

Typhoid Fever

Revision Dates

Case Definition	June 2013
Reporting Requirements	April 2018
Remainder of the Guideline (i.e., Etiology to References sections inclusive)	April 2014

Case Definition

Confirmed Case

Laboratory confirmation of infection with or without clinical illness^[1]:

- Isolation of *Salmonella typhi* from an appropriate clinical specimen (e.g., feces, blood, urine, bone marrow)^[2].

Probable Case

Clinical illness^[1] in a person who is epidemiologically linked to a confirmed case.

Carrier

Individuals who continue to shed *S. typhi* for one year or greater are considered to be carriers^[3].

^[1] Clinical illness is characterized by insidious onset of sustained fever, headache, malaise, anorexia, relative splenomegaly, constipation or diarrhea, and non-productive cough. Relative bradycardia and rose spots (less than 25% of individuals) may be seen. Atypical presentations occur and severity of illness varies. Chronic carrier state (< 5% of population) is usually linked to the biliary or urinary tract and should be distinguished from short-term faecal carriage.

^[2] Refer to the [Provincial Laboratory for Public Health \(ProvLab\) Guide to Services](#) for current specimen collection and submission information.

^[3] Alberta Health maintains a Typhoid/Paratyphoid Registry for purposes of monitoring carriers as they potentially pose a long term health risk for transmission of disease.

Reporting Requirements

1. Physicians, Health Practitioners and others

Physicians, health practitioners and others shall notify the Medical Officer of Health (MOH) (or designate) of the zone, of all confirmed and probable cases in the prescribed form by the Fastest Means Possible (FMP).

2. Laboratories

All laboratories shall report all positive laboratory results:

- by FMP to the MOH (or designate) of the zone, and
- by mail, fax or electronic transfer within 48 hours (two business days) to the Chief Medical Officer of Health (CMOH) (or designate).

3. Alberta Health Services and First Nations and Inuit Health Branch

- The MOH (or designate) of the zone where the case currently resides shall notify the CMOH (or designate) by FMP of all confirmed and probable cases.
- The MOH (or designate) of the zone where the case currently resides shall forward the initial Notifiable Disease Report (NDR) of all confirmed and probable cases to the CMOH (or designate) within one week of notification and the final NDR (amendment) within two weeks of notification.
- For out-of-province and out-of-country reports, the following information should be forwarded to the CMOH (or designate) by FMP:
 - name,
 - date of birth,
 - out-of-province health care number,
 - out-of-province address and phone number,
 - positive laboratory report, and
 - other relevant clinical / epidemiological information.

Etiology

Typhoid fever is caused by *Salmonella enterica subsp. enterica serovar typhi* (commonly known as *S. typhi*).⁽¹⁾

Clinical Presentation

Typhoid is a systemic bacterial disease characterized by insidious onset of sustained fever, severe headaches, malaise, anorexia, a non-productive cough in the early stage of the illness, a relative bradycardia, splenomegaly and abdominal discomfort.⁽¹⁾ A transient, macular rash of rose-colored spots can occasionally be seen on the trunk.⁽²⁾ In adults, constipation is more often seen than diarrhea. The clinical picture can vary from mild illness to severe clinical disease with abdominal discomfort and other complications. The severity of illness is dependent on the infecting dose, the virulence of the bacterial strain, duration of the illness before initiation of appropriate treatment, age, and vaccine history.⁽¹⁾ Complications such as ulceration of Peyer's patches in the ileum causing intestinal haemorrhage or perforation (in about 1% of cases) can occur, especially late in untreated cases. Case fatality rate can fall to <1% with prompt, appropriate antimicrobial treatment.⁽¹⁾ Relapses (generally milder than the initial clinical illness) can occur depending on what antimicrobials are used in treatment.⁽¹⁾

Diagnosis

The causative organisms can be isolated from the blood early in the disease, and from urine and feces after the first week. Bone marrow culture provides the greatest sensitivity for bacteriological confirmation even in persons who have already received antibiotics.⁽¹⁾

Epidemiology

Reservoir

Humans are the sole reservoirs for typhoid. Family contacts may be transient or permanent carriers and inadvertently spread infection.⁽¹⁾

Transmission

Typhoid is transmitted by the fecal-oral route through ingestion of food and water contaminated by urine or feces from infected cases or carriers. The infection is rarely spread by casual contact. Shellfish (particularly oysters) taken from sewage-contaminated beds, raw fruits, vegetables fertilized by night soil (human excrement) and eaten raw, contaminated milk and milk products (usually contaminated by hands of carriers), are important sources of infection to consider. Flies may also infect foods in which the organism can multiply to achieve an infective dose. The infective dose for typhoid is much lower than that of paratyphoid.⁽¹⁾

Incubation Period

The incubation period is usually 8–14 days but can range from 3–> 60 days depending on the size of infecting dose and host factors.⁽¹⁾

Period of Communicability

The period of communicability lasts as long as the bacilli are present in the excreta. This usually begins from the first week after onset of illness and continues through convalescence and for a variable period thereafter. It is estimated that approximately 10% of untreated typhoid cases can continue to discharge bacilli for three months after onset of symptoms.⁽¹⁾

The carrier state may follow acute illness, mild or even subclinical infections. Between 2–5% of cases infected with *S. typhi* may become chronic carriers and can be more commonly seen in individuals (especially women) infected during middle age, and those who have biliary tract

abnormalities, including gallstones. Chronic urinary carriers may occur with schistosome infections or kidney stones.⁽¹⁾

Host Susceptibility

Susceptibility is general and is increased in persons with achlorhydria (a condition in which production of gastric acid in the stomach is absent or low or more commonly, treatment with acid suppression agents) (S. Houston, 2013, Personal Communication, January 28). Relative specific immunity follows clinical disease, asymptomatic infection and immunization.⁽¹⁾

Occurrence

General

Worldwide occurrence. Typhoid fever continues to be a public health concern in many developing countries with school age children (aged 5–15) being disproportionately affected. In some endemic countries, incident rates in younger children (< 5years) have been seen to be similar or exceed those of school age children. It is conservatively estimated by WHO that the annual global occurrence of typhoid is approximately 21 million cases, with 1–4% ending in death.⁽³⁾

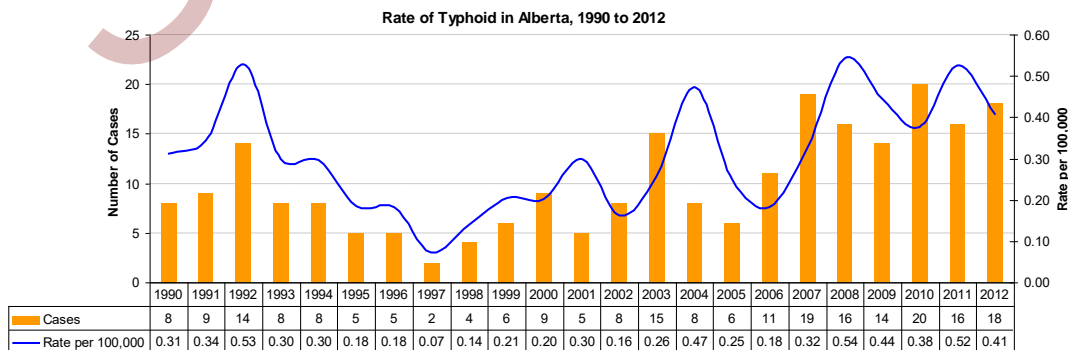
In developed countries, where standards of sanitation are high, disease incidence is sporadic and mainly associated with foreign travel to endemic countries.⁽¹⁾

Canada

The incidence of typhoid is very low in Canada. From 2009–2012, the number of cases reported nationally ranged between 136 (2012) and 183 (2011) with a rate of 0.39–0.53 cases per 100,000 respectively.⁽⁴⁾ The greatest risk of typhoid infection for Canadians occurs while travelling to countries where sanitation is likely to be poor and associated with exposures to food and water in uncontrolled settings. (i.e., market stalls, street vendors, family settings).⁽⁵⁾ The risk of typhoid fever is highest for travelers to southern Asia.⁽²⁾

Alberta

The greatest risk of typhoid infection for Albertans appears to be travel related to endemic countries. Between 2000 and 2012, the number of cases of typhoid reported annually varied from 5 (2001) to 20 (2010) representing rates of 0.30 cases per 100,000 to 0.38 cases per 100,000 respectively. During this same period of time, 140/165 cases reported travel outside of Canada (e.g., travelled to South Asia), an additional 12/165 cases reported recent immigration to Canada and for 11/165 cases there is no information available. One of the 165 cases was epi-linked to a confirmed case that travelled outside of Canada.⁽⁶⁾



Source: Alberta Health Communicable Disease Reporting System (CDRS) June 2013⁽⁶⁾

Key Investigation

Single Case/Household Cluster

- Confirm the diagnosis.
- Obtain a history of illness including the date of onset and signs and symptoms.
- Identify any underlying medical conditions (e.g., decreased gastric acidity).
- Determine immunization history.
- Determine the occupation of the case (e.g., food handler, childcare facility worker, healthcare worker,) and identify specific duties at work.
- If the case is a child, determine attendance at a childcare facility (e.g., daycare, dayhome) or other childcare site.
- Determine whether the case had any other type of institutional contact (e.g., long term care).
- Determine the possible source of infection taking into account the incubation period, reservoir, and mode of transmission. Assessment should include:
 - Determining history of travel. **NOTE:** Additional specimens (e.g., urine for *S.typhi/S.paratyphi* +/- serology for schistosomiasis) may be indicated in special circumstances. Refer to Management of a Case.
 - Determining history of residing in areas with poor sanitation including improper water treatment and sewage disposal (including recent immigration).
 - Obtaining a detailed food history (including consumption of shellfish).
 - Identifying any risk behaviours including lifestyle risks for infection (e.g., high risk sexual practices especially contact with feces).
 - Determining any exposure (either household or non-household) to a confirmed case of typhoid.
 - Identifying symptomatic household or other close contacts (e.g., travel companions or others) that had recently travelled to a developing country.
- Identify contacts that may have had exposure during the period that the case was infectious. Consider the following individuals when identifying contacts:
 - household contacts;
 - recent co-travellers (includes anyone who travelled with the case and is likely to have been exposed to the same source of infection as the case rather than someone who only travelled on the same plane/bus as the case); or
 - other close, non-household contacts (e.g., sexual contacts, childcare site contacts).
- From the contacts identified above, identify individuals involved in sensitive occupations or situations (i.e., those who pose a higher risk of transmission to others). They would generally include:
 - Food handlers whose work involves:
 - touching unwrapped food to be consumed raw or without further cooking; and/or
 - handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking. **NOTE:** Generally, food handlers who do not touch food, equipment or utensils in this way are not considered to pose a transmission risk however, circumstances for each case should be assessed on an individual basis.
 - Healthcare workers providing direct patient care and persons involved in the care of young children, elderly, highly susceptible or dependent individuals.
 - Children attending a childcare facility who are diapered or unable to implement good standards of personal hygiene.
 - Any individual (child or adult) who is unable to implement good standards of personal hygiene (e.g., those with disabilities/challenges that may impact ability to perform good hand hygiene).

Control

Management of a Case

- Provide information about disease transmission and the appropriate infection prevention and control measures to be implemented to minimize the possibility of transmission including strict hand hygiene especially after using the washroom, changing diapers and before preparing/handling and serving food.
- Routine practices should be adhered to for hospitalized patients. For hospitalized children or adults with poor hygiene habits or who have incontinence that cannot be contained, additional precautions (i.e., contact precautions) should be implemented. ⁽⁷⁾
- Advise the case to refrain from preparing food for others for the duration of the period of communicability.
- Exclude symptomatic and asymptomatic cases who are involved in sensitive occupations or situations as outlined above.
- See [Annex 1](#) for information on stool collection to demonstrate microbiological clearance for cases involved in sensitive occupations or situations.
- If the case is involved in a sensitive occupation or situation AND has traveled to or lived in a schistosomiasis-endemic area (see www.cdc.gov/parasites/schistosomiasis/epi.html ⁽⁸⁾) and may have been exposed to schistosomiasis, urine for *S. typhi*/*S. paratyphi* +/- serology for schistosomiasis (depending whether there is a recurrence of Salmonella bacteremia or bacteriuria) will need to be collected in addition to stools to demonstrate microbiological clearance. See [Annex 1](#).
 - If required, serology for schistosomiasis should be collected according to recommendations outlined in [Annex 1](#). Specimens collected before the recommended time frames, may yield false negative results (Kowaleska-Grochowska, K., 2012, Personal Communication, November 19).
- Exclusion would apply until:
 - Two consecutive stool specimens collected from a confirmed case are reported as negative **AND** one urine culture for *S. typhi* is reported negative from a case who has EVER travelled to or lived in a schistosomiasis endemic country and may have been exposed to schistosomiasis.
 - Stool specimens should be collected when stools have returned to normal and at least 21 days following completion of antibiotic and not less than 24 hours apart.
 - If one or both stool samples are positive for *S. typhi*, continue submitting samples for testing at the specified intervals as outlined in [Annex 1](#).
 - If urine sample is positive for *S. typhi*, collect serology for schistosomiasis 8 weeks post exposure to areas where risk exists for infection with *Schistosoma japonicum*, *S. mansoni*, *S. mekongi* and *S. intercalatum* exists or 12 weeks post exposure to areas where risk exists for infection with *S. haematobium*. Specimens collected before this time, may yield false negative results (Kowaleska-Grochowska, K., 2012, Personal Communication, November 19). See [Annex 1](#).
 - if urine sample is positive for *S. typhi* and schistosomiasis, refer case back to physician and advise physician to treat case concurrently for both infections, even if this means repeating antibiotic treatment.
 - Persons co-infected with schistosomiasis should be treated with praziquantel to eliminate possible carriage of salmonella bacteria (including *S. typhi* and *S. paratyphi*) by the schistosomes. ⁽¹⁾
- If possible, consideration may be given to temporary redeployment away from activities that involve increased risk of transmission.
- Advise all other cases (i.e., those not involved in sensitive occupations or situations) to remain off work until they are free from diarrhea and other gastrointestinal symptoms and for 48 hours

following resumption of normal stool. Continued public health surveillance is not required for these cases, however, follow-up with the personal physician for clearance of the organism is recommended. Persons not involved in high risk activities/occupations present a minimal risk of spreading gastrointestinal pathogens if they are healthy and have normal, well-formed stools.

Treatment

- Generally fluoroquinolones are effective for treatment in adults, however, antibiotic resistance has become a public health problem in many areas (especially Asia) and therefore, clinicians should consider local resistance patterns when choosing appropriate antimicrobials for treatment. ^(1,9,10)
- Consultation with an infectious diseases specialist may be appropriate.

Management of Contacts

- “Warn and inform” contacts by providing information about disease transmission and appropriate infection prevention and control measures. Stress the measures that need to be taken to minimize possible fecal-oral transmission including strict hand hygiene, especially after using the washroom, changing diapers, and before eating and preparing/handling foods.
- Refer all symptomatic contacts to their physician for assessment.
- Exclude symptomatic contacts involved in sensitive occupations or situations until:
 - two consecutive stool specimens are taken not less than 24 hours apart and are reported as negative prior to returning to work or back to their childcare facility.
 - If any stool sample is positive, manage as a confirmed case.
 - If stool sample is negative, advise contact to remain home while symptomatic and until 48 hours after last symptoms before returning to work or childcare facility. Continue to self-monitor for symptoms within 28 days after initial negative stools and seek prompt medical attention and inform public health if symptoms develop.
- Screen asymptomatic co-travellers who are involved in sensitive occupations or situations:
 - Collect one stool specimen and question about symptoms both while away travelling and since returning.
 - No exclusion is necessary for asymptomatic co-travellers while waiting for results of screening stool specimen. If stool result is positive then they would be treated and managed as a confirmed case.
- Refer asymptomatic co-travellers who are not involved in sensitive occupations or situations to their own health care provider for screening and follow-up.
- Collect ONE screening stool for asymptomatic household or other close, non-household contacts (e.g., sexual contacts) involved in sensitive occupations or situations and asymptomatic childcare site contacts (e.g., staff and children in the same room). Exclusions are **not** necessary while waiting for results of screening UNLESS:
 - the individual is unable/unwilling to comply with good hand hygiene OR unwilling to provide a screening stool sample. In that event, exclusion would apply until one stool specimen is submitted and reported as negative prior to returning to work or back to their childcare facility
 - Consultation with the MOH is appropriate.
 - Contacts should be advised to self-monitor and seek prompt medical attention AND contact public health if they develop symptoms within 28 days of the initial negative stool result.
- See [Annex 2](#) for information on stool collection for contacts involved in sensitive occupations or situations.

- Public health follow-up is generally not required for contacts of a case who do not pose a higher risk of transmission to others, (i.e., not involved in sensitive occupations or situations), however, the circumstances should be considered individually. Follow-up with their health care provider is appropriate.
- Additional contact follow-up and assessment of a source of infection may be necessary if cases are identified with no recent travel history and/or for whom travel is an unlikely source of infection. Stool samples may be requested on identified contacts to determine the source of the infection in the case.

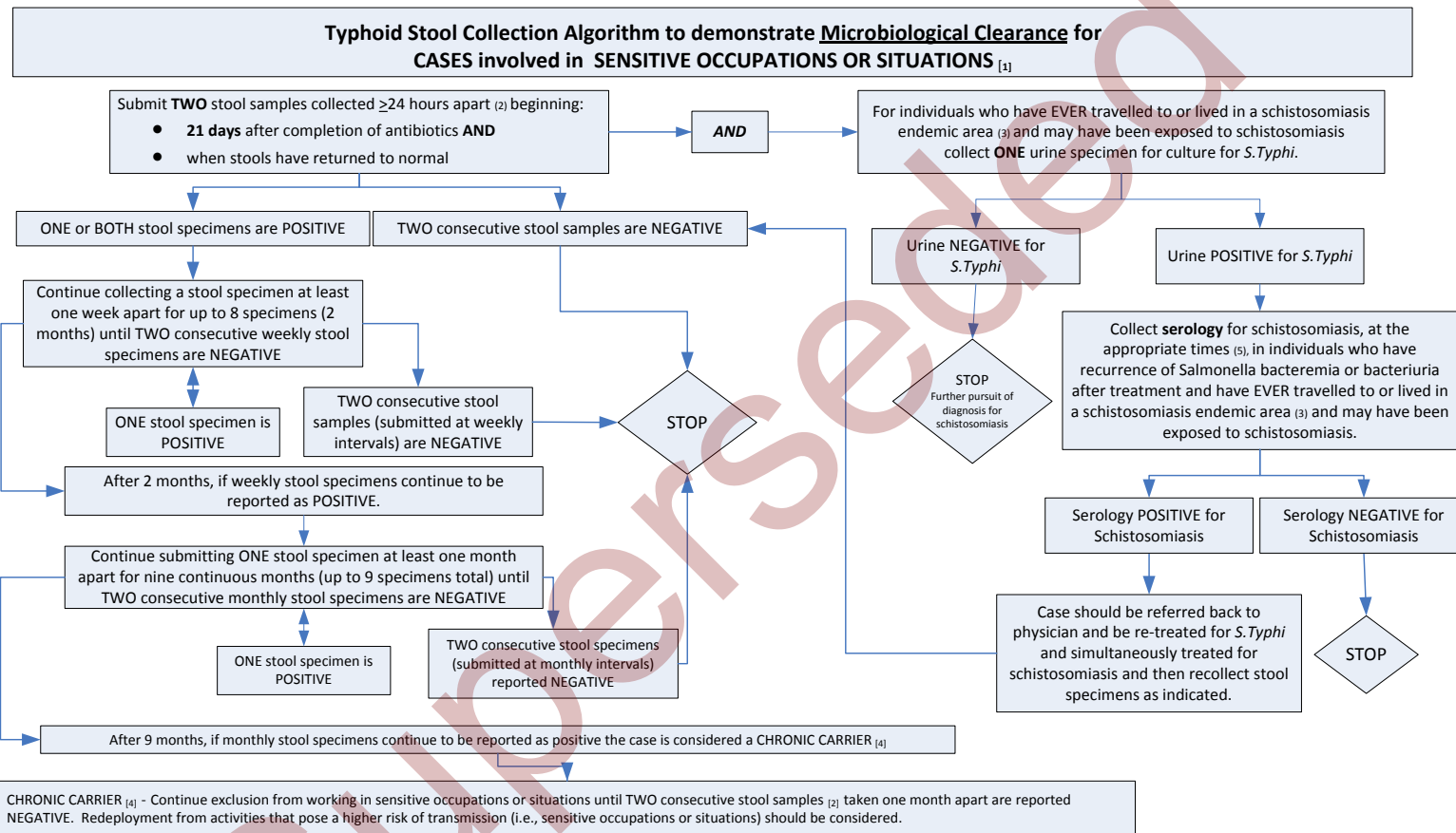
Management of Chronic Carriers and their Contacts

- Individuals who continue to shed *S. typhi* for one year or greater are considered carriers.
- Monitoring of carriers is maintained through the Alberta Health Typhoid/Paratyphoid Registry.
- Refer to [Annex 1](#) for details on continued stool testing for carriers.
- Medical intervention may be indicated for individuals who become carriers and consult with an infectious diseases specialist should be considered.
- Exclude chronic carriers from activities that are involved in sensitive occupations or situations and continue submitting stool specimens as outlined in [Annex 1](#).
- If possible, consideration may be given to temporary redeployment of the carrier away from activities that involve increased risk of transmission.
- Contacts of carriers should be advised to seek prompt medical assessment and notify public health if they become symptomatic.
- Exclude symptomatic contacts of carriers who are involved in sensitive occupations or situations until:
 - two consecutive stool specimens taken not less than 24 hours apart are reported as negative prior to returning to work or back to their childcare facility.
- Asymptomatic contacts of carriers are not excluded and no stool specimens are required.
- Public health follow up is generally not required for contacts of a carrier who do not pose a risk of transmission to others (i.e., those not involved in sensitive occupations or situations), however, stool specimens may be requested to determine the source of the infection in the case.
- Typhoid vaccine may be recommended, in consultation with the CMOH (or designate), for people with ongoing household or intimate exposure to *S. typhi* carriers. ^(5,11)

General Preventive Measures

- Educate the public regarding the need for:
 - thorough hand washing especially after using the washroom, changing diapers, and before eating and preparing/handling foods;
 - sanitary disposal of feces, and
 - hygienic food preparation and food and equipment handling practices.
- Recommend typhoid vaccine for household or intimate contacts of a typhoid carrier as outlined in the current Alberta Immunization Policy (AIP). ⁽¹¹⁾
- Encourage all travellers to seek travel advice before visiting areas of high prevalence of disease and emphasize the importance of good sanitation, proper arrangements for safe water supplies and scrupulous personal hygiene while travelling.
- Reinforce information about boiling or steaming shellfish for at least 10 minutes before serving.
- Encourage travellers to receive typhoid vaccine before travelling to countries where there is an increased risk of exposure to *S. typhi*.
- Recommend typhoid vaccine for laboratory workers who frequently handle cultures of *S. typhi* as outlined in the current AIP. ⁽¹¹⁾

ANNEX 1



[1] Sensitive Occupations or Situations are those that pose a higher risk of transmission to others. The circumstances for each case, contact or carrier in these groups should be assessed on an individual basis taking into account the type of employment, work duties, provision of sanitary facilities at work, school or institutions and standards of personal hygiene. **Sensitive Occupations or Situations include:**

- food handlers whose work involves touching unwrapped food to be consumed raw or without further cooking and/or handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking.

NOTE: Generally, food handlers who do not touch food, equipment or utensils in this way are not considered to pose a transmission risk HOWEVER circumstances should be assessed on an individual basis.

- healthcare, childcare staff or other staff who have direct contact or contact through serving food with highly susceptible patients or persons
- healthcare workers providing direct patient care and persons involved in the care of young children, elderly or dependent individuals
- children attending a childcare facility who are diapered or unable to implement good standards of personal hygiene
- any individual (child or adult) who is unable to implement good standards of personal hygiene (e.g. mentally or physically challenged)

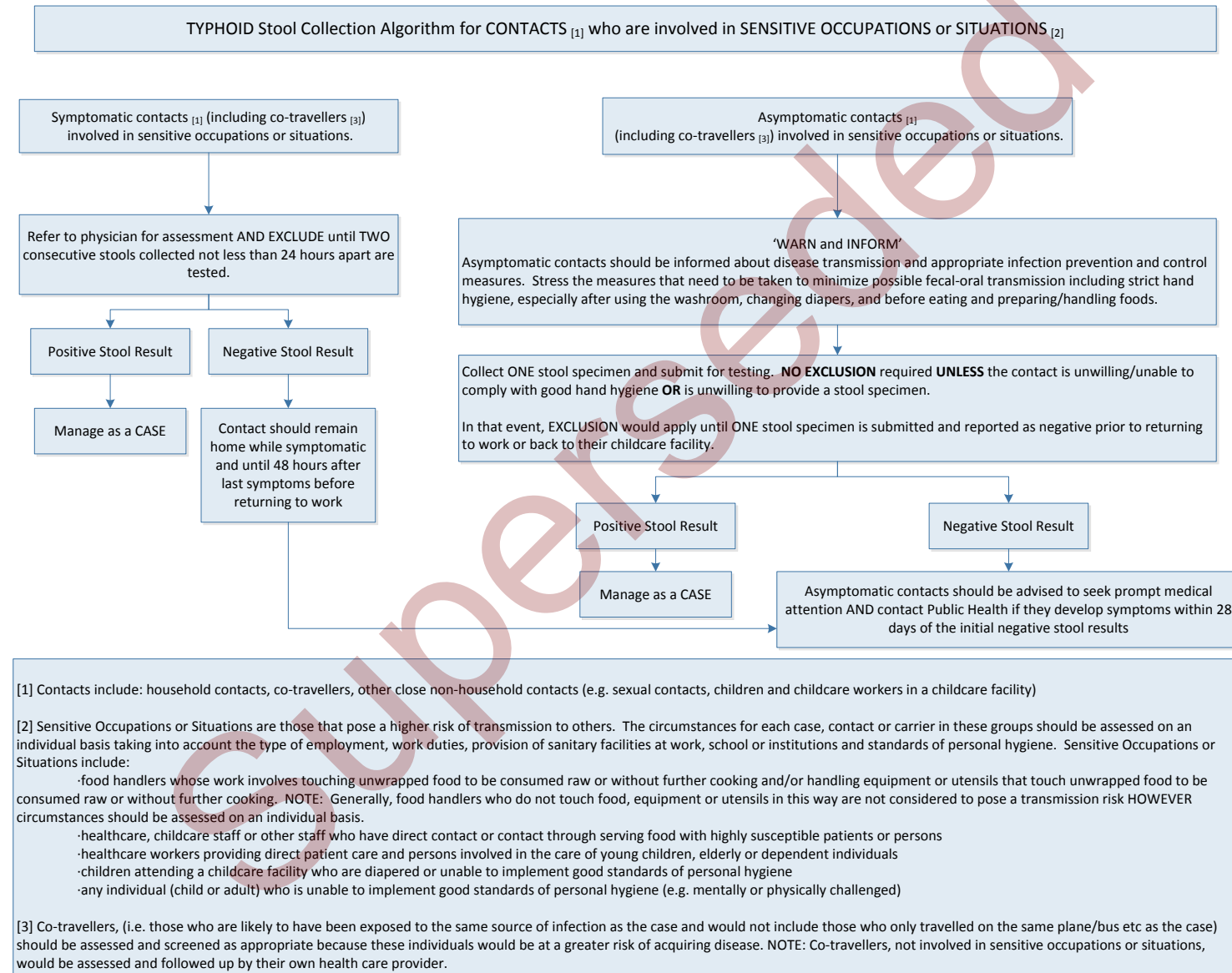
[2] For persons who continue to shed the bacteria, the majority of cases are positive on the first sample, however since there is risk of intermittent shedding, a second sample is required.

[3] *Schistosoma mansoni* and *S. haematobium* are distributed throughout Africa; *S. mansoni* is also found in South America including Brazil, Suriname, Venezuela and Caribbean (risk is low) including Dominican Republic, Guadeloupe, Martinique and Saint Lucia; only *S. haematobium* is found in areas of the Middle East; *S. japonicum* is found in Indonesia and parts of China and Southeast Asia. Two other species can infect humans: *S. mekongi*, found in Cambodia and Laos, and *S. intercalatum*, found in parts of Central and West Africa. (Source: <http://www.cdc.gov/parasites/schistosomiasis/epi.html>)

[4] "Chronic Carriers" are defined as those individuals who continue to shed *S. Typhi* for \geq one year. Medical intervention may be indicated and consult with Infectious Diseases should be considered.

[5] Collect serology for schistosomiasis 8 weeks post exposure to areas where risk exists for infection with *S. japonicum*, *S. mansoni*, *S. mekongi* and *S. intercalatum* or 12 weeks post exposure to areas where risk exists for infection with *S. haematobium*. Specimens collected before this time, may yield false negative results. Serology may need to be repeated if done too early or if the risk for infection is considered to be high. O&P in stool & urine may be appropriate in certain circumstances. ID consult should be considered.

ANNEX 2



References

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