

TYPHOID AND PARATYPHOID FEVER

I. DESCRIPTION AND EPIDEMIOLOGY

A. Overview

Typhoid fever is a systemic bacterial disease caused by *Salmonella enterica* subspecies *enterica* serovar Typhi (*S. Typhi*). Paratyphoid fever is a milder form of typhoid fever-like illness that is caused by *Salmonella enterica* subspecies *enterica* serovars Paratyphi A, B (tartrate negative), or C. Typhoid and paratyphoid fever are not endemic in the U.S; most cases in the U.S. are acquired during international travel to areas where the disease is endemic, including Asia, Africa, and Latin America.

B. Typhoid Fever in California

The California Department of Public Health (CDPH) Infectious Diseases Branch (IDB) monitors cases and epidemiologic trends of typhoid and paratyphoid fever in California and assists in the investigation of outbreaks and clusters. All typhoid and paratyphoid fever reports are reviewed and verified by an IDB Subject Matter Expert (SME). Approximately 50-100 cases of typhoid and paratyphoid fever are reported each year in California. Most cases are sporadic and are associated with international travel during the incubation period. There have been rare foodborne outbreaks reported, such as the 2010 outbreak of *S. Typhi* infections associated with imported frozen mamey fruit pulp.

C. Symptoms

Typhoid fever is a systemic illness that often presents with high fever, headache, malaise, anorexia, lethargy, abdominal pain, and constipation. Diarrhea may be absent, especially early in the course of illness. Many patients develop hepatosplenomegaly. Some cases develop a salmon-colored macular rash, called rose spots, on the trunk. Because this is a systemic illness, blood cultures tend to have a higher yield than stool cultures, especially early in the clinical course. Illness can range from mild to severe. Complications, including gastrointestinal bleeding or perforation, may occur rarely. Paratyphoid fever is clinically indistinguishable from typhoid fever, though symptoms tend to be less severe.

D. Transmission

Unlike with other salmonellas, humans are the only reservoir for *S. Typhi*; no animal or environmental reservoirs have been identified. For paratyphoid fever, animals have been rarely identified as reservoirs. Infected persons can spread disease as long as the organism is being shed in their feces or urine. Shedding begins one week after symptom onset and continues throughout convalescence and afterward for a variable amount of time. Transmission can occur by ingestion of food or water that has been contaminated by the feces or urine of an infected person. Examples include raw shellfish from contaminated water, fruit and vegetables eaten raw that have been fertilized by human feces (known as night soil), and other food and drink contaminated by the hands of carriers.

Convalescent typhoid carriers are defined as those that harbor *S. Typhi* for 3 to 12 months after illness onset. Chronic carriers are defined as those that continue to excrete *S. Typhi* for more than 12 months after the onset of typhoid fever. Between 2 and 5% of persons with *S. Typhi* infection will become chronic carriers. Middle aged persons, especially women with gall bladder abnormalities, are at highest risk of becoming chronic carriers. Carriers may unknowingly spread infection through food handling.

Paratyphoid fever also has a chronic carrier state, although it is thought to occur less frequently than chronic *S. Typhi*. Little is known about chronic paratyphoid fever carriage.

E. Incubation Period

The typical incubation period for typhoid fever is 8 to 14 days, but it may range from 3 to 60 days. Paratyphoid has a shorter incubation period of 1 to 10 days.

F. Clinical Management

Clinical management decisions, including attempts to treat chronic carriers, should generally be made by the patient's primary care physician or an infectious diseases specialist.

II. COUNCIL OF STATE AND TERRITORIAL EPIDEMIOLOGISTS (CSTE) SURVEILLANCE CASE DEFINITIONS

A. Typhoid Fever (*Salmonella enterica* serotype Typhi) (1997)

The CSTE case definition for typhoid fever can be found on the CDC website at:
[1997 CSTE case definition for Typhoid Fever](#)

CSTE Position Statement

09-ID-67: <http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/PS/09-ID-67.pdf>

Clinical Description

An illness caused by *Salmonella enterica* serotype 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 serotype Typhi may be prolonged.

Laboratory Criteria for Diagnosis

Isolation of serotype Typhi from blood, stool, or other clinical specimen

Case Classification

Probable: A clinically compatible case that is epidemiologically linked to a confirmed case in an outbreak.

Confirmed: A clinically compatible case that is laboratory confirmed.

Comment(s)

Isolation of the organism is required for confirmation. Serologic evidence alone is not sufficient for diagnosis. Asymptomatic carriage should not be reported as typhoid fever. Isolates of *Salmonella enterica* serotype Typhi are reported to the Enteric Diseases Epidemiology Branch, Division of Foodborne, Waterborne, and Enteric Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC, through the Laboratory-Based Enteric Disease Surveillance (LEDS).

B. Paratyphoid Fever

There is no CSTE case definition specifically for Paratyphoid Fever. Therefore, the CSTE case definition for Salmonellosis (*Salmonella spp.*) 2012 is applicable:

[2012 CSTE case definition for Salmonellosis](#)

Note that only infections caused by *S. Paratyphi* A, B (tartrate **negative**), and C should be reported out as paratyphoid fever. Tartrate **positive** *S. Paratyphi* B should be reported as non-typhoidal salmonellosis.

C. Typhoid Carrier

There is no CSTE case definition specifically for Typhoid carrier. The case definitions used by CDPH for the purposes of surveillance and tracking have been adapted from Title 17 California Code of Regulations, Section 2628 (details below).

Case Classification

Convalescent Carriers: Any person who harbors typhoid bacilli for three or more months after onset is defined as a convalescent carrier.

Chronic Carriers: If the person continues to excrete typhoid bacilli for more than 12 months after onset of typhoid fever, he/she is defined as a chronic carrier. Any person who gives no history of having had typhoid fever or who had the disease more than one year previously, and whose feces or urine are found to contain typhoid bacilli on two separate examinations at least 48 hours apart, confirmed by State's Microbial Diseases Laboratory, is also defined as a chronic carrier.

Other Carriers: A person should be held under surveillance if typhoid bacilli are isolated from surgically removed tissues, organs, e.g., gallbladder, kidney, etc., or from draining lesions such as osteomyelitis. If the person continues to excrete typhoid bacilli for more than 12 months, he/she is defined as a chronic carrier and may be released after satisfying the criteria for other chronic carriers.

III. CASE SURVEILLANCE, INVESTIGATION, AND REPORTING

A. Purpose of Surveillance, Investigation, and Reporting

- To identify typhoid and paratyphoid fever outbreaks and carriers, recognize food vehicles, and interrupt potential sources of ongoing transmission

- To detect new and emerging typhoid and paratyphoid serotypes, and monitor epidemiologic trends
- To better understand the epidemiology of typhoid and paratyphoid fever in California, and to develop targeted interventions to decrease rates of illness
- To monitor typhoid carriers in accordance with CCR Title 17
- To educate people about how to reduce their risk of typhoid and paratyphoid fever infection

B. Local Health Jurisdiction (LHJ) General Case Investigation Recommendations

- Begin investigation as soon as typhoid or paratyphoid fever is reported from a healthcare provider or clinical laboratory. Cases must be reported to the local health jurisdiction within one working day of identification.
- Case-patients should be interviewed using the CDPH Typhoid and Paratyphoid Fever Case Report (see below). Please obtain information about contacts and household members and determine if any of these contacts have been ill with similar illness recently.
- Obtain information about travel history and travel details (e.g., dates of travel, locations visited). If there is no report of international travel to an endemic country, it is important to attempt to determine the source of the patient's infection.
- Determine if the patient is in a sensitive occupation and administer appropriate infection control recommendations.
- If the patient appears to be part of a point-source outbreak, follow your protocol for foodborne outbreak investigations. This should include notifying CDPH about the outbreak.
- If you require assistance with your investigation, call the Disease Investigations Section (DIS) at 510-620-3434.
- Ensure that the patient isolate is saved and forwarded to the local public health laboratory or to the CDPH Microbial Diseases Laboratory (MDL) for additional testing.
- If case-patient is identified as a convalescent carrier, it is not necessary to complete an additional case report form.
- If case-patient is identified as a chronic typhoid carrier (i.e., continues to shed *S. Typhi* for more than 12 months), the CDPH Typhoid Carrier Case Report form (see below) should be completed even if the patient has previously been reported as an acute typhoid fever case.

C. LHJ Reporting

LHJ Reporting Overview

Typhoid fever has been a nationally notifiable disease since 1944. CDC has been collecting additional surveillance information for typhoid fever cases since 1975, and began collecting data on cases of paratyphoid fever in 2007. The three associated conditions that should be reported to CDPH are:

- Typhoid Fever
- Paratyphoid Fever
- Chronic Typhoid Carrier

All typhoid and paratyphoid fever surveillance report forms, along with typhoid carrier forms, are reviewed by the DIS Typhoid Fever SME in CalREDIE. Typhoid fever cases are not confirmed and closed by the state until reviewed by the SME. Confirmed and probable typhoid fever cases closed by the state SME are included in CDC's year-end national Typhoid Fever case count. The paratyphoid fever case report form is sent to CDC after review by the SME. However, paratyphoid fever is not nationally reportable as a separate condition, but is included as part of the non-typhoidal *Salmonella* case count. To expedite the SME review process, it is important that all of the fields needed to appropriately classify and confirm the case are entered; this includes both the laboratory as well as clinical data. Confirmed and probable paratyphoid fever cases closed by the state SME are included in CDC's year-end national *Salmonellosis* case count.

An overview of national-level typhoid and paratyphoid fever surveillance is available at: http://www.cdc.gov/ncezid/dfwed/PDFs/typhi_surveillance_overview_508c.pdf

While chronic typhoid carrier case report forms are reviewed by the SME, these forms are not sent to CDC. Furthermore, the CDPH Surveillance and Statistics Section (SSS) maintains a registry of all California residents who are chronic typhoid carriers that is updated each January and July. There is no national registry for typhoid carriers.

Instructions for CalREDIE-participating jurisdictions (acute typhoid and paratyphoid fevers)

- Begin the case investigation and enter the patient information into CalREDIE upon notification of the case by the clinical laboratory or health care provider. Select "Typhoid Fever" or "Paratyphoid Fever" as "Disease Being Reported".
- In the Clinical Info page, please indicate whether or not the patient was ill with symptoms consistent with Typhoid or Paratyphoid Fever.
- In the Laboratory Info page, please enter serotype information (Typhi or Paratyphi A, B tartrate negative, or C).
- Clearance specimen results do not need to be entered into CalREDIE. Only the details of the first positive lab result and Public Health Laboratory (PHL) confirmation need to be entered into CalREDIE.
- The CalREDIE report will NOT be reviewed by SME and "Closed by State" unless the process status is "Closed by LHD", regardless of the resolution status. The "Closed by LHD" process status is the trigger for the SME to review the incident report.

Instructions for CalREDIE NON-participating jurisdictions (acute typhoid and paratyphoid fevers)

For jurisdictions currently not participating CalREDIE, CMR and case report data must still be reported:

<http://www.cdph.ca.gov/pubsforms/forms/CtrlForms/cdph110a.pdf>

<http://www.cdph.ca.gov/pubsforms/forms/CtrlForms/cdph8586.pdf>

- In the Clinical Information section, please indicate whether or not the patient was ill with symptoms consistent with typhoid or paratyphoid fever.
- In the Laboratory Information Section, please serotype information (Typhi or Paratyphi A, B tartrate negative, or C).

Instructions for CalREDIE-participating jurisdictions (chronic typhoid carrier)

- Begin the case investigation and enter the patient information into CalREDIE upon identification of a chronic typhoid carrier. Select “Typhoid Carrier” as “Disease Being Reported”.
- In the Clinical Info page, please indicate whether or not the patient was ill with symptoms consistent with Typhoid Fever and whether the patient had a previous history of Typhoid Fever.
- In the Laboratory Info page, please enter the lab results summary.
- In the Epidemiologic Info page, please indicate whether cases have been traced to the carrier.
- The CalREDIE report will NOT be reviewed by SME and “Closed by State” unless the process status is “Closed by LHD”, regardless of the resolution status. The “Closed by LHD” process status is the trigger for the SME to review the incident report.

Instructions for CalREDIE NON-participating jurisdictions (chronic typhoid carrier)

- For jurisdictions currently not participating CalREDIE, CMR and case report data must still be reported:
<http://www.cdph.ca.gov/pubsforms/forms/CtrlForms/cdph110a.pdf>
<http://www.cdph.ca.gov/pubsforms/forms/CtrlForms/cdph8566.pdf>
- In the Clinical Info page, please indicate whether or not the patient was ill with symptoms consistent with Typhoid Fever and whether the patient had a previous history of Typhoid Fever.
- In the Laboratory Info page, please enter the lab results summary.

Instructions for the CDPH Typhoid Carrier Registry

LHJs that have a typhoid carrier living in their jurisdictions should complete the Typhoid Carrier Register-Semiannual Update (CDPH 8466) and submit it to the CDPH SSS each January and July. This form updates chronic carriers’ disease status, including address information. This form is available as a fillable form on the CDPH Communicable Disease Control Forms site:

<http://www.cdph.ca.gov/pubsforms/forms/CtrlDForms/cdph8466.pdf>, and must be completed and submitted to CDPH SSS as a hard copy. This form is not available in CalREDIE.

Reporting Outbreaks and Clusters

Outbreaks of typhoid and paratyphoid fevers are rare. If a local source or domestic product is suspected, please report immediately upon identification to CDPH via phone call to DIS at 510-620-3434.

If the outbreak source is associated with travel:

- *CalREDIE-participating jurisdictions*: Create a new outbreak in CalREDIE and select the appropriate disease category.
- *Non-participating jurisdictions*: Complete and the Preliminary Report of Communicable Disease Outbreak form (CDPH 9060, <http://www.cdph.ca.gov/pubsforms/forms/CtrlDForms/cdph9060.pdf>) and fax to Infectious Diseases Branch at 510-620-3425 or email to CDOUTBREAK@cdph.ca.gov. For foodborne outbreaks, complete a Foodborne Disease Outbreak Report form (CDPH 8567, <http://www.cdph.ca.gov/pubsforms/forms/CtrlDForms/cdph8567.pdf>) and send to Infectious Diseases Branch, Surveillance and Statistics Section (address on form).

Special Considerations

- Typhoid fever and paratyphoid fever are similar diseases; however, they have different reporting requirements. Please see Table below for reporting details.
 - Typhoid Fever: Only illness caused by *Salmonella* Typhi is nationally reportable as typhoid fever.
 - Paratyphoid Fever: Illnesses caused by *Salmonella* Paratyphi A, *Salmonella* Paratyphi C, and *Salmonella* Paratyphi B tartrate **negative** should be reported as paratyphoid fever. Paratyphoid fever is not covered under the same statute as typhoid fever and may be managed as nontyphoidal salmonellosis in terms of the management of case and contacts.
 - *Salmonella* Paratyphi B tartrate **positive** does not cause paratyphoid fever and should be reported and managed as nontyphoidal *Salmonella*.
- Persons returning from an international location who were diagnosed with typhoid fever while abroad:
 - Attempt to confirm the diagnosis. Serological tests (e.g., the Widal test) are commonly used in developing countries but positive serological tests are not sufficient to meet the case definition for typhoid fever.
 - If patient's clinical presentation was consistent with typhoid fever (even if labs are unavailable to meet the case definition), collect clearance specimens, as per guidelines.
- Asymptomatic contacts to a confirmed case
 - If typhoid bacilli are identified in the feces or urine on two separate examinations at least 48 hours apart, then an asymptomatic contact is considered a carrier and should be managed accordingly.

Table: Reporting Typhoid Fever, Paratyphoid Fever, Nontyphoidal Salmonellosis, and Salmonellosis Outbreaks to CDPH.

Disease (<i>Salmonella</i> Serotype)	CalREDIE Jurisdictions	Non-Participating Jurisdictions
Typhoid Fever <ul style="list-style-type: none"> • S. Typhi 	Create CalREDIE incident, selecting “ Typhoid Fever ” or “ Chronic Typhoid Fever ” as “Disease Being Reported”	Complete the Confidential Morbidity Report form and Typhoid and Paratyphoid Fever Case Report (required). Complete Typhoid Carrier Case Report for chronic carriers.
Paratyphoid Fever <ul style="list-style-type: none"> • S. Paratyphi A • S. Paratyphi C • S. Paratyphi B tartrate negative 	Create CalREDIE incident, selecting “ Paratyphoid Fever ” as “Disease Being Reported”	Complete the Confidential Morbidity Report form and Typhoid and Paratyphoid Fever Case Report (required)
Nontyphoidal Salmonellosis <ul style="list-style-type: none"> • S. Paratyphi B tartrate positive • All other <i>Salmonella</i> serotypes NOT listed for typhoid and paratyphoid fevers. 	Create CalREDIE incident, selecting “ Salmonellosis (Other than Typhoid Fever) ” as “Disease Being Reported”	Complete the Confidential Morbidity Report form and the Salmonellosis Case Report form (CDPH 8640) (optional but recommended)
Salmonellosis Outbreaks <ul style="list-style-type: none"> • All <i>Salmonella</i> serotypes 	Create an outbreak in CalREDIE. Select the appropriate disease category such as “GI, Foodborne”, “GI, Waterborne”, etc	Complete the Preliminary Report of Communicable Disease Outbreak form and the appropriate CDPH outbreak report form when investigation is completed (required)

D. Laboratory Considerations/Microbial Diseases Laboratory (MDL) Resources

While cultures are widely considered 100% specific, false negatives are not uncommon, depending on timing of presentation. The diagnosis of typhoid or paratyphoid fever is typically made by isolation of S. Typhi or S. Paratyphi in blood, stool, or other clinical specimen.

- Most clinical laboratories have the capacity to reliably identify S. Typhi and S. Paratyphi A. The public health laboratories or MDL will be able to verify these results, as well as identify S. Paratyphi B (tartrate negative) and C.
- Even if a clinical laboratory identifies the *Salmonella* serotype as Typhi or Paratyphi, the isolate must still be forwarded to a public health laboratory. By statute, all local public health laboratories, with the exception of Los Angeles County, must submit *Salmonella* isolates to MDL for serotyping. Pulsed-field gel electrophoresis (PFGE) is performed on both S. Typhi and S. Paratyphi isolates and uploaded to PulseNet. MDL provides results to the local public health laboratory that submitted the specimen. Note that MDL does not perform antimicrobial susceptibility testing on *Salmonella* isolates at this time.
- There is no definitive serological test for paratyphoid and typhoid fever, and serological test results are not used to confirm case definition.
- The Widal test is a serological test that is used widely in developing countries. This test is unreliable and should not be used to determine the diagnosis.

IV. CASE MANAGEMENT AND PUBLIC HEALTH CONTROL MEASURES

Please see management guidelines prepared the California Communicable Disease Controller Association (CACDC):

<http://www.cdph.ca.gov/programs/cid/Pages/Guidelines.aspx>

A. Management of Cases of Typhoid Fever

Public Health management of patients with acute and chronic typhoid fever is dictated by the California Code of Regulations (CCR). Title 17 (Section 2628) requires that the infected person will be under “supervision by the local health officer until three successive specimens of feces and urine taken at least 24 hours apart, beginning at least one week after discontinuation of specific therapy and not earlier than one month after onset of disease, have been found negative for typhoid bacilli at a public health laboratory approved by the State Department of Health Services. If any one of this series is positive, cultures of both urine and feces shall be repeated at intervals of 1 month during the 12-month period following onset, until at least three sets of negative cultures are obtained.” The multiple specimen collection is to improve yield, due to the relatively low sensitivity of stool culture. Furthermore, the statute specifies exclusion criteria for foodhandlers, childcare or eldercare workers, and healthcare workers with typhoid fever. See “Applicable Statutes” Section for complete language.

B. Management of Contacts of Typhoid Fever

Unlike with non-typhoidal salmonellosis, CCR also specifies follow up and management for household contacts of typhoid fever case-patients. Title 17 (Section 2628) specifies that a member of the typhoid fever case’s household should be excluded from preparing, serving, or handling food or milk that will be eaten by anyone other than the immediate family. See “Applicable Statutes” Section for complete language.

The California Association of Communicable Disease Controllers (CACDC) has proposed guidelines for the additional management of contacts to typhoid fever cases, which are not bound by state statute (and therefore, is left to the discretion of the Health Officer). These guidelines recommend restriction/exclusion if a symptomatic contact is in an sensitive occupation or setting or is five years or younger in a group setting until two stool specimens taken at least 24 hours apart are negative for clearance. Clearance specimens are also recommended for symptomatic contacts not in a sensitive occupation.

Of note, if asymptomatic contacts are found to have positive stool cultures during the contact investigation, these persons should be evaluated as typhoid carriers.

C. Management of Chronic Typhoid Fever Carriers

It is important to consult with an Infectious Disease specialist when managing chronic carriers. Various eradication protocols have been used with varying success. Per Title 17 (Section 2628); all chronic carriers must be reported to the local health officer. Instructions on restrictions will be given to the carrier in writing by the local health department. Furthermore, the local health department must communicate with carriers in their jurisdiction at least twice a year to obtain updated information on address, job, and activities and to determine whether the carrier is following the written instructions. Please note that the LHJ should immediately notify the

receiving California LHI if chronic typhoid carrier is moving within California. If the receiving LHI plans to enter the chronic typhoid carrier into CalREDIE, they should select “Previously Reported” as the Resolution Status. If a chronic typhoid carrier is moving out of state, the LHI should complete the Interstate Reciprocal Notification of Disease and submit it to CDPH SSS. <http://www.cdph.ca.gov/pubsforms/forms/Documents/cdc42.1e.pdf>

Requirements for the release of chronic fecal and urinary carriers are described in the “Applicable Statutes” Section. Please review for additional details. Chronic fecal carriers may be released “if six successive authentic stool and urine specimens taken at intervals of not less than one month are determined to be negative by a public health laboratory approved by the State Department of Health Services. If any one of these specimens is positive, he shall not be released unless the carrier condition has been cured by cholecystectomy, or by such other methods as are acceptable to the State Department of Health Services.” If a carrier is lost to follow up, the LHI should maintain the case-patient’s records in case he is located at a later date.

- Chronic typhoid carriers are reportable to CDPH and should be reported in CalREDIE. The Typhoid Carrier Case Report is also available at (CDPH 8566, <http://www.cdph.ca.gov/pubsforms/forms/CtrlForms/cdph8566.pdf>)
- Chronic typhoid carriers should sign the Typhoid Carrier Agreement (CDPH 8563, <http://www.cdph.ca.gov/pubsforms/forms/CtrlForms/cdph8563.pdf>)
- LHJs should complete the Typhoid Carrier Register-Semiannual Update in January and July using hard copy form CDPH 8466 and submit to CDPH SSS. The form is not in CalREDIE. It is available at: <http://www.cdph.ca.gov/pubsforms/forms/CtrlForms/cdph8466.pdf>

D. Management of Contacts of Chronic Typhoid Fever Carriers

Detailed guidelines for the management of contacts of chronic typhoid fever carriers are available in the CACDC Enteric Exclusion Summary Chart at <http://www.cdph.ca.gov/programs/cid/Pages/Guidelines.aspx>.

These guidelines recommend that symptomatic contacts of chronic typhoid fever carriers working in an SOS or children five years and younger in a group setting are restricted/excluded until two consecutive stool specimens taken at least 24 hours apart are negative. Symptomatic contacts not in SOS should also undergo clearance. Typhoid vaccination may be considered in contacts to chronic carriers.

E. Management of Cases and Contacts of Paratyphoid Fever

Cases and contacts of paratyphoid fever are managed according to the applicable statutes for nontyphoidal salmonellosis cases, as per Title 17 Section 2612 of the California Code of Regulations. Please see Salmonellosis (Non-typhoidal) guidelines. Cases in an SOS or children five years and younger in a group setting should be restricted or excluded until two consecutive stool specimens taken at least 24 hours apart, and collected at least 48 hours after cessation of antibiotics are negative. Contacts in SOS should be restricted and/or excluded until two stool specimens taken at least 24 hours apart are negative. For additional details on management of cases and contacts of paratyphoid fever, refer to the CACDC Enteric Disease Exclusion Summary at <http://www.cdph.ca.gov/programs/cid/Pages/Guidelines.aspx>

F. Infection Control Measures

Case-patients must be educated regarding appropriate hand hygiene after using the toilet, changing diapers, and before preparing or eating food.

Hospitalized patients should be cared for using standard precautions. Use contact precautions for patients who are diapered or incontinent for the duration of the illness or to control institutional outbreaks.

G. Special Considerations

There are two licensed vaccines for typhoid fever that are available in the U.S.: an oral live attenuated vaccine and a Vi capsular polysaccharide vaccine for intramuscular use. CDC recommends vaccination for travelers to endemic areas where there is an increased risk of S. Typhi infection, and also as a consideration for intimate contacts of typhoid carriers. However, the efficacy of the typhoid fever vaccines is only 50-80%. Thus, persons who have been vaccinated against typhoid fever may still get infected. There is no vaccine for paratyphoid fever.

To prevent infection, it is important that persons traveling to areas where typhoid and paratyphoid fever are endemic avoid risky foods or drinks, including ice. Travelers should adhere to the “boil it, cook it, peel it, or forget it” rule.

V. APPLICABLE STATE STATUTES

California Code of Regulations, Title 17, Public Health, Section 2628: Typhoid Fever.

2628:(a) CASE. A culture of the organism on which the diagnosis of typhoid fever is established shall be submitted first to a local public health laboratory and then to the State Microbial Diseases Laboratory for phage typing. The patient shall be isolated in accordance with Section 2518 until clinical recovery. The patient shall remain subject to supervision by the local health officer until three successive specimens of feces and urine taken at least 24 hours apart, beginning at least one week after discontinuation of specific therapy and not earlier than one month after onset of disease, have been found negative for typhoid bacilli at a public health laboratory approved by the State Department of Health Services. If any one of this series is positive, cultures of both urine and feces shall be repeated at intervals of 1 month during the 12-month period following onset, until at least three sets of negative cultures are obtained. The patient shall not take any part in the preparation, serving, or handling of milk or other food to be consumed by individuals other than his immediate family, or participate in the management of a dairy, milk distributing plant, boarding house, restaurant, food store, or any place where food is prepared or stored, or engage in any occupation involving the direct care of young children or the elderly or of patients in hospitals or other institutional settings until release specimens have been obtained, as described above, and are negative for typhoid organisms. (See Section 2534.)

(b) CONTACTS. There are no restrictions on contacts, except that any member of the patient's household shall not take part in the preparation, serving, or handling of milk or other food to be consumed by individuals, other than the immediate family except at the discretion and under the restrictions of the local health officer.

(c) DEFINITION OF CARRIERS.

(1) Convalescent Carriers: Any person who harbors typhoid bacilli for three or more months after onset is defined as a convalescent carrier. Convalescent carriers may be released when three consecutive negative specimens of feces and urine taken at intervals of not less than one month, beginning at least one week after discontinuation of specific therapy are obtained. Such release may be granted at any time from 3- 12 months after onset.

(2) Chronic Carriers: If the person continues to excrete typhoid bacilli for more than 12 months after onset of typhoid fever, he is defined as a chronic carrier. Any person who gives no history of having had typhoid fever or who had the disease more than one year previously, and whose feces or urine are found to contain typhoid bacilli on two separate examinations at least 48 hours apart, confirmed by State Microbial Diseases Laboratory, is also defined as a chronic carrier. All carriers shall be reported to the local health officer. Such reports shall be kept confidential and shall not be divulged to persons other than the carrier and his immediate family, except as may be required for the protection of the public health.

(3) Other Carriers: A person should be held under surveillance if typhoid bacilli are isolated from surgically removed tissues, organs, e.g., gallbladder, kidney, etc., or from draining lesions such as osteomyelitis. If the person continues to excrete typhoid bacilli for more than 12 months he is defined as a chronic carrier and may be released after satisfying the criteria for other chronic carriers.

(d) Carrier Restrictions and Supervision. When any known or suspected carrier of this disease is reported to the local health officer, he shall make an investigation and submit a report to the State Department of Health Services. He shall have performed laboratory work as defined in subsection (e) below. Any known or suspected carrier of this disease shall be subject to modified isolation and the provisions of this isolation shall be considered as fulfilled during such period as he complies with the instructions issued by the State Department of Health Services and the local health officer.

(1) Restrictions. Instructions shall be given to the carrier in writing by the local health officer.

(2) Supervision. The local health officer or his representative shall communicate with each carrier living within his jurisdiction at least twice a year to learn of any changes in the carrier's address, occupation or activities and to determine whether all instructions are being carried out. The local health officer shall submit a report to the State Department of Health Services every six months on each carrier in his jurisdiction. Any changes of address shall be reported immediately.

(e) Laboratory Tests. Whenever laboratory tests are required for the release of typhoid cases or carriers, the tests shall be taken by the local health officer or his representatives under such conditions that he can certify as to their being authentic specimens of the individual, and shall be submitted to a public health laboratory approved by the State Department of Health Services. Cultures from release specimens which are found positive by the approved laboratory shall be forwarded to the State Division of Laboratories for phage typing.

(f) Requirements for Release of Chronic Carriers. Authority for Release of Carriers. Any person ascertained to be a chronic typhoid carrier may be released from supervision by the Director of the State Department of Health Services or his designated representative provided the carrier applies for such release through his local health officer and fulfills the requirements specified by the Director of the State Health Department or his designated representative.

(1) Fecal Carriers. A person who has been determined to be a chronic fecal carrier may be released if six successive authentic stool and urine specimens taken at intervals of not less than one month are determined to be negative by a public health laboratory approved by the State Department of Health Services. If any one of these specimens is

positive, he shall not be released unless the carrier condition has been cured by cholecystectomy, or by such other methods as are acceptable to the State Department of Health Services. The necessary requirements for such release will be submitted to the carrier and to the local health officer by the State Department of Health Services when application for the release is submitted.

(2) Cholecystectomy. The local health officer or, in areas not served by a local health department, the Director of the State Department of Health Services, shall be notified before a cholecystectomy is undertaken unless a specimen of duodenal contents, containing bile, has been found positive for typhoid bacilli, since in some cases the infection is not localized in the gall bladder. The patient shall be released under the same conditions as outlined for a fecal carrier.

(3) Urinary Carriers. A person who has been determined to be a chronic urinary carrier may be released if six successive authentic urine specimens taken at intervals of not less than one month are determined to be negative by a public health laboratory approved by the State Department of Health Services. If any one of these specimens is positive, he may be released following the surgical removal of the infected kidney or by such other methods as are acceptable to the State Department of Health Services. The necessary requirements for such release will be submitted to the carrier and to the local health officer by the State Department of Health Services when application for the release is submitted.

VI. ADDITIONAL RESOURCES

A. Food Safety

Information for food and water safety while traveling is available on the CDC website: <http://wwwnc.cdc.gov/travel/page/food-water-safety>

B. General Information/Patient Education

- CDPH: <http://www.cdph.ca.gov/healthinfo/discond/pages/typhoidfever.aspx>
- CDC: http://www.cdc.gov/nczved/divisions/dfbmd/diseases/typhoid_fever/
<http://wwwnc.cdc.gov/travel/yellowbook/2012/chapter-3-infectious-diseases-related-to-travel/typhoid-and-paratyphoid-fever.htm>

C. References

- Heymann, DL Ed. *Control of Communicable Diseases Manual, 19th Edition*. Washington, DC, American Public Health Association, 2008.

VII. UPDATES

Original version finalized and completed on August 10, 2015.

TYPHOID AND PARATYPHOID FEVER

VIII. Summary of Action Steps: Typhoid and Paratyphoid Fever

Action	Specific Steps
<input type="checkbox"/> Begin investigation as soon as <i>S. Typhi</i> or <i>S. Paratyphi</i> is reported from a clinical laboratory or healthcare provider.	<ul style="list-style-type: none"> Review information in the CDPH IDB Guidance and other resources as needed. Obtain and review clinical documentation, medical records, and lab reports as applicable. Contact patient for interview.
<input type="checkbox"/> Confirm case definition.	<ul style="list-style-type: none"> To count as a confirmed case for acute typhoid fever, patient must have clinically compatible symptoms and <i>S. Typhi</i> isolated from a clinical specimen To count as Paratyphoid Fever, only laboratory confirmation that <i>S. Paratyphi</i> has been isolated from a human specimen is needed. The specimen site can be sterile (such as blood) or unsterile (such as stool).
<input type="checkbox"/> Attempt to identify source of exposure.	<ul style="list-style-type: none"> Use the CDPH Typhoid and Paratyphoid Fever Case Report form to guide your interview. If the patient appears to be part of a point-source outbreak, follow your protocol for foodborne outbreak investigations (also see CDPH Infectious Diseases Branch CD Guidelines: Foodborne Outbreaks). This should include notifying CDPH about the outbreak. Suspected <i>Salmonella</i> outbreaks, including point-source outbreaks and PFGE clusters within your jurisdiction, should be reported within 24 hours to CDPH.
<input type="checkbox"/> Implement control measures.	<ul style="list-style-type: none"> See Enteric Disease Matrix at http://www.cdph.ca.gov/programs/cid/Pages/Guidelines.aspx Manage typhoid fever in accordance with state regulations. Clearance specimens are required for both cases and household contacts. Manage paratyphoid fever as non-typhoidal salmonellosis (but DO fill out the typhoid and paratyphoid surveillance form). Determine if the patient is in a sensitive occupation; administer appropriate infection control recommendations.
<input type="checkbox"/> Confirm <i>Salmonella</i> isolate.	<ul style="list-style-type: none"> Ensure that the <i>Salmonella</i> isolate is forwarded to MDL for serotyping and possible molecular subtyping.

<ul style="list-style-type: none"><input type="checkbox"/> Report to CDPH. Confirmed and probable cases must be reported.<input type="checkbox"/> Ensure proper documentation.	<ul style="list-style-type: none">• Confirmed and probable typhoid and paratyphoid fever cases should be reported to CDPH. See Table for the summary of reporting guidelines for salmonellosis.• Select appropriate disease being reported.• CalREDIE non-participating jurisdictions must also complete the Confidential Morbidity Report form (CDPH 110a).• If patient meets case criteria for chronic typhoid carrier (continues to excrete bacilli for more than 12 months after onset or has no history of typhoid fever or had the disease more than one year prior and feces or urine have bacilli on two separate exams at least 48 hours apart) complete typhoid carrier case report. Complete Typhoid Carrier Agreement (CDPH 8563). Complete and submit Typhoid Carrier Register-Semiannual Update (CDPH 8466) each January and July.
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If you require assistance with your investigation, call the DIS at 510-620-3434.