25% of cases. Constipation is more common than diarrhea in adults. Many mild and atypical infections occur. Approximately 2%-5% of people infected with S. Typhi become carriers.

Case-fatality rates are below 1% with prompt antimicrobial treatment but ranges 12%-30%
for patients who are not treated. Approximately 15%-20% of patients may experience a relapse, but symptoms are generally milder compared to the initial clinical illness.

**DIAGNOSIS**

Typhoid fever is diagnosed by isolating the organism from blood, stool, bone marrow, bile or other body fluid. Serology tests are not useful for diagnosis.

Some hospital laboratories have the ability to identify *Salmonella* Typhi. ODH Laboratory performs testing for *Salmonella*, including serotype Typhi. 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 (BID) at (614) 995-5599.

Clinical laboratories are asked to send all *Salmonella* isolates and 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 of *Salmonella* Typhi 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**

Typhoid fever occurs worldwide, but most of the disease burden occurs in resource-limited countries, particularly India, Bangladesh and Pakistan. Ohio reports approximately 10 cases annually, most of whom have a recent history of foreign travel.

**Mode of Transmission**

Ingestion of food or water contaminated with feces or urine symptomatic people or carriers is the most common way *Salmonella* Typhi 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. Direct person-to-person transmission by the fecal-oral route may also occur. Sexual transmission from an asymptomatic carrier of *S. Typhi* has been documented.

**Period of Communicability**

The organism is shed in the stool during the acute illness and throughout convalescence. About 10% of those with *S. Typhi* infections who are untreated shed the bacteria for 3 months after symptom onset. Approximately 2%-5% of typhoid fever patients, whether treated or untreated, become chronic carriers.

**Incubation Period**

3 days to over 60 days, usually 7-14 days.
PUBLIC HEALTH MANAGEMENT

Case Investigation
Local health departments are asked to contact ODH Bureau of Infectious Diseases at (614) 995-5599 upon learning of a new case of typhoid fever to expedite the investigation and follow-up. Ensure that the *Salmonella* serotype Typhi isolate (bacterial culture) is sent to ODH Laboratory. All cases should be contacted to obtain demographic and epidemiologic data. All cases, regardless of their occupation, should have 3 stool specimens tested for *Salmonella* serotype Typhi. 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. Fluoroquinolones appear to be the drug of choice for adults, but resistance is developing in some regions. Relapses occur in 3%-4% of cases.

The chronic carrier state may be eradicated with 4 weeks of oral therapy with ciprofloxacin or norfloxacin, antimicrobial agents that are highly concentrated in bile. High-dose parenteral ampicillin can also be used if 4 weeks of oral fluoroquinolone therapy is not well tolerated. Cholecystectomy may be indicated in some adults if antimicrobial therapy alone fails.

Isolation and Follow-Up Specimens
Ohio Administrative Code (OAC) 3701-3-13 (BB) states:
“Typhoid fever: a person with typhoid fever 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 after the person is asymptomatic and after three consecutive follow-up stool specimens are negative for *Salmonella* Typhi.”

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 typhoid 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.

Contacts
All household members and close contacts should be tested for *Salmonella* Typhi, 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 typhoid fever.
**Food Handlers**
Symptomatic persons shall be excluded from work. As detailed in Isolation above, food handlers may only return to work when asymptomatic and with three consecutive follow-up stool specimens negative for *Salmonella*.

The Food Service Operation rules also pertain. *Salmonella* Typhi 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/ohiouniform/FoodSafetyCodeManagementAndPersonnel/EmployeeHealth) (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 and when three consecutive follow-up stool specimens are negative for *Salmonella* Typhi.

**Child Care Center Outbreak Control**
Whenever a case of *Salmonella* Typhi 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* Typhi. Arrangements to have this testing done at ODH Laboratory may be made by contacting ODH’s Bureau of Infectious Diseases at (614) 995-5599.

**Vaccine**
Routine typhoid vaccination is not recommended in the U.S. Vaccination is indicated for the following people:
- Travelers to parts of the world where *Salmonella* Typhi is common,
- Close contacts to a *Salmonella* Typhi carrier,
- Microbiologists who work with *Salmonella* Typhi bacteria and
- People living outside the U.S. in areas where *Salmonella* Typhi is common.

Routine vaccination is not warranted for sewage workers in the U.S., summer camp attendees or persons affected by floods or other natural disasters in the U.S.

Two different typhoid vaccines are available in the U.S.; one is injectable and one is oral. Contact a travel clinic, local health department or the ODH Immunization Program at (614) 466-4643 for additional information. Please also refer to [CDC’s Advisory Committee on Immunization Practices (ACIP) recommendations](https://www.cdc.gov/vaccines/schedules/hcp/acip-recs/pdf/2018/acip2018.pdf).

**Special Information**
Travel to Asia, Africa and Latin America is especially risky for acquiring *Salmonella* Typhi infection. The risk of acquiring *Salmonella* Typhi infection while traveling overseas can be reduced by:
- Getting vaccinated against typhoid fever.
- Avoiding risky food and drink.

Typhoid vaccines are not 100% effective. If you acquire a drug-resistant strain of *Salmonella* Typhi and are not treated with effective antibiotics, a serious and prolonged illness can result. For these reasons, avoid risky food and drink. Bottled or boiled water is safe, as are hot, cooked foods. Avoid ice and raw fruits and vegetables that cannot be peeled. The adage “Boil it, cook it, peel it or forget it” applies! These precautions will also help the traveler avoid other diseases, such as dysentery and travelers’ diarrhea.
What is typhoid fever?
Typhoid fever is a life-threatening illness caused by the bacterium *Salmonella* Typhi. Typhoid 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 22 million people worldwide each year. In the United States, about 350 people are diagnosed with typhoid fever each year, most often after traveling outside the United States to countries such as India, Bangladesh and Pakistan.

How is typhoid fever spread?
People who are actively ill with typhoid fever and people who are carriers of *Salmonella* Typhi bacteria can both spread the bacteria to other people. Carriers are people who have recovered from typhoid 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* Typhi in their feces (poop).

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

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

Can typhoid fever be prevented?
Yes. Typhoid fever can be prevented. If you are planning to travel outside the United States, you should get vaccinated against typhoid fever and 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.

**Getting vaccinated.**

If you are traveling to a country where typhoid is common, you should consider being
vaccinated against typhoid fever. Visit a doctor or travel clinic to discuss your vaccination options. The typhoid vaccine is not 100% effective and typhoid fever could still occur. Both vaccines protect 50%-80% of recipients.

Remember that you will need to complete your vaccination at least 1-2 weeks before you travel, so that the vaccine has time to take effect. Typhoid vaccines lose effectiveness after several years. If you were vaccinated in the past, check with your doctor to see if it is time for a booster vaccination. Taking antibiotics will not prevent typhoid fever; they only help treat it.

The chart below provides basic information on typhoid vaccines that are available in the United States.

<table>
<thead>
<tr>
<th>Vaccine Name</th>
<th>How Given</th>
<th>Number of Doses Necessary</th>
<th>When Taken</th>
<th>Time Completed before Travel</th>
<th>Minimum Age</th>
<th>Booster Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ty21a (Vivotif, Swiss PaxVax)</td>
<td>1 capsule by mouth</td>
<td>4</td>
<td>Every other day</td>
<td>1 week</td>
<td>6 years</td>
<td>Every 5 years</td>
</tr>
<tr>
<td>ViCPS (Typhim Vi, Sanofi Pasteur)</td>
<td>Injection</td>
<td>1</td>
<td>Once</td>
<td>2 weeks</td>
<td>2 years</td>
<td>Every 2 years</td>
</tr>
</tbody>
</table>

The parenteral heat-phenol-inactivated vaccine (manufactured by Wyeth-Ayerst) has been discontinued.

Can animals spread typhoid fever to people?
No. Salmonella Typhi 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 after someone ingests Salmonella Typhi?
When someone consumes a food or drink contaminated with Salmonella Typhi, the bacteria can multiply and spread into the bloodstream, causing typhoid fever.

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

What do you do if you think you have typhoid fever?
The only way to know for sure if an illness is typhoid fever is to have a sample of blood or stool (poop) tested for Salmonella Typhi. 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 typhoid fever treated?
Typhoid fever is treated with antibiotics. Resistance to multiple antibiotics is increasing in the bacteria that cause typhoid 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 typhoid fever, it is important to do the following:
- Keep taking the prescribed 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 that no *Salmonella* Typhi 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)