Typhoid Fever / Paratyphoid Fever

24-Hour Reportable Disease

Note: This chapter focuses on typhoid fever (caused by *Salmonella* Typhi) and paratyphoid fever (caused by *Salmonella* Paratyphi A, B or C). For information about non-typhoid salmonellosis, refer to the chapter entitled **Salmonellosis (Non-Typhoid).**

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Typhoid fever is a systemic bacterial disease caused primarily by *Salmonella* Typhi (not to be confused with *Salmonella* Typhimurium). Paratyphoid fever is a similar illness but is usually much milder and is caused by the organism *Salmonella* Paratyphi A or *S.* Paratyphi B or *S.* Paratyphi C (these 3 serotypes will be referred to in this chapter as "Paratyphi")

B. Clinical Description

Typhoid fever has a different presentation than common salmonellosis. Initial symptoms typically include sustained fever, anorexia, lethargy, malaise, dull continuous headache 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 on the trunk and upper abdomen. Other symptoms can include intestinal bleeding, slight deafness and parotitis. Mild and atypical infections are common, but as many as 10–20% of untreated infections may be fatal (the case-fatality rate is <1% with prompt antibiotic treatment). Relapses are not uncommon.

Persons infected with S. Paratyphi may develop paratyphoid fever, a milder version of typhoid fever, or may have a gastrointestinal illness consistent with common salmonellosis.

C. Reservoirs

Humans are the reservoir for *S.* Typhi and *S.* Paratyphi. Domestic animals may harbor *S.* Paratyphi, but this is rare. Chronic carriers are the most important reservoirs for *S.* Typhi. About 2–5% of typhoid fever cases become chronic carriers.

D. Modes of Transmission

*S.*Typhi is transmitted by ingestion of food or water contaminated with feces or urine of infected people or directly from person-to-person. Shellfish harvested from sewage-contaminated water are potential vehicles, as are fruits and vegetables grown in soil fertilized with human waste ("night soil") in developing countries. Person-to-person transmission can also occur through certain types of sexual contact (e.g., oral-anal contact).

E. Incubation Period

The incubation period for typhoid fever ranges from 3 days to 2 months (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 could be permanent, although carriage may be eliminated with antibiotics. Less is known about the likelihood of becoming a chronic carrier after paratyphoid fever, however it appears that persons with *S.* Paratyphi infections become carriers less frequently than person infected with *S.* Typhi.

G. Epidemiology

In the United States, approximately 400 cases of typhoid fever occur each year, and 70% of these are acquired while traveling internationally. Colorado averages fewer than 5 cases of typhoid fever reported each year and fewer than 10 cases of paratyphoid fever reported each year. Antimicrobial-resistant strains are becoming increasingly prevalent.

Colorado typhoid fever statistics are available at the CDPHE website:
www.cdphe.state.co.us/dc/CODiseaseStatistics/index.html

2) CASE DEFINITION

Note: this chapter contains information about S. Typhi and S. Paratyphi infections. *For case reporting purposes, persons infected with S. Paratyphi should be reported as cases of salmonellosis.*

Typhoid Fever

Clinical Description

An illness caused by *Salmonella* Typhi that is often characterized by insidious onset of sustained fever, headache, malaise, anorexia, relative bradycardia, constipation or diarrhea, and nonproductive cough. However, many mild and atypical infections occur. Carriage of *S.* Typhi may be prolonged.

Laboratory Criteria for Diagnosis

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

Case Classification

Probable: A clinically compatible case that is epidemiologically linked to a confirmed case.
Confirmed. A clinically compatible case that is laboratory confirmed.

Salmonellosis (use for paratyphoid fever)

Clinical Description

An illness of variable severity commonly manifested by diarrhea (sometimes bloody), abdominal pain, nausea, and sometimes vomiting. A mild typhoid fever-like illness may occur. Asymptomatic infections may occur and the organism may cause extra-intestinal infections.

Laboratory Criteria for Diagnosis

Isolation of *Salmonella* from a clinical specimen (including stool, blood, and urine).

Case Classification

Probable: a clinically compatible case that is epidemiologically linked to a confirmed case.
Confirmed: a case that is laboratory confirmed. Confirmed cases include asymptomatic infections and infections at sites other than the gastrointestinal tract that are laboratory confirmed.

3) REPORTING CRITERIA

What to Report to the Colorado Department of Public Health and Environment (CDPHE) or local health agency

- Confirmed and probable typhoid fever or salmonellosis (for paratyphoid fever) cases.
- Typhoid fever cases should be reported within 24 hours of diagnosis or a positive laboratory test.
- Cases should be reported using the Colorado Electronic Disease Reporting System (CEDRS), fax or telephone to CDPHE or local health departments. See below for phone and fax numbers.
- Suspected foodborne/enteric disease outbreaks should be reported to CDPHE or local health departments within 24 hours, even if the causative agent is not yet known.

Purpose of Surveillance and Reporting

- To identify cases for investigation and potential outbreaks
- To monitor trends in disease incidence

Important Telephone and Fax numbers

- CDPHE Communicable Disease Epidemiology Program
  - Phone: 303-692-2700 or 800-866-2759
  - Fax: 303-782-0338
  - After hours: 303-370-9395
- CDPHE Microbiology laboratory: 303-692-3480
- Communicable Disease Manual website: **http://www.cdphe.state.co.us/dc/epidemiology/dcguide.asp**

4) STATE LABORATORY SERVICES

Laboratory Testing Services Available

The services listed below are for public health purposes; clinical laboratories are ***not*** *charged for these services.*

- Clinical laboratories are encouraged to submit S. Typhi and *S.* Paratyphi isolates to the CDPHE laboratory for confirmatory testing.
- The CDPHE Laboratory will test bulk stool or rectal swab specimens from cases and contacts of cases for the presence of *S.* Typhi or *S.* Paratyphi in situations where such testing is warranted for public health purposes.
- For more information on *S.* Typhi or *S.* Paratyphi testing, contact the CDPHE Microbiology Laboratory.
- Note: Authorization by the CDPHE Communicable Disease Program is required before submitting bulk stool, rectal swabs, or implicated food items to the CDPHE Laboratory.
- See Section 6 (E)--Environmental Measures, for more information about food testing.

5) CASE INVESTIGATION

Typhoid fever cases should be reported within 24 hours and should be interviewed as soon as possible, including interviews of symptomatic contacts of confirmed cases and others whose symptoms are suspected to be caused by *S.* Typhi. The goals of typhoid fever case investigation are to determine:

- Potential source of infection (*In Colorado, the majority of typhoid fever cases report international travel during their incubation period. If a case reports appropriately timed international travel then the focus of the rest of the interview should be disease control efforts. If a case has had no international contact, then an intense investigation should occur to determine the source of the patient's infection.)*
- If others are ill
- If the case or the case's contacts may be a source of infection for others (e.g. a high-risk worker or a diapered child), and if so, prevent further transmission
- When the case can be released from public health surveillance (i.e. has not become a carrier, as demonstrated by 3 consecutive negative stools)

Organized local health departments have primary responsibility for interviews of sporadic cases in their jurisdictions. In other jurisdictions, public health nursing services should consult with regional epidemiologists to establish primary responsibility for interviews of sporadic cases.

For single cases, complete the CDPHE **Typhoid Fever Case Investigation Form** or a similar local health agency form. Following patient interviews, complete the CEDRS record for all confirmed and probable cases and **fax the completed form to CDPHE**. If an outbreak is suspected, please contact CDPHE for assistance.

A. Case Investigation/ Forms

1. Complete all sections of the **Typhoid Fever Case Investigation Form** that can be found on the CD manual website and **fax the completed form to CDPHE**. Local health departments are encouraged to use the standard CDPHE investigation form.

For agencies that choose to use their own case investigation forms, the following information should be collected and faxed to CDPHE:

- *Demographics (including address, date of birth, gender, ethnicity, race, and nationality)*
- *Occupation **(High risk occupations include: food service, child care, and health care**)*
- *Childcare or School Attendance*
- *Symptoms and Onset Date*
- *Laboratory (date of specimen collection and antibiotic susceptibility pattern of isolate)*
- *Hospitalization and Medical Treatment Received*
- *Travel History (locations, dates and purpose of travel)*
- *History of vaccination for typhoid fever*
- *Contacts with Persons with a similar Illness*

If the case reports NO international travel, also collect:

- *Food History*
- *Restaurant History (include food items and date consumed)*
- *Drinking Water Source*
- *Recent Group Activities*

2. Because a significant proportion of persons infected with S. Typhi become chronic carriers, **every typhoid fever case should be followed by public health until three consecutive stool cultures taken 24 hours apart, beginning at least one month after onset of illness (and no**

sooner than 48 hours after antibiotics are completed), are negative. Bulk stool is preferred over rectal swabs for this testing. Urine should also be tested if the case has a history of schistosomiasis or urinary tract disease. **If cultures from the first round of testing are positive, the patient should be retested after at least one month has passed.** This testing pattern should continue until a patient has 3 consecutive negative cultures as described above. **Patients are not considered chronic carriers until they have continued to test positive for at least one year after initial illness.** During this time, if the case does not work in a sensitive occupation (such as child care, health care, or food handling) he/she may return to work, provided symptoms have resolved. Cases undergoing follow up testing should be instructed in good hygiene, not to prepare food for others, and to alert the health department if they move so that continued follow up can be provided.

3. Persons infected with S. Paratyphi are usually reported as salmonellosis cases. Serotyping information may not be available for several days, often not until the initial case investigation as a salmonellosis case is complete. For this reason, CDPHE may contact local public health agencies and request additional information be collected from cases who subsequently are found to have serotypes Paratyphi A, B or C. Local public health agencies that are aware of a paratyphi case before interviewing should use the typhoid fever case investigation form. The follow up needed for paratyphoid fever cases is considerably less standardized. CDPHE recommends that local public health agencies follow the guidance for salmonellosis cases and perform no additional follow up for cases who do not work in sensitive occupations (i.e. no requirement to obtain negative stool cultures). **However, if a case works in a sensitive occupation (such as child care, health care, or food handling), then CDPHE strongly recommends that the local public health agency obtain 3 negative stools before allowing the case to resume normal work activities and follow the additional guidance in section 5A(2) for typhoid fever.**

B. Identify and Evaluate Contacts

1. Symptomatic Contacts

- Contacts of a confirmed case who are ill with symptoms consistent with typhoid fever should be referred to a health care provider for evaluation and testing. Contacts who report symptoms that have resolved should be asked to submit stool for testing. All contacts with current or resolved symptoms should be considered probable cases and should be handled the same as confirmed cases for disease control purposes. See Section 6--Disease Control Measures.
- Complete the **Typhoid Fever Case Investigation Form** for all epidemiologically-linked individuals having symptoms compatible with typhoid fever and fax the form to CDPHE.

2. Asymptomatic Contacts

- Ask all household and other close contacts about sensitive occupations, food handling, childcare, and/or school.
- Contacts who are high-risk workers (e.g., food handlers, health care, child care) should not work until 2 negative stool cultures have been obtained at least 24 hours apart.
- Provide information about symptoms and preventive measures. See Section 6 (C)--Education.

C. Reported Incidence Is Higher than Usual/Outbreak Suspected

If you suspect an outbreak, investigate to determine the source of infection and mode of transmission. Consult with a CDPHE Communicable Disease Epidemiologist. CDPHE staff can assist local public health agencies to investigate outbreaks and determine a course of action to prevent further cases, and can coordinate surveillance of cases that cross county lines.

6) DISEASE CONTROL MEASURES

A **Typhoid Fever Fact Sheet** is available on the CD manual website.

A. Treatment

Typhoid fever can be treated with antibiotics, however antimicrobial resistance is a growing problem with *S.* Typhi. Persons given antibiotics usually begin to feel better within 2 to 3 days, and deaths rarely occur. However, persons who do not get treatment may continue to have fever for weeks or months, and as many as 20% may die from complications of the infection.

B. Prophylaxis

No prophylactic treatment or vaccination of close contacts is recommended. For people traveling to a country where typhoid is common, vaccination against typhoid should be considered. The vaccination does not protect against paratyphoid fever. Typhoid fever travel and vaccination information is available at the CDC's website: http://www.cdc.gov/travel/diseases/typhoid.htm.

C. Education

- Educate case and household contacts on proper hand washing techniques.
- Always wash hands thoroughly with soap and water before eating or preparing food, after using the toilet, after changing diapers, and after touching pets or other animals (especially stool of puppies and kittens with diarrhea).
- After changing diapers, wash your hands AND the child's hands.
- In a childcare setting, dispose of stool and soiled diapers in a sanitary manner.
- Avoid sexual practices that may permit fecal-oral transmission. 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.

D. Managing Special Situations

1. Food Handlers

- Food handlers with *S.* Typhi must be excluded from work.
- Foodhandlers may only return to work after producing **three** consecutive negative stool specimens each taken no less than 24 hours apart, at least 48 hours after antibiotics are completed, and collected no sooner than 1 month after illness onset.

2. Childcare/ Preschool

- Children or staff members in a childcare center who test positive for S. Typhi should be excluded until they have produced **three** consecutive negative stool specimens each taken no less than 24 hours apart, at least 48 hours after antibiotics are completed, and collected no sooner than 1 month after illness onset. However, if the case is toilet-trained and hygienic practices at the center are deemed excellent, it may be possible to shorten the duration of exclusion.

- Parents of cases should be counseled not to take their children to another childcare facility during this period of exclusion.
- In addition, stool specimens from all staff and attendees in the same classroom should be tested and all infected individuals excluded as well.
- Since most staff are considered food handlers, see Section 6 (D1)--Food Handlers above.
- Reinforce the importance of meticulous handwashing with childcare center staff.

3. School

In general, school-aged children may return to school once they are feeling well enough to attend and have not had diarrhea for at least 24 hours. As with all cases, public health follow up should continue until the case has three negative stools as described above.

- If there are concerns about the case's hygiene (e.g. the case has developmental disabilities and wears diapers) the case should not return to school until he/she has submitted **three** consecutive negative stool specimens each taken no less than 24 hours apart, at least 48 hours after antibiotics are completed, and collected no sooner than 1 month after illness onset.
- Students or staff who handle food and have a *S.* Typhi infection must not prepare food until they are cleared by public health (three negative stools). See Section 6 (D1)--Food Handlers.

4. Community Residential Programs (facilities serving the developmentally disabled)

Actions taken in response to a case of typhoid fever in a community residential program will depend on the type of program and the level of functioning of the residents. In general:

- Residents with typhoid fever should be placed on contact precautions until their symptoms subside.
- If the resident has questionable hygiene, is incontinent, or there are other concerns, the resident should remain on contact precautions symptoms subside and until he/she has submitted **three** consecutive negative stool specimens each taken no less than 24 hours apart, at least 48 hours after antibiotics are completed, and collected no sooner than 1 month after illness onset.
- Residents with typhoid fever must not handle or prepare food for others until their symptoms have resolved and until have had provided **three** consecutive stool cultures as described above.
- Staff members who provide direct patient care (e.g., feed patients, give mouth or denture care, or give medications) are considered foodhandlers and are subject to foodhandler restrictions. See section 6 (D1)--Food Handlers.

5. Patients and Staff in Health Care Facilities (Hospitals and Long Term Care Facilities)

Hospitals and long term care facilities generally have written infection control policies and procedures for handling cases of communicable disease among patients and staff members. If a facility does not have such policies in place, provide the following recommendations:

- Patients with typhoid fever should be placed on contact precautions until their symptoms subside.
- If the patient has questionable hygiene, is incontinent, or there are other concerns, the patient should remain on contact precautions until symptoms subside and until **three** consecutive negative stool specimens each taken no less than 24 hours apart, at least 48

hours after antibiotics are completed, and collected no sooner than 1 month after illness onset.

- Healthcare workers should be excluded from work until symptoms subside and until they have provided **three** consecutive stool cultures as described above.

E. Environmental Measures

- Implicated food items must be removed from the environment.
- A decision about testing suspect/implicated food items must be made in consultation with CDPHE Communicable Disease Program
- If a commercial product is suspected, CDPHE Communicable Disease Program will coordinate follow-up with the CDPHE Consumer Protection Division and relevant outside agencies.
- CDPHE **Food and Stool Specimen Collection Instructions** can be found on the CD manual website.

REFERENCES

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CDC Website: www.cdc.gov → click on “Diseases and Conditions”.

Heymann DL, ed. *Control of Communicable Diseases Manual, 18th Edition.* Washington, DC, American Public Health Association, 2004.