# Salmonellosis

Salmonellosis *is a Class B Disease and must be reported to the state within one business day.*

Salmonellosis is an infection caused by Gram-negative bacteria in the genus *Salmonella.* As of 2004, more than 2500 serovars of *Salmonella* have been described; some of these are pathogenic for both animals and humans. The primary habitats of *Salmonella* are the intestinal tracts of mammals (cattle, swine, rodents, dogs and cats), birds (poultry), reptiles (lizards, iguanas and turtles), amphibians (frogs and toads), and insects. The majority of *Salmonella* organisms have a wide range of possible hosts.

## Epidemiology

The main mode of transmission of *Salmonell*a is ingestion of bacteria from contaminated food or water. Direct contact with animals and human carriers has also been implicated. The most frequent sources of *Salmonella* infection are contaminated poultry, eggs, meat, dairy products, fruits and vegetables. Up to 90% of *Salmonella* infections in the U.S. are food-borne in origin. Typical food-borne transmission is the result of two events: first, contamination of the food product; second, improper handling of the food that fosters sufficient bacterial growth to reach an infectious dose.

Direct contact with infected animals is a route of transmission in some cases. In recent years, there have been several multi-state outbreaks linked to pet turtles and backyard flocks of chickens and ducks. Pet bearded dragons, lizards, snakes, salamanders, and other reptiles, as well as aquarium fish, have also been responsible for several cases. Pet birds may also be a source.

Neonates are at a greater risk for fecal-oral transmission secondary to achlorhydria (absence of gastric acid) or lower levels of gastric acid secondary to consumption of large quantities of milk or formula with characteristically strong buffering properties. A mother who has not properly washed her hands may deliver a low dose of *Salmonell*a to the baby; this low dose could survive stomach passage and cause infection.

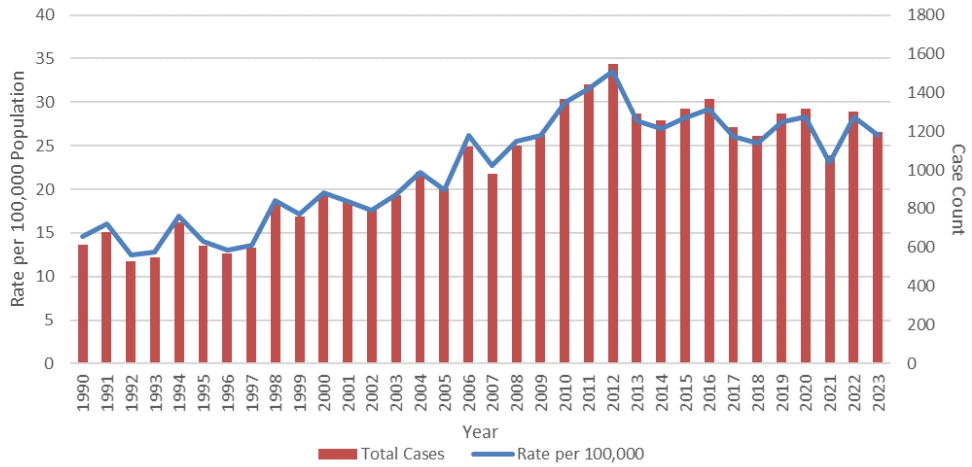
Food handlers who are infected with *Salmonella* may contaminate foods they prepare when they do not wash hands after using the restroom. Some food-borne outbreaks have involved food handlers who were infected with *Salmonella* and who prepared the food while ill with the bacteria; however, most were probably infected from contact with the food rather than being the source of the bacteria that precipitated the outbreak. In fact, routine surveillance has recorded very few cases among food handlers.

## Incidence

In the U.S., an estimated 1.2 million people are infected with non-typhoid *Salmonella* annually. According to FoodNet data, *Salmonella* incidence rates reported in the United States among all age groups combined were 16.6 cases per 100,000 population in 2023. *Salmonella* cases in Louisiana have steadily increased since the 1990's. Increased cases are likely due to reporting practices and testing availability rather than a true increase of prevalence. However, in 2023 the

incidence rate of *Salmonella* was 26.15 cases per 100,000 population (Figure 1), which is higher than the national average recorded by FoodNet in 2023.

**Figure 1:** *Salmonella* Cases and Incidence Rates - Louisiana, 1990-2023




## Age Distribution

*Salmonella* isolate submission is most common for cases in infants, newborn to one-year of age, and in children, one to five-years old. The high rate of identification in these young age groups may result from prompt seeking of medical care when symptoms become evident among infants and young children, and more frequent submission of stool cultures from children during investigations of diarrheal illnesses (Figure 2). These practices result in over-sampling of children. Most *Salmonella* infections in children occur outside of child-care environments, with only 1.1% of cases among infants and children being associated with a day care. There are no gender differences in disease occurrence (Figure 3).

**Figure 2:** *Salmonella* Incidence Rates by Age - Louisiana, 1990-2023

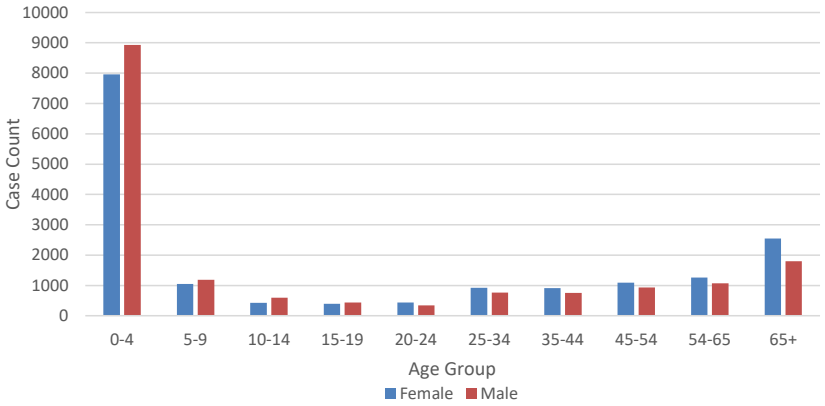
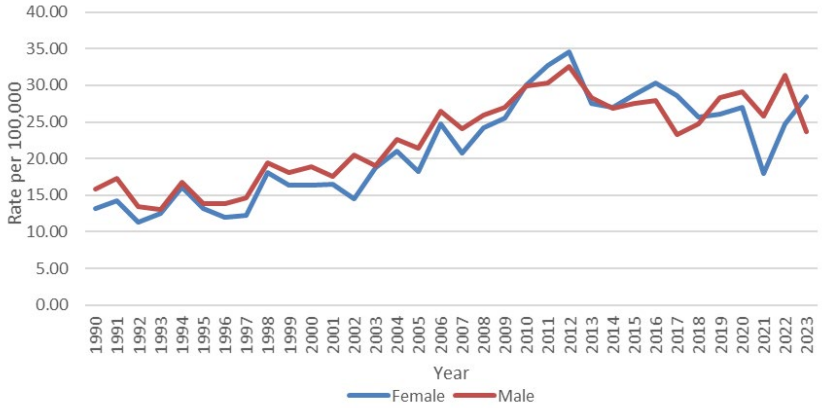


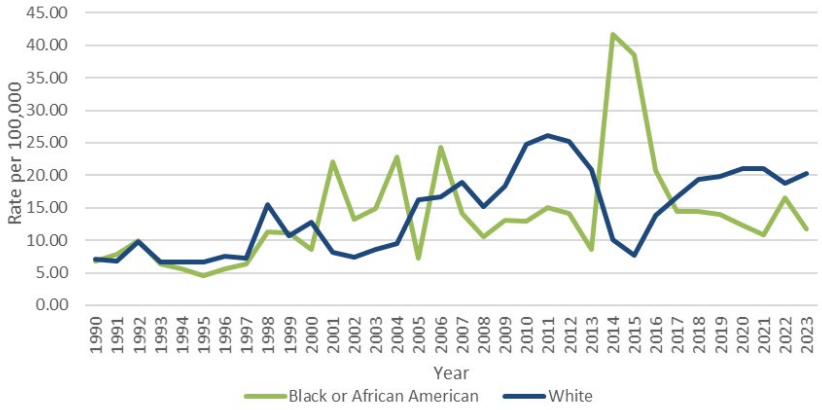

**Figure 3:** *Salmonella* Average Incidence Rates by Gender - Louisiana, 1990-2023




## Race Distribution

When comparing incidence rates by race distribution, no racial pattern is identified (Figure 4). However, race is not consistently reported in all case records, which may affect the accuracy of these comparisons.

**Figure 4:** *Salmonella* average incidence rates by age and race – Louisiana, 1990-2023




## Geographical Distribution

The geographic distribution of *Salmonella* reflects reporting practices rather than true differences in incidence. For example, some parishes are served by medical facilities that are more likely to culture and report *Salmonella*, resulting in consistently higher rates (Table 1). In addition, parishes with smaller populations and strong reporting practices can show disproportionately high incidence rates. For example, Lafourche Parish reported only 21 cases in 2023, yet it has the highest 10-year incidence rate at 186.27 cases per 100,000 population.

**Table 1:** *Salmonella* average incidence rates by parish - Louisiana, 2014-2023

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| Parish | Incidence Rate 2014-2023 | Parish | Incidence Rate 2014-2023 |
|---|---|---|---|
| Acadia | 49.08 | Madison | 8.42 |
| Allen | 25.03 | Morehouse | 33.50 |
| Ascension | 28.96 | Natchitoches | 15.77 |
| Assumption | 25.24 | Orleans | 13.44 |
| Avoyelles | 27.96 | Ouachita | 36.09 |
| Beauregard | 28.26 | Plaquemines | 19.85 |
| Bienville | 25.69 | Pointe Coupee | 28.55 |
| Bossier | 20.48 | Rapides | 26.86 |
| Caddo | 21.26 | Red River | 19.62 |
| Calcasieu | 35.86 | Richland | 34.18 |
| Caldwell | 149.89 | Sabine | 23.25 |
| Cameron | 14.58 | Saint Bernard | 13.92 |
| Catahoula | 55.53 | Saint Charles | 26.58 |
| Claiborne | 6.58 | Saint Helena | 12.33 |
| Concordia | 22.89 | Saint James | 25.65 |
| De Soto | 20.65 | Saint Landry | 29.49 |
| East Baton Rouge | 21.31 | Saint Martin | 31.28 |
| East Carroll | 26.60 | Saint Mary | 24.77 |
| East Feliciana | 33.03 | Saint Tammany | 33.03 |
| Evangeline | 32.42 | St John the Baptist | 20.76 |
| Franklin | 46.58 | Tangipahoa | 25.25 |
| Grant | 35.53 | Tensas | 34.52 |
| Iberia | 24.72 | Terrebonne | 33.62 |
| Iberville | 21.49 | Union | 33.04 |
| Jackson | 33.58 | Vermilion | 41.54 |
| Jefferson | 20.44 | Vernon | 20.15 |
| Jefferson Davis | 36.30 | Washington | 43.79 |
| La Salle | 2.96 | Webster | 23.39 |
| Lafayette | 107.24 | West Baton Rouge | 27.72 |
| Lafourche | 186.27 | West Carroll | 36.23 |
| Lincoln | 27.31 | West Feliciana | 26.61 |
| Livingston | 24.07 | Winn | 20.71 |

While the overall number of cases and rates by parish have increased, this is likely just an increase in detection of disease and reporting statewide. The geographic distribution of cases has remained relatively consistent over time (Figure 8).

**Figure 8:** *Salmonella* Average Incidence Rate (Cases per 100,000 Population) Louisiana, 2014 -2023

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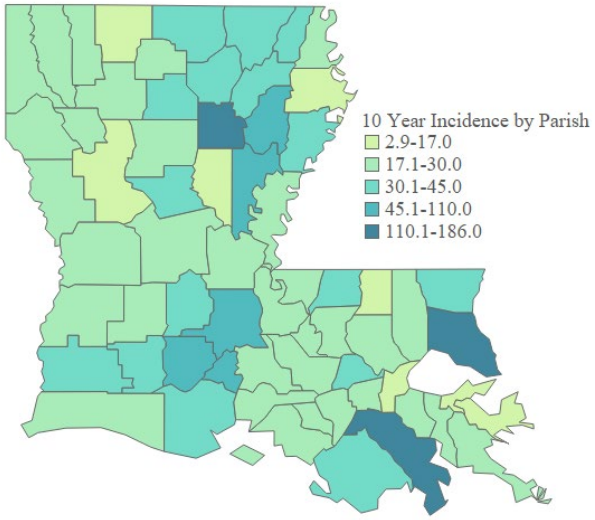
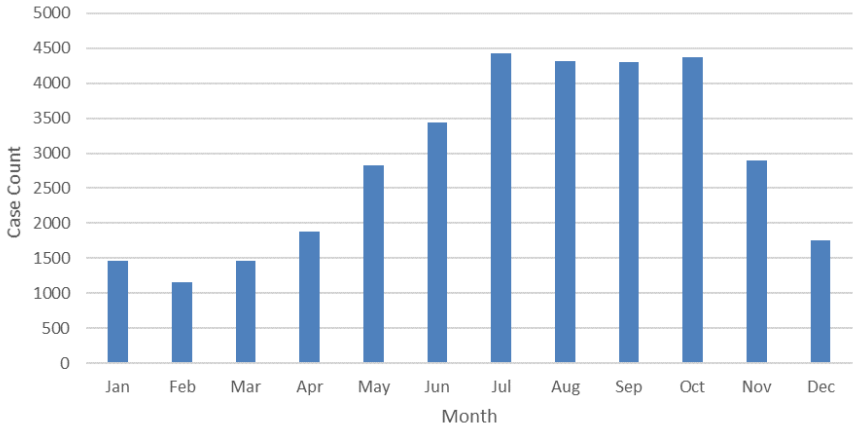



**Seasonal Pattern**

There is a clear seasonal pattern in the occurrence of *Salmonella* infection with a peak from summer through fall (Figure 9). Better growth of *Salmonella* at higher temperatures leads to higher concentrations of *Salmonella* in the food supply in the warmer months. Inadequate cooking practices are also more common during these months (picnics, barbecues). This seasonal distribution is observed throughout all age groups.

**Figure 9:** *Salmonella* Average Rates by Month - Louisiana, 1990-2023




## Serotypes

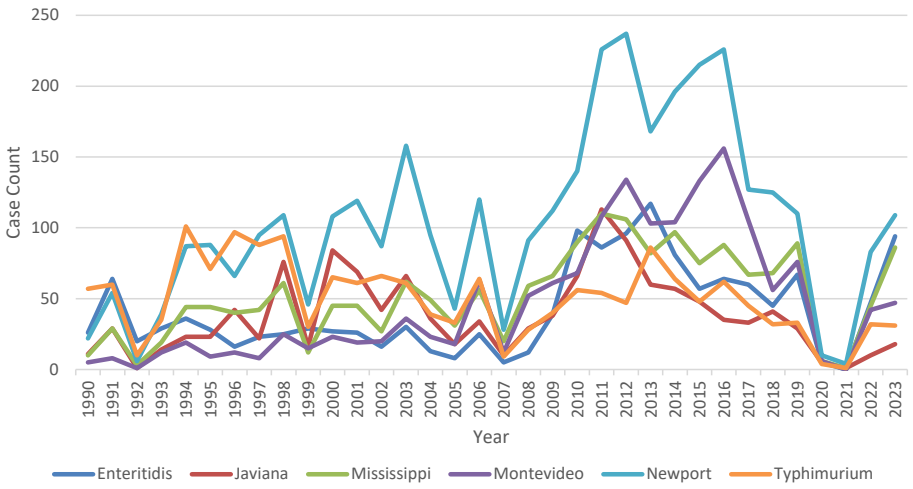
The CDC adopted the Kaufmann-White Scheme for designation of *Salmonella* serotypes on January 1, 2003. The genus *Salmonella* (family – Enterobacteriaceae) is divided into two species, *Salmonella enterica* and *Salmonella bongori*. *Salmonella enterica* is further subdivided into six subspecies that are designated by names or Roman numerals. Under the Kauffmann-White Scheme, subspecies I serotypes are named; subspecies II through VI serotypes are identified by formula. *Salmonella enterica* subspecies I includes the majority of serotypes that can infect humans. Within *S. enterica* there are over 2,500 serotypes based on analysis of the somatic antigen (O) and flagellar antigen (H). Each serotype is given a name, for example, *S. enterica* serotype Typhimurium, is often abbreviated as *S. typhimurium*. Of the more than 2,500 serotypes, some 200 can infect humans. The most common serotypes cultured in Louisiana for the period 1990 to 2023 are presented in Table 2.

**Table 2:** *Salmonella* Common Serotypes - Louisiana, 1990– 2023

| Serotype | Total |
|---|---|
| Newport | 3549 |
| Mississippi | 1774 |
| Typhimurium | 1704 |
| Montevideo | 1579 |
| Enteritidis | 1414 |
| Javiana | 1290 |
| Muenchen | 753 |
| Give | 481 |
| Heidelberg | 418 |
| Braenderup | 417 |
| Infantis | 383 |
| Bareilly | 373 |
| Rubislaw | 369 |
| Gaminara | 357 |
| Oranienburg | 296 |
| Thompson | 258 |
| Anatum | 223 |
| Hvittingfoss | 170 |
| Saintpaul | 164 |
| Lichtfield | 132 |
| Agona | 120 |
| Hadar | 105 |

*Salmonella* Newport, *S.* Enteritidis*, S.* Javiana, *S.* Mississippi, and *S.* Montevideo are increasing in numbers. During the COVID-19 outbreak, there has been a decrease in reporting of non-COVID diseases due to individuals being less likely to seek care for non-COVID illnesses, providers testing for fewer diseases, and many individuals not congregating or being exposed to other illnesses in general (Figure 10).

**Figure 10:** *Salmonella* trends – Serotype Isolates in Reported Cases - Louisiana, 1990-2023




With the exception of *Salmonella* Typhimurium, all serotypes show the same seasonal distribution (higher numbers in the summer and autumn). *S.* Typhimurium, however, remains more constant throughout the year.

There have been clusters among rare serotypes: *Salmonella* Adelaide from 1999 to 2002, *S.* Brandeburg in 1994, and more recently *S.* Hvittingfoss from 2011 to 2015, *S.* Inverness and *S.* Uganda from 2012 to 2014, *S.* Johannesburg, *S.* Urbana, *S.* Poona from 2011 to 2012.

**Serotype Uganda Outbreak Investigation**

*Salmonella enterica* serotype Uganda is a rare serotype locally and nationally. Nationwide, the only previously published *Salmonella* Uganda outbreak was in 2001, involving cases associated with consuming pork products. In Louisiana, no cases of *Salmonella* Uganda were reported in the state from 2007 through 2011.

Between the end of October and the beginning of December 2012, six cases of *Salmonella* Uganda were confirmed by the Louisiana Department of Health (LDH) Public Health Laboratory and were found to have matching Pulse Field Gel Electrophoresis (PFGE) patterns. A seventh case was reported at the end of February 2013. The average age of the cases was 73 years with a range of 58 to 87 years; the majority of the cases were male (57%). Illness onset dates ranged from mid-October to mid-January. Seventy-one percent of the cases were hospitalized with no deaths reported. The cases resided in LDH Regions* 2 (14%), 4 (43%), 5 (29%), and 7 (14%). During the initial investigation, no cases were reported in other states.

All cases were interviewed to assess for exposures using a standardized questionnaire which asked about all food exposures prior to illness onset. No food item was reported being eaten by more than one case. Based on the demographics, location of the cases, and the past outbreak involving pork products, a hypothesis was generated that suggested the source of the *Salmonella* was a regional meat-based food item. All cases were re-interviewed using a questionnaire that focused on meat-based food items popular in Louisiana; all seven cases reported consuming hog head cheese in the seven days prior to illness onset. Five of the seven cases reported consuming Brand A hog head cheese. No other food items were reported being eaten by more than one case.

Four intact packages of Brand A hog head cheese were purchased from a grocery store and were tested for *Salmonella* at the state laboratory. *Salmonella* was not detected in these four packages.

Brand A hog head cheese is produced in an out-of-state facility that is inspected by the United States Department of Agriculture (USDA). USDA was notified of the illnesses possibly associated with consumption of Brand A hog head cheese; as a result, the facility was inspected and their procedures were reviewed. Product testing at an independent laboratory found *Salmonella* in four of nine packages of Brand A hog head cheese. These findings resulted in the recall of 4,700 pounds of hog head cheese.

**2017 Caldwell Parish Outbreak**

In October of 2017, the Louisiana Office of Public Health investigated a Salmonella outbreak in Caldwell Parish in Region 8 resulting in 118 cases of salmonellosis. Caldwell is one of the lowest populated parishes in the state, with an estimated 10,600 residents in 2017. The high number of cases related to this outbreak combined with the low population, partially explain the high rate of cases in Caldwell Parish presented in figure 8.