

Enteric Fever (*Salmonella* Typhi/Paratyphi) Surveillance and Investigation Protocol

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I. ABOUT THE DISEASE

A. Clinical Presentation

The clinical presentation of *Salmonella* Typhi and *Salmonella* Paratyphi are indistinguishable from each other. Infections from both *Salmonella* serotypes start with a fever that increases daily and can reach up to 104°F by the third day after onset. Fever is typically lowest in the morning and highest in the evening. Other common symptoms include headaches, malaise, anorexia, abdominal pain, constipation, and/or diarrhea. Adults with *S. Typhi* infections also commonly experience bradycardia. Less common symptoms that some people experience include fatigue, body aches, sore throat, a dry cough, and a transient rash with flat, rose-colored spots visible on the trunk. Severe illness in children is characterized by shock, delirium, stupor, coma, and a change in mental status. The factors that determine how severe a person's illness will be include the strain virulence, quantity ingested, age of the patient, vaccination status, and how long a person was sick before they sought treatment.

Without treatment, illness caused by *S. Typhi* can last for a month. Relapses and chronic carriage also occur although the carrier state is uncommon among children. About 1-4% of cases who receive treatment for *S. Typhi* become asymptomatic chronic carriers. Relapses occur in 15-20% of *S. Typhi* cases and 3-4% of *S. Paratyphi* cases.

Patients with prolonged untreated infections are at greater risk for complications. Complications occur in about 10-15% of hospitalized *S. Typhi* cases and include gastrointestinal hemorrhage, intestinal perforation, and encephalopathy. Myocarditis and endocarditis are rare but serious complications. With prompt treatment the mortality rate is <1% for *S. Typhi* infections.

B. Etiologic Agent

Salmonella bacteria have two main species: *S. enterica* and *S. bongori*. *Salmonella enterica* subspecies *enterica* include the serotypes Typhi and Paratyphi which are responsible for Typhoidal *Salmonella* in humans. *Salmonella* Typhi is the bacterial etiologic agent responsible for causing Typhoid fever. Paratyphoid fever is caused by *Salmonella enterica* serotype Paratyphi A, Paratyphi B [tartrate negative], or Paratyphi C. Collectively, illness caused by these *Salmonella* serotypes are called Enteric Fever.

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C. Reservoir

Salmonella enterica serotypes Typhi and Paratyphi are human-specific pathogens and cause Typhoid and Paratyphoid fever, respectively. Chronic carriers serve as a long-term reservoir for *S. Typhi* in regions where Typhoid fever is endemic.

D. Incubation Period

The incubation period for Typhoid fever is typically seven to 14 days (range: 3-60 days) and one to 10 days for Paratyphoid fever. The dose ingested may impact the incubation period.

E. Mode of Transmission

Typhoid and Paratyphoid fever are transmitted through the consumption of food or water that has been contaminated by feces or urine from a person shedding *Salmonella* Typhi or Paratyphi bacteria. The risk of infection is high in resource limited countries with poor sanitation and unsafe water where these conditions are endemic. In countries with poor sanitation and unsafe water, transmission also occurs when food or drinks are contaminated by sewage or when food has been rinsed using contaminated water. Returning international travelers constitute about 85% of Typhoid fever and 80% of Paratyphoid fever cases in the United States. Travel to South Asia primarily Bangladesh, India, and Pakistan make up 70% of travel-associated cases in the United States. Although rare, transmission through sexual contact particularly among men who have sex with men can occur. Waterborne transmission of *Salmonella* Typhi requires a low dose of bacteria. In comparison, foodborne transmission typically has a large dose and results in high attack rates over short periods of time.

F. Period of Communicability

A person will remain infectious as long as the *Salmonella enterica* serotypes responsible for causing Typhoid and Paratyphoid fever are shed in the stool or urine. Excretion typically starts a week after symptoms develop and continues through recovery. Some people will continue to excrete *S. Typhi/Paratyphi* even after recovery and remain infectious despite no longer having symptoms. Chronic carriers continue to shed bacteria in their urine or feces for months or years after recovery and remain an important source of infection. About 10% of untreated Typhoid fever cases will excrete *S. Typhi* for three months after symptom onset. People with Paratyphoid fever are usually infectious for one to two weeks after symptoms develop. Fewer people infected with *S. Paratyphi* become chronic carriers.

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II. DISEASE CONTROL AND PREVENTION

A. Disease Control Objectives

Reduce the occurrence of secondary *Salmonella* Typhi and Paratyphi cases in West Virginia by:

1. Providing education to the public and healthcare providers on transmission and prevention.
2. Rapidly investigating cases and implementing case management strategies.
3. Intensively searching for unidentified cases and carriers as well as for food or water vehicles that are the source of infection.
4. Completing contact investigations and implementing management approaches to identify cases.

B. Disease Prevention Objectives

Reduce risk of disease by educating the public and healthcare providers about prevention strategies:

1. *S. Typhi* and Paratyphi are endemic in some parts of the world. Travelers to Africa, East Asia, South Asia, and Latin America should take precautions to protect themselves from *S. Typhi* and Paratyphi infection.
2. When traveling to a country with poor sanitation and unsafe water:
 - Talk to your healthcare provider about getting the Typhoid vaccine before your trip.
 - There are no vaccines to protect against Paratyphoid fever, travelers should focus on safe eating and drinking practices to keep themselves healthy.
3. Follow safe eating and drinking measures during travel, including:
 - Washing hands with soap and water before eating, preparing food, and after going to the bathroom. When soap and water are not available use hand sanitizer.
 - Eat foods that are fully cooked and still hot.
 - Avoid eating raw fruits or vegetables that cannot be peeled.
 - Avoid drinking unpasteurized milk or eating unpasteurized dairy products.
 - Avoid eating foods from street vendors unless they are served hot.
 - Only drink water from unopened, sealed water bottles. If bottled water is not available, boil water for at least a minute before drinking. At elevations above 6,500 feet, boil for three minutes.
 - Avoid ice, popsicles, and flavored ice unless they are made with bottled water or water that was boiled for at least one minute.

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- Boil milk and water used for infant feeding, if not breastfeeding.
4. People diagnosed with *S. Typhi* including Typhoid carriers should not participate in food preparation or patient care until the local health department releases them from public health supervision.

C. Disease Treatment

People with infections of *S. Typhi* and Paratyphi who receive treatment with an appropriate antibiotic for their infection experience a shortened illness and have a lower risk of complications and death. The rise of multidrug-resistant and extensively drug-resistant strains limit treatment options; antimicrobial susceptibility testing is needed to select an effective antimicrobial treatment. Empiric treatment should consider the patient's travel history and the antibiotic resistance patterns common to the travel destination while waiting for the results of the culture and susceptibility tests. Critically ill patients that receive short-term high-dose corticosteroid treatment in combination with antibiotics and supportive care have a lower risk of death. *S. Typhi* carriers have been successfully treated with oral ciprofloxacin or norfloxacin twice daily for 28 days in up to 90% of cases.

Recommendations for empiric treatment include:

- Patients with a travel history to Pakistan or Iraq in the 30 days before symptom onset may be treated empirically with azithromycin for uncomplicated illness or carbapenem antibiotic for complicated illness.
- Returning international travelers who did not visit Pakistan or Iraq may be treated empirically with ceftriaxone or azithromycin.
- Patients from the United States that do not report international travel are recommended to receive azithromycin for uncomplicated illness and carbapenem for complicated illness.
- In the United States, most infections with *S. Typhi* and Paratyphi are fluoroquinolone non-susceptible, **fluoroquinolones are not recommended for empiric treatment** but may be used to treat fluoroquinolone susceptible infections based on the results of susceptibility testing.

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III. DISEASE INVESTIGATION

A. *Salmonella enterica* serotype Typhi Case Definition and Case Classification

Clinical Description

Infections caused by *Salmonella enterica* serotype Typhi (*S. Typhi*) 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. Typhi* may be prolonged.

Clinical Criteria

One or more of the following:

- Fever
- Diarrhea
- Abdominal Cramps
- Constipation
- Anorexia
- Relative bradycardia

Laboratory Criteria

Confirmatory laboratory evidence:

- Isolation of *S. Typhi* from a clinical specimen.

Presumptive laboratory evidence:

- Detection of *S. Typhi* in a clinical specimen using a culture-independent diagnostic test (CIDT).

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

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Epidemiologic 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.

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.

Case Classifications

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.

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 serologic testing is conducted and how is at the discretion of the jurisdiction.

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

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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., pulsed-field gel electrophoresis [PFGE], 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* 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.

B. *Salmonella enterica* Paratyphi A, B [tartrate -], and C Case Definition and Case Classification

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

One or more of the following:

- Fever
- Diarrhea
- Abdominal Cramps
- Constipation
- Anorexia
- Relative bradycardia

Laboratory Criteria

Confirmatory laboratory evidence:

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- Isolation of *S. Paratyphi* A, B [tartrate negative], or C from a clinical specimen.

Presumptive laboratory evidence:

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

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.

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.

Case Classifications

Probable

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

Confirmed

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- A person with confirmatory laboratory evidence.

Comments

Persons with isolation of *S. 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 of factors, including advanced laboratory testing (e.g., pulsed-field gel electrophoresis [PFGE], 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.

C. Reporting Time Frame to Public Health

Report all cases to the local health department as soon as possible, but within the following time frame:

- Sporadic cases of *Salmonella* Typhi/Paratyphi: within 24 hours of diagnosis.
- Outbreaks of *Salmonella* Typhi/Paratyphi: immediately (see outbreak recognition and definition below).

D. Outbreak Recognition

Outbreak of *Salmonella* Typhi: a cluster of two or more people with isolation of *Salmonella* Typhi from clinical specimens or isolation of the *Salmonella* Typhi from an epidemiologically implicated food. Most often foreign travel is associated.

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Foodborne Disease Outbreak: two or more people who experience a similar illness after ingestion of a common food.

When you suspect an outbreak:

1. Contact the Regional Epidemiologist and Office of Epidemiology and Prevention Services (OEPS) epidemiologist on-call to report the outbreak. The epidemiologist on-call may be reached at (304) 558-5358.
2. Notify the district sanitarian as early as possible in the investigation.
3. Investigate cases, identify contacts, and collect epidemiologic risk factors including travel history.
4. Compile the line list(s) to construct a timeline and track important epidemiological data.
5. Implement case management strategies including sensitive setting exclusions, antimicrobial susceptibility testing, and treatment to prevent secondary cases.
6. Implement contact management strategies including sensitive setting exclusions, testing, and treatment if needed to identify additional cases and prevent further spread.
7. Identify additional cases by reviewing surveillance data, contact investigations, educating providers on reporting requirements, notifying healthcare providers when there has been an increase in cases, and surveying people who shared the same exposure as the case.
8. Collect food, water, and other specimens as needed.
9. Consult the OEPS epidemiologist on-call to coordinate outbreak testing through the Office of Laboratory Services (WV OLS) for appropriate collection, handling, and shipping of specimens.
10. Request assistance from the district sanitarian and/or West Virginia Office of Environmental Health Services (WV OEHS) to conduct a complete environmental investigation of the facility or site of any suspected outbreak.
11. Generate a hypothesis about the source of the outbreak based on who is getting sick, when, and where illnesses are occurring. Use a hypothesis generating questionnaire when routine surveillance interviews do not point to a suspected source.
12. Confirm the source of the outbreak based on epidemiologic evidence, traceback investigations, and food/environmental testing.
13. Include the LHD sanitarian, WV OEHS, and the West Virginia Department of Agriculture (WVDA) for assistance in food product traceback, recall, and testing for foodborne outbreak source confirmation.
14. Provide education to cases, contacts, and affected settings about how Enteric fever is transmitted and how to prevent infection.

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15. Complete the final outbreak report and submit to the OEPS outbreak lead with all supporting documentation.

E. Healthcare Provider Responsibilities

1. Report all *Salmonella* Typhi/Paratyphi cases to the local health department serving the patient's county of residence within 24 hours of diagnosis.
2. Report all suspected or confirmed outbreaks to the local health department serving the patient's county of residence immediately.
3. In addition to standard precautions, implement contact precautions while caring for infected patients. Hospital care may be necessary during acute illness with Enteric fever.
4. Blood cultures are the recommended test for diagnosis. Obtain blood and stool cultures for all children with unexplained fever after travel or after having contact with someone who has traveled internationally. Blood cultures should be considered for patients who are at risk of severe illness.
5. Obtain stool cultures for all contacts that traveled internationally with the *Salmonella* Typhi/Paratyphi positive patient.
6. Serologic tests do not differentiate between acute infection, past infection, or vaccination and should not be used to diagnose *Salmonella* Typhi. However, elevated antibody titers to purified Vi polysaccharide will assist in the identification of *S. Typhi* carriers.
7. Obtain a travel history for patients with *Salmonella* Typhi/Paratyphi infection. Antibiotic resistant strains have become prevalent worldwide and resistance patterns vary by geographic region. Travel history should inform empiric treatment decisions.
8. Empiric treatment recommendations are as follows:
 - a. For patients with a **history of travel to Iraq or Pakistan** and for **patients who did not travel internationally** include:
 - i. Treatment of uncomplicated illness with azithromycin.
 - ii. Treatment of complicated illness with a carbapenem.
 - b. For **patients returning from countries other than Iraq and Pakistan**, empiric treatment with ceftriaxone and azithromycin is recommended.
 - c. Many *Salmonella* Typhi/Paratyphi strains are not susceptible to fluoroquinolones. Fluoroquinolones are not recommended for empiric treatment.
9. Request an antimicrobial susceptibility test on all *Salmonella* isolates.
10. Use the results of antimicrobial susceptibility testing to guide clinical management decisions.
11. Patients with Enteric fever are often mis-identified as having malaria. Healthcare professionals should consider Enteric fever when patients do not respond to antimalarial medication and have traveled to a country where *S. Typhi*/Paratyphi are endemic.

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Vaccine Recommendations

There are two vaccines that are licensed for use against Typhoid fever in the United States: Vivotif, an oral live attenuated multidose vaccine using *S. enterica* Typhi strain Ty21a and ViCPS, a single-dose intramuscular vaccine containing the polysaccharide Vi antigen. Vaccine efficacy ranges from 50-80%. Currently, there are no vaccines available to protect against *S. Paratyphi* although Typhoid vaccine Ty21a is thought to provide partial cross-protection against *S. Paratyphi* B.

Immunization is recommended for:

- People two years and older, who plan to travel to areas where Enteric fever is endemic. Destination specific vaccine recommendations may be found at: <https://wwwnc.cdc.gov/travel>.
- People who have intimate exposure to a chronic *S. Typhi* carrier.
- People with potential occupational exposure to *S. Typhi*.

Table 1: Typhoid Fever Vaccines Available in the United States					
Vaccine	Approved Use by Age	Dose and Route of Administration	Number of Doses	Dosing Interval	Booster Dose Interval
Vivotif: live attenuated Ty21a vaccine					
Primary Series	≥6 years	1 capsule, orally every other day	4	48 hours	N/A
Booster	≥6 years	1 capsule, orally every other day	4	48 hours	Every 5 years
ViCPS: Vi Capsular polysaccharide vaccine					
Primary Series	≥2 years	0.5 mL, IM injection	1	N/A	N/A
Booster	≥2 years	0.5 mL, IM injection	1	N/A	Every 2 years

F. Laboratory Responsibilities

1. Report cases of *Salmonella* Typhi/Paratyphi to the local health department serving the patient’s county of residence within 24 hours of diagnosis. Electronically report the lab result or fax a copy of the result, including antibiotic sensitivities.

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2. Report all suspected or confirmed outbreaks to the local health department serving the patient's county of residence immediately.
3. Clinical laboratories performing multiplex PCR tests that are positive for *Salmonella* should then perform culture confirmation. Isolate recovery is an essential step to guide clinical management as many infections are caused by multidrug-resistant strains of *Salmonella* Typhi/Paratyphi and antimicrobial susceptibility testing requires an isolate.
4. Submit all *Salmonella* isolates for serotyping to the Office of Laboratory Services along with the completed [Microbiology Laboratory Specimen Submission Form](#). For instructions on specimen collection, see [Stool Specimen Collection Instructions](#) (Enteric). Send specimens to the Office of Laboratory Services at 167 11th Avenue, South Charleston, WV 25303. For questions, call (304) 558-3530.
5. The West Virginia Office of Laboratory Services will perform serotyping and whole genome sequencing. All *Salmonella* Typhi isolates will be submitted to the National Antimicrobial Resistance Monitoring System (NARMS).

G. Local Health Responsibilities

Investigate sporadic cases of *Salmonella* Typhi and *Salmonella* Paratyphi.

1. Evaluate laboratory results to determine if requirements of the case definition are satisfied. Serologic evidence alone is not sufficient for a diagnosis. Isolation of the organism by CIDT or culture is required.
2. Interview the case using the [CDC Typhoid and Paratyphoid Fever Surveillance Report Form](#).
3. Determine the source of infection for every case by searching for unreported cases, carriers, and/or contaminated food or water sources. Selectively eliminate suspected sources of contaminated food or water sources based on epidemiologic evidence.
4. Identify household contacts, contacts in sensitive settings, and international travel companions for public health follow up and medical evaluation.
5. If an epidemiologically linked person with clinically compatible symptoms is identified, investigate as a separate case, and open an investigation in the West Virginia Electronic Disease Surveillance System (WVEDSS).
6. Enter the case data, contact investigation, and laboratory information into WVEDSS and attach the CDC Typhoid and Paratyphoid Fever Surveillance Report Form to the *Attachments* section in the *Supplemental Info* tab.
7. Educate healthcare providers and laboratories on reporting responsibilities, transmission, recommended testing, and prevention.
8. Educate cases and the public about how *Salmonella* Typhi/Paratyphi is transmitted, [prevention](#), and precautions to take during international travel.

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9. Ensure clinical laboratories are submitting specimens to WV OLS for further testing. Provide guidance and assistance as needed.
10. Implement appropriate contact management strategies:
 - a. Public health follow up should be implemented for all international travel companions to the case, household contacts, other close contacts, and contacts in sensitive settings.
 - b. Household contacts should not be employed in sensitive settings until two negative stool cultures collected at least 24 hours apart have been obtained.
 - c. For contacts that work as food handlers refer to the Food Handler Exclusion Worksheet for guidance on when to exclude food handlers from service and criteria for reinstatement.
 - d. For contacts that are members of healthcare or daycare settings refer to the Enteric Conditions Exclusion Worksheet for guidance on exclusion and reinstatement criteria for staff and attendees.
 - e. Administration of the Typhoid vaccine may be considered for contacts that are exposed to carriers of *Salmonella* Typhi for a prolonged period or on a continuous basis.
 - f. Asymptomatic contacts who had contact with a case of *Salmonella* Typhi but did not travel internationally should be evaluated on a case-by-case basis to determine the need for testing and treatment.
 - g. Case and contacts should be instructed in proper hand washing before, preparing, eating or servicing food and after defecation. The local health department should be confident that proper hand washing technique is being followed.
11. Determine if the case is a member of a sensitive setting and institute appropriate control measures.
 - a. If the case works in or attends a daycare facility.
 - i. Interview manager/operator and check attendee records to identify contacts as well as other symptomatic attendees or staff.
 - ii. Refer to the Enteric Conditions Exclusion Worksheet for guidance on exclusion and reinstatement criteria for staff and attendees.
 - iii. For those five years of age and older, exclude until 24 hours without diarrhea. Supervised hand washing of class should be encouraged.
 - iv. For *S. paratyphi* cases in childcare attendees or staff members, stool specimens should be collected from attendees and staff members. Those who test positive should be excluded.
 - v. Provide education to the facility administrator on proper food handling and hand washing, especially after changing diapers.
 - vi. Refer symptomatic contacts to a healthcare provider for medical evaluation and testing.

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- vii. Conduct an environmental inspection if there are other suspected cases.
- viii. Instruct the manager/operator to notify the local health department if additional daycare attendees or staff become ill.
- b. If the case is a food handler:
 - i. Conduct an environmental inspection of the facility. Interview the manager/operator and check records to identify suspect cases.
 - ii. Refer symptomatic individuals to a healthcare provider for medical evaluation and testing.
 - iii. Educate employees on the importance of general hygienic practices including hand washing, reportable signs and symptoms of illness, and to stay home when ill.
 - iv. Refer to the Food Handler Exclusion Worksheet for guidance on when to exclude food handlers from service and criteria for reinstatement. All food handler exclusion guidance is based on the FDA Food Code adopted under the West Virginia Legislative Rule 64CSR17, the Food Establishment Code.
- c. If the case is a member of healthcare or residential care facility:
 - i. Identify any abnormal incidence of diarrheal illness and common sources of exposure.
 - ii. Symptomatic individuals should receive medical evaluation and testing.
 - iii. In addition to standard precautions, healthcare providers should use contact precautions for any suspected *S. Typhi* cases until the results of three consecutive stool cultures taken at least one month after symptom onset and collected at least 24 hours apart and at least 48 hours after the cessation of antimicrobial therapy are negative.
 - iv. Conduct an environmental inspection of the facility.
 - v. Refer to the Enteric Conditions Exclusion Worksheet for guidance on exclusion and reinstatement criteria for staff and attendees.

Lost to follow-up (LTF) is defined as a patient who cannot be located or contacted by disease investigators to provide disease education or preventative intervention. A case investigation can be deemed “Lost to Follow Up” by local health department (LHD) staff after:

- The LHD has made three unsuccessful contact attempts* to the patient. Contact attempts must be documented in the WVEDSS General Comments.
- Documentation of LTFU status must be completed within 30 days of the investigation start date.

**Avenues of contact the LHD can consider are phone calls, text messages, emails, in person visits or speaking with a medical power of attorney. For best practice, contact attempts can be made on three different days and times.*

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H. State Health Responsibilities

1. Provide consultative support to local health departments and regional epidemiologists on case and outbreak management as needed.
2. Work with the Centers for Disease Control and Prevention (CDC), U.S. Food and Drug Administration (FDA), United States Department of Agriculture (USDA) and West Virginia Office of Environmental Health Services (OEHS) on multi-state outbreaks.
 - a. When a case is identified as part of a CDC-identified outbreak, provide the local health department with the CDC Case Report Form to complete the case.
 - b. Send the completed case report form to the CDC and enter case data into the System for Enteric Disease Response, Investigation, and Coordination (SEDRIC).
3. Open, review, and close cases in WVEDSS.

IV. DISEASE SURVEILLANCE

A. Public Health Significance

The disease burden for Enteric fever primarily impacts resource limited countries that have poor sanitation and unsafe water. Globally, an estimated 9.2 million Typhoid fever illnesses and 3.8 million Paratyphoid fever illnesses occur each year. In the United States, Typhoid fever causes about 5,700 illnesses and 620 hospitalizations annually, with 85% of Typhoid and 80% of Paratyphoid fever cases associated with international travel. Since 2020, there have been three cases of Paratyphoid Fever and four cases of Typhoid Fever in West Virginia. International travel was identified as the source of infection in three of the four West Virginia Typhoid fever cases. Despite the comparatively low prevalence of these conditions in the United States, travel-associated transmission and the rise of antibiotic-resistant strains means that Enteric fever continues to pose a public health threat.

Antimicrobial-resistant strains of *Salmonella* Typhi are frequently transferred internationally; these resistant strains have been shown to replace the local drug-susceptible strains. Among cases in the United States, returning international travelers commonly report travel to South Asia, primarily Bangladesh, India, and Pakistan. From 2006 to 2015, 244 United States Typhoid fever cases reported traveling to Pakistan prior to becoming ill, 79% of the specimens available from these cases were fluoroquinolone nonsusceptible and 50% were multidrug-resistant. In 2016, Pakistan experienced an outbreak of extensively drug-resistant Typhoid fever which was resistant to all, but two antibiotic classes recommended for treatment. From 2016-2018, 29

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United States cases of Typhoid fever reported travel to Pakistan and five were infected with an extensively drug-resistant strain of *Salmonella* Typhi.

The emergence of increasingly antimicrobial-resistant strains of *S. Typhi* complicates patient treatment and may impact patient outcomes. Fluoroquinolones were a commonly used treatment in the 1990s that were initially effective against multidrug-resistant strains of *S. Typhi*. However, most infections with Typhoid fever in the United States are now fluoroquinolone nonsusceptible. Fluoroquinolone nonsusceptibility has been associated with treatment failure or delayed clinical response. In 2013, a *Salmonella* Typhi strain that was resistant to azithromycin emerged in Bangladesh. Azithromycin-resistant *S. Typhi* have now been identified in Bangladesh, India, Pakistan, Nepal, and Singapore.

The emergence and spread of antimicrobial-resistant *S. Typhi* underscores the importance of continued public health surveillance and prevention efforts. Without effective disease control, improved sanitation, and improved access to safe drinking water, the risk of international transmission from resource limited countries where *S. Typhi* is endemic will persist. The rapid detection of Typhoid and Paratyphoid cases is essential to prevent local transmission within the United States. Identifying resistance patterns will ensure that patients will receive effective antibiotic treatment and improve patient outcomes.

B. Disease Surveillance Objectives

1. Promptly identify cases to prevent further spread.
2. To understand the occurrence of drug-resistant strains in West Virginia.
3. To rapidly recognize and respond to outbreaks of *S. Typhi*/Paratyphi.

C. Surveillance Indicators

1. The proportion of cases with complete demographic, clinical, and epidemiologic information.
2. The proportion of cases with susceptibility testing.
3. The proportion of cases that received antimicrobial treatment.
4. The proportion of cases with a suspected/confirmed source of infection identified.
5. The proportion of cases with specimens sent to WV OLS for serotyping and whole genome sequencing.

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V. REFERENCES

1. CDC. Typhoid and Paratyphoid Fever. Yellow Book. Published August 28, 2025. https://www.cdc.gov/yellow-book/hcp/travel-associated-infections-diseases/typhoid-and-paratyphoid-fever.html#cdc_report_pub_study_section_6-diagnosis
2. CDC. Symptoms of Typhoid Fever and Paratyphoid Fever. Typhoid Fever and Paratyphoid Fever. Published 2024. <https://www.cdc.gov/typhoid-fever/signs-symptoms/>
3. Kimberlin D, Banerjee R, Barnett E, Lynfield R, Sawyer M, eds. RED BOOK: 2024-2027 Report of the Committee on Infectious Diseases. 33rd ed. American Academy of
4. Control of Communicable Diseases Manual (21st Edition) Heymann D, Ross E, eds. Control of Communicable Diseases Manual. 21st ed. American Public Health Association; 2022:681-688.
5. CDC. About Typhoid Fever and Paratyphoid Fever. Typhoid Fever and Paratyphoid Fever. Published April 25, 2024. <https://www.cdc.gov/typhoid-fever/about/index.html>
6. Underwood WJ, Blauwiel R, Delano ML, Gillesby R, Mischler SA, Schoell A. Biology and Diseases of Ruminants (Sheep, Goats, and Cattle). Laboratory Animal Medicine. 2015;3:623-694. doi:<https://doi.org/10.1016/b978-0-12-409527-4.00015-8>
7. CDC. Preventing Typhoid Fever and Paratyphoid Fever. Typhoid Fever and Paratyphoid Fever. Published May 16, 2024. <https://www.cdc.gov/typhoid-fever/prevention/index.html>
8. CDC. Clinical Guidance for Typhoid Fever and Paratyphoid Fever. Typhoid Fever and Paratyphoid Fever. Published 2024. <https://www.cdc.gov/typhoid-fever/hcp/clinical-guidance/index.html>
9. Chatham-Stephens K, Medalla F, Hughes M, et al. Emergence of Extensively Drug-Resistant *Salmonella* Typhi Infections Among Travelers to or from Pakistan — United States, 2016–2018. MMWR Morb Mortal Wkly Rep 2019;68:11–13. DOI: <http://dx.doi.org/10.15585/mmwr.mm6801a3>
10. *Salmonella* Typhi infection (*Salmonella enterica* serotype Typhi) 2019 Case Definition | CDC. Published June 9, 2021. <https://ndc.services.cdc.gov/case-definitions/salmonella-typhi-infection-2019/>
11. *Salmonella* Paratyphi infection (*Salmonella enterica* serotypes Paratyphi A, B [tartrate negative], and C [*S.* Paratyphi]) 2019 Case Definition | CDC. Published June 1, 2022. <https://ndc.services.cdc.gov/case-definitions/salmonella-paratyphi-infection-2019/>
12. CDC. Multistate Foodborne Outbreaks: Investigation Steps. Foodborne Outbreaks. Published December 2025. <https://www.cdc.gov/foodborne-outbreaks/outbreak-basics/investigation-steps.html>

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13. Centers for Disease Control and Prevention (U.S.) (2019). Antibiotic resistance threats in the United States, 2019.
14. da Silva KE, Tanmoy AM, Pragasam AK, et al. The international and intercontinental spread and expansion of antimicrobial-resistant *Salmonella* Typhi: a genomic epidemiology study. *Lancet Microbe*. 2022;3(8):e567-e577. doi:10.1016/S2666-5247(22)00093-3