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Salmonellosis Nontyphoidal (NTS)

Overview^{1, 2, 5, 6, 7, 12}

Salmonellae are a gram-negative, rod-shaped bacillus which can cause illness in both animals and humans. Nontyphoidal salmonellosis (NTS) refers to illnesses caused by all serotypes of *Salmonella* (*S.*) except for *S. Typhi*, *S. Paratyphi A*, *S. Paratyphi B*, and *S. Paratyphi C*. [**Important:** For information on *S. Typhi*, *S. Paratyphi A*, *S. Paratyphi B*, and *S. Paratyphi C* go to the [Typhoid / Paratyphoid Fever](#) section of this manual.] More than 2,500 serotypes have been identified; a small number of which usually account for the majority of infections. *S. Typhimurium*, *S. Enteritidis*, *S. Newport*, and *S. Javiana* are the most common serotypes in the United States; accounting for almost half of the culture-confirmed *Salmonella* isolates.⁵ Anyone can get salmonellosis, but age-specific incidences for NTS are highest in children younger than 5 years of age.⁵ Young children, the elderly, and the immunocompromised are the most likely persons to have severe salmonellosis.

Transmission often occurs through the consumption of foods, mainly of animal origin (i.e., raw or undercooked meats and eggs, unpasteurized milk and cheese products) contaminated with animal feces. However, all foods, including fruits, vegetables and water can become contaminated. Transmission can also occur through direct contact with infected animals or their environment, especially poultry, swine, cattle, rodents and pets, such as reptiles (turtles, iguanas, snakes, lizards, and African Dwarf frogs), chicks, ducklings, birds, dogs and cats. Person-to-person transmission can also occur since the organism is shed in stool, often for weeks or months after infection.

The incubation period for salmonellosis is 6-72 hours, usually 12-36 hours. However incubation periods of up to 16 days have been documented.¹ The most common symptoms of NTS are acute diarrhea, with sudden onset of headache, fever, abdominal pain, and sometimes vomiting. The illness usually lasts 4-7 days, and most people recover without treatment. Asymptomatic infection or mild illness is common. Salmonellosis outcomes differ by serotype. Sustained or intermittent bacteremia can occur, and focal infections are recognized in as many as 10% of patients with nontyphoidal *Salmonella* bacteremia.²

Current recommendations are to treat most patients with uncomplicated salmonellosis with supportive therapy and no antimicrobial agents, because it does not shorten the duration of disease and can prolong excretion of the organism in feces. Antibiotic therapy is recommended for patients with severe illness (e.g., those with severe diarrhea, high fever, bloodstream infection, or who need hospitalization) or those at risk of severe disease or complications, including young infants, older adults (over 65 years old) and immunocompromised persons.⁵

Nontyphoidal *Salmonellae* are a leading cause of bacterial diarrhea worldwide; they are estimated to cause 94 million cases of gastroenteritis and 115,000 deaths globally each year.⁶ The number of reported NTS cases in Missouri ranged from 839 to 1,071 for the 5 year period 2011-2015. Because many milder cases are not diagnosed or reported, the actual number of infections is thought to be much higher. About 60-80% of cases occur sporadically, but large outbreaks are not uncommon.



Outbreaks in the United States have been traced to processed meat products, inadequately cooked poultry, raw milk, dairy products, and uncooked or lightly cooked products containing eggs. More recently, fresh produce has been implicated in outbreaks. Contaminated utensils and work surfaces can also spread salmonellosis.

Control measures must focus on appropriate food processing and handling, proper handwashing, and exclusion of symptomatic persons from food handling and direct child or patient care. For a complete description of NTS, 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 GL, Bennett JE, Dolin RD, eds. *Mandell, Douglas, and Bennett's Principles and Practices of Infectious Diseases: Vol. 2*. 8th ed; 2015.

2017 Case Definition – Salmonellosis (*Salmonella* spp.)⁴ – (5/2017)

Background

In 2011, CSTE updated the salmonellosis case definition, classifying a positive culture-independent diagnostic testing (CIDT) result that is not culture-confirmed as a suspect case. Modification of the 2011 case definition is needed to address underreporting of salmonellosis cases and to make case definitions for enteric bacterial pathogens more consistent. This 2016 case definition changes the case classification for a case with a positive *Salmonella* CIDT result from suspect to probable.

Clinical

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

Laboratory Criteria for Diagnosis

Supportive laboratory evidence: Detection of *Salmonella* spp. in a clinical specimen using a CIDT.

Confirmatory laboratory evidence: Isolation of *Salmonella* spp. from a clinical specimen.

Epidemiologic Linkage

Probable: A clinically compatible case that is epidemiologically linked to a case that meets the supportive or confirmatory laboratory criteria for diagnosis.

Criteria to Distinguish a New Case from an Existing Case

A case should not be counted as a new case if laboratory results were reported within 365 days of a previously reported infection in the same individual.

When two or more different serotypes are identified from one or more specimens from the same individual, each should be reported as a separate case.



Case Classification

Probable:

- A case that meets the supportive laboratory criteria for diagnosis; **OR**
- A clinically compatible case that is epidemiologically linked to a case that meets the supportive or confirmatory laboratory criteria for diagnosis.

Confirmed: A case that meets the confirmed laboratory criteria for diagnosis.

Comments

The use of CIDs as stand-alone tests for the direct detection of *Salmonella* in stool is increasing. Specific performance characteristics such as sensitivity, specificity, and positive predictive value of these assays likely depend on the manufacturer and are currently unknown. It is therefore useful to collect information on the type(s) of testing performed for reported salmonellosis cases. When a specimen is positive using a CIDT it is also helpful to collect information on all culture results for the specimen, even if those results are negative. Culture confirmation of CIDT-positive specimens is ideal, although it might not be practical in all instances. State and local public health agencies should make efforts to encourage reflexive culturing by clinical laboratories that adopt culture-independent methods, should facilitate submission of isolates/clinical material to state public health laboratories, and should be prepared to perform reflexive culture when not performed at the clinical laboratory as isolates are currently necessary for molecular typing (PFGE and whole genome sequencing) that are essential for outbreak detection.

Note: Salmonella Typhi while rare in Missouri is a serious illness. If a case of *Salmonella Typhi* is reported, contact the [District Communicable Disease Coordinator](#) immediately. See the manual section [Typhoid or Paratyphoid Fever](#) for information on these conditions.


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) and the [Record of Investigation of Enteric Illness](#) (CD-2C) from the patient or a knowledgeable family member.

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

Identifying the source of infection. The information obtained from the public health investigation will be used to help identify the source.

- Does the case or a member of the case's household attend a child care center or nursery school?

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- Does the case or a member of the case's household work as a food handler, health care provider, or in an animal operation?
- Has the case recently traveled or is the serotype and/or Pulsed-Field Gel Electrophoresis (PFGE) result associated with an ongoing outbreak?
- Has the case had contact with livestock or other domestic or wild animals, including fowl (e.g., chicks, ducks) or reptiles?
- Has the case prepared or consumed undercooked meat (beef, pork, or poultry products)?
- Has the case consumed unpasteurized milk, cheeses, or raw eggs?
- Is this case related to a food recall? *NOTE: Sometimes the source cannot be identified.*

Provide *Salmonella* information to persons at risk for infection and the general public as needed. Efforts should be made to promote NTS awareness and provide prevention information to the public to reduce the risk of salmonellosis. Cases should be educated on the importance of personal hygiene, particularly after using the toilet and before and after food handling.

Information on salmonellosis prevention can be found on CDC's website at:

<http://www.cdc.gov/salmonella/general/prevention.html>.

Contaminated food and water often pose a risk for travelers; see CDC's website Travelers' Health, *2016 Yellow Book, Food and Water Precautions* at:

<http://wwwnc.cdc.gov/travel/yellowbook/2016/the-pre-travel-consultation/food-water-precautions>.

United States Department of Agriculture (USDA) website at:

http://www.fsis.usda.gov/wps/portal/ffis/topics/food-safety-education/get-answers/food-safety-fact-sheets/foodborne-illness-and-disease/salmonella-questions-and-answers/ct_index.

U.S. Food and Drug Administration (FDA) website at:

<https://www.fda.gov/AnimalVeterinary/ResourcesforYou/AnimalHealthLiteracy/ucm509766.htm>


Center for Food Security and Public Health, Iowa State University, College of Veterinary Medicine website at:

http://www.cfsph.iastate.edu/FastFacts/pdfs/nontyphoidal_salmonellosis_F.pdf.

***Salmonella* Surveillance.** Review WebSurv to determine whether there have been other salmonellosis cases in the same geographic area or facility. When cases are related by person, place, or time; serotype and/or PFGE pattern, efforts should be made to identify a common 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.

Notification

Immediately contact the [District Communicable Disease Coordinator](#), or the [Senior Epidemiology Specialist for the District](#), or the Missouri Department of Health and Senior Services (MDHSS) - BCDCP, phone (573) 751-6113, Fax (573) 526-0235, or for afterhours notification contact the MDHSS/ERC at (800) 392-0272 (24/7) if an outbreak of salmonellosis is suspected. If the case is in a high-risk setting or job such as food handling, child care or

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healthcare, contact the [District Communicable Disease Coordinator](#) and the appropriate organization below:

- If a case(s) is a food handler, BCDCP or the LPHA will contact the 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, BCDCP or the local public health agency (LPHA) will contact the 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, BCDCP or the LPHA will contact the Section for Long Term Care Regulation, phone (573) 526-8524, Fax (573) 751-8493.
- 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.

Control Measures

General Control Measures¹³

There is no vaccine to prevent NTS. The best defense against salmonellosis is thorough, frequent handwashing and proper cooking, handling and storage of food. Therefore you should:

- Not prepare food or pour beverages for others while ill with diarrhea. Salmonellosis cases and ill contacts should be excluded from food handling, the care of children or patients, and other occupations that pose significant risk of transmission until after the diarrhea has ceased for 24 hours.⁷ (See specific recommendations for food handlers and child care providers below).
- Wash your hands after going to the bathroom.
- Educate all food handlers about the importance of handwashing before, during and after food preparation.
- Wash your hands with soap and warm water after touching animals (especially reptiles, birds, or amphibians), raw meat, poultry, pet foods, including pet treats, or pet poop.
- Keep reptiles (like turtles, iguanas, and snakes) away from babies, the elderly, or people with weak immune systems.
- Always wash your hands with soap and warm water before touching a baby (for example, to feed or change their diaper), especially after you have touched any pets or uncooked poultry or meat.
- Supervise handwashing of toddlers and small children after they use the toilet.
- Dispose of soiled diapers properly and wash, rinse and sanitize diaper changing areas after using them.
- Keep children with diarrhea out of child care settings.



- Mother’s milk is the safest food for young infants. Breastfeeding prevents salmonellosis and many other health problems.
- Travelers should follow CDC’s [food and water precautions](#).
- Cook poultry (like chicken or turkey), meat, hamburger, and eggs thoroughly.
- Don’t eat or drink foods that have uncooked eggs or raw (unpasteurized) milk in them.
- If you are in a restaurant, send back all undercooked meat, poultry or eggs to the kitchen and have them cook it longer.
- If fresh fruits, vegetables or other commercially acquired products are suspected as the vehicle of transmission during an outbreak, a trace-back of the product performed by health authorities may prevent additional cases.
- Wash all kitchen work areas and utensils with soap and warm water right away after you have used them for cooking with raw meat or poultry.
- Avoid swallowing water from ponds, lakes, or untreated pools.
- If coliform bacteria are detected in a private water supply (e.g., cistern, well), advise the family to boil the water (bring water to a full rolling boil for one minute) used for drinking, food preparation, dishwashing, and tooth brushing until the problem in the water supply can be corrected.
- Infected persons should refrain from recreational water venues (e.g., swimming pools, water parks) for 2 weeks after symptoms resolve.⁶
- Prompt case reports to public health authorities by health care providers is essential.


High-risk Settings:

Food Handlers^{1,3}

Educate all food handlers about the importance of handwashing before, during and after food preparation, maintenance of time-temperature standards for food handling – to include the thorough cooking of all foodstuffs derived from animal sources, avoid recontamination within the kitchen after cooking is complete, and maintain a sanitary kitchen and protect foods against rodent and insect contamination.

In situations where public health risk appears minimal it is permissible to allow individuals to return to work after diarrhea has resolved for 24 hours. Two consecutive negative stools samples should be required for food handlers whose work involves touching unwrapped foods that are consumed raw or served without further cooking; for food handlers with questionable hygiene habits; when two or more epidemiologically linked cases of nontyphoidal salmonellosis are identified among food handlers of the same establishment; in situations where the establishment has exhibited a history of non-compliance with priority violations and/or a lack of cooperation or knowledge by the person in charge, especially related to personal hygiene and/or the transmission, reporting, and exclusion of foodborne disease; and during sustained community or foodborne outbreaks wherein the Department deems such actions are necessary for the protection of public health.^{1,3} The two (2) consecutive negative stool cultures for *Salmonella* should be collected not less than 24 hours apart; and if antibiotics are used, no earlier than forty-eight (48)



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hours after discontinuance. **NOTE:** For additional Measures for the “Control of Communicable, Environmental and Occupational Diseases” see [19 CSR 20-22.040](#), [19 CSR 20-20.060](#) “Control Measures for Food Handler” and the “[Missouri Food Code for the Food Establishments of the State of Missouri - June 3, 2013](#)”.

Child Care


Increased surveillance within the child care facility to identify others with diarrheal illness is important. Children and child care staff with diarrhea should be excluded from the facility until after the diarrhea has ceased for 24 hours. Instruct asymptomatic individuals in strict personal hygiene. Stress proper handwashing.^{1,7,9}

- Emphasize handwashing. Because good hand hygiene is the best preventive measure, supervised handwashing after visiting the bathroom and before eating is essential for all children. Waterless hand sanitizers may also be helpful as an adjunct to washing hands with soap and warm water.
- Employees handling food in child care settings should follow the criteria listed in the [Missouri Food Code](#).
- Staff who prepare food should not change diapers, or assist children in using the toilet.
- If a child in diapers has salmonellosis, everyone who changes the child’s diapers should be sure the diapers are disposed of properly in a closed-lid garbage can, and should wash his or her hands and the child’s hands carefully with soap and warm water immediately after changing the diapers. After use, the diaper changing area should be wiped down with a disinfectant such as diluted household bleach, Lysol or bactericidal wipes.
- Other surfaces and objects should be decontaminated regularly; daily during an outbreak of salmonellosis.
- If several cases occur in a child care center, the local public health agency should coordinate efforts to improve handwashing among the staff, children, and their families. Contact the [Section for Child Care Regulation](#) for an Environmental Public Health Specialist to perform an assessment of the child care facility. The inspection should include emphasis on the items listed in “[Day Care Establishment Inspection Related to Enteric Infection](#)” (CD-8).
- Access to shared water-play areas and contaminated diapers should be eliminated.

To prevent the spread of infection, efforts should be made to avoid the transfer of children to other child care centers. Closure of affected child care centers may lead to placement of infected children in other centers (with subsequent transmission in those centers) and is counterproductive.

Health Care Providers³

To limit the risk of health care-associated transmission, patients with NTS should be managed with “Standard Precautions,” including the use of personal protective equipment,[§] including gloves, when providing patient care or handling soiled articles. Proper handwashing should be emphasized.

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Infected health care workers and ill contacts should be excluded from patient care and other health care-related duties that pose significant risk of transmission, until diarrhea ceases for 24 hours. Instruct individuals in good personal hygiene, to include proper handwashing.

NOTE: Two consecutive negative stools samples should be considered for health care providers with questionable hygiene habits.

[§] = Personal protective equipment, or PPE, as defined by the Occupational Safety and Health Administration, or OSHA, is “specialized clothing or equipment, worn by an employee for protection against infectious materials.”

Schools and Preschools

In the school setting, hand hygiene is the most important control measure. Teachers and students with any diarrheal illness should be excluded from the school until 24 hours after their diarrhea has ceased.⁷ Stress proper handwashing.

If an outbreak in a school cannot be controlled with improved hygiene and exclusion of those with diarrhea, then additional interventions may be necessary.

If biological terrorism is suspected²

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 Website 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 NTS 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.
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

Clinical Specimens: If testing of stool samples is to be performed by the Missouri State Public Health Laboratory (MSPHL); collect stool specimens in Cary-Blair media using the Enteric Specimen Collection Kit. Specimens should be shipped refrigerated. Diagnosis is based on culture of the organism. *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.*

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* 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.

Reporting Requirements


Salmonellosis is a reportable disease and shall be reported to the local health authority or to the Missouri Department of Health and Senior Services (MDHSS) within three (3) days of first knowledge or suspicion, by telephone, facsimile, or other rapid communication.

Instances of salmonellosis that appear to be the result of a terrorist act or the intentional or deliberate release of a biological agent are a Category 1(B) disease and shall be reported to the local health authority or to the MDHSS **immediately** upon of 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 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, complete a [Disease Case Report](#) (CD-1) and a [Record of Investigation of Enteric Illness](#) (CD-2C). **Important:** For *S. Typhi* and *S. Paratyphi* complete CDC’s [“Typhoid and Paratyphoid Fever Surveillance Report”](#) – send completed




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report to the District Health Office. [See the [Typhoid & Paratyphoid](#) section of this manual for additional information on these conditions.]

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. All outbreaks or “suspected” outbreaks must be reported as soon as possible (by phone, facsimile, or e-mail) to the District Communicable Disease Coordinator. This can be accomplished by completing the [Missouri Outbreak Surveillance Report](#) (CD-51).
5. If an outbreak is associated with food, person-to-person transmission, environmental contamination, animal contact, or indeterminate/other/unknown etiology, a CDC 52.13 form ([National Outbreak Reporting System – Foodborne Disease Transmission, Person-to-Person Disease Transmission, Animal Contact](#)) is to be completed and submitted to the District Communicable Disease Coordinator at the conclusion of the outbreak.
6. If an outbreak is associated with the consumption or use of water for drinking, or with ingestion, contact, or inhalation of recreational water, a CDC 52.12 form ([National Outbreak Reporting System - Waterborne Disease Transmission](#)) is to be completed and submitted to the District Communicable Disease Coordinator at the conclusion of the outbreak.
7. Within 90 days from the conclusion of an outbreak, submit the final outbreak report to the District Communicable Disease Coordinator.

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