



Note: For information about typhoid fever (or *Salmonella* infection caused by *Salmonella* Typhi), refer to the chapter entitled "Typhoid Fever."

The Disease and Its Epidemiology

A. Etiologic Agent

Salmonellosis is caused by any serotype of bacteria in the genus *Salmonella* other than *Salmonella* Typhi (the *Salmonella* serotype that causes typhoid fever). Approximately 2,500 different serotypes of *Salmonella* have been identified.

B. Clinical Description

The most common symptoms of salmonellosis are diarrhea (sometimes bloody), stomach cramps, fever, nausea, and sometimes vomiting. Dehydration may be severe, especially among infants and the elderly, and invasive disease may occur. The infection may also present as septicemia, a urinary tract infection, an abscess, arthritis, or cholecystitis (inflammation of the gallbladder). Asymptomatic infections also occur.

C. Reservoirs

Salmonella bacteria are widely distributed in the animal kingdom, including livestock, pets, poultry and other birds, reptiles and amphibians. Most infected animals are chronic carriers. Humans can also be sources of infection.

D. Modes of Transmission

Salmonella bacteria are transmitted via the fecal-oral route. The most common mode of transmission is ingestion of food or water that has been contaminated with human or animal feces. This includes raw or undercooked poultry, eggs and egg products; undercooked meats; produce; and raw milk or milk products. However, any food contaminated with the bacteria can be a source of infection and recent outbreaks have involved a wide variety of processed foods, such as peanut butter, cereals and snack foods. In addition, pet chicks and reptiles such as iguanas, snakes, and lizards are chronic carriers of these bacteria and are relatively common sources of infection. Person-to-person spread can occur, especially among household contacts, preschool children in childcare, the elderly and developmentally disabled living in residential facilities, and through certain types of sexual contact (e.g., oral-anal contact). The infectious dose is thought to vary depending on the serotype, the vehicle with which *Salmonella* is ingested and host factors such as age or presence of certain medical conditions.

E. Incubation Period

The published incubation period can vary from 6 to 72 hours, but is usually about 12 to 36 hours. Incubation periods longer than 3 days have been documented in numerous outbreaks, including in Colorado. For this reason, CDPHE and CDC recommend using a 7-day exposure period for case investigation purposes.

F. Period of Communicability or Infectious Period

The disease is communicable for as long as the infected person excretes *Salmonella* bacteria in their stool, however, persons are most infectious while they have diarrhea. *Salmonella* carriage lasts from days to

months, depending on the serotype, but rarely lasts more than one year. Treatment with antibiotics may prolong carriage.

G. Epidemiology

Salmonellosis is reported throughout the year in Colorado, however, reported cases peak in the summer months. The three most commonly reported serotypes are *S. Typhimurium*, *S. Enteritidis*, and *S. Newport*.

Colorado *Salmonella* statistics are available at the CDPHE website:
<https://www.colorado.gov/pacific/cdphe/foodborne-illness-data>

Case Definition

Clinical Description

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

Laboratory Criteria for Diagnosis

Confirmed: Isolation of *Salmonella* (i.e., culture) from a clinical specimen (including stool, blood, wound, and urine).

Note: For *Salmonella* Typhi, see chapter on "Typhoid Fever."

Supportive: Detection of *Salmonella* in a clinical specimen using a culture-independent diagnostic test (CIDT), such as PCR.

Case Classification

Confirmed: A case that is laboratory confirmed (using culture). Confirmed cases can include asymptomatic infections.

Probable:

- A case that meets the supportive laboratory criteria for diagnosis (a positive CIDT and negative culture or a positive CIDT where culture was not performed), OR
- A clinically compatible case that is epidemiologically-linked to a case that meets the supportive or confirmatory laboratory criteria.

Reporting Criteria

What to Report to the Colorado Department of Public Health and Environment (CDPHE) or local health agency

- Confirmed and probable salmonellosis cases.
- Salmonellosis cases should be reported within 7 days of diagnosis or a positive laboratory test.
- Cases should be reported using the Colorado Electronic Disease Reporting System (CEDRS), or fax or telephone to CDPHE or local health departments. See below for phone and fax numbers.
- Suspected foodborne/enteric disease outbreaks should be reported to CDPHE or local health departments within 24 hours, even if the causative agent is not yet known.

Purpose of Surveillance and Reporting

- To identify cases for investigation and potential outbreaks
- To monitor trends in disease incidence

Important Telephone and Fax Numbers

CDPHE Communicable Disease Epidemiology Branch

- Phone: 303-692-2700 or 800-866-2759
- Fax: 303-782-0338
- After hours: 303-370-9395

CDPHE Microbiology laboratory: 303-692-3480

Communicable Disease (CD) Manual website: <https://www.colorado.gov/pacific/cdphe/communicable-disease-manual>

State Laboratory Services

Laboratory Testing Services Available

The services listed below are for public health purposes; clinical laboratories are *not* charged for these services.

- CDPHE Laboratory requests all *Salmonella* isolates or clinical material from clinical laboratories be submitted for serotyping and pulsed-field gel electrophoresis (PFGE) testing (i.e., molecular subtyping).
- The CDPHE Microbiology Laboratory will test raw stool or rectal swab specimens for the presence of *Salmonella* and will serotype isolates of *Salmonella*.

Note: Authorization from the CDPHE Communicable Disease Branch is required before submitting stool, rectal swabs, or implicated food items to the CDPHE Laboratory.

- For more information contact the CDPHE Microbiology Laboratory.
- See Disease Control Measures, section E (Environmental Measures), for more information about food testing.

Case Investigation

Interview all salmonellosis cases including symptomatic contacts of laboratory-diagnosed cases and others whose symptoms are suspected to be caused by *Salmonella* to determine:

- Potential source of infection, and to implement control measures as appropriate
- If others are ill (i.e., could this be an outbreak?)
- If the case may be a source of infection for others (e.g., a high-risk worker or a diapered child), and if so, to prevent further transmission

Local public health agencies have primary responsibility for interviews of sporadic cases in their jurisdictions. Smaller agencies should consult with regional epidemiologists to establish primary responsibility for interviews of sporadic cases. CDPHE is available to assist with case investigation.

A. Case Investigation / Forms

For single cases, complete the CDPHE [Salmonellosis Case Investigation Form](#). Interview all cases, regardless of specimen source (stool, blood, wound, urine, etc.). At a minimum, collect information about symptoms, hospitalization, outcome, school/work, contacts and international travel for all cases.

Determining the exposure period can be difficult for cases who do not have an acute onset of gastrointestinal symptoms. It's important to do a complete assessment for GI illness, even when the specimen was blood, a wound or urine to determine if any GI symptoms were present, even if mild.

Use the table below to determine the date for calculating the exposure period:

Guidance for determining exposure period for enteric disease case interviews

If case...	...then use the following date to determine exposure period:
Reports diarrhea or vomiting	Onset date of diarrhea/vomiting
Does NOT report GI illness, but had onset of other symptoms	Onset date of other symptoms
Reports NO onset of any symptom	Specimen collection date

The first exposure question on the CDPHE interview form is about international travel. If a case reports international travel for even one day during the exposure period, it is fine to complete the international travel questions and conclude the interview. No other food or exposure information needs to be collected.

After the interview, complete the CEDRS record for all cases and conduct any necessary disease control activities. If an outbreak is suspected, outbreak-specific interview forms should be used. Please contact CDPHE (303-692-2700) to report the outbreak and/or for assistance.

B. Identify and Evaluate Contacts

Symptomatic Contacts

- Contacts of a confirmed case who have diarrhea are probable cases and are treated the same as confirmed cases for disease control purposes. See Section 6--Disease Control Measures.
- Complete a case investigation form for all epidemiologically-linked individuals having symptoms compatible with salmonellosis.
- Refer symptomatic individuals who have not previously been tested (especially if they are high-risk workers) to their health care providers for stool cultures. If testing will be performed by CDPHE, refer to the Instructions for Enteric and Food Specimen Packaging and Shipping on the [Specimen Collection Guidelines](#) webpage.
- CDPHE recommends that people who are experiencing symptoms submit stool specimens through their health care provider rather than to the state laboratory for several reasons:
 - ▶ The patient will receive appropriate medical care for the illness, including antimicrobial therapy, if appropriate.
 - ▶ Results will be known more quickly if stool is tested by a commercial laboratory than if tested at the state laboratory.
 - ▶ Commercial labs generally perform antimicrobial susceptibility testing, whereas, the state lab does not routinely perform such testing.
- Symptomatic contacts should be entered into CEDRS as probable salmonellosis cases. (It is helpful if you enter the CEDRS ID numbers of the lab-confirmed cases to whom probable cases are epi-linked in the CEDRS case notes.)
- If a common source of infection is suspected, please notify CDPHE.

Asymptomatic Contacts

- Ask about sensitive occupations, food handling, childcare, and/or school.
- Provide information about symptoms and preventive measures. See Disease Control Measures, section C (Education).
- Counsel asymptomatic high-risk workers (e.g., food handlers). Stress importance of good handwashing, personal hygiene, and removing themselves from working and notifying their supervisor whenever they have a diarrheal illness.
- If an asymptomatic contact who is a high-risk worker develops diarrhea, exclude her/him from work, obtain a stool sample and notify the worker's supervisor.
- Consult with Environmental Health staff and recommend a glove order if necessary.

C. Reported Incidence Is Higher than Usual/Outbreak Suspected

If the number of reported cases of *Salmonella* in your jurisdiction is higher than usual, or if an outbreak is suspected, investigate to determine the source of infection and mode of transmission. Consult with a CDPHE Communicable Disease Epidemiologist. CDPHE staff can assist local public health agencies to investigate outbreaks and determine a course of action to prevent further cases, and can coordinate surveillance of cases that cross county lines.

Disease Control Measures

A [Salmonellosis Fact Sheet](#) is available on the CDC website.

A. Treatment

Antibiotics are not usually indicated for uncomplicated salmonellosis cases. Antibiotics do not shorten the duration of disease and may prolong shedding of the bacteria in the stool. However, antibiotics are recommended for cases with gastroenteritis *and* an increased risk of invasive disease, such as:

- Infants <3 months of age
- Chronic gastrointestinal tract disease
- Malignant neoplasms
- HIV infection
- Immunosuppressive illnesses and therapies
- Severe colitis

B. Prophylaxis

No prophylactic treatment of close contacts is recommended.

C. Education

- Educate case and household contacts on proper hand washing techniques.
- Always wash hands thoroughly with soap and water before eating or preparing food, after using the toilet, after changing diapers, and after touching pets or other animals (especially reptiles).
- After changing diapers, wash your hands AND the child's hands.
- In a childcare setting, dispose of stool and soiled diapers in a sanitary manner.
- Cases should not prepare food for other individuals until symptoms resolve.
- Keep food that will be eaten raw, such as vegetables, from becoming contaminated by animal-derived food products.
- Thoroughly cook all food products from animals, especially poultry and eggs, and avoid consuming raw or cracked eggs, unpasteurized milk, or other unpasteurized products.
- Infants, children, elderly, and immunocompromised individuals should avoid contact with reptiles and reptiles' cages.
- Avoid sexual practices that may permit fecal-oral transmission. Latex barrier protection should be emphasized as a way to prevent the spread of salmonellosis to sexual partners as well as being a way to prevent the exposure to and transmission of other pathogens.

D. Managing Special Situations

Food Handlers

- Food handlers must be excluded from work until at least 24 hours after diarrhea has resolved and adequate hygiene can be maintained, ideally as verified by environmental health. "Exclude" means to prevent a person from working as an employee in a food establishment or entering a food establishment as an employee.
- While individual circumstances may vary, cases are generally not required to provide two consecutive negative stools to return to work.

- If a case has questionable hygienic practices or there are other concerns, a food handler should be excluded from work until two consecutive negative stool tests have been obtained at least 24 hours apart.
- In an outbreak situation, negative tests may be required to return to food handling.
- If the case being re-tested has received antibiotics, stool should be collected at least 48 hours after antibiotics are completed

Childcare / Preschool

Refer childcare providers to the CDPHE [Infectious Disease in Child Care and School Settings](#) for an overview of *Salmonella* infections.

- Children and staff members with *Salmonella* infection who have diarrhea should be excluded until at least 24 hours after their diarrhea has resolved. Parents of cases should be counseled not to take their children to another childcare center during this period of exclusion.
- Children returning to childcare are not required to provide follow up stool tests.
- Reinforce the importance of meticulous handwashing with childcare center staff after diaper changing and toileting children. If possible, this should be verified by environmental health.
- Since many childcare center staff assist with food preparation and /or feeding children, it is very important that those with *Salmonella* infection be excluded until at least 24 hours after diarrhea has resolved. See Section D1 (Food Handlers) above.
- If there are concerns about hygienic practices at the child care center, consider obtaining two consecutive negative stool tests obtained at least 24 hours apart before a case returns to class.
- If the case being re-tested has received antibiotics, stool should be collected at least 48 hours after antibiotics are completed.
- When a case of salmonellosis is identified in a child attending childcare, determine whether additional children have or have recently had diarrhea. Other children with diarrhea should be excluded, should be seen by their physician, and should submit stool for *Salmonella* testing. If other cases in the center are identified, consider sending a letter home to parents.
- If the case is the only child in the classroom or center who has been ill, no further action is indicated for other children in that classroom or center.

School

Refer school personnel to the CDPHE [Infectious Disease in Child Care and School Settings](#) for an overview of *Salmonella* infections.

- Students or staff with *Salmonella* infection who have diarrhea should be excluded until at least 24 hours after their diarrhea has resolved.
- In general, students or staff with *Salmonella* who do not have diarrhea and are not otherwise sick may remain in school.
- If there are concerns about the case's hygiene (e.g., the case has developmental disabilities and wears diapers) consider obtaining two consecutive negative stool tests at least 24 hours apart before a case returns to class.
- If the case being re-tested has received antibiotics, stool should be collected at least 48 hours after antibiotics are completed.
- Students or staff who handle food and have a *Salmonella* infection must not prepare food until at least 24 hours after their diarrhea has resolved. See Disease Control Measures, section D (Food Handlers) above.

Community Residential Programs (facilities serving the developmentally disabled)

Actions taken in response to a case of salmonellosis in a community residential program will depend on the type of program and the level of functioning of the residents. In general:

- Residents with salmonellosis should be placed on contact precautions until at least 24 hours after their symptoms subside.
- If the resident has questionable hygiene, is incontinent, or there are other concerns, the resident should remain on contact precautions until two negative stool tests have been obtained at least 24 hours apart.

- If the case being re-tested has received antibiotics, stool should be collected at least 48 hours after antibiotics are completed.
- Residents with salmonellosis must be excluded from handling or preparing food for other residents until their diarrhea has resolved.
- For staff members who provide direct patient care (e.g., feed patients, give mouth or denture care, or give medications) follow guidelines for staff in health care facilities below.
- Staff members with *Salmonella* infection should be excluded from work until at least 24 hours after their diarrhea has resolved.

Patients and Staff in Health Care Facilities (Hospitals and Long Term Care Facilities)

Hospitals and long term care facilities generally have written infection control policies and procedures for handling cases of communicable disease among patients and staff members. If a facility does not have such policies in place, provide the following recommendations:

- Patients with salmonellosis should be placed on contact precautions until at least 24 hours after their symptoms subside.
- If the patient has questionable hygiene, is incontinent, or there are other concerns, the patient should remain on contact precautions until two consecutive negative stool tests are obtained at least 24 hours apart.
- If case being re-tested has received antibiotics, stool should be collected at least 48 hours after antibiotics are completed.
- Healthcare workers should be excluded from work until diarrhea has resolved.
- While individual circumstances may vary, in general, healthcare workers are not required to provide two negative stools to return to work.
- In an outbreak situation, negative cultures may be required to return to work.

E. Environmental Measures

- Implicated food items must be removed from the environment.
- A decision about testing suspect/implicated food items must be made in consultation with CDPHE Communicable Disease Branch.
- If a commercial product is suspected, CDPHE Communicable Disease Branch will coordinate follow-up with the CDPHE Division of Environmental Health and Sustainability and relevant outside agencies.
- The Instructions for Enteric and Food Specimen Packaging and Shipping are available on the [Specimen Collection Guidelines](#) webpage.
- The general policy of the CDPHE Laboratory and the Communicable Disease Branch is only to test food samples associated with outbreaks, not in single cases.
- For single cases, CDPHE may suggest that the holders of food locate a private laboratory that will test food, or that they store the food in their freezer for a period of time in case additional reports are received.
- The CDPHE laboratory can test food samples associated with isolated cases of illness on a fee for service basis. For more information, contact the CDPHE Microbiology Laboratory.

References

American Academy of Pediatrics. *2015 Red Book: Report of the Committee on Infectious Diseases, 30th Edition*. Illinois, Academy of Pediatrics, 2015.

Case Definitions for Infectious Conditions Under Public Health Surveillance. <http://wwwn.cdc.gov/nndss/case-definitions.html>

CDC Website: <http://www.cdc.gov> (click on "Diseases and Conditions")

Heymann DL, ed. *Control of Communicable Diseases Manual, 20th Edition*. Washington, DC, American Public Health Association, 2015.