

SALMONELLOSIS

REPORTING INFORMATION

- **Class B:** Report by the end of the next business day after the case or suspected case presents and/or a positive laboratory result to the local public health department where the patient resides. If patient residence is unknown, report to the local public health department in which the reporting health care provider or laboratory is located.
- Reporting Form(s) and/or Mechanism:
 - The Ohio Disease Reporting System (ODRS) should be used to report lab findings to the Ohio Department of Health (ODH). For healthcare providers without access to ODRS, you may use the [Ohio Confidential Reportable Disease form](#) (HEA 3334).
 - The [Ohio Enteric Case Investigation Form](#) may be useful in the local health department follow-up of cases. Do not send this form to ODH; information collected from the form should be entered into ODRS where fields are available, and the form should be uploaded in Administration section of ODRS.
 - The [National Hypothesis-Generating Questionnaire](#) may be helpful when investigating cases involved in multistate or multicounty clusters.
- Key fields for ODRS reporting include: sensitive occupation (e.g., direct patient care, child care provider, food handler), sensitive setting (e.g., day care or preschool attendee, long term care facility resident), import status (whether the infection was travel-associated or Ohio-acquired), date of illness onset, the interview fields, the fields in the Food History module and the fields in the Travel and Other Exposures module.

AGENT

Over 2,500 serotypes of *Salmonella* are known. *Salmonella* serotype Typhimurium and *Salmonella* serotype Enteritidis account for nearly half of all human *Salmonella* isolates typed in Ohio. *Salmonella* Typhi is the agent of typhoid fever and should be reported as typhoid fever, not salmonellosis.

Infectious dose: In general, 100-1,000 organisms, but fewer organisms may sometimes cause infection.

CASE DEFINITION

Clinical Criteria

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

Supportive laboratory evidence: Detection of *Salmonella* spp. in a clinical specimen using culture-independent diagnostic testing (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.

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

Comments

The use of CIDTs 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 (pulsed-field gel electrophoresis [PFGE] and whole genome sequencing) that are essential for outbreak detection.

SIGNS AND SYMPTOMS

Salmonellosis is most commonly an acute gastrointestinal illness characterized by diarrhea, abdominal cramps, fever and sometimes vomiting. Infection may progress from gastroenteritis to septicemia or a focal infection (e.g., cholecystitis, meningitis).

DIAGNOSIS

Salmonellosis is diagnosed by isolating the organism from stool, blood, urine or other body fluid. Serology tests are not useful for diagnosis. Tests have been developed to detect *Salmonella* nucleic acid by polymerase chain reaction (PCR) and *Salmonella* antigens by enzyme immunoassay (EIA), latex agglutination and monoclonal antibodies.

Most hospital laboratories have the ability to identify *Salmonella*. The ODH Laboratory performs testing for *Salmonella*. In some circumstances, testing of cases and contacts can be done at the ODH Laboratory without charge. To obtain the fee exemption and to arrange for receipt of the stool transport kit, contact the ODH Outbreak Response and Bioterrorism Investigation Team (ORBIT) at (614) 995-5599. Clinical labs are asked to send all *Salmonella* isolates and specimens that test positive for *Salmonella* via CIDT to ODH Lab for serotyping and pulsed-field gel electrophoresis typing. This is important for identifying and investigating outbreaks and to monitor the incidence of *Salmonella* serotypes.

EPIDEMIOLOGY

Source

Animals and humans are the reservoir of *Salmonella*. Domestic or wild animals may be infected, including livestock, poultry and pets (including dogs, cats and reptiles). Food and water may be contaminated with *Salmonella* from animals or their waste. Raw

meats, milk and shell eggs may be contaminated with *Salmonella*. Raw produce may be contaminated from raw meat juices or animal feces (e.g., through contaminated irrigation water, during transport or processing). Food may also become contaminated by infected food handlers.

Occurrence

Salmonellosis occurs worldwide. In Ohio, there is a slight increase in incidence during the mid-summer. Most recognized cases occur in children <5 years of age, persons with immunosuppressive conditions and adults >60 years of age; however, all persons are at risk.

Mode of Transmission

Humans may acquire *Salmonella* directly (via the fecal-oral route) from animals (e.g., pets, livestock, reptiles) or from ingestion of contaminated food or water. Direct person-to-person transmission may occur via the fecal-oral route but is uncommon.

Period of Communicability

Salmonella is shed in the feces while the patient is acutely ill and perhaps for a week or two after symptoms end. Antibiotic use may prolong the period of shedding. The carrier state develops in $\leq 5\%$ of patients and can continue for months, especially in infants. Approximately 1% of adults and 5% of children <5 years old continue to shed *Salmonella* for up to 1 year.

Incubation Period

The incubation period is 6-72 hours, usually 12-36 hours. Longer incubation periods of up to 16 days have been documented and may not be uncommon following low-dose ingestion.

PUBLIC HEALTH MANAGEMENT

Case

Investigation

All cases reported to the local health department should initially be followed up with a telephone call to obtain demographic and epidemiologic data. No further work-up is recommended if neither the case nor any household member is employed in a sensitive occupation (food handler, healthcare worker or employee in child care center who handles food or directly cares for children) or attends a child care center, unless there is evidence that the case is part of an outbreak or cluster.

Treatment

Antibiotics are generally not administered in cases of uncomplicated gastroenteritis, as they can lead to the carrier state. Antibiotic treatment may be indicated for salmonellosis in infants, the elderly, those with underlying medical conditions and patients with continued fever or extra-intestinal infections.

Isolation and Follow-up Specimens

Ohio Administrative Code 3701-3-13 (U) states:

"Salmonellosis: a person with salmonellosis who attends a child care center or works in a sensitive occupation shall be excluded from the child care center or work in the sensitive occupation and may return when the following conditions are met:

- 1) The child may return to the child care center after diarrhea has ceased.
- 2) A person may return to work in a sensitive occupation after diarrhea has ceased, provided that his or her duties do not include food handling.
- 3) A person who is a food handler may return to work after diarrhea has ceased and after two consecutive follow-up stool specimens are negative for *Salmonella*."

Obtain the first stool specimen no sooner than 48 hours after cessation of diarrhea or, if being treated, at least 48 hours after completion of antibiotic therapy. Obtain the remaining specimen(s) at least 24 hours apart.

Note: Even if *Salmonella* was initially recovered from blood or urine, the follow-up testing as described above is done on stool samples.

ODH has developed an instructional [video](#) for patients submitting stool specimens that may be helpful to ensure specimens are collected appropriately and safely.

Contacts

Any household member who has diarrhea and is employed in a sensitive occupation or attends a child care center should be tested for *Salmonella*.

Prevention and Control

All meat and egg dishes should be thoroughly cooked. Avoid cross-contamination of food (especially raw fruits and vegetables) with raw meat juices. Hand washing after contact with animals can help prevent salmonellosis. Chicks, ducklings and all reptiles, which might be *Salmonella* carriers, are inappropriate pets for small children.

Thorough hand washing should be emphasized, especially after bowel movements, after changing diapers and before eating or preparing food.

Food Handlers

Symptomatic persons shall be excluded from work (see **Special Information** below). As detailed in **Isolation** above, food handlers may only return to work after diarrhea has ceased and two consecutive follow-up stool specimens are negative for *Salmonella*.

Food Service Operation rules also pertain to this situation. Salmonellosis is a disease which can be transmitted through food. Persons infected with a disease that is communicable by food are not permitted to work as a food handler. For additional information, refer to Ohio Administrative Code (OAC) Chapter 3717-1 (Ohio Uniform Food Safety Code) Section 02.1, Management and Personnel: Employee Health.

Healthcare Workers

Symptomatic persons shall be excluded from work (see **Special Information** below). As detailed in **Isolation** above, persons who work in sensitive occupations may return when diarrhea has ceased, provided their duties do not include food handling. However, it is also recommended that healthcare workers who provide direct care of infant, elderly, immunocompromised or institutionalized patients be excluded from work until diarrhea has ceased and after two consecutive follow-up stool specimens are negative for *Salmonella*.

Child Care Workers and Children who Attend Child Care Centers

Symptomatic persons shall be excluded from work (see **Special Information** below). As detailed in **Isolation** above, children who attend child care centers and persons who work in sensitive occupations may return when diarrhea has ceased, provided their duties do not include food handling.

Child Care Center Outbreak Control

Whenever a case of salmonellosis has been identified in a child care center attendee or worker, staff and children who are symptomatic and in the same classroom as the case should be cultured for *Salmonella*. Stool cultures are not required for asymptomatic

contacts. Arrangements to have this testing done at ODH Lab can be made by contacting ODH ORBIT at (614) 995-5599. Children and staff members with salmonellosis do not require follow up stool testing, as long as their duties do not include handling food, and may return to the child care facility once the diarrhea has resolved. Reptiles, amphibians and adult and baby poultry are not appropriate pets for child care centers.

Special Information

Persons with diarrhea of infectious or unknown cause (e.g., confirmed or suspected cases of salmonellosis) are not permitted to work in sensitive occupations or attend child care centers, according to OAC 3701-3-13 (H), which states: "Diarrhea, infectious or of unknown cause: a person with diarrhea, of infectious or unknown cause, who attends a child care center or works in a sensitive occupation shall be excluded from the child care center or work in the sensitive occupation and may return only after diarrhea has ceased. A person with infectious diarrhea of known cause shall be isolated in accordance with the provisions of the rule set forth for the specified disease."

" 'Sensitive occupation' means direct food handling, direct patient care, the handling of food or provision of direct care to children in a child care center, or any other occupation which provides significant opportunity for an infected individual to transmit infectious disease agents" per OAC 3701-3-01 (X).

Prevention Resources

General:

- [CDC Salmonella Information](#)
- [CDC Salmonella Atlas](#)

Animals:

- [CDC Animals in School and Day Care Settings](#)
- [CDC Stay Healthy at Animal Exhibits](#)
- [CDC Poster: Animal Exhibits \(Spanish, French\)](#)
- [NASPHV Poster: Animal Exhibit Safety](#)
- [CDC Live Animal & Bird Markets](#)
- [CDC Poster: Salmonella & Small Animals \(Spanish\)](#)
- [CDC Poster: Stay Healthy When Working with Farm Animals](#)

Pet Food:

- [CDC Salmonella & Pet Food](#)
- [CDC Poster: Tips for Keeping People and Pets Healthy and Safe from Germs in Pet Food \(Spanish\)](#)

Live Poultry:

- [ODH Salmonella & Baby Poultry](#)
- [ODH Zoonotic Disease Program Poultry Information](#)
- [CDC Keeping Backyard Poultry](#)
- [CDC Salmonella Risk from Baby Poultry](#)
- [CDC Article: Keeping Live Poultry](#)
- [CDC Poster: After You Touch Ducklings or Chicks, Wash Your Hands So You Don't Get Sick! \(Spanish, French\)](#)
- [CDC Poster: Don't Play Chicken with Your Health](#)
- [CDC Poster: Have a Backyard Flock? Don't Wing It!](#)

Reptiles & Amphibians:

- [CDC Salmonella & Reptiles/Amphibians](#)
- [CDC Turtles Kept as Pets](#)
- [FDA Small Turtle Ban](#)
- [CDC Article: Turtles & Other Reptiles Are Risky Pets](#)
- [CDC Article: Aquatic Frogs Can Make Your Child Sick](#)

- [FDA Consumer Health Information Article: Pet Turtles – Cute but Commonly Contaminated with *Salmonella*](#)
- [CDC Poster: After You Touch Amphibians or Reptiles, Wash Your Hands So You Don't Get Sick! \(Spanish, French, Chinese\)](#)
- [CDC Poster: After You Feed and Handle Reptiles, Wash Your Hands So You Don't Get Sick! \(Spanish\)](#)
- [PIJAC Poster: Healthy Herp Handling](#)
- [CDC Infographic: The Trouble with Tiny Turtles](#)
- [FDA/CDC Brochure: Pet Turtles – A Source of Germs](#)

Raw Milk:

- [CDC Food Safety & Raw Milk](#)
- [CDC Raw Milk Questions & Answers](#)
- [CDC Infographic: Raw Milk – Know the Raw Facts](#)

Eggs:

- [CDC *Salmonella* & Eggs](#)
- [CDC *Salmonella* in Eggs: An Unwelcome Summer Visitor](#)
- [FDA Egg Safety: What You Need to Know](#)
- [USDHHS Eggs & Egg Products](#)
- [USDHHS Egg Safety & Eating Out](#)
- [USDHHS Egg Storage Chart](#)
- [USDA Shell Eggs From Farm to Table](#)
- [USDA Egg Products & Food Safety](#)

Laboratory Exposure

- [CDC Advice to Students & Employees in Microbiology Laboratories](#)
- [CDC Poster: What You Work With Can Make You Sick](#)

What is salmonellosis?

Salmonellosis is an infection with a bacterium called *Salmonella*. Most persons infected with *Salmonella* develop diarrhea, fever and abdominal cramps 12-72 hours after infection. The illness usually lasts 4-7 days, and most persons recover without treatment. In some persons, the diarrhea may be so severe that the patient needs to be hospitalized. In these patients, the *Salmonella* infection may spread from the intestines to the blood stream and then to other body sites. In these cases, *Salmonella* can cause death unless the person is treated promptly with antibiotics. The elderly, infants and those with impaired immune systems are more likely to have a severe illness.

How common is salmonellosis?

The Centers for Disease Control and Prevention (CDC) estimates that approximately 1.2 million illnesses and approximately 450 deaths occur due to non-typhoidal *Salmonella* annually in the United States. There are many different kinds of *Salmonella* bacteria. *Salmonella* serotype Typhimurium and *Salmonella* serotype Enteritidis are the most common in the United States. Salmonellosis is more common in the summer than in winter.

Who is at highest risk for *Salmonella* infection?

Children are at the highest risk for *Salmonella* infection. Children under the age of 5 years have higher rates of *Salmonella* infection than any other age group. Young children, older adults and people with weakened immune systems are the most likely to have severe infections.

Are there long term consequences to a *Salmonella* infection?

Persons with diarrhea due to a *Salmonella* infection usually recover completely, although it may be several months before their bowel habits are entirely normal. A small number of persons with *Salmonella* develop pain in their joints. This is called Reiter's syndrome or reactive arthritis. Reactive arthritis can last for months or years and can lead to chronic arthritis, which can be difficult to treat. Antibiotic treatment of the initial *Salmonella* infection does not make a difference in whether or not the person develops arthritis. People with reactive arthritis can also develop irritation of the eyes and painful urination.

How can *Salmonella* infections be diagnosed?

Diagnosing salmonellosis requires testing a clinical specimen (such as stool or blood) from an infected person to distinguish it from other illnesses that can cause diarrhea, fever and abdominal cramps. Once *Salmonella* is identified in the specimen, additional testing can be done to further characterize the *Salmonella*.

How can *Salmonella* infections be treated?

Salmonella gastrointestinal infections usually resolve in 5 to 7 days and often do not require treatment other than oral fluids. Persons with severe diarrhea may require rehydration with intravenous fluids. Antibiotic therapy can prolong the duration of excretion of non-typhoidal *Salmonella* and is recommended only 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. Antibiotic resistance is increasing among some *Salmonella* bacteria; therefore, susceptibility testing can help guide appropriate therapy.

How do people get *Salmonella*?

Salmonella live in the intestinal tracts of humans and other animals. *Salmonella* is usually transmitted to humans by eating foods contaminated with animal feces. Contaminated

foods usually look and smell normal. Contaminated foods are often of animal origin, such as beef, poultry, milk, fish or eggs, but any food, including vegetables and fruit or processed foods, may become contaminated.

Foods can also be contaminated in the kitchen. Drippings from raw meat or poultry can contaminate surfaces and other foods in the refrigerator or shopping cart. When raw meat or poultry are prepared with a cutting board and knife without being washed thoroughly between uses, they can contaminate other foods. When preparing raw meat or poultry, food handlers can transfer *Salmonella* on their hands to other foods if they do not wash their hands between food preparation steps. Food handlers who do not wash their hands with soap after using the bathroom can also contaminate food with *Salmonella*.

Salmonella live in the intestinal tracts of humans and other animals, including poultry and other birds, amphibians and reptiles. *Salmonella* may also be found in the feces of some animals, and people can become infected if they do not wash their hands after contact with animals or animal feces. Many animals carry *Salmonella* germs but appear perfectly healthy and clean. Animals' bodies, whether covered with fur, feathers or scales, can be contaminated with germs. Reptiles such as turtles, lizards and snakes are particularly likely to harbor *Salmonella*. Many chicks, ducks and other poultry including those in backyard flocks can carry *Salmonella* in their feces. You cannot look at an animal and tell if it is infected with *Salmonella*. The area where an animal lives, such as its cage or water in its tank or the places where it roams, may be contaminated with *Salmonella*, which can cause illness in people who come into direct contact with the animal area, cage or tank water.

What can be done to prevent this illness?

There is no vaccine to prevent salmonellosis. Since foods of animal origin may be contaminated with *Salmonella*, people should not eat raw or undercooked eggs, poultry or meat. Raw eggs may be unrecognized in some foods such as homemade Hollandaise sauce, Caesar and other salad dressings, tiramisu, homemade ice cream, homemade mayonnaise, cookie dough and frostings. Poultry and meat, including hamburgers, should be well-cooked, not pink in the middle. Persons also should not consume raw or unpasteurized milk or other dairy products. Produce should be thoroughly washed before consuming.

Cross-contamination of foods should be avoided. Uncooked meats should be kept separate from produce, cooked foods and ready-to-eat foods. Hands, cutting boards, counters, knives and other utensils should be washed thoroughly after touching uncooked foods. Hands should be washed before handling any food and between handling different food items.

People who have salmonellosis should not prepare food or pour water for others until their diarrhea has resolved. Many health departments require that restaurant workers with *Salmonella* infection have a stool test showing they are no longer carrying the bacterium before they return to work.

People should wash their hands after contact with animal feces. Because reptiles are particularly likely to have *Salmonella* and it can contaminate their skin, everyone should immediately wash their hands after handling reptiles. Reptiles (including turtles) are not appropriate pets for small children and should not be in the same house as an infant. *Salmonella* carried in the intestines of chicks and ducklings contaminate their environment and the entire surface of the animal. Children can be exposed to the bacteria by simply holding, cuddling or kissing the birds. Children should not handle baby chicks or other young birds. Everyone should immediately wash their hands after touching birds, including baby chicks and ducklings, or their environment.

Some prevention steps occur everyday without you thinking about it. Pasteurization of milk and treatment of municipal water supplies are highly effective prevention measures that have been in place for many years. In the 1970s, small pet turtles were a common source of salmonellosis in the United States, so in 1975, the sale of small turtles was banned in this country. However, small turtles are sometimes still sold, and cases of salmonellosis associated with pet turtles have been reported. Improvements in farm animal hygiene, in slaughter plant practices and in vegetable and fruit harvesting and packing operations may help prevent salmonellosis caused by contaminated foods. Better education of food industry workers in basic food safety and restaurant inspection procedures may prevent cross-contamination and other food handling errors that can lead to outbreaks. Wider use of pasteurized eggs in restaurants, hospitals and nursing homes is an important prevention measure. In the future, irradiation or other treatments may greatly reduce contamination of raw meat.

What can I do to prevent salmonellosis?

- Cook poultry, ground beef and eggs thoroughly before eating. Do not eat or drink foods containing raw eggs or raw (unpasteurized) milk.
- If you are served undercooked meat, poultry or eggs in a restaurant, do not hesitate to send it back to the kitchen for further cooking.
- Wash hands, kitchen work surfaces and utensils with soap and water immediately after they have been in contact with raw meat or poultry.
- Be particularly careful with foods prepared for infants, the elderly and the immunocompromised.
- Wash hands with soap after handling reptiles, birds or baby chicks and after contact with pet feces.
- Avoid direct or even indirect contact between reptiles (turtles, iguanas, other lizards, snakes) and infants or immunocompromised persons.
- Do not work with raw poultry or meat and an infant (e.g., feed, change diaper) at the same time.
- Mother's milk is the safest food for young infants. Breastfeeding prevents salmonellosis and many other health problems.

For more information, please visit these websites:

- CDC *Salmonella* Information: <http://www.cdc.gov/salmonella>
- CDC Healthy People Healthy Pets – *Salmonella* Infection: <https://www.cdc.gov/healthypets/diseases/salmonella.html>
- CDC *Salmonella* and Pet Food: <http://www.cdc.gov/Features/SalmonellaDryPetFood/>
- CDC *Salmonella* and Live Baby Poultry: <http://www.cdc.gov/Features/SalmonellaBabyBirds/>
- CDC *Salmonella* and Reptiles: <http://www.cdc.gov/Features/SalmonellaFrogTurtle/>