

Typhoid Fever

(*Salmonella typhi*, also known as Enteric Fever,
Typhus Abdominalis)

Note: This chapter focuses on typhoid fever, caused by a serotype of the *Salmonella* bacteria called *Salmonella typhi*. For information about non-typhoid salmonellosis, refer to the chapter entitled “Salmonellosis (Non-Typhoid).”

DISEASE REPORTABLE WITHIN 24 HOURS OF DIAGNOSIS

Per NJAC 8:57, health care providers and administrators shall report by mail or by electronic reporting within 24 hours of diagnosis, confirmed cases of invasive pneumococcal disease to the health officer of the jurisdiction where the ill or infected person lives, or if unknown, wherein the diagnosis is made. A directory of local health departments in New Jersey is available at

<http://www.state.nj.us/health/lh/directory/lhdselectcounty.shtml>.

If the health officer is unavailable, the health care provider or administrator shall make the report to the Department by telephone to 609.826.5964, between 8:00 A.M. and 5:00 P.M. on non-holiday weekdays or to 609.392.2020 during all other days and hours.



1 THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Typhoid fever is a systemic bacterial disease caused primarily by a serotype of *Salmonella* called *Salmonella typhi*. A new *Salmonella* serotype nomenclature has been proposed based on DNA correlation. The proposed nomenclature would change the current name *Salmonella typhi* to *Salmonella enterica serovar Typhi*, abbreviated *S. Typhi*.

B. Clinical Description

Typhoid fever has a different presentation than common salmonellosis. Initial symptoms typically include sustained fever as high as 103° to 104° F (39° to 40° C), anorexia, lethargy, malaise, dull continuous headache, splenomegaly, relative bradycardia and non-productive cough. Vomiting and diarrhea are typically absent, but constipation is frequently reported. During the second week of illness, there is often a protracted fever and mental dullness, which is how the disease got the name “typhoid,” which means “stupor-like.” After the first week or so, many cases develop a maculopapular rash (rose-colored spots) on the trunk and upper abdomen. Other symptoms can include intestinal bleeding, slight deafness and parotitis. Mild and atypical infections are common. Approximately 10-20% of untreated infections may be fatal, although the case-fatality rate is usually <1% with prompt antibiotic treatment. Relapses are not uncommon. Paratyphoid fever is a similar illness but is usually much milder and is caused by a different *Salmonella* serotype called *Salmonella Paratyphi*.

C. Reservoirs

Humans are the reservoir for *S. typhi* and *S. paratyphi*. Domestic animals may harbor *S. paratyphi*, but this is rare. Chronic carriers (excretion of the organism for more than 1 year) occurs in approximately 5% of infected persons, some after mild or inapparent infection. Chronic carriers are the most important reservoirs for *S. typhi*. Persons with abnormalities of the genitourinary system, including schistosomiasis, have a much higher prevalence of urinary carriage than those with a normal GI system.

D. Modes of Transmission

S. Typhi is transmitted via the fecal-oral route, either directly from person-to-person or by ingestion of food or water contaminated with feces or urine. Large epidemics are most often related to fecal contamination of water supplies or street vended foods. Shellfish harvested from sewage-contaminated water are potential vehicles, as are fruits and vegetables grown in soil fertilized with human waste in developing countries. Transmission can also occur person-to-person through certain types of sexual contact (e.g., oral-anal contact).

E. Incubation Period

The incubation for typhoid fever ranges from 3 days to 1 month (depending on the infecting dose), with a usual range of 1–2 weeks. For paratyphoid fever, the incubation period is usually 1–10 days.

F. Period of Communicability or Infectious Period

The disease is communicable for as long as the infected person excretes *S. typhi* or *S. paratyphi* in the feces or urine. This usually begins about a week after onset of illness and continues through convalescence and for a variable period thereafter. If a carrier state develops, excretion of *S. typhi* or *S. paratyphi* could be permanent.

G. Epidemiology

In the United States, about 400 cases of typhoid fever occur each year, and 75% of these are acquired during international travel (i.e., imported). Typhoid fever is still common in the developing world, where it affects about 21.5 million persons each year, with an estimated 600,000 deaths. Without therapy, the illness may last for 3 to 4 weeks, and death rates range between 12% and 30%. Over the past 10 years, travelers to Asia, Africa and Latin America have been especially at risk. Increasing resistance to available antimicrobial agents, including fluoroquinolones, are becoming more and more prevalent and may foretell dramatic increases in case-fatality rates. Epidemics and high endemic disease rates have occurred in the Central Asian Republics, the Indian subcontinent, and across Asia and the Pacific Islands. Outbreaks have occurred in the United States from food that had been brought here from other countries. Despite suggestions to the contrary, outbreaks do not occur as a result of floods or other disasters in countries that do not have endemic Typhoid, such as the United States. In New Jersey, approximately 30 cases of typhoid fever are reported annually to New Jersey Department of Health and Senior Services.

2 CASE DEFINITION

NOTE: Case definitions establish uniform criteria for identifying and classifying cases for reporting purposes, and should NOT be used for establishing clinical diagnoses or determining the standard of care necessary for a particular patient. For many conditions of public health importance, action to contain disease should be initiated as soon as a problem is identified; in many circumstances, appropriate public health action should be undertaken even when available information is insufficient to determine a clinical diagnosis or case status.

A. New Jersey Department of Health and Senior Services (NJDHSS) Case Definition

CONFIRMED

A clinically compatible case, **AND**

- Isolation of *S. Typhi* from blood, stool or other clinical specimen.

PROBABLE

A clinically compatible case that is epidemiologically linked to a confirmed case

POSSIBLE

Not used.

B. Differences from the Centers for Disease Control and Prevention (CDC) Case Definition

The CDC and NJDHSS surveillance case definition are the same.

3 LABORATORY TESTING AVAILABLE

Laboratory diagnosis is based on isolation of *S. Typhi* from the blood early in the disease and from stool and urine after the first week of disease. Salmonella can be also cultured from the bone marrow (this is the single most sensitive method of isolating of *S. Typhi*). The serologic Widal test is generally of little diagnostic value.

The PHEL requests that all laboratories submit all *S. Typhi* isolates for typing to aid in public health surveillance (NJAC 8:57-1.6 (f)). For more information on submitting specimens, contact the PHEL at 609.292.7368. After authorization from the Division of Epidemiology, Occupational and Environmental Services, PHEL will test implicated food items from a cluster or outbreak.

NOTE: Isolates of *S. Typhi* must be submitted within the three (3) working days to the New Jersey Department of Health and Senior Services, Division of Public Health and Environmental Laboratories, Specimen Receiving and Records, P.O. Box 361, John Fitch Plaza, Trenton, NJ 08625-0361.

4 PURPOSE OF SURVEILLANCE AND REPORTING REQUIREMENTS

A. Purpose of Surveillance and Reporting

- To identify transmission sources of public health concern (e.g., contaminated food or water) and to stop transmission from such sources.
- To identify whether the patient may be a source of infection for other persons (e.g., day-care worker or attendee, food handler, health care provider) and, if so, to prevent further transmission.
- To provide education about reducing the risk of infection.

B. Laboratory Reporting Requirements

The New Jersey Administrative Code (NJAC 8:57-1.6) stipulates that laboratories report (by telephone, confidential fax, or over the Internet using the Communicable Disease Reporting and Surveillance System [CDRSS]) all cases of *S. Typhi* to the local health officer having jurisdiction over the locality in which the patient lives, or, if unknown, to the health officer in whose jurisdiction the health care provider requesting the laboratory examination is located. The report shall contain, at a minimum, the reporting laboratory's name, address, and telephone number; the age, date of birth, gender, race, ethnicity, home address and telephone number of person tested; the test performed; the date of testing; the test results; and the health care provider's name and address.

C. Healthcare Provider Reporting Requirements

The New Jersey Administrative Code (NJAC 8:57-1.4) stipulates that health care providers report (by telephone, confidential fax, or in writing) all cases of typhoid fever to the local health officer having jurisdiction over the locality in which the patient lives, or, if unknown, to the health officer in whose jurisdiction the health care provider requesting the laboratory examination is located. The report shall contain the name of the disease; date of illness onset; name, age, date of birth, race, ethnicity, home address, telephone number of the person they are reporting. Additionally, name, address, institution and telephone number of reporting official, and other information as may be required by NJDHSS concerning a specific disease.

D. Health Officer's Reporting and Follow-Up Responsibilities

The New Jersey Administrative Code (NJAC 8:57-1.7) stipulates that each local health officer must report the occurrence of any case of Typhoid fever within 24 hours of receiving

a report from a laboratory or healthcare provider to the NJDHSS, Infectious and Zoonotic Disease Program (IZDP). A report can be mailed or filed electronically over the Internet using the confidential and secure Communicable Disease Reporting and Surveillance System (CDRSS).

5 CASE INVESTIGATION

A. Forms

It is the health officer's responsibility to complete an official CDC Typhoid Fever Surveillance Report form <http://www.cdc.gov/nationalsurveillance/PDFs/Paratyphoidsurvform.pdf> by interviewing the patient and others who may be able to provide pertinent information. Much of the clinical information can be obtained from the patient's healthcare provider or the medical record. When contacting the hospital, check with the infection control professional if the laboratory submitted the isolate to the PHEL.

- When asking about exposure history (food, travel, activities, and so forth), use the incubation period for *S. Typhi* (1–3 weeks). Specifically, focus on the period beginning a minimum of 1 week prior to the patient's symptoms onset date back to no more than three weeks before onset. If possible, record any restaurants at which the case-patient ate, including food item(s) and date consumed, and any travel during exposure period.
- In a case of an outbreak, immediately notify the NJDHSS IZDP by telephone at 609.588.7500 during business hours and 609.392.2020 after business hours and on weekends and holidays.
- If there have been several unsuccessful attempts to obtain patient information, please fill out the report with as much information as possible. Please note on the report why it could not be completed.

After completing the worksheet, mail it (in an envelope marked "Confidential") to the NJDHSS IZDP or file the report electronically over the Internet using the confidential and secure CDRSS.

The mailing address is:

NJDHSS
Division of Epidemiology, Environmental and Occupational Health
Infectious and Zoonotic Diseases Program
P.O. Box 369
Trenton, NJ 08625-0369

- Institution of disease control measures is an integral part of case investigation. It is the local health officer's responsibility to understand, and, if necessary, to institute the control guidelines listed below in Section 6, "Controlling Further Spread."

B. Entry into CDRSS

The mandatory fields for all cases in CDRSS include: disease, last name, county, municipality, gender, race, ethnicity, case status, report status.

The following table can be used as a quick reference guide to determine which fields in CDRSS are necessary for accurate and complete reporting of Typhoid Fever cases. The first column represents the tabs along the top of the CDRSS screen. The Required Fields column reflects a detailed explanation of the essential data for each tab.

CDRSS Screen	Required Information
Patient Info	Enter disease name (“TYPHOID FEVER”), patient demographics, patient onset and date report was made to the local health department. There are no subgroups for typhoid fever.
Addresses	Determine whether the case-patient attends or works at a daycare facility and/or is a food handler. Use as needed for additional addresses (e.g., work address, school, temporary NJ address for out-of-state case). Use the Comments section in this screen to record any pertinent information about the alternate address (e.g., the times per week the case-patient attends daycare). Entering an alternate address will allow other disease investigators access to the case if the alternate address falls within their jurisdiction.
Clinical Status	Clinical information such as past medical history, any treatment that the patient received, name of medical facility(s) including date of initial healthcare evaluation and dates of hospitalization, treating physician(s), history of vaccination against typhoid fever, and mortality status are entered here. (NOTE: If the patient received care from 2 or more medical facilities, be sure all are recorded in the case including admit/discharge dates so the case can be accessed by all infection control professionals (ICPs) covering these facilities)
Signs/Symptoms	Make every effort to get complete information by interviewing the physician, family members, ICP, or others who might have knowledge of the patient’s illness. Check appropriate boxes for signs and symptoms and indicate their onset and resolution.

CDRSS Screen	Required Information
<p>Risk Factors</p>	<p>Enter complete information about risk factors including complete food history, travel history, any gatherings or outdoor activities attended, questions about water supply (typhoid fever may be acquired through water consumption), and record in the Comments section.</p> <p>When asking about exposure history (food, travel, activities, etc.), use the incubation period for <i>S. Typhi</i> (1–3 weeks). Specifically, focus on the period beginning a minimum of one week prior to the patient’s symptoms onset date back to no more than three weeks before onset. If possible, record any restaurants at which the case-patient ate, including food item(s) and date consumed.</p>
<p>Laboratory Eval</p>	<p>Laboratory test name “MICROORGANISM IDENTIFIED”, Lab Specimen ID, Specimen, Date specimen collected, Lab Name, Referring Physician Name, Referring Medical Facility name, Test Result, i.e., Positive/reactive or Negative/no reactive.</p>
<p>Contact Tracing</p>	<p>All potentially exposed contacts are entered into the contact tracing tab for local, county and statewide surveillance efforts. CDRSS requires a “YES” response to one of the two typhoid fever exposure questions in order to add case contacts.</p> <p>Contacts are added individually by selecting the Enter Contact By Name feature:</p> <p>Each contact record reflects the period of exposure, symptomatic or asymptomatic, contact demographics, telephone numbers, exposure risk, i.e., close, casual, unknown, and LHD response activities are noted. An exposure setting is selected for each contact from the drop down to the right of the contact’s name.</p> <p>A summary reflecting the following contact details: total number, name, age, relationship, exposure specifics as well as all LHD recommendations to prevent further transmission of illness are entered into the contact tracing text box.</p>
<p>Case Comments</p>	<p>Any additional case investigation findings that can not be entered in discrete data fields are documented in the general comment section.</p>

CDRSS Screen	Required Information
<p>Epidemiology</p>	<p>Select the route of transmission route, import status of infection, i.e., whether the case was imported and from where (another county, state, country), LHD notification of illness and association with high-risk venue type, name, location and last day of attendance, whether case-patient is a daycare worker or attendee, foodhandler, or healthcare worker.</p> <p>The NJDHSS assigned outbreak or investigation number is selected for all involved cases which automatically populates a summary of the initial report.</p>
<p>Case Classification Report Status</p>	<p>Case status options are: “REPORT UNDER INVESTIGATION (RUI),” “CONFIRMED,” “PROBABLE,” “POSSIBLE,” and “NOT A CASE.”</p> <ul style="list-style-type: none"> • All cases entered by laboratories (including LabCorp electronic submissions) should be assigned a case status of “REPORT UNDER INVESTIGATION (RUI).” • Cases still under investigation by the LHD should be assigned a case status of “REPORT UNDER INVESTIGATION (RUI).” • Upon completion of the investigation, the LHD should assign a case status on the basis of the case definition. “CONFIRMED”, “PROBABLE” and “NOT A CASE” are the only appropriate options for classifying a case of <i>Typhoid Fever</i> (See section 2). <p>Report status options are: “PENDING,” “LHD OPEN,” “LHD REVIEW,” “LHD CLOSED,” “DELETE,” “REOPENED,” “DHSS OPEN,” “DHSS REVIEW,” and “DHSS APPROVED.”</p> <ul style="list-style-type: none"> • Cases reported by laboratories (including LabCorp electronic submissions) should be assigned a report status of “PENDING.” • Once the LHD begins investigating a case, the report status should be changed to “LHD OPEN.” • The “LHD REVIEW” option can be used if the LHD has a person who reviews the case before it is closed (eg, health officer or director of nursing). • Once the LHD investigation is complete and all the data are entered into CDRSS, the LHD should change the report status to “LHD CLOSED.” • “LHD CLOSED” cases will be reviewed by DHSS and be assigned one of the DHSS-specific report status categories. If additional information is needed on a particular case, the

CDRSS Screen	Required Information
	<p>report status will be changed to “REOPENED” and the LHD will be notified by e-mail. Cases that are “DHSS APPROVED” cannot be edited by LHD staff.</p> <p>If a case is inappropriately entered as a case of typhoid fever the case should be assigned a report status of “DELETE.” A report status of “DELETE” should NOT be used if a reported case of typhoid fever simply does not meet case definition. Rather, it should be assigned the appropriate case status, as described above.</p>

C. Other Reporting/Investigation Issues

- Case report forms DO NOT need to be mailed to NJDHSS as long as mandatory fields in CDRSS indicated in section B are completed.
- Once LHD completes its investigation and assigns a report status of “LHD CLOSED,” NJDHSS will review the case. NJDHSS will approve the case by changing the report status to “DHSS APPROVED.” At this time, the case will be submitted to CDC and the case will be locked for editing. If additional information is received after a case has been placed in “DHSS APPROVED,” you will need to contact NJDHSS to reopen the case. This should be done only if the additional information changes the case status of the report.
- Every effort should be made to complete the investigation within three months of opening a case. Cases that remain open for three months or more and have no investigation or update notes will be closed by NJDHSS.

6 CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (NJAC 8:57-1.10)

Patients can be released from supervision from local health department after no fewer than **three (3)** consecutive negative cultures of stool (and urine in patients with schistosomiasis) taken at least 24 hours apart and at least 48 hours after any antimicrobials. If any of these are positive, repeat cultures at intervals of one month during the 12 months following onset until at least **three (3)** consecutive negative cultures are obtained. Foodhandlers with *S. Typhi* must not work directly with food. For foodhandlers with *S. Paratyphi* or other *Salmonella* species, please refer to Section 4A of the chapter entitled “Salmonella (Non-Typhoidal).”

Minimum Period of Isolation of Patient

Foodhandlers must not work directly with food until they have three (3) consecutive, negative stool specimens taken no less than 48 hours apart. If the patient has been treated with an antimicrobial, the first stool specimen shall not be submitted until at least 48 hours after completion of therapy.

Minimum Period of Quarantine of Contacts

All foodhandling employees, symptomatic or asymptomatic, who are contacts of a patient with Typhoid fever shall be considered the same as a patient and handled in the same fashion.

NOTE: A foodhandler is any person directly preparing or handling food. This can include a patient care or child care provider.

B. Protection of Contacts of a Case

Members of households of known carriers are candidates for immunization and should check with their healthcare providers for vaccine options.

C. Managing Special Situations

Daycare

Since typhoid fever may be transmitted person-to-person through fecal-oral transmission, it is important to carefully follow up patients with Typhoid fever in a daycare setting. General recommendations include:

- A child care attendee or staff member in whom *S. Typhi* is identified should be excluded until **three (3) consecutive negative stool cultures** are obtained, each taken 48 hours apart (and no sooner than 48 hours after the completion of antibiotic therapy). In addition, stool specimens from all staff and attendees should be tested, and all infected individuals excluded as well.

School Setting

Since typhoid fever may be transmitted person-to-person through fecal-oral transmission, it is important to carefully follow up cases of typhoid fever in a school setting. General recommendations include:

- Students or staff member with *S. Typhi* who are experiencing symptoms, such as diarrhea, fever and abdominal pain should be excluded until symptoms are gone.
- Students or staff with *S. Typhi* who do not handle food, have no symptoms and are not otherwise ill, may remain in school if special precautions are taken. If a patient with *S. Typhi* occurs in a kindergarten, 1st grade or a preschool class (where hygiene may not be optimal), more stringent control measures may be indicated (see Daycare section above).
- Students or staff who handle food and have a *S. Typhi* infection (symptomatic or not) must not prepare or handle food for others until they have **three (3)** negative stool tests taken 48 hours apart (and no sooner than 48 hours after the cessation of antibiotic therapy).

Community Residential Programs

Actions taken in response to a patient with *S. Typhi* living in community residential programs will depend on the type of program and the level of functioning of the residents.

In long-term care facilities, residents with *S. Typhi* should be placed on standard (including enteric) precautions until symptoms subside and they test negative with **three (3)** consecutive stool samples. Close contacts in the long-term care facility, including staff and roommates, should also be tested. If positive, they should be placed on enteric precautions until producing **three (3)** negative stool cultures. Staff members with typhoid fever infection who give direct patient care (e.g., feed patients, give mouth or denture care, give medications) are considered foodhandlers and must be excluded until producing **three (3)** negative stool specimens.

In residential facilities for the developmentally disabled, staff and clients with *S. Typhi* must refrain from handling or preparing food for other residents until their symptoms have subsided and **three (3)** stool specimens test negative (taken 48 hours apart and no sooner than 48 hours after the cessation of antibiotic therapy). Other close contacts in the facility should be tested as well, and if positive, subject to the same restrictions stated above.

7 OUTBREAK SITUATIONS

If one or more cases of *S. Typhi* is/are reported in a city/town among people who have not traveled out of the United States, investigate the patient or patients to determine source of infection and mode of transmission.

A common vehicle (such as water, food or association with a daycare center) should be determined and applicable preventive or control measures should be instituted. Control of person-to-person transmission requires special emphasis on personal hygiene and sanitary disposal of feces. Consult with NJDHSS IZDP. IZDP staff can help determine a course of action to prevent additional infections and can perform surveillance for patients that may cross several jurisdictions and therefore be difficult to identify at a local level.

8 PREVENTIVE MEASURES

Environmental Measures

Implicated food items must be removed from the environment. A decision about testing implicated food items can be made in consultation with the NJDHSS IZDP and the Food and Drug Safety Program (FDSP). The FDSP can help coordinate pickup and testing of food samples. If a commercial product is suspected, the FDSP will coordinate follow-up with relevant outside agencies (e.g., FDA, USDA). The FDSP can be reached at 609.588.3123.

NOTE: The role of the FDSP is to provide policy and technical assistance with the environmental investigation such as interpreting the New Jersey Food Code, conducting a hazardous analysis and critical control points (HACCP) risk assessment, initiating enforcement actions and collecting food samples.

The general policy of the PHEL is only to test food samples implicated in suspected outbreaks, not in single cases (except when botulism is suspected). The health officer may suggest that the holders of food implicated in single case incidents locate a private laboratory that will test food or store the food in their freezer for a period of time in case additional reports are received. However, a single, confirmed case with leftover food consumed within the incubation period may be considered for testing only under special circumstances.

Personal Preventive Measures/Education

To avoid exposure, recommend that individuals:

- Wash their hands thoroughly with soap and water before eating or preparing food, after using the toilet and after changing diapers.
- Dispose of feces in a sanitary manner, especially in a daycare setting.
- Scrub their hands thoroughly with plenty of soap/water after assisting in the following: caring for someone with diarrhea, cleaning toilets, or changing soiled diapers, clothing or bed linens.
- Avoid sexual practices that may permit oral contact with feces or urine. Latex barrier protection should be emphasized as a way to prevent the spread of typhoid fever to sexual partners as well as being a way to prevent the exposure to and transmission of other pathogens.

International Travel

Persons traveling to typhoid endemic areas should consider vaccination against typhoid fever. They should check with their healthcare provider or a travel clinic for vaccine options. This needs to be done in advance so that the vaccine has time to take effect. Typhoid vaccination loses effectiveness after several years; people vaccinated in the past should check with their doctor to see if they need a booster. Typhoid vaccination is not 100% effective; therefore, travelers must exercise caution when consuming local foods and beverages (which will also protect travelers from other illnesses including travelers' diarrhea, cholera, dysentery and hepatitis A).

Recommend the following to travelers:

- “Boil it, cook it, peel it, or forget it.” Avoid foods and beverages from street vendors.
- Drink only bottled or boiled water, keeping in mind that bottled carbonated water is safer than uncarbonated water.
- Ask for drinks without ice unless the ice is made from bottled or boiled water.
- Avoid popsicles and flavored ices that may have been made with contaminated water.
- Eat foods that have been thoroughly cooked and are still hot and steaming.

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- Avoid raw vegetables and fruits that cannot be peeled. Vegetables like lettuce are easily contaminated and are very hard to thoroughly wash.

NOTE: For more information regarding international travel and the typhoid fever vaccine, contact the Centers for Disease Control and Prevention “Travelers Health” at 877.394.8747.

Additional Information

A Typhoid Fever Fact Sheet can be obtained at the NJDHSS website at <http://www.state.nj.us/health>.

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