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Typhoid & Paratyphoid Fever (Enteric Fevers)

Overview^{1, 2, 3, 6, 7, 8}

Typhoid fever is a potentially severe and occasionally life-threatening febrile illness caused by the bacterium *Salmonella (S.) enterica* serotype Typhi. Paratyphoid fever is a similar illness caused by *S. enterica* serotype Paratyphi A, Paratyphi B (tartrate negative), or Paratyphi C. The term “enteric fever” is sometimes used to describe the invasive febrile infections caused by these 4 serovars. *S. Typhi*, *S. Paratyphi A* and *S. Paratyphi B* have no known hosts other than humans²; humans and possibly domestic animals for the other serovar.

Typhoid fever is endemic in many developing countries (particularly in Asia), but relatively uncommon in the United States, which has 300-400 cases annually and approximately 150 cases annually of paratyphoid fever reported most years. Therefore the vast majority of typhoid fever infections are acquired while traveling internationally.^{2, 7} Over the past 10 years, travelers from the United States to Asia, Africa, and Latin America have been especially at risk. Typhoid and paratyphoid are transmitted through contaminated water or food. This occurs when you eat food or drink beverages that have been handled by a person who is shedding the bacteria, or if sewage contaminated with the bacteria get into the water you use for drinking or washing food. The bacteria can also be transmitted by the fecal-oral route. Water, ice, raw vegetables, salads and shellfish are important sources of infection for travelers. The disease commonly occurs in association with poor standards of hygiene in food preparation and handling.⁸

The disease is communicable for as long as the infected person excretes *S. Typhi* or *S. Paratyphi* in the feces or urine. The incubation period for typhoid fever ranges from 3 days to more than 60 days, but is usually 8-14 days depending on the inoculum ingested and the health and immune status of the person.¹ The incubation period for paratyphoid fever is 1-10 days.¹ The onset of illness can be insidious, with gradually increasing fatigue and a fever that increases daily from low-grade to as high as 102°F-104°F by the third to fourth day of illness. Symptoms can range from mild illness with low-grade fever to severe disease with abdominal discomfort with either diarrhea or constipation, and multiple complications. Headache, malaise, and anorexia are nearly universal. Hepatosplenomegaly can often be detected. After the first several days of illness, some cases (<5% of patients) develop maculopapular rash on the trunk and upper abdomen “rose spots”. Untreated, the illness can last for a month, and as many as 10-15% of untreated infections may be fatal. Relapses are not uncommon. The serious complications of typhoid fever generally occur after 2-3 weeks of illness and the most common include intestinal hemorrhage, perforation, and typhoid encephalopathy which can be life threatening.⁷ In infants and toddlers, invasive infection with enteric fever serotypes can manifest as a mild, nondescript febrile illness accompanied by self-limited bacteremia, or invasive infection can occur in association with more severe clinical symptoms and signs, sustained bacteremia, and meningitis. Constipation can be an early feature. Unlike nontyphoidal *Salmonella*, initial therapy is generally recommended for typhoid and paratyphoid fevers.²



Two vaccines are currently available in the U.S. to prevent typhoid fever. One is injected in a single dose two weeks before possible exposure. The other vaccine is given orally in four capsules, with one capsule to be taken every other day and completed 1 week before possible exposure. Neither vaccine is 100% effective, and both require repeat immunizations as vaccine effectiveness diminishes over time.¹⁴ In the United States, immunization is recommended only for the following people: 1) Travelers to areas where risk of exposure to *S. Typhi* is recognized. 2) People with intimate exposure to a documented typhoid fever carrier, as occurs with continued household contact. 3) Laboratory workers with frequent contact with *S. Typhi* and 4) People living outside the U.S. in areas with endemic typhoid infection.² **NOTE:** *Vaccination does not provide full protection from infection and travelers should be advised to exercise care in selecting food and drinks.* Detailed information regarding the typhoid vaccines are available on CDC's website at: <http://www.cdc.gov/vaccines/vpd-vac/typhoid/default.htm>.

Prevention of enteric fevers is based on populations having access to clean water and proper sanitation, as well as adherence to safe food handling practices. For a complete description of enteric fevers refer to:

- *Control of Communicable Diseases Manual (CCDM)*, American Public Health Association, 20th ed; 2015.
- American Academy of Pediatrics. *Red Book: 2015 Report of the Committee on Infectious Diseases*. 30th ed; 2015.
- *Mandell, Douglas, and Bennett's Principles and Practices of Infectious Diseases: Vol. 2*. 8th ed. 2015.

1997 Case Definition - Typhoid Fever (7/15) **(*Salmonella enterica* serotype Typhi)⁴**

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. In addition, a National Typhoid and Paratyphoid Fever Surveillance Report form should be submitted for all cases: <http://www.cdc.gov/nationalsurveillance/PDFs/typhi-surveillance->



[form.pdf](#)). *Salmonella* Typhi while rare in Missouri is a serious illness. If a case of *S. Typhi* is reported, contact the [District Communicable Disease Coordinator](#) immediately.

Case Classification⁹

Any person whose feces or urine contains typhoid bacilli (*Salmonella* serotype Typhi) and is not ill shall be considered a typhoid carrier. If a typhoid carrier has had typhoid fever within the past twelve (12) months s/he shall be considered a convalescent typhoid carrier.

If a typhoid carrier continues to have typhoid bacilli in his/her feces or urine for more than twelve (12) months after typhoid fever or in the absence of a history of typhoid fever, he/she shall be considered a chronic typhoid carrier.

2012 Case Definition – (*Salmonella* spp. other than *S. Typhi*)⁴ (7/15)

Clinical Description

An illness of variable severity commonly manifested by diarrhea, abdominal pain, nausea, and sometimes vomiting. Asymptomatic infections may occur, and the organism may cause extraintestinal infections.

Laboratory Criteria for Diagnosis

Suspect: Detection of *Salmonella* from a clinical specimen using a non-culture based method.

Confirmed: Isolation of *Salmonella* from a clinical specimen.

Case Classification

Suspected: A case that meets the suspect laboratory criteria for diagnosis.

Probable: A clinically compatible case that is epidemiologically linked to a confirmed case (i.e., a contact of a confirmed case or a member of a risk group defined by public health authorities during an outbreak).

Confirmed: A case that meets the confirmed laboratory criteria for diagnosis. When available, O and H antigen serotype characterization should be reported.

Comment(s): Both asymptomatic infections and infections at sites other than the gastrointestinal tract, if laboratory confirmed, are considered confirmed cases that should be reported.

Information Needed for Investigation

Verify the diagnosis. What laboratory tests were conducted and what were the results? Obtain demographic, clinical and laboratory information on the case from the attending physician, hospital, and/or laboratory. Obtain the other epidemiological information necessary to complete the [Disease Case Report](#) (CD-1), the [Typhoid and Paratyphoid Surveillance Form](#) and the [Record of Investigation of Enteric Illness](#) (CD-2C) for non-travel-related cases. The information may be obtained from the patient or a knowledgeable family member.

Establish the extent of illness. Have there been other cases linked by travel, time, place, or person? Ask about illnesses among household, child care, sexual, hospital or long term care contacts,



and travel companions. Determine if the case provided child or patient care, or prepared food for anyone outside the household while symptomatic. Ask if the case lived or spent significant time in another household. If ill persons are identified, advise them to contact their medical provider for evaluation.


Identifying the source of infection. Search intensively for the case/carrier that is the source of infection; and for the vehicle through which infection was transmitted. Chronic carriers are important reservoir for *S. Typhi*. Between 1–5% of cases become chronic carriers, and up to 25% of chronic carriers do not have history of typhoid infection. The information obtained from the public health investigation will be used to help identify the source. *NOTE: Humans are the only known host for S. Typhi, S. Paratyphi A and Paratyphi B.*² Typhoid and paratyphoid fever are most often acquired through consumption of water or food that has been contaminated by feces or urine of infected people.¹⁵ Although typhoid fever and paratyphoid fever are uncommon in the United States, these infections are highly endemic in many resource-limited countries, particularly in Asia. Consequently, typhoid fever and paratyphoid fever infections in residents of the U.S. usually are acquired during international travel.² Transmission through sexual contact, especially among men who have sex-with-men, have been documented rarely.⁷ *COMMENT: Sometimes the source is not identified.*

Provide enteric fever information to persons at risk for infection and the general public as needed. Efforts should be made to promote enteric fever awareness - cases should be educated on the importance of personal hygiene:

- **Wash your hands often.** This is the single most important thing you can do to keep from spreading the infection to others. Use plenty of hot, soapy water and scrub thoroughly for at least 30 seconds, especially after using the toilet and before eating.
- **Clean household items daily.** Clean toilets, door handles, telephone receivers and water taps at least once a day with a household cleaner and paper towels or disposable cloths.
- **Avoid handling food.** Avoid preparing food for others until your health care provider or public health says you're no longer infectious. If you work in the food service industry or a health care facility, you won't be allowed to return to work until tests show that you're no longer shedding bacteria.
- **Keep personal items separate.** Set aside towels, bed linen and utensils for your own use and wash them frequently in hot, soapy water. Heavily soiled items can be soaked first in disinfectant.¹⁴ A [Typhoid Fever - Frequently Asked Questions](#) sheet is available from the Centers for Disease Control and Prevention for distribution.

The two most important ways to avoid enteric fever abroad is to get the typhoid fever vaccination and to avoid risky foods and drinks. As previously stated, current typhoid vaccines are not 100% effective; therefore, even vaccinated travelers should follow [recommended food and water precautions](#) and [frequent handwashing](#). Remember that you will need to complete your vaccination at least 1-2 weeks (dependent upon vaccine type) before you travel so that the vaccine has time to take effect. *NOTE: Typhoid fever immunization is **advised** for international travelers to endemic areas, especially if travel is likely to involve exposure to unsafe food and water or close contact in rural areas to indigenous populations. Currently it is **not** a*



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requirement for entry into any country, thus it is important for the traveler to determine potential risk and get vaccinated if necessary.¹ The most recent pre-travel vaccination guidelines can be found at: <http://wwwnc.cdc.gov/travel/>.

- If you drink water, buy it bottled or bring it to a rolling boil for 1 minute before you drink it. 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 that are still hot and steaming.
- Avoid raw vegetables and fruits that cannot be peeled. Vegetables like lettuce are easily contaminated and are very hard to wash well.
- When you eat raw fruit or vegetables that can be peeled, peel them yourself. (Wash your hands with soap first.) Do not eat the peelings.
- Avoid foods and beverages from street vendors. It is difficult for food to be kept clean on the street, and many travelers get sick from food bought from street vendors.⁶


NOTE: These precautions are the only prevention method for paratyphoid fever, as no vaccines are available.⁷ For additional information on safe food and water precautions see: [Chapter 2, Food & Water Precautions](#) of the *CDC Health Information for International Travel 2014*.

Enteric fever Surveillance. Review WebSurv to determine whether there have been other enteric fever cases in the same geographic area or facility. When a non travel-related case is identified, every effort should be made to identify the source. Information obtained through the public health investigation will be used to identify a possible source of infection and to characterize persons or geographic areas in which additional efforts are needed to raise awareness and reduce disease incidence. When investigating a suspected outbreak of gastrointestinal illness of unknown etiology, see the [Outbreak Investigation](#) section of this manual.

Notification

Within 24 hours from notification of a typhoid fever case and within 3 days from notification of a paratyphoid case, the Local Public Health Agency (LPHA) should contact the [District Communicable Disease Coordinator](#), or the [Senior Epidemiology Specialist for the District](#), or the Missouri Department of Health and Senior Services (MDHSS) – Bureau of Communicable Disease Control and Prevention (CDCP), phone (573) 751-6113, Fax (573) 526-0235, or for afterhours notification contact the MDHSS/ERC at (800) 392-0272 (24/7). If the case is in a high-risk group or job such as food handling, child care or health care, contact the appropriate organization below:

- If a case(s) is a foodhandler, BCDP or the LPHA will contact Bureau of Environmental Health Services (BEHS), phone (573) 751-6095, Fax (573) 526-7377.
- If a case(s) is associated with a child care center, BCDP or the LPHA will contact BEHS, phone (573) 751-6095, Fax (573) 526-7377 and the Section for Child Care Regulation, phone (573) 751-2450, Fax (573) 526-5345.
- If a case(s) is associated with a long-term care facility, BCDP or the LPHA will contact the Section for Long Term Care Regulation, phone (573) 526-8524, Fax (573) 751-8493.

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- If a case is associated with a hospital, hospital-based long-term care facility, or ambulatory surgical center BCDCP or the LPHA will contact the Bureau of Health Services Regulation phone (573) 751-6303, Fax (573) 526-3621.
- Contact the Department of Natural Resources, Public Drinking Water Branch, at (573) 751-1187, Fax (573) 751-3110 if cases are associated with a public water supply, or BEHS, phone (573) 751-6095, Fax (573) 526-7377, if cases are associated with a private water supply.

*An outbreak is defined as the occurrence in a community or region, illness(es) similar in nature, clearly in excess of normal expectancy and derived from a common or a propagated source.

Control Measures


Initial antimicrobial therapy is generally recommended for typhoid and paratyphoid fever cases.⁸ Appropriate antibiotic treatment reduces the mortality rate of enteric fever from 10-15% to less than 1% and shortens the duration of fever from 3-4 weeks to 3-5 days. Resistance to multiple antibiotics is increasing among *Salmonellae* that cause typhoid and paratyphoid fever.³ Reduced susceptibility to fluoroquinolones (e.g., ciprofloxacin) and the emergence of multidrug-resistance has complicated treatment of infections, especially those acquired in South Asia. Antibiotic susceptibility testing can help guide appropriate therapy.⁶ **NOTE:** *The laboratory diagnosis of enteric fever is often challenging because current diagnostic tests for enteric fever fail to achieve the optimal combination of sensitivity and specificity. For this reason, it is often appropriate to treat patients with suspected enteric fever with empirical antibiotic therapy, but once antimicrobial susceptibility results are known, therapy should be changed as appropriate.*^{2,3} *The diagnosis of enteric fever should be considered in any person with fever, especially in those with fever lasting longer than 3 days and who have had an exposure in the last 1-6 weeks to an area where enteric fever is endemic.*³ **COMMENT:** *Specific treatment and clinical management advice is outside the scope of this guidance but may be found in references such as the Mandell, Douglas, and Bennett's Principles and Practices of Infectious Diseases: Vol. 2. 8th ed. 2015.*

Education should be given to the patient regarding the importance of completing the course of antibiotics, the possibility of relapse, persisting excretion, the need for good personal hygiene, especially thorough hand washing with soap and water after toilet use and before food preparation and do not prepare or serve food for other people.^{6,8}

Enteric Fever Risk Assessment:⁵

The initial risk assessment needs to be performed as soon as possible, on the same day as notification is preferred, which may require an afterhours assessment. This will facilitate the early identification of the possible source, exclusion of symptomatic cases in [risk groups](#), and identification and management of symptomatic contacts. The completion of the [Disease Case Report](#) (CD-1) and the [Typhoid and Paratyphoid Fever Surveillance Report](#) can be delayed until the next working day.

NOTE: *A risk assessment should **not** automatically result in exclusions. Any recommendation for exclusion should be based on a risk assessment of possible secondary transmission arising from the activities undertaken by the individual case in their work/care role, and should take into*

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account the hygiene behavior of the individual as well as infection control measures in place at the workplace/care facility. Redeployment away from activities that involve an unacceptable risk in the workplace/care facility should always be considered as an alternative to exclusion. Risk assessments should be reviewed and updated when new or additional information is obtained.

Insert 1. Case Definitions for Public Health Action⁵

NOTE: The following definitions are to be used in conjunction with the “[Algorithm for Public Health Management of Enteric Fever Cases](#)” located below. These definitions are **not** the national notifiable diseases surveillance case definitions that are used for reporting purposes.

Typhoid and Paratyphoid Case Definitions:⁵

Possible case

- A person with a clinical history compatible with enteric fever and where the clinician suspects typhoid or paratyphoid as the most likely diagnosis, OR
- A person with clinical history of fever and malaise and /or gastrointestinal symptoms with an epidemiological link to a source of enteric fever, OR
- A returning traveler reporting a diagnosis abroad with **no** documented evidence of blood or fecal culture, or confirmation with serological testing alone.

Probable case

- Local laboratory presumptive identification of *Salmonella* Typhi or Paratyphi on fecal or blood culture, with or without a clinically compatible history, OR
- A returning traveler giving a clinical history compatible with enteric fever and with documentation of a positive blood/fecal culture and/or treatment for enteric fever overseas.

Confirmed case

- A clinically compatible case that is laboratory confirmed.

Travel-related case

- Is a case that develops symptoms of enteric fever within 28 days of travel to an endemic region of the world. The 28-day timeframe should be used as a guide but should not be seen as prescriptive. The majority of endemic countries are those in the Indian subcontinent, South-East Asia, sub-Saharan Africa and Latin America.

Convalescent carrier

- A person who is still excreting *S. Typhi* or *S. Paratyphi* after two courses of appropriate antibiotic therapy, but has been excreting for less than 12 months.


Chronic carrier

- A person who continues to excrete *S. Typhi* or *S. Paratyphi* for 12 months or more.

Typhoid and Paratyphoid Contact Definitions:⁵

Co-traveler

- Someone who travelled with the case who is likely to have been exposed to the same source of infection as the case (rather than someone who merely travelled on the same bus/train/plane as the case). They may not necessarily live with the case.

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Household

- Someone who lives/stayed in the same household as the case, and/or has shared a bathroom, and/or food prepared by the case, while the case was symptomatic and up to 48 hours after commencement of antibiotics.

Other contacts

- May include close/sexual contacts or close friends/family members who have eaten food prepared by the case while they were symptomatic.

Wider contacts

- May need to be considered, for example, colleagues who prepare and eat food with the case at a catering establishment, if the case was there while symptomatic or if the case is a non travel-related case.

Risk Groups at Higher Risk For Secondary Transmission:⁵

Risk Group A

- Any person of doubtful personal hygiene or with unsatisfactory toilet, hand washing or hand drying facilities at home, work or school. The risk assessment should take into account the workplace.

Risk Group B

- All children aged five years old or under who attend school, pre-school, nursery or other child care groups. Explore informal child care arrangements (e.g., family or friends providing child care).

Risk Group C

- People whose work involves preparing or serving or in any way handling water, ice, milk or milk products, or any other food to be consumed by persons other than those in his/her immediate family (i.e., unwrapped food to be served raw or not subjected to further heating, or provide opened beverages or ice to patrons). Consider informal or volunteer food handlers.

Risk Group D

- Clinical, social care or nursery staff who work with young children, the elderly, or other particularly vulnerable people, and whose activities increase the risk of transferring infection via the fecal-oral route. Such activities include helping with feeding or handling objects, to include medications that could be transferred to the mouth. Someone may be an informal care giver (e.g., caring for a chronically sick relative or friend).

Insert 2. Algorithm for Public Health Management of Enteric Fever Cases.
*Source: Public Health Operational Guidelines for Typhoid and Paratyphoid (Enteric Fever) – January 2, 2012.*⁵

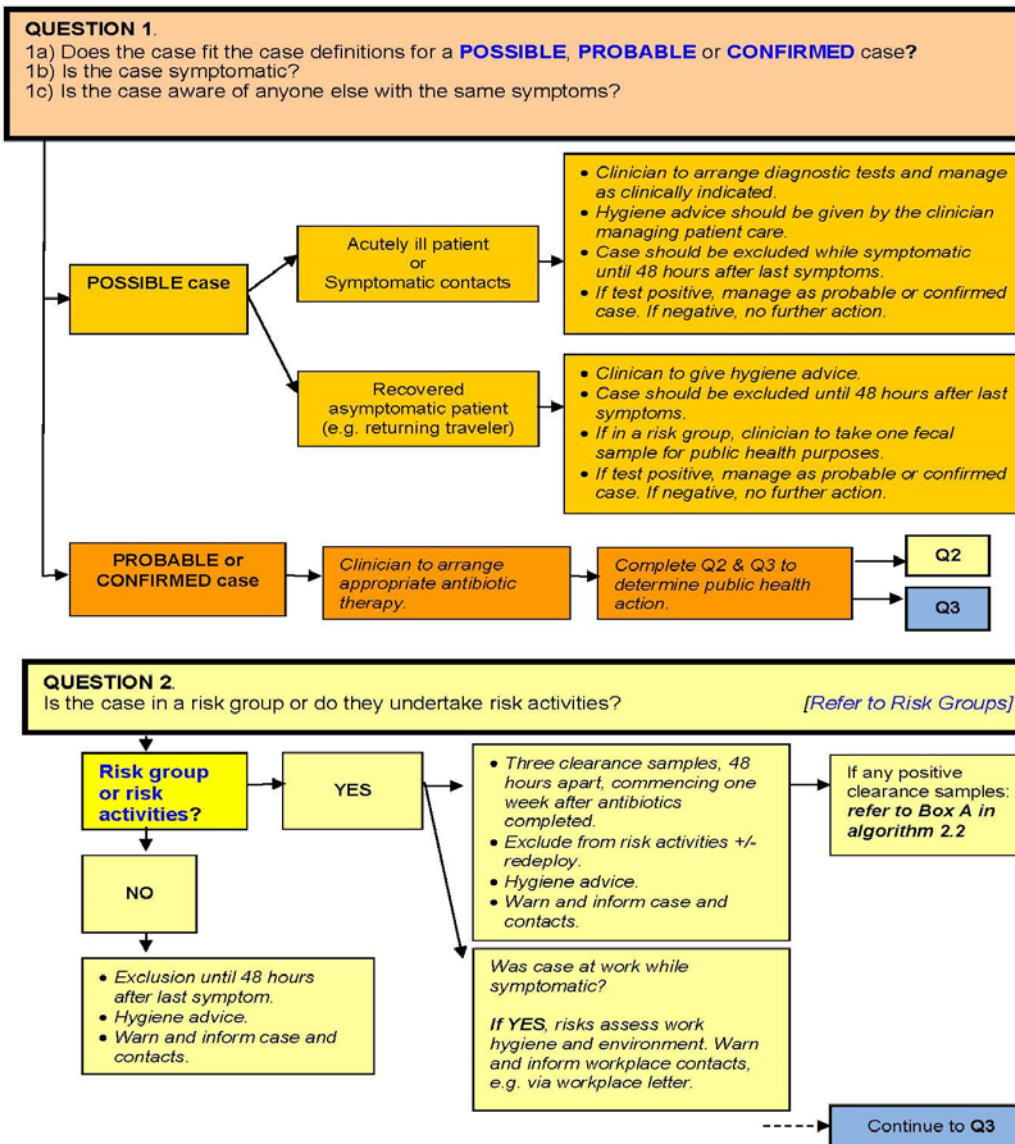
[Continued on next page.]



2 Algorithms for public health management

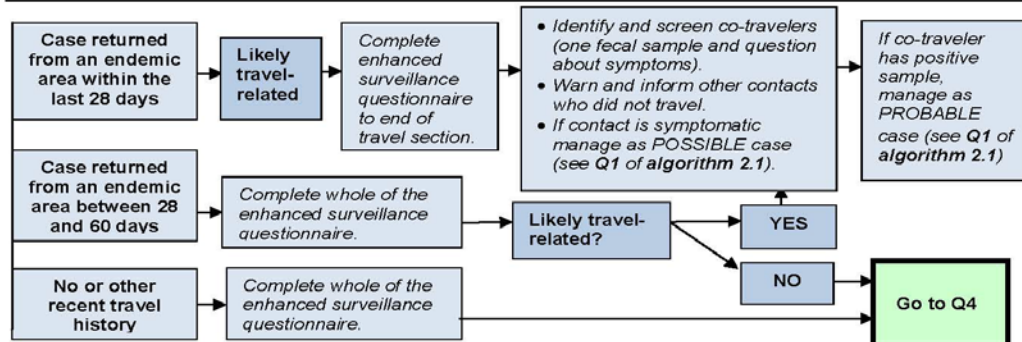
The initial risk assessment should be completed on the same day as notification, including after-hours as per local arrangements.

2.1 Public health management of cases and contacts





QUESTION 3.
 Did the case travel to an endemic area? 96% of cases who have a travel history develop symptoms within 28 days of return from an endemic area.

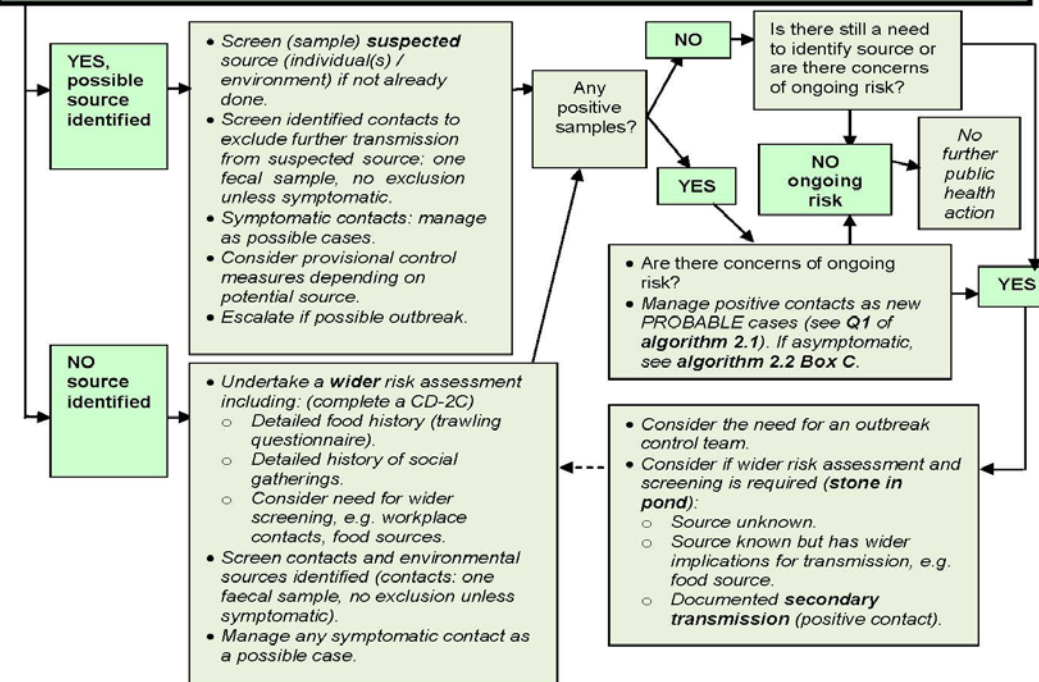


QUESTION 4. For cases with no recent travel history and/or for whom travel is an unlikely source of infection, further contact tracing and assessment of source is necessary.

4a) Does the case have a documented history of previous enteric fever?
 If YES: Move to algorithm 2.2, Box B on the next page.
 If NO: Go on to Question 4b below.

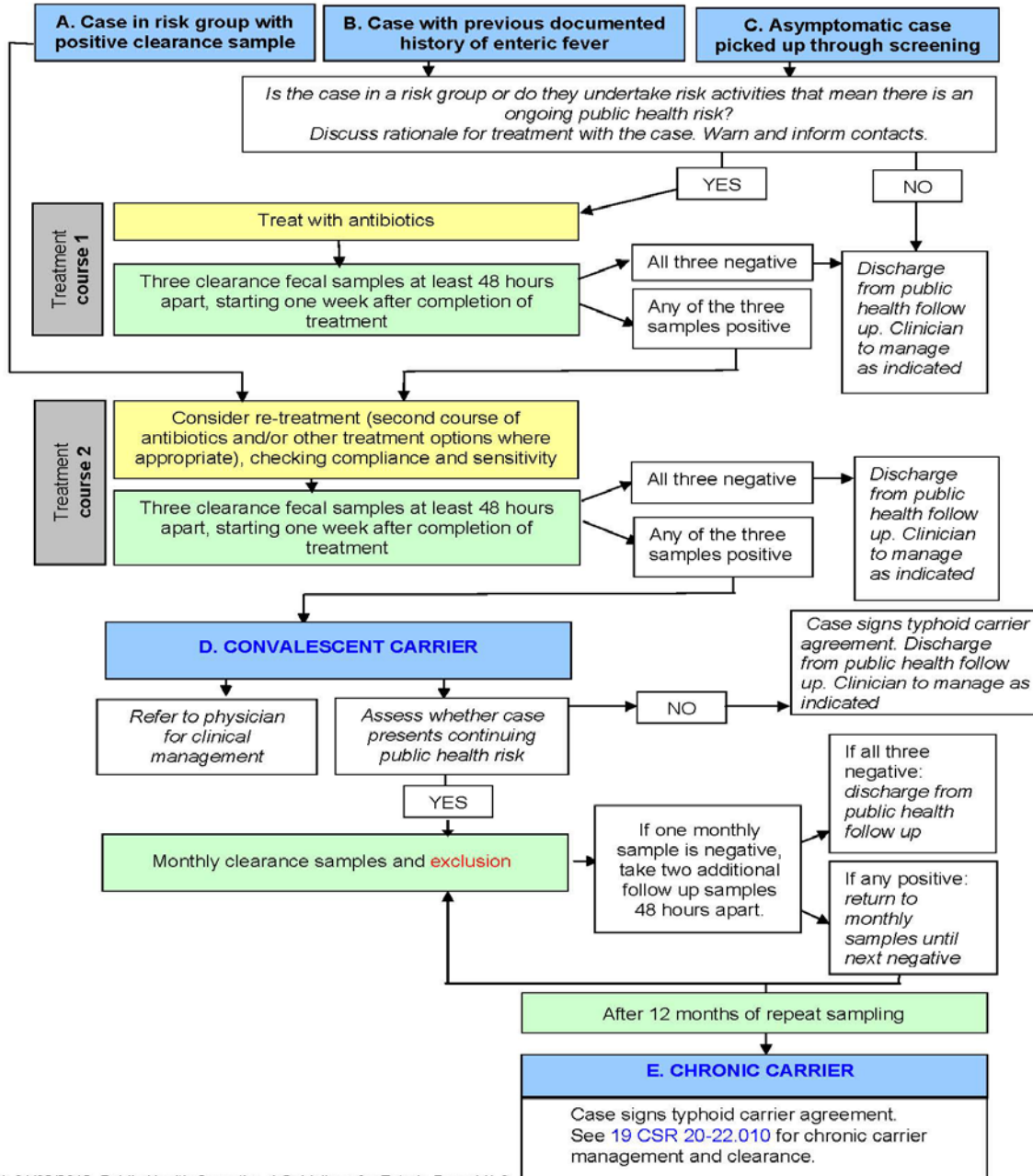
4b) Does the initial risk assessment identify a possible source of transmission? For example:

- A contact with similar symptoms or with a travel history.
- A confirmed epidemiological link with a known case.
- An implicated food item.






2.2 Public health management of cases with positive screening/clearance samples and those with previous documented history of enteric fever



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NOTE: Consideration should be given to obtaining 2 negative stool cultures taken 24 hours apart from household and close contacts before allowing them to be employed in high risk occupations (e.g., food handlers). Routine administration of typhoid vaccine is of limited value for family, household, and nursing contacts that have been or may be exposed to cases; it should be considered for contacts that may be exposed to carriers for a prolonged period.¹

TRAVELERS

If indicated, travelers should receive the typhoid vaccine before travel **and** follow CDC's [food and water precautions](#). *NOTE: The most recent pre-travel vaccination guidelines can be found at: <http://wwwnc.cdc.gov/travel/>. Currently there is no effective immunization for paratyphoid fever, thus following the CDC food and water precaution is the best option.*

FOOD HANDLERS

See the **Missouri Food Code for the Food Establishments of the State of Missouri** - June 3, 2013.

2-201.12 Exclusions and Reinstatement.


5. An infection from *Salmonella* Typhi, or reports a previous infection with *Salmonella* Typhi within the past three (3) months, without having received antibiotic therapy as determined by a health practitioner shall be:
 - (a) Excluded by the person in charge; and
 - (b) Reinstated if the person in charge obtains approval from the regulatory authority and the food employee provides to the person in charge written medical documentation from a health practitioner that states the food employee is free from *S. Typhi* infection.

*NOTE: For additional measures for the “Control of Communicable, Environmental and Occupational Diseases” see [19 CSR 20-22.040](#) and [19 CSR 20-20.060](#) “Control Measures for Food Handler”. **IMPORTANT:** See the [Algorithm 2.1 Question 2 above](#) ⇨ It addresses the management of “Risk Groups at Higher Risk for Secondary Transmission” (e.g., food handlers, health care workers, child care, etc.).*

Supervision of Typhoid Carriers:

Important: The following control measures are specific to typhoid carriers as determined by Missouri Rule [19 CSR 20-22.010](#) - Supervision of Typhoid Carriers:

- (1) Any person whose feces or urine contains typhoid bacilli (*Salmonella* Typhi) and is not ill shall be considered a typhoid carrier. If a typhoid carrier has had typhoid fever within the past twelve (12) months s/he shall be considered a convalescent typhoid carrier. If a typhoid carrier continues to have typhoid bacilli in his/her feces or urine for more than twelve (12) months after having typhoid fever or in the absence of a history of typhoid fever, s/he shall be considered a chronic typhoid carrier.
- (2) A typhoid carrier shall be under the supervision of the health officer having jurisdiction. No typhoid carrier shall prepare, serve or in any way handle water, milk or milk products or

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any other food to be consumed by persons other than those in his/her immediate family.

NOTE: See the [Algorithm 2.2 D above](#) ⇨ It addresses the management of convalescent typhoid carriers. Public health risk assessments should be **reviewed and updated any time new or additional information is obtained.**


- (4) The health officer or his/her representative shall instruct chronic typhoid carriers regarding their infection and the measures necessary to avoid transmission of infection to others. Chronic typhoid carriers may be permitted by the health officer to be in free communication with others upon *the signing of and adherence to the following [typhoid carrier agreement](#)*; one (1) copy of which will be retained by the carrier; one (1) by the health officer; and a third forwarded to the district health administrator having jurisdiction or to the Department of Health.
- (6) A health officer may release a chronic typhoid carrier from further supervision if the carrier submits, under the supervision of the health officer, six (6) consecutive feces specimens (for intestinal carriers) or urine specimens (for urinary carriers) at monthly intervals which are found to be culturally negative for typhoid bacilli. The release shall be in the form of a written dated statement, signed by the health officer, indicating that the patient has met the requirements for release from supervision and is no longer classified as a typhoid carrier. One (1) copy of this statement shall be given to the carrier, one (1) retained by the local health department and one (1) forwarded to the district health office having jurisdiction or to the Department of Health.

IMPORTANT: Each **chronic typhoid carrier** must sign and adhere to a “Typhoid Carrier Agreement” as specified in state rules [19 CSR 20-22.010](#), *Supervision of Typhoid Carriers*.

If biological terrorism is suspected.²

Some infectious agents have the potential to be used in acts of bioterrorism. Clinicians should be familiar with reporting requirements within their public health jurisdiction for these conditions. When clinicians suspect that illness is caused by an act of bioterrorism, they should contact their local public health agency (LPHA) immediately so that appropriate infection-control measures and outbreak investigations can begin. In the event of a bioterrorist attack, clinicians should review the CDC Emergency Preparedness and Response Web site at: <http://emergency.cdc.gov> for current information and specific prophylaxis and treatment guidelines. Public health authorities should be contacted before obtaining and submitting patient or environmental specimens for identification of suspected agents of bioterrorism. If salmonellosis is suspected to be the result of a terrorist act, or the intentional or deliberate release thereof; the LPHA should:

1. Notify local law enforcement and the [Senior Epidemiology Specialist](#) for the District, or the Missouri Department of Health and Senior Service’s Emergency Response Center (ERC) at (800) 392-0272 (24/7) immediately.
2. Work with law enforcement and implement “Chain of Custody” procedures for all laboratory samples, as they will be considered evidence in a criminal investigation.

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3. Work to define the population at risk which is essential to guide response activities. Public health authorities will play the lead role in this effort, but must consult with law enforcement, emergency response and other professionals in the process.
4. Once the mechanism and scope of delivery has been defined, identify symptomatic and asymptomatic individuals among the exposed and recommend treatment as appropriate.
5. Establish and maintain a detailed line listing of all cases and contacts with accurate identifying and locating information.

Laboratory Procedures


The definitive diagnosis of enteric fever requires the isolation of *S. Typhi* or *S. Paratyphi* from blood, bone marrow, another sterile site, rose-spots, stool, urine, or intestinal secretions.^{2,3}

Clinical Specimens: Collect stool specimens in Cary-Blair media using the Enteric Specimen collection kit supplied by the Missouri State Public Health Laboratory (MSPHL).

Specimens should be shipped refrigerated. **NOTE:** *Raw stool specimens will only be accepted from city or county health departments, unless there are special circumstances and previous approval has been obtained. The MSPHL does not test any other types of clinical specimens for enteric pathogens. If submission of urine specimens is required, contact the District Communicable Disease Coordinator for further instruction. NOTE: Because antibiotic resistance occurs in Salmonella Typhi, antibiotic susceptibility tests should be performed. Antibiotic susceptibility is **not** performed by the MSPHL.*

Every laboratory performing testing on human specimens in Missouri that obtain the result of any test that is positive for, or suggestive of *Salmonella* spp. are required by state reporting rule [19 CSR 20-20.080 Duties of Laboratories](#) to send isolates or specimens positive for *Salmonella* spp. to the MSPHL for epidemiological or confirmation purposes. The MSPHL performs this testing at no charge to the submitting laboratory. Information on the collection or shipment of clinical specimens for Salmonella testing by the MSPHL may be viewed at: <http://health.mo.gov/lab/enterics.php> or you may call the (MSPHL) Microbiology Unit at (573) 751-3334.

Food Samples: Food samples can be sent refrigerated to the MSPHL to be tested for *Salmonella* spp. as part of an epidemiological investigation. Samples should be collected in their final **intact package** for testing. If an intact sample of a product is too large to submit to the lab, submit a sterile sample container with at least four ounces of the product to be tested. Please contact the District Environmental Public Health Specialist prior to submitting food samples. The Environmental Bacteriology Unit at the MSPHL should also be notified. For additional information concerning food sample collection or food sample transport visit the MSPHL website at <http://health.mo.gov/lab/foodtesting.php> or call the (MSPHL) Environmental Bacteriology Unit at (573) 751-3334.

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Reporting Requirements


Salmonella Typhi is a reportable disease and shall be reported to the local health authority or to the Missouri Department of Health and Senior Services within one (1) day of first knowledge or suspicion by telephone, facsimile, or other rapid communication.

Currently all other *Salmonella* spp. are reportable to the local health authority or to the Missouri Department of Health and Senior Services in writing within three (3) days of first knowledge or suspicion by telephone, facsimile or other rapid communication.

Instances of *Salmonella* that appear to be the result of a terrorist act or the intentional or deliberate release of a biological agent is a Category 1(B) disease and shall be reported to the local health authority or to the Missouri Department of Health and Senior Services (MDHSS) **immediately** upon first knowledge or suspicion by telephone, facsimile, or other rapid communication. The MDHSS may be contacted afterhours through the MDHSS/ERC by calling (800) 392-0272 (24/7).

As a Nationally Notifiable Condition, confirmed and probable cases of enteric fevers are a **STANDARD** report to the CDC. **STANDARD** reporting requires the MDHSS to report to CDC by electronic transmission via WebSurv within the next normal reporting cycle.


1. For confirmed and probable cases of enteric fevers complete a [Disease Case Report](#) (CD-1). For *S. Typhi* and *S. Paratyphi* A, B (tartrate negative), and C complete CDC's "[Typhoid and Paratyphoid Fever Surveillance Report](#)". For non travel-related enteric fever cases also complete the [Record of Investigation of Enteric Illness](#) (CD-2C) and send the completed reports to the District Health Office.
2. Entry of the completed Disease Case Report and Record of Investigation of Enteric Illness form into WebSurv negates the need for the forms to be forwarded to the District Health Office.
3. MDHSS will report to CDC following the above reporting criteria (see box).
4. Complete a "[Typhoid Carrier Record](#)," (CD 3) for all chronic typhoid carriers and convalescent typhoid carriers for documentation of clearance samples. The form is also available to document case histories, laboratory findings, and contact information as needed.
5. All outbreaks or "suspected" outbreaks must be reported as soon as possible (by phone, fax or e-mail) to the District Communicable Disease Coordinator. This can be accomplished by completing the [Missouri Outbreak Surveillance Report](#) (CD-51).
6. If an outbreak is associated with food, person-to-person transmission, environmental contamination, animal contact, or indeterminate/other/unknown etiology, a [National Outbreak Reporting System – Foodborne Disease Transmission, Person-to-Person Disease Transmission, Animal Contact](#) form (CDC 52.13) is to be completed and submitted to the District Communicable Disease Coordinator at the conclusion of the outbreak.
7. If an outbreak is associated with the consumption or use of water for drinking, or with ingestion, contact, or inhalation of recreational water, a [National Outbreak Reporting System - Waterborne Disease Transmission](#) form (CDC 52.12) is to be completed and submitted to the District Communicable Disease Coordinator at the conclusion of the outbreak.

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8. Within 90 days from the conclusion of an outbreak, submit the final outbreak report to the District Communicable Disease Coordinator.
9. Complete a “[Typhoid Carrier Agreement](#),” (CD 3A) for all chronic typhoid carriers.

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TYPHOID CARRIER RECORD

MISSOURI DEPARTMENT OF HEALTH

Name _____
LAST FIRST MIDDLE

Other Names _____
MAIDEN, NICKNAME, ETC.

Date _____

Address _____

Birth Date _____ Sex _____ Race _____

Occupation _____

Date classified as carrier _____

Physician _____

Date carrier agreement signed _____

Health Unit having
 Jurisdiction _____

- How discovered:
- Release specimens following typhoid
 - Investigation of source of typhoid
 - Transferred in from _____
 - Other _____

History of Typhoid _____ Date _____

Phage Type _____

Laboratory examinations confirming carrier state: _____

Agglutinations _____

DATE	CULTURE SPECIMENS			NAME AND ADDRESS OF LABORATORY
	FECES	URINE	OTHER (SPECIFY)	

Remarks: _____

DISPOSITION

Released _____ DATE _____ Died _____ DATE _____ Moved from _____

Laboratory examinations for release as required by regulations: To _____ DATE _____

DATE	CULTURE SPECIMENS			NAME AND ADDRESS OF LABORATORY
	FECES	URINE	OTHER (SPECIFY)	

Missouri Department of Health and Senior Services
TYPHOID CARRIER AGREEMENT

To Whom It May Concern

Date _____

I, _____ of _____

Acknowledge that I am a typhoid carrier and that in order that I might be placed under modified isolation I hereby agree that:

- A. I will not at any time handle, prepare or cook any food or drink to be consumed by others than my immediate family.
- B. I will thoroughly wash my hands with soap and water after each visit to the toilet.
- C. I will not bathe in any public or private swimming pool.
- D. If my residence is not connected to a municipal sewage treatment system, I agree to have an onsite sewage treatment facility that complies with the minimum standards as determined by the Missouri Department of Health and Senior Services.
- E. I will notify the health officer or the local health department within one week of any change of address.
- F. I will submit such fecal and urine specimens as may be requested by the health officer or local health department.
- G. If I become ill and require hospital or institutional care, I will inform the superintendent or person in charge of such hospital or institution that I am a typhoid carrier.
- H. I understand that failure to abide by the provisions of this agreement subjects me to necessary enteric precautions as determined by the Missouri Department of Health and Senior Services.
- I. I have explained these provisions to _____ and in view of the above Agreement I hereby grant permission for _____ to be in free communications with others as long as _____ complies with the conditions of the agreement.

Signed _____

Address _____