18-ID-08

Committee: Infectious Disease

Title: Public Health Reporting and National Notification for *Salmonella enterica* serotype Typhi (*S.* Typhi) and *Salmonella enterica* serotypes Paratyphi A, B (tartrate negative), and C (*S.* Paratyphi) Infections.

☒Check this box if this position statement is an update to an existing standardized surveillance case definition.

I. Statement of the Problem

S. Typhi and *S.* Paratyphi infections have similar epidemiological characteristics, including risk factors and routes of transmission, lending themselves to a similar structure for case classification and reporting. However, infections with *S.* Paratyphi A, B, and C are currently reported as salmonellosis, while infections with *S.* Typhi are reported as typhoid fever. These two diseases typically have different reporting timeframes at the jurisdictional level (salmonellosis: routine, typhoid fever: immediate). Of note, effective 2018 jurisdictions were instructed by CDC to report *S.* Paratyphi infections under a paratyphoid fever event code for which there is no standardized case definition. In addition, the current typhoid fever case definition requires a person to have a clinically compatible illness and be culture positive for *S.* Typhi to be classified as a confirmed case. Modification of this case definition is needed to address the following concerns.

1. Classification of *S.* Paratyphi infections as salmonellosis can delay public health reporting, potentially having further implications on public health actions.
2. Inconsistent classification of *S.* Paratyphi infections due to lack of a standardized case definition.
3. Persons with atypical infections who do not report symptoms are not being counted as typhoid fever cases, potentially leading to under-ascertainment of laboratory-diagnosed cases.
4. Case definitions for bacterial enteric pathogens are not consistent. CSTE position statements for salmonellosis, shigellosis, and vibriosis (2016) as well as Shiga toxin-producing *E. coli* (STEC) infection (2017), do not require clinical compatibility for the confirmed case classification.

To address these concerns, this position statement proposes that:

1. Infections with *S.* Paratyphi A, B (tartrate negative), and C be classified as *S.* Paratyphi Infection instead of salmonellosis.
2. A standardized case definition for *S.* Paratyphi Infection be developed and S. Paratyphi Infection be added to the Nationally Notifiable Condition list.
3. Typhoid fever be renamed to *S.* Typhi Infection.
4. The clinical compatibility requirement be removed for the confirmed case classification for both conditions.

II. Background and Justification

S. Typhi and *S.* Paratyphi A, B (tartrate negative), and C are bacteria that often cause a potentially severe and occasionally life-threatening bacteremic illness known collectively as enteric fever. While fever and gastrointestinal symptoms are most common, the clinical presentation varies, including mild and atypical infections. Of note, *S.* Paratyphi B (tartrate positive), previously known as *S.* Java, typically causes an uncomplicated gastroenteritis with lower rates of hospitalization and recent international travel. For these reasons, Paratyphi B (tartrate positive) is categorized as salmonellosis instead of an *S.* Paratyphi Infection. In the United States, approximately 300 cases of typhoid fever are reported each year, 85% of which are acquired during international travel. Comparatively, approximately 80 cases of paratyphoid fever caused by *S.* Paratyphi A are reported each year, 90% of which are acquired during international travel. Cases of paratyphoid fever caused by serotypes *S.* Paratyphi B and C are reported much less frequently. Ongoing surveillance of *S.* Typhi and *S.* Paratyphi Infections is essential to detect and control outbreaks, determine public health priorities, monitor trends in illness, and assess effectiveness of public health interventions.

III. Statement of the desired action(s) to be taken

CSTE recommends the following actions:

1. Utilize standard sources (e.g. reporting*) for case ascertainment for *S.* Typhi and *S.* Paratyphi Infections. Surveillance for *S.* Typhi and *S.* Paratyphi Infections should use the following recommended sources of data to the extent of coverage presented in Table III.

   Table III. Recommended sources of data and extent of coverage for ascertainment of cases of *S.* Typhi Infection and *S.* Paratyphi Infection.

Source of data for case ascertainment	Coverage	
	Population-wide	Sentinel sites
Clinician reporting	X	
Laboratory reporting	X	
Reporting by other entities (e.g., hospitals, veterinarians, pharmacies, poison centers), specify:	X	
Death certificates	X	
Hospital discharge or outpatient records	X	
Extracts from electronic medical records	X	
Telephone survey		
School-based survey		
Other, specify:		

*Reporting: process of a healthcare provider or other entity submitting a report (case information) of a condition under public health surveillance TO local or state public health. Note: notification is addressed in a Nationally Notifiable Conditions Recommendation Statement and is the process of a local or state public health authority submitting a report (case information) of a condition on the *Nationally Notifiable Conditions List* TO CDC.

2. Utilize standardized criteria for case ascertainment and classification (Sections VI and VII and Technical Supplement) for *S.* Typhi and *S.* Paratyphi Infections.

3. *S.* Typhi Infection and *S.* Paratyphi Infection should be reported to CDC under separate event codes.

4. Please see accompanying NNC Recommendation Statement for additional Desired Actions to be Taken (page 9).

IV. Goals of Surveillance

To provide information on the temporal, geographic, and demographic occurrence of *S.* Typhi and *S.* Paratyphi Infections to facilitate their prevention and control.

V. Methods for Surveillance: Surveillance for *S.* Typhi and *S.* Paratyphi Infections should use the recommended sources of data and the extent of coverage listed in Table III.

VI. Criteria for Case Ascertainment

A. Narrative: A description of suggested criteria for case ascertainment of a specific condition.

Report any person to public health authorities that meets any of the following criteria:

S. Typhi Infection

- A person with *S.* Typhi isolated from a clinical specimen.
- A person with *S.* Typhi detected in a clinical specimen using a culture-independent diagnostic test (CIDT)
- A person with antibodies to *S.* Typhi detected in a clinical specimen.
- A person with fever, diarrhea, abdominal cramps, constipation, anorexia, or relative bradycardia who is a contact of a confirmed or probable case of *S.* Typhi Infection with laboratory evidence or a member of a risk group defined by public health authorities during an outbreak.
- A person whose healthcare record contains a recent diagnosis of *S.* Typhi Infection.
- A person whose death certificate lists *S.* Typhi Infection as a cause of death or a significant condition contributing to death.

S. Paratyphi Infection

- A person with *S.* Paratyphi A, B, or C isolated from a clinical specimen.
- A person with *S.* Paratyphi A, B, or C detected in a clinical specimen using a CIDT.
- A person with antibodies to *S.* Paratyphi A, B, or C detected in a clinical specimen.
- A person with fever, diarrhea, abdominal cramps, constipation, anorexia, or relative bradycardia who is a contact of a confirmed or probable case of *S.* Paratyphi Infection with laboratory evidence or a member of a risk group defined by public health authorities during an outbreak.
- A person whose healthcare record contains a recent diagnosis of *S.* Paratyphi Infection.
- A person whose death certificate lists *S.* Paratyphi Infection as a cause of death or a significant condition contributing to death.

B. Disease-specific data elements to be included in the initial report

Epidemiological Risk Factors

- Day care attendee
- International travel in 60 days before symptom onset
  - Countries visited
- Immunization history
  - Date(s) of typhoid vaccination

Transmission Risk Factors

- Food handler
- Health care worker
- Day care worker

VII. Case Definition for Case Classification

A. Narrative: Description of criteria to determine how a case should be classified.

Clinical Description

Infections caused by *Salmonella enterica* serotype Typhi (*S.* Typhi) or *Salmonella enterica* serotypes Paratyphi A, B (tartrate negative), and C (*S.* Paratyphi) that are often characterized by insidious onset of sustained fever, headache, malaise, anorexia, relative bradycardia, constipation or diarrhea, and non-productive cough. However, mild and atypical infections may occur. Carriage of *S.* Typhi and *S.* Paratyphi A, B (tartrate negative), and C may be prolonged.

Clinical Criteria

One or more of the following:

- Fever

- Diarrhea
- Abdominal cramps
- Constipation
- Anorexia
- Relative bradycardia

Laboratory Criteria

S. Typhi Infection

Confirmatory laboratory evidence:

- Isolation of S. Typhi from a clinical specimen.

Presumptive laboratory evidence:

- Detection of S. Typhi in a clinical specimen using a culture-independent diagnostic test (CIDT).

S. Paratyphi Infection

Confirmatory laboratory evidence:

- Isolation of S. Paratyphi A, B (tartrate negative), or C from a clinical specimen.

Presumptive laboratory evidence:

- Detection of S. Paratyphi A, B (tartrate negative), or C in a clinical specimen using a CIDT.

*Serologic testing (i.e., detection of antibodies to *S.* Typhi or *S.* Paratyphi A, B, or C) should not be utilized for case classification.

Epidemiologic Linkage

S. Typhi Infection

- Epidemiological linkage to a confirmed *S.* Typhi Infection case, or
- Epidemiological linkage to a probable *S.* Typhi Infection case with laboratory evidence, or
- Member of a risk group as defined by public health authorities during an outbreak.

S. Paratyphi Infection

- Epidemiological linkage to a confirmed *S.* Paratyphi Infection case, or
- Epidemiological linkage to a probable *S.* Paratyphi Infection case with laboratory evidence, or
- Member of a risk group as defined by public health authorities during an outbreak.

Case Classifications

S. Typhi Infection

Confirmed:

- A person with confirmatory laboratory evidence.

Probable:

- A clinically compatible illness in a person with presumptive laboratory evidence.
- A clinically compatible illness in a person with an epidemiological linkage.

S. Paratyphi Infection

Confirmed:

- A person with confirmatory laboratory evidence.

Probable:

- A clinically compatible illness in a person with presumptive laboratory evidence.
- A clinically compatible illness in a person with an epidemiological linkage.

B. Criteria to distinguish a new case of this disease or condition from reports or notifications which should not be enumerated as a new case for surveillance.

S. Typhi Infection

A new case should be created when a positive laboratory result is received more than 365 days after the most recent positive laboratory result associated with a previously reported case in the same person.

S. Paratyphi Infection

A new case should be created when either:

- A positive laboratory result is received more than 365 days after the most recent positive laboratory result associated with a previously reported case in the same person or
- Two or more different serotypes are identified in one or more specimens from the same person.

Comments

Persons with isolation of *S.* Paratyphi B (tartrate positive) from a clinical specimen should be categorized as a salmonellosis case.

Several serological tests have been developed to detect antibodies to *S.* Typhi and *S.* Paratyphi A, B, and C. However, no current serological test is sufficiently sensitive or specific to replace culture-based tests for the identification of *S.* Typhi and *S.* Paratyphi infections. Whether public health follow-up for positive serologic testing is conducted and how is at the discretion of the jurisdiction.

It is estimated that approximately 2-5% of persons infected with S. Typhi become chronic intestinal carriers who continue to shed *S.* Typhi for more than one year. These people are typically referred to as chronic carriers. The percentage of persons with S. Paratyphi A, B (tartrate negative), or C infections that become chronic carriers is not known.

Differentiating whether a person became a chronic carrier or is experiencing a new infection often relies on a variety of factors, including advanced laboratory testing (e.g., pulsed-field gel electrophoresis [PFGE], whole genome sequencing [WGS]) to compare the isolate from the previous infection to the new isolate. While these methodologies can provide detailed information about the genetic make-up of the organisms, there is still significant variability in how two organisms can be defined as different. Given the potential for inconsistent application of the label “different” across jurisdictions, this case definition does not exclude persons with a previously reported S. Typhi or S. Paratyphi Infection case from being counted as a new case if the subsequent positive laboratory result is more than 365 days from the most recent positive laboratory result associated with the existing case.

VIII. Period of Surveillance

Surveillance should be ongoing.

IX. Data sharing/release and print criteria

CSTE recommends the following case statuses be included in the CDC Print Criteria:

☒Confirmed
☒Probable
☐Suspect
☐Unknown

- Data will be used to determine the burden of illness due to *S.* Typhi and *S.* Paratyphi A, B, and C infections, assess trends in illness over time, assess the effectiveness of control programs, and monitor progress toward *S.* Typhi and *S.* Paratyphi infection control.
- Data may be used to look for vaccine failures, antimicrobial resistance trends, compare case numbers across jurisdictions, and compare case numbers with information from other disease surveillance systems.
- Provisional and final data on confirmed and probable *S.* Typhi and *S.* Paratyphi Infection cases will be published in the weekly and annual Notifiable Infectious Diseases and Conditions (NIDC) Data Tables available through the National Notifiable Diseases Surveillance System (NNDSS) – Data and Statistics webpage (https://wwwn.cdc.gov/nndss/infectious-tables.html). Data for *S.* Typhi Infection cases will be published separately from *S.* Paratyphi Infection cases. Data in the NIDC data tables are hosted by the CDC Wide-ranging Online Data for Epidemiologic Research (WONDER) platform.
- All cases are verified with the state health departments before publication. Individual case notifications are made to state and local health departments depending on circumstances. The frequency of reports and feedback to the states and territories will depend on the current epidemiologic situation in the country. Frequency of cases, epidemiologic distribution, importation status, transmission risk, and other factors will influence communications.

X. Revision History

Position Statement ID	Section of Document	Revision Description
09-ID-67	-----	- REVISED Typhoid Fever to *S.* Typhi Infection
09-ID-67	III. Statement of the desired action(s) to be taken	- ADDED new subtype for inclusion: *S.* Paratyphi Infection
09-ID-67	IV. Goals of Surveillance	- ADDED new subtype for inclusion: *S.* Paratyphi Infection
09-ID-67	V. Methods for Surveillance	- ADDED new subtype for inclusion: *S.* Paratyphi Infection
09-ID-67	VI-A. Criteria for Reporting - Narrative	- ADDED new subtype for inclusion: *S.* Paratyphi Infection - ADDED serologic laboratory testing (detection of antibodies to *S.* Typhi in a clinical specimen) - ADDED serologic laboratory testing (detection of antibodies to *S.* Paratyphi A, B, or C in a clinical specimen)
09-ID-67	VII-A. Case Definition - Narrative	- ADDED new subtype for inclusion: *S.* Paratyphi Infection - ADDED clinical criteria sub-section to clarify “clinical compatibility” - REMOVED clinical compatibility requirement for confirmed case classification - ADDED culture-independent diagnostic testing (CIDT) as presumptive laboratory evidence - ADDED ability to epidemiologically link a case to a probable case with laboratory evidence - ADDED a clinically compatible person with presumptive laboratory evidence as new probable case scenario ADDED new section to define criteria to distinguish a new case from a previously reported case
09-ID-67	IX. Data Sharing/Release and Print Criteria	- ADDED new subtype for inclusion: *S.* Paratyphi Infection

XI. References

Centers for Disease Control and Prevention (CDC). National Typhoid and Paratyphoid Fever Surveillance Overview. Atlanta, Georgia: US Department of Health and Human Services, CDC, 2011.

Centers for Disease Control and Prevention (CDC). Traveler's Health - Yellow Book - Chapter 3: Infectious Diseases Related to Travel - Typhoid & Paratyphoid Fever. Atlanta: CDC. Available from https://wwwnc.cdc.gov/travel/yellowbook/2018/infectious-diseases-related-to-travel/typhoid-paratyphoid-fever. Last updated: 2017 May 31. Accessed: 2018 March 13.

Centers for Disease Control and Prevention (CDC). Typhoid Fever. Atlanta: CDC. Available from https://www.cdc.gov/typhoid-fever/. Last updated: 2016 July 18. Accessed: 2018 March 13.

Council of State and Territorial Epidemiologists (CSTE). Public Health Reporting and National Notification for Salmonellosis (non-typhoidal). CSTE position statement 16-ID-03. Atlanta: CSTE; June 2016.

Council of State and Territorial Epidemiologists (CSTE). Public Health Reporting and National Notification for Shiga Toxin-Producing *Escherichia coli* (STEC). CSTE position statement 17-ID-10. Atlanta: CSTE; June 2017.

Council of State and Territorial Epidemiologists (CSTE). Public Health Reporting and National Notification for Shigellosis. CSTE position statement 16-ID-04. Atlanta: CSTE; June 2016.

Council of State and Territorial Epidemiologists (CSTE). Public Health Reporting and National Notification for Typhoid Fever. CSTE position statement 09-ID-67. Atlanta: CSTE; June 2009.

Council of State and Territorial Epidemiologists (CSTE). Public Health Reporting and National Notification for Vibriosis. CSTE position statement 16-ID-05. Atlanta: CSTE; June 2016.

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Nationally Notifiable Conditions (NNC) Recommendation Statement

Position Statement Title: Public Health Reporting and National Notification for *Salmonella enterica* serotype Typhi (*S.* Typhi) and *Salmonella enterica* serotypes Paratyphi A, B (tartrate negative), and C (*S.* Paratyphi) Infections.

Disease/Condition: *Salmonella enterica* serotype Typhi (*S.* Typhi) and *Salmonella enterica* serotypes Paratyphi A, B (tartrate negative), and C (*S.* Paratyphi) Infections

☒This statement updates a disease/condition already on the *Nationally Notifiable Conditions List*.

- ☒No change to the CDC notification timeframe is recommended.
- ☒New subtype(s) or additional disease/condition categories are added to the accompanying position statement.

This NNC Recommendation Statement recommends the following:

1. Utilize standardized criteria for case ascertainment and classification (based on Sections VI and VII and Technical Supplement of accompanying position statement) for *S.* Typhi and *S.* Paratyphi Infections and add *S.* Typhi and *S.* Paratyphi Infections to the *Nationally Notifiable Condition List*
   - ☐ Immediately notifiable, extremely urgent (within 4 hours)
   - ☐ Immediately notifiable, urgent (within 24 hours)
   - ☒ Routinely notifiable
   - ☐ No longer notifiable

2. CSTE recommends that all States and Territories enact laws (statue or rule/regulation as appropriate) to make this disease or condition reportable in their jurisdiction. Jurisdictions (e.g. States and Territories) conducting surveillance (according to these methods) should submit case notifications* to CDC.

3. Expectations for Message Mapping Guide (MMG) development for a newly notifiable condition: NNDSS is transitioning to HL7-based messages for case notifications; the specifications for these messages are presented in MMGs. When CSTE recommends that a new condition be made nationally notifiable, CDC must obtain OMB PRA approval prior to accepting case notifications for the new condition. Under anticipated timelines, notification using the Generic V2 MMG would support transmission of the basic demographic and epidemiologic information common to all cases and could begin with the new MMWR year following the CSTE annual conference. Input from CDC programs and CSTE would prioritize development of a disease-specific MMG for the new condition among other conditions waiting for MMGs.

4. CDC should publish data on *S.* Typhi and *S.* Paratyphi Infections as appropriate (see Section IX of corresponding position statement).

5. CSTE recommends that all jurisdictions (e.g. States or Territories) with legal authority to conduct public health surveillance follow the recommended methods as outlined here and in the accompanying standardized surveillance position statement.

*Notification: process of a local or state public health authority submitting a report (case information) of a condition on the *Nationally Notifiable Conditions List* TO CDC.

Technical Supplement

Table VI. Table of criteria to determine whether a case should be reported to public health authorities.

Criterion	*Salmonella enterica* serotype Typhi (*S.* Typhi) Infection		*Salmonella enterica* serotypes Paratyphi A, B (tartrate negative), and C (*S.* Paratyphi) Infection	
Clinical evidence				
Fever		O		O
Diarrhea		O		O
Abdominal cramps		O		O
Constipation		O		O
Anorexia		O		O
Relative bradycardia		O		O
Healthcare record contains a recent diagnosis of *S.* Typhi infection	S			
Death certificate lists *S.* Typhi infection as a cause of death or a significant condition contributing to death	S			
Healthcare record contains a recent diagnosis of *S.* Paratyphi A, B, or C infection			S	
Death certificate lists *S.* Paratyphi A, B, or C infection as a cause of death or a significant condition contributing to death			S	
Laboratory evidence				
Isolation of S. Typhi from a clinical specimen	S			
Detection of S. Typhi in a clinical specimen using a CIDT	S			
Detection of antibodies to S. Typhi in a clinical specimen	S			
Isolation of S. Paratyphi A, B, or C from a clinical specimen			S	
Detection of S. Paratyphi A, B, or C in a clinical specimen using a CIDT			S	
Detection of antibodies to S. Paratyphi A, B, or C in a clinical specimen			S	
Epidemiological evidence				
Epidemiologically linked to a confirmed S. Typhi Infection case		O		
Epidemiologically linked to a probable S. Typhi Infection case with laboratory evidence		O		
Epidemiologically linked to a confirmed S. Paratyphi Infection case				O
Epidemiologically linked to a probable S. Paratyphi Infection case with laboratory evidence				O
Member of a risk group as defined by public health authorities during an outbreak		O		O

Notes:
S = This criterion alone is SUFFICIENT to report a case.
N = All "N" criteria in the same column are NECESSARY to report a case.
O = At least one of these "O" (ONE OR MORE) criteria in **each category** (categories=clinical evidence, laboratory evidence, and epidemiological evidence) **in the same column**—in conjunction with all "N" criteria in the same column—is required to report a case.

Table VII. Classification Table: Criteria for defining a case of *Salmonella enterica* serotype Typhi (*S.* Typhi) and *Salmonella enterica* serotypes Paratyphi A, B (tartrate negative), and C (*S.* Paratyphi) Infections.

Criterion	S. Typhi Infection			S. Paratyphi Infection		
	Probable		Confirmed	Probable		Confirmed
Clinical evidence						
Fever	O	O		O	O	
Diarrhea	O	O		O	O	
Abdominal cramps	O	O		O	O	
Constipation	O	O		O	O	
Anorexia	O	O		O	O	
Relative bradycardia	O	O		O	O	
Laboratory evidence						
Isolation of S. Typhi from a clinical specimen			N			
Detection of S. Typhi in a clinical specimen using a CIDT		N				
Isolation of S. Paratyphi A, B (tartrate negative), or C from a clinical specimen						N
Detection of S. Paratyphi A, B (tartrate negative), or C in a clinical specimen using a CIDT					N	
Epidemiological evidence						
Epidemiologically linked to a confirmed S. Typhi Infection case	O					
Epidemiologically linked to a probable S. Typhi Infection case with laboratory evidence	O					
Epidemiologically linked to a confirmed S. Paratyphi Infection case				O		
Epidemiologically linked to a probable S. Paratyphi Infection case with laboratory evidence				O		
Member of a risk group as defined by public health authorities during an outbreak	O			O		
Criteria to distinguish a new case						
A positive laboratory result reported more than 365 days after the most recent positive laboratory result associated with a previously reported case in the same person		N	N		O	O
Two or more different serotypes identified in one or more specimens from the same person					O	O

Notes:
S = This criterion alone is SUFFICIENT to classify a case.
N = All "N" criteria in the same column are NECESSARY to classify a case. A number following an "N" indicates that this criterion is only required for a specific disease/condition subtype (see below). If the absence of a criterion (i.e., criterion NOT present) is required for the case to meet the classification criteria, list the absence of criterion as a necessary component.
O = At least one of these "O" (ONE OR MORE) criteria in **each category** (categories=clinical evidence, laboratory evidence, and epidemiologic evidence) **in the same column**—in conjunction with all "N" criteria in the same column—is required to classify a case. A number following an "O" indicates that this criterion is only required for a specific disease/condition subtype.

Appendix A. Calculating and Interpreting the 365-Day Time Period to Distinguish a New Case from a Previously Reported Case of *S.* Typhi and *S.* Paratyphi Infections

Formula

Date* of current positive laboratory result
– Date* of most recent positive laboratory result associated with the previously reported case
= X days

* Hierarchy of dates: Available information can vary between laboratory results. To account for this, a hierarchy of dates to be used in the above calculation follows (highest priority to lowest priority):

- Specimen collection date
- Specimen received date
- Laboratory report date
- Symptom onset date (for individuals who do not have laboratory testing)

Interpretation

- If X is less than or equal to 365 days, the result should be considered part of the previously reported case (i.e., a new case should not be created).
  - Please note that in this situation, a current result documenting a serotype different from the previously reported case would then cause a new case to be created.
- If X is greater than 365 days, a new case should be created.