# National Enteric Disease Surveillance: *Salmonella* Annual Report, 2010

An overview of surveillance methods and systems for *Salmonella* infections is available at http://www.cdc.gov/nationalsurveillance/PDFs/NationalSalmSurveillOverview_508.pdf (1).

## Human Surveillance Data: Laboratory-based Enteric Disease Surveillance (LEDS)

The Laboratory-based Enteric Disease Surveillance (LEDS) system collects reports of isolates from laboratory-confirmed human *Salmonella* infections from state public health laboratories.  Reporting to LEDS is voluntary, and the number of states submitting reports varies somewhat from year to year although almost all states report every year. Serotypes are summarized in this annual report as reported by state laboratories; they are usually not confirmed by CDC.  Occasionally, more than one isolate is reported from a single episode of infection in a person; this report includes only one isolate of a given *Salmonella* serotype per person within a 30-day period.

In this report, we summarize the number of infections reported and also report incidence rates (cases per 100,000 population), which are calculated as the number of *Salmonella* infections in humans reported for a given year divided by the state population for that year.

Data were received from all 51 reporting jurisdictions (50 states plus the District of Columbia) in 2010.  For maps (Figures 2a to 2h), data was excluded from states where

- the number of laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of the number of salmonellosis cases reported to the National Notifiable Diseases Surveillance System (NNDSS)

  » 8 reporting jurisdictions were excluded: Florida, Illinois, Kansas, Louisiana, Nevada, South Carolina, Tennessee, Vermont

- the number of fully serotyped laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of *Salmonella* isolates reported to LEDS:

  » 7 reporting jurisdictions were excluded: Kentucky, Maine, Montana, Nebraska, Texas, Utah, Wyoming

*Data in this report current as of 1/14/2013.*
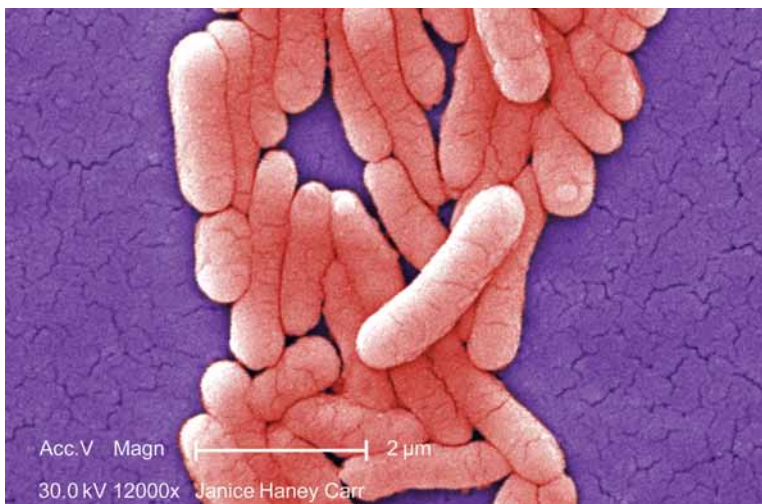


Colorized scanning electron micrograph (SEM) of clustered Gram-negative *Salmonella typhimurium* bacteria.

**National Center for Emerging and Zoonotic Infectious Diseases**
Division of Foodborne Waterborne, and Environmental Diseases

**Table 1.** Laboratory-confirmed human *Salmonella* infections reported to CDC, with the 20 most frequently reported serotypes listed individually, United States, 2010

| Rank | Serotype | Number Reported | Percent |
|:---:|---|:---:|:---:|
| 1 | Enteritidis | 8915 | 19.2 |
| 2 | Typhimurium (including Typhimurium var. 5-) | 6129 | 13.2 |
| 3 | Newport | 5067 | 10.9 |
| 4 | Javiana | 3020 | 6.5 |
| 5 | I 4,[5],12:i:- | 1192 | 2.6 |
| 6 | Heidelberg | 1099 | 2.4 |
| 7 | Montevideo | 1067 | 2.3 |
| 8 | Saintpaul | 890 | 1.9 |
| 9 | Muenchen | 833 | 1.8 |
| 10 | Infantis | 813 | 1.8 |
| 11 | Branderup | 731 | 1.6 |
| 12 | Oranienburg | 662 | 1.4 |
| 13 | Agona | 509 | 1.1 |
| 14 | Thompson | 482 | 1.0 |
| 15 | Typhi | 479 | 1.0 |
| 16 | Mississippi | 475 | 1.0 |
| 17 | Paratyphi B var. L(+) tartrate+ | 451 | 1.0 |
| 18 | Schwarzengrund | 395 | 0.9 |
| 19 | Bareilly | 339 | 0.7 |
| 20 | Poona | 271 | 0.6 |
| | **Sub Total** | **33819** | **73.0** |
| | All Other Serotyped | 6854 | 14.8 |
| | Unknown | 4095 | 8.8 |
| | Partially serotyped | 1338 | 2.9 |
| | Rough, mucoid, and/or nonmotile isolates | 233 | 0.5 |
| | **Sub Total** | **12520** | **27.0** |
| | **Total** | **46339** | **100** |

All serotyped isolates are listed in Table 3

State public health laboratories reported 46,339 laboratory-confirmed *Salmonella* infections to CDC through LEDS

- The top 4 serotypes were Enteritidis (19%), Typhimurium (including Typhimurium var. 5- ) (13%), Newport (11%), and Javiana (7%).

**Table 2.** Laboratory-confirmed human *Salmonella* infections reported to CDC, percent change among the 20 most frequently reported serotypes, comparing 2000, 2005, and 2010

| Rank | | | | Number Reported | | | Percent Change | | |
|---|---|---|---|---|---|---|---|---|---|
| 2000 | 2005 | 2010 | Serotype | 2000 | 2005 | 2010 | 2000 vs 2005 | 2005 vs 2010 | 2000 vs 2010 |
| 2 | 2 | 1 | Enteritidis | 6487 | 6732 | 8915 | 4 | 32 | 37 |
| 1 | 1 | 2 | Typhimurium* | 7428 | 6987 | 6129 | -6 | -12 | -17 |
| 3 | 3 | 3 | Newport | 3074 | 3300 | 5067 | 7 | 54 | 65 |
| 5 | 5 | 4 | Javiana | 1204 | 1324 | 3020 | 10 | 128 | 151 |
| 21 | 6 | 5 | I 4,[5],12:i:- | 233 | 884 | 1192 | 279 | 35 | 412 |
| 4 | 4 | 6 | Heidelberg | 1772 | 1905 | 1099 | 8 | -42 | -38 |
| 6 | 7 | 7 | Montevideo | 841 | 809 | 1067 | -4 | 32 | 27 |
| 11 | 9 | 8 | Saintpaul | 548 | 685 | 890 | 25 | 30 | 62 |
| 7 | 8 | 9 | Muenchen | 642 | 733 | 833 | 14 | 14 | 30 |
| 8 | 13 | 10 | Infantis | 613 | 506 | 813 | -17 | 61 | 33 |
| 12 | 10 | 11 | Braenderup | 531 | 603 | 731 | 14 | 21 | 38 |
| 10 | 11 | 12 | Oranienburg | 563 | 590 | 662 | 5 | 12 | 18 |
| 14 | 16 | 13 | Agona | 406 | 369 | 509 | -9 | 38 | 25 |
| 9 | 15 | 14 | Thompson | 609 | 428 | 482 | -30 | 13 | -21 |
| 15 | 17 | 15 | Typhi | 399 | 350 | 479 | -12 | 37 | 20 |
| 19 | 12 | 16 | Mississippi | 286 | 566 | 475 | 98 | -16 | 66 |
| 13 | 14 | 17 | Paratyphi B var. L(+) tartrate+ | 468 | 460 | 451 | -2 | -2 | -4 |
| 33 | 29 | 18 | Schwarzengrund | 113 | 139 | 395 | 23 | 184 | 250 |
| 23 | 22 | 19 | Bareilly | 182 | 201 | 339 | 10 | 69 | 86 |
| 17 | 24 | 20 | Poona | 337 | 196 | 271 | -42 | 38 | -20 |

Note: * Typhimurium includes var. 5- (formerly var. Copenhagen)

Although reports of serotype I 4,[5],12:i:- increased 412% in 2010 from 2000, this reflects, for the most part, a change in reporting practice (1).

In 2010, serotype Schwarzengrund had the largest increase (250%) compared with 2000 of any of the top 20 serotypes for which surveillance has been stable; most of this increase occurred after 2005.

**Figure 1.** Incidence rate of laboratory-confirmed human *Salmonella* infection reported to CDC (all serotypes and serotypes with more than 1000 infections reported to CDC in 2010), United States, 1970–2010
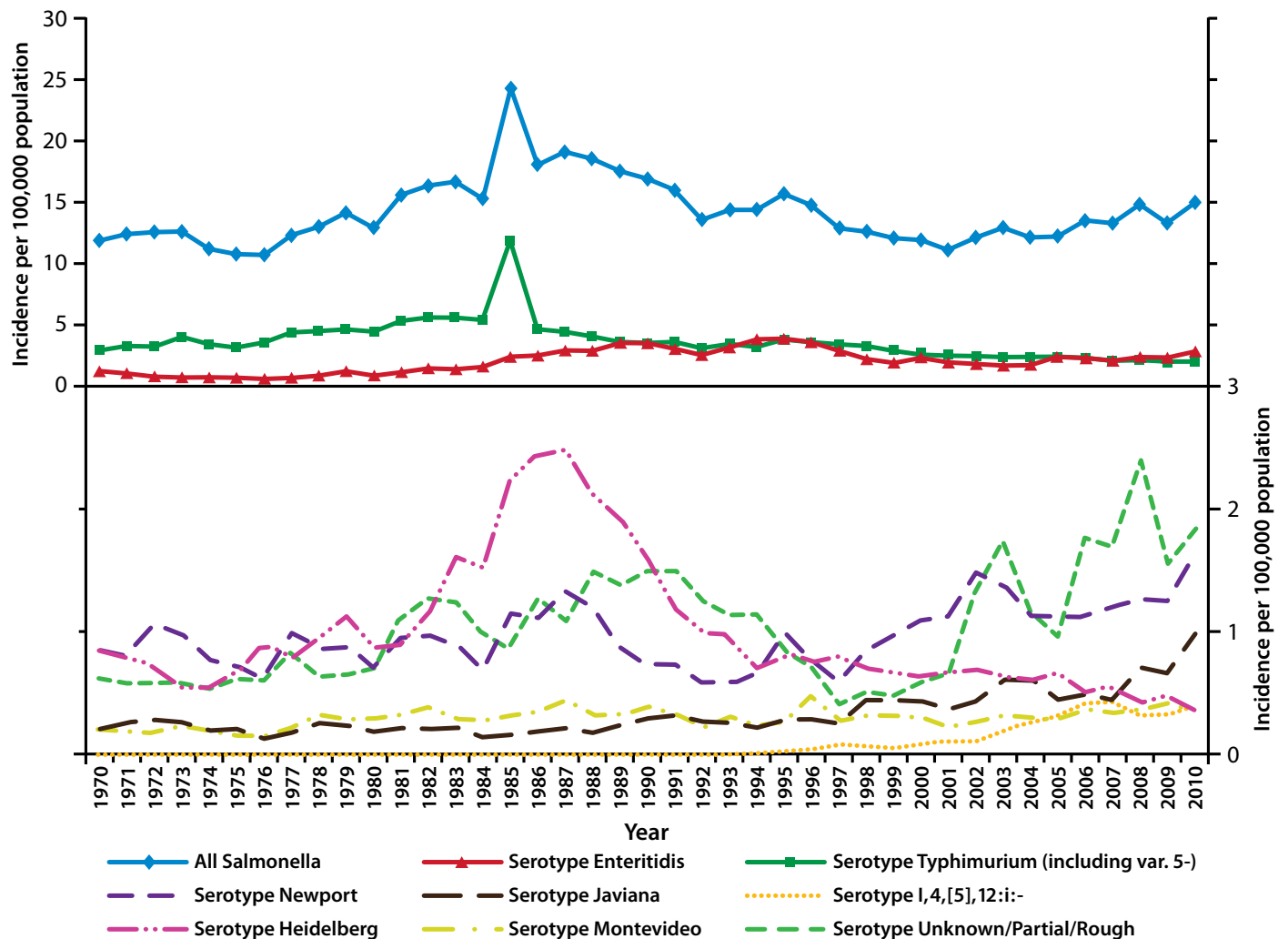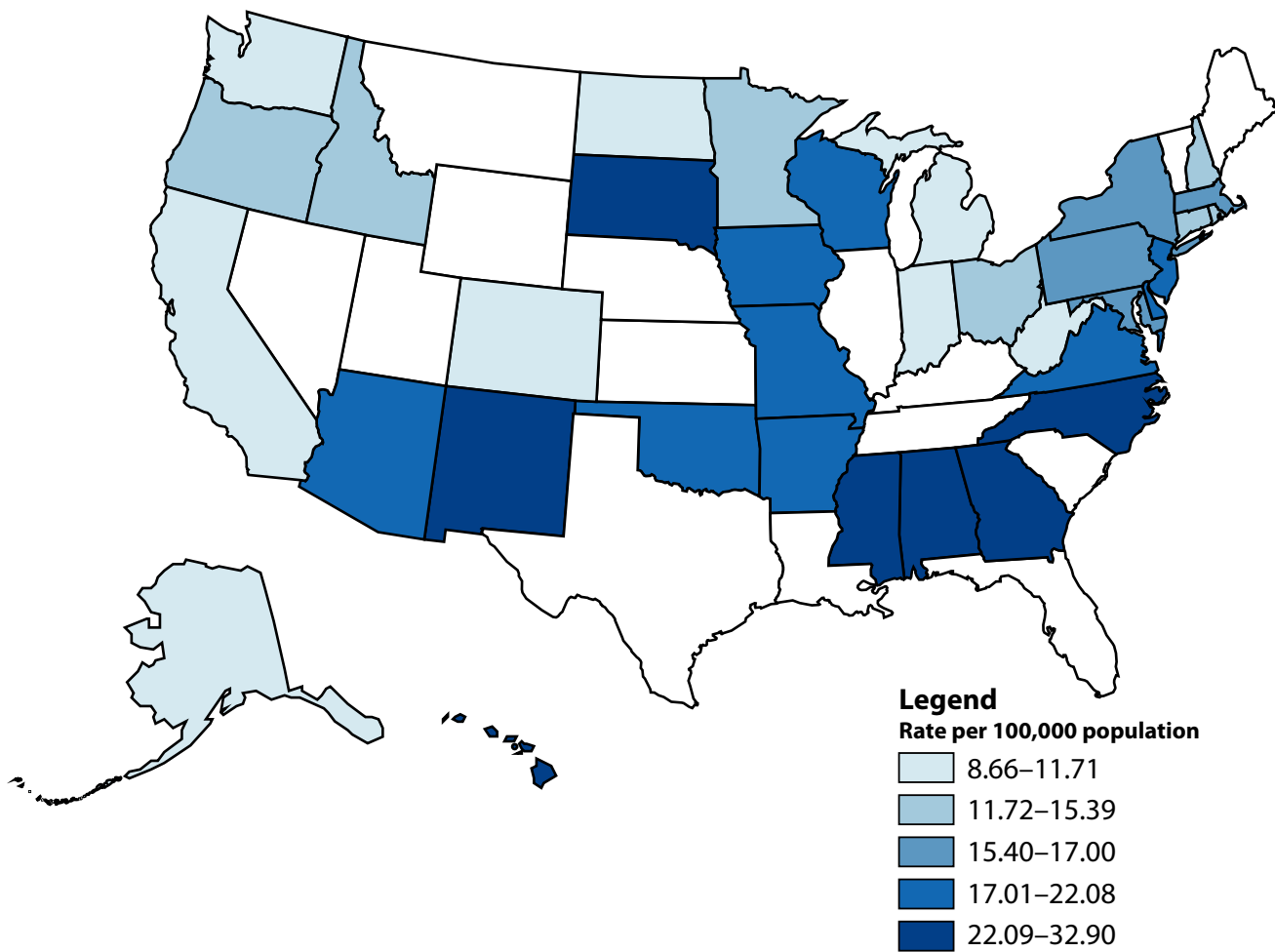


The top panel of this graph shows the incidence rate of infection with *Salmonella* (all serotypes) and with serotypes Typhimurium (including serotype Typhimurium var. 5-) and Enteritidis from 1970 to 2010

- Since 1970, the incidence rate of infection with all *Salmonella* has been driven largely by the incidence rate of infection with serotypes Typhimurium (including serotype Typhimurium var. 5-) and Enteritidis

- The spike in incidence rate seen in 1985 reflects an outbreak of *Salmonella* serotype Typhimurium infections associated with pasteurized milk (2)

The bottom panel of this graph shows the incidence rate of infection with all serotypes of *Salmonella* with more than 1000 infections reported to CDC in 2010: this includes serotypes Newport, Javiana, I, 4,[5],12:i:-, Heidelberg, Montevideo, and infections with an unknown, rough, or partial serotype

- The incidence rate of infection with serotype Heidelberg has been decreasing steadily following a peak in 1987

- Since the late 1990s, the incidence rates of infection with serotypes Javiana, Newport, and I,4,[5],12:i:- have been steadily increasing

- Since 2000, the incidence of infection with isolates with an unknown, rough, or partial serotype have been increasing
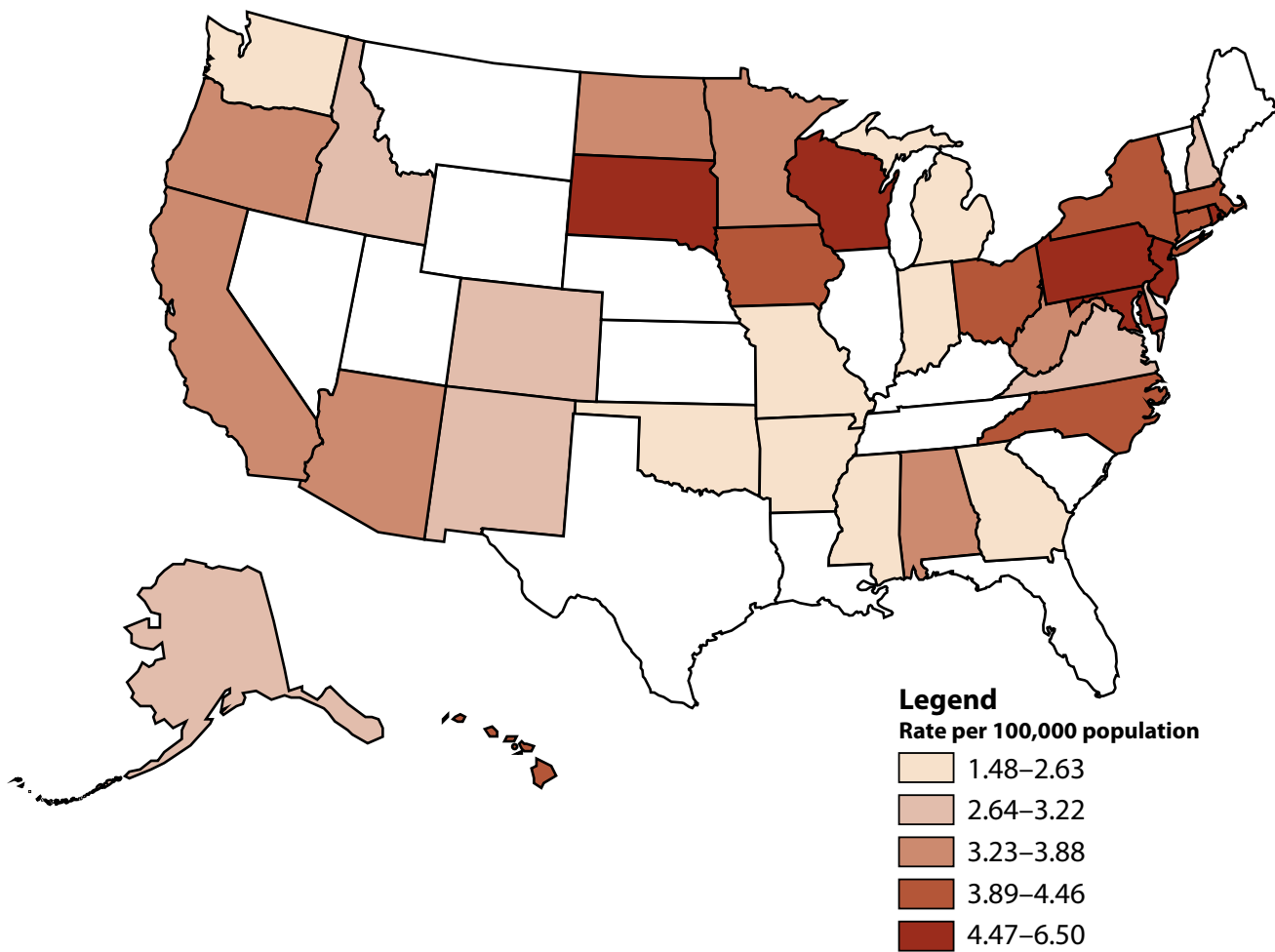
**Figure 2a.** Incidence rate of laboratory-confirmed human *Salmonella* infection reported to CDC (all serotypes), by reporting jurisdiction, United States, 2010*



**Legend**
**Rate per 100,000 population**

- 8.66–11.71
- 11.72–15.39
- 15.40–17.00
- 17.01–22.08
- 22.09–32.90

* Unshaded reporting jurisdictions are those excluded from mapping because the number of laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of the number of salmonellosis cases reported to the National Notifiable Diseases Surveillance System (NNDSS) (Florida, Illinois, Kansas, Louisiana, Nevada, South Carolina, Tennessee, Vermont) or because the number of fully serotyped laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of *Salmonella* isolates reported to LEDS (Kentucky, Maine, Montana, Nebraska, Texas, Utah, Wyoming).

The reporting jurisdictions with the highest reported incidence rates (cases per 100,000 population) of *Salmonella* infection were Mississippi (32.9), Alabama (28.8), and North Carolina (28.6).
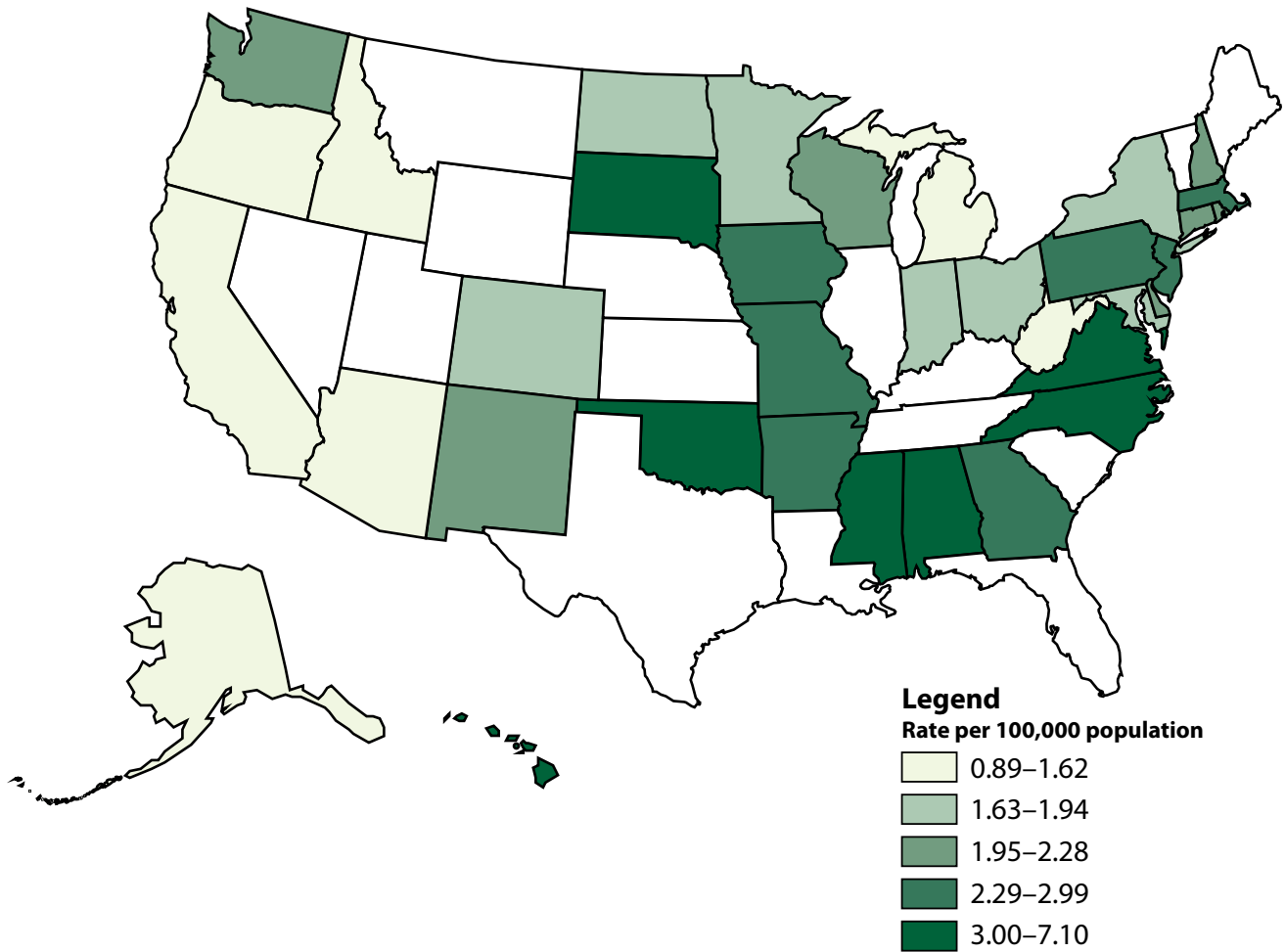
**Figure 2b.** Incidence rate of laboratory-confirmed human *Salmonella* serotype Enteritidis infection reported to CDC, by reporting jurisdiction, United States, 2010*



**Legend**
**Rate per 100,000 population**
- 1.48–2.63
- 2.64–3.22
- 3.23–3.88
- 3.89–4.46
- 4.47–6.50

*Unshaded reporting jurisdictions are those excluded from mapping because the number of laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of the number of salmonellosis cases reported to the National Notifiable Diseases Surveillance System (NNDSS) (Florida, Illinois, Kansas, Louisiana, Nevada, South Carolina, Tennessee, Vermont) or because the number of fully serotyped laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of *Salmonella* isolates reported to LEDS (Kentucky, Maine, Montana, Nebraska, Texas, Utah, Wyoming).

The reporting jurisdictions with the highest reported incidence rates of serotype Enteritidis infection (cases per 100,000 population) were Maryland (6.5), District of Columbia (5.8), and Rhode Island (5.2).

**Figure 2c.** Incidence rate of laboratory-confirmed human *Salmonella* serotype Typhimurium (including Typhimurium var. 5-) infection reported to CDC, by reporting jurisdiction, United States, 2010*



**Legend**
**Rate per 100,000 population**

- 0.89–1.62
- 1.63–1.94
- 1.95–2.28
- 2.29–2.99
- 3.00–7.10

*Unshaded reporting jurisdictions are those excluded from mapping because the number of laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of the number of salmonellosis cases reported to the National Notifiable Diseases Surveillance System (NNDSS) (Florida, Illinois, Kansas, Louisiana, Nevada, South Carolina, Tennessee, Vermont) or because the number of fully serotyped laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of *Salmonella* isolates reported to LEDS (Kentucky, Maine, Montana, Nebraska, Texas, Utah, Wyoming).

The reporting jurisdictions with the highest reported incidence rates of serotype Typhimurium (including Typhimurium var. 5-) infection (cases per 100,000 population) were South Dakota (7.1), Mississippi (6.9), and Alabama (5.8).

**Figure 2d.** Incidence rate of laboratory-confirmed human *Salmonella* serotype Newport infection reported to CDC, by reporting jurisdiction, United States, 2010*
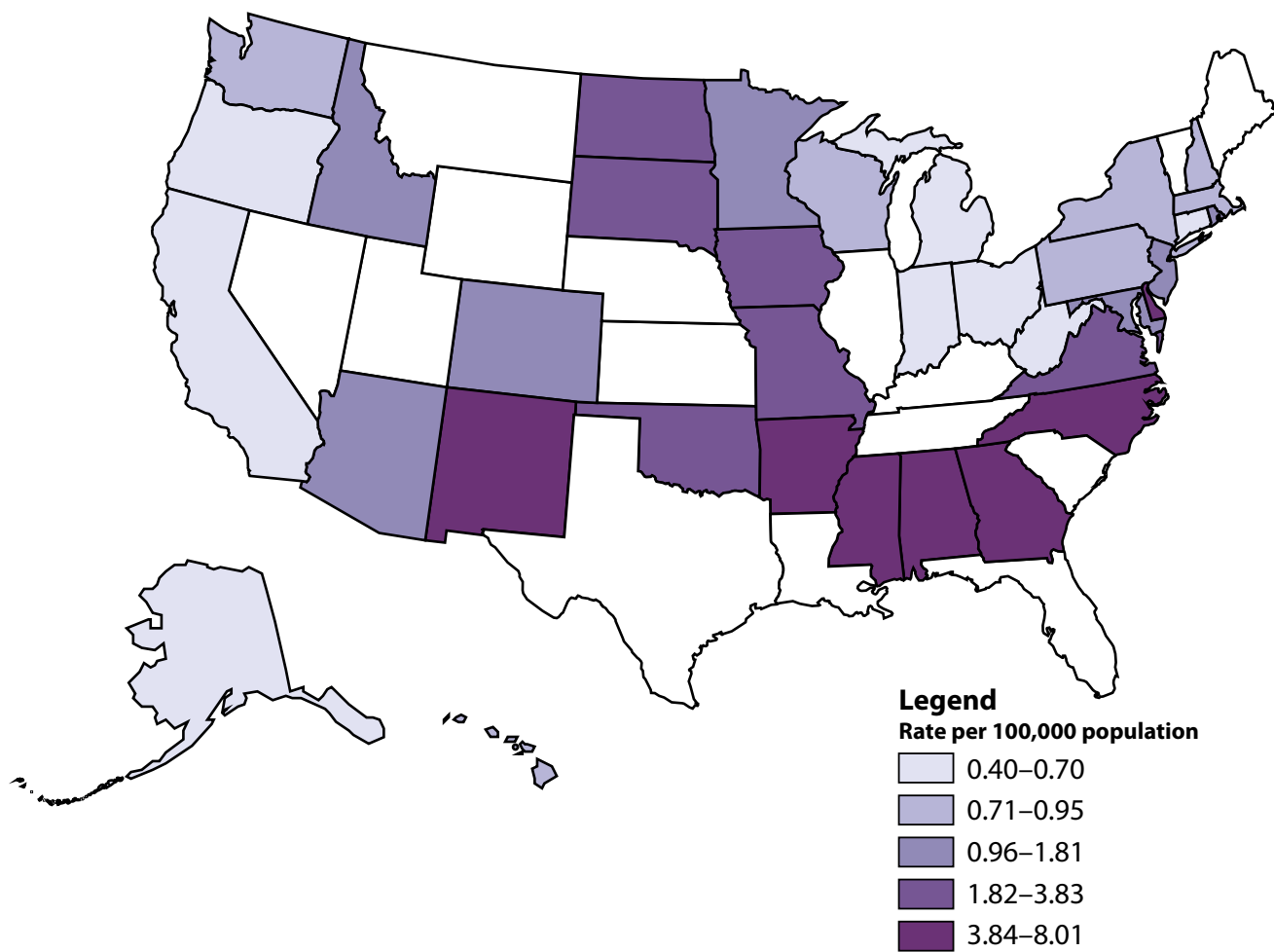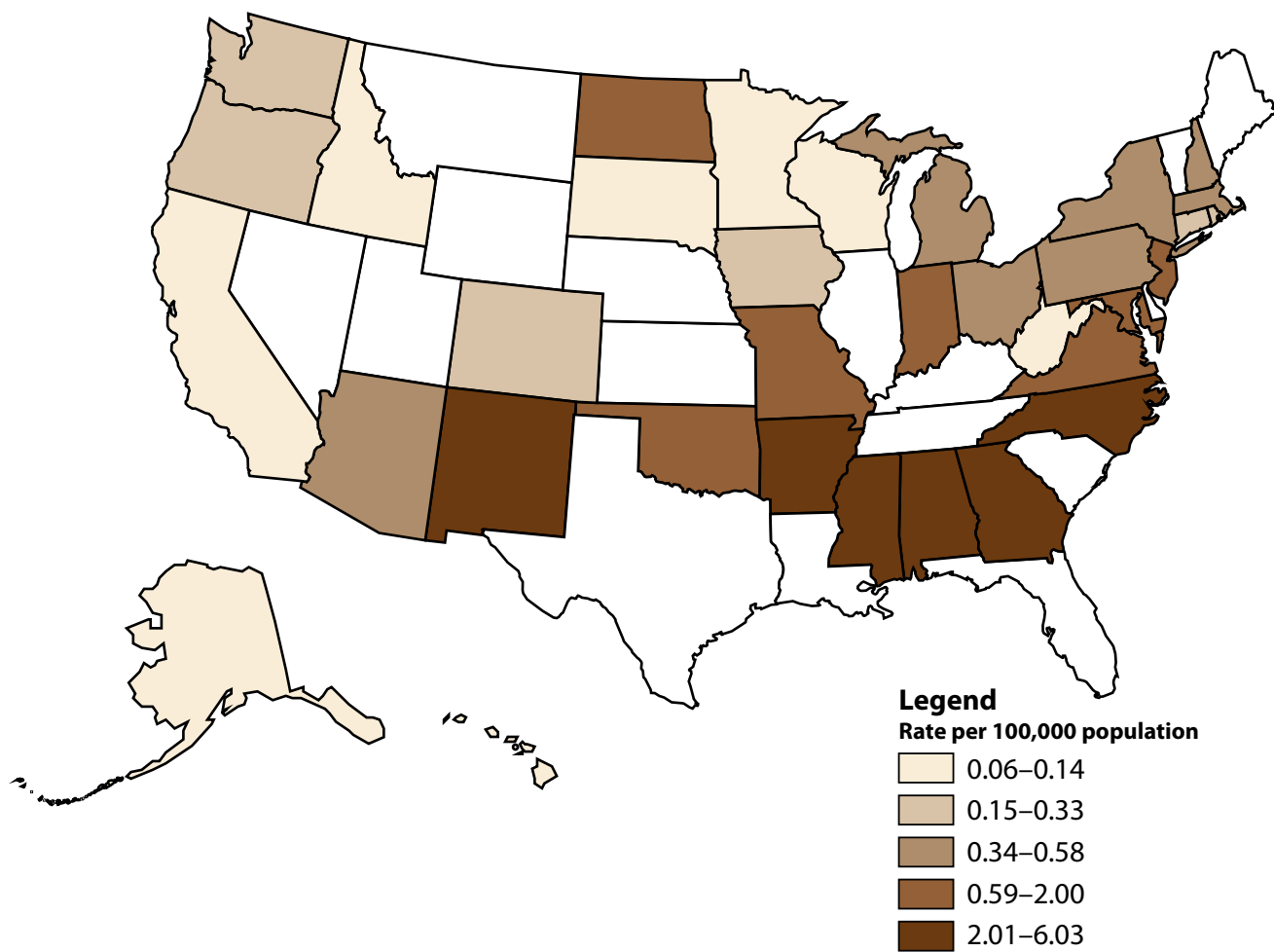


**Legend**
**Rate per 100,000 population**

- 0.40–0.70
- 0.71–0.95
- 0.96–1.81
- 1.82–3.83
- 3.84–8.01

*Unshaded reporting jurisdictions are those excluded from mapping because the number of laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of the number of salmonellosis cases reported to the National Notifiable Diseases Surveillance System (NNDSS) (Florida, Illinois, Kansas, Louisiana, Nevada, South Carolina, Tennessee, Vermont) or because the number of fully serotyped laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of *Salmonella* isolates reported to LEDS (Kentucky, Maine, Montana, Nebraska, Texas, Utah, Wyoming).

The reporting jurisdictions with the highest reported incidence rates of serotype Newport infection (cases per 100,000 population) were Arkansas (8.0), North Carolina (6.5), and Mississippi (6.2).
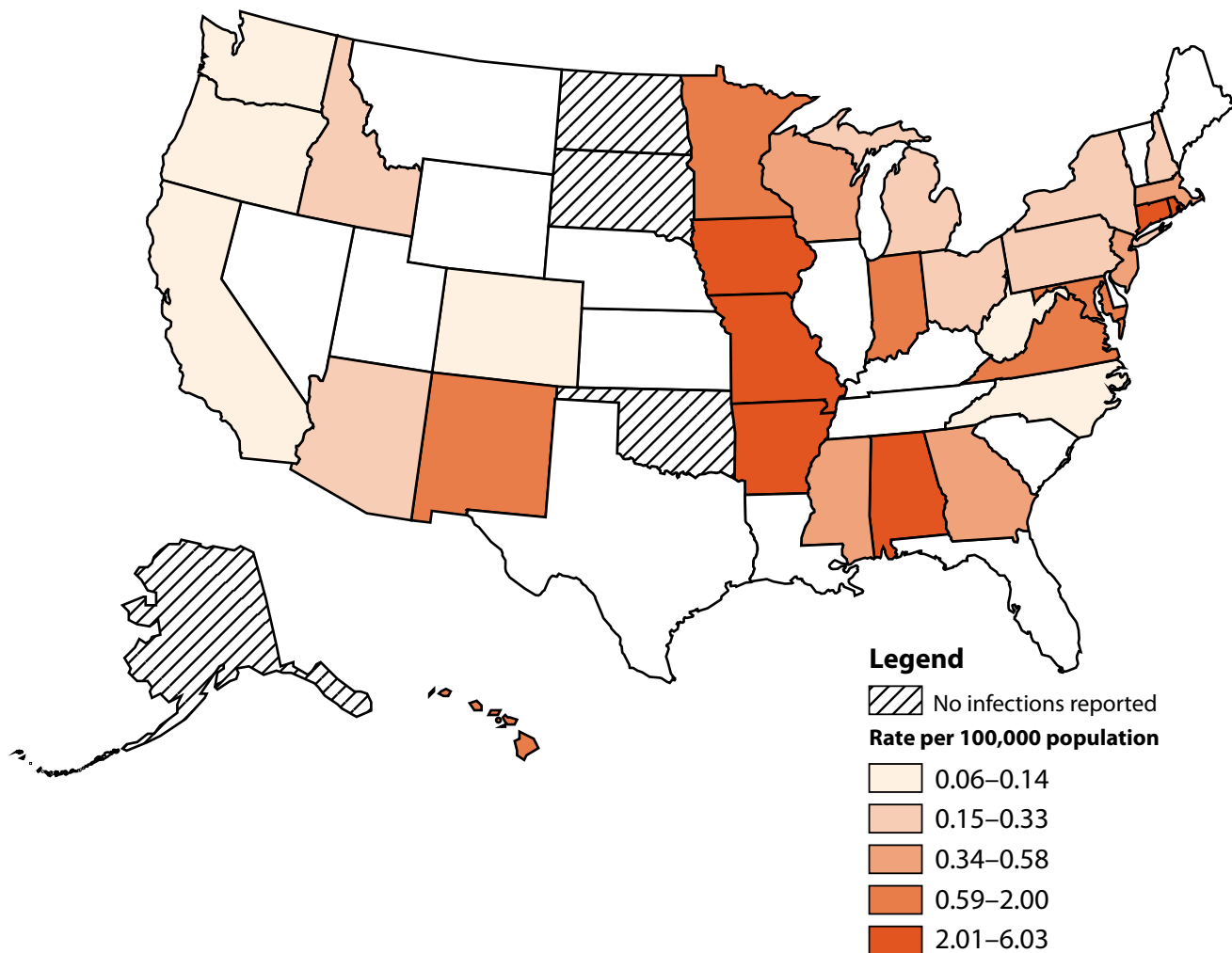
**Figure 2e.** Incidence rate of laboratory-confirmed human *Salmonella* serotype Javiana infection reported to CDC, by reporting jurisdiction, United States, 2010*



**Legend**
**Rate per 100,000 population**
- 0.06–0.14
- 0.15–0.33
- 0.34–0.58
- 0.59–2.00
- 2.01–6.03

*Unshaded reporting jurisdictions are those excluded from mapping because the number of laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of the number of salmonellosis cases reported to the National Notifiable Diseases Surveillance System (NNDSS) (Florida, Illinois, Kansas, Louisiana, Nevada, South Carolina, Tennessee, Vermont) or because the number of fully serotyped laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of *Salmonella* isolates reported to LEDS (Kentucky, Maine, Montana, Nebraska, Texas, Utah, Wyoming).

The reporting jurisdictions with the highest reported incidence rates of serotype Javiana infection (cases per 100,000 population) were Mississippi (6.0),Georgia (5.6), and Alabama (4.9).
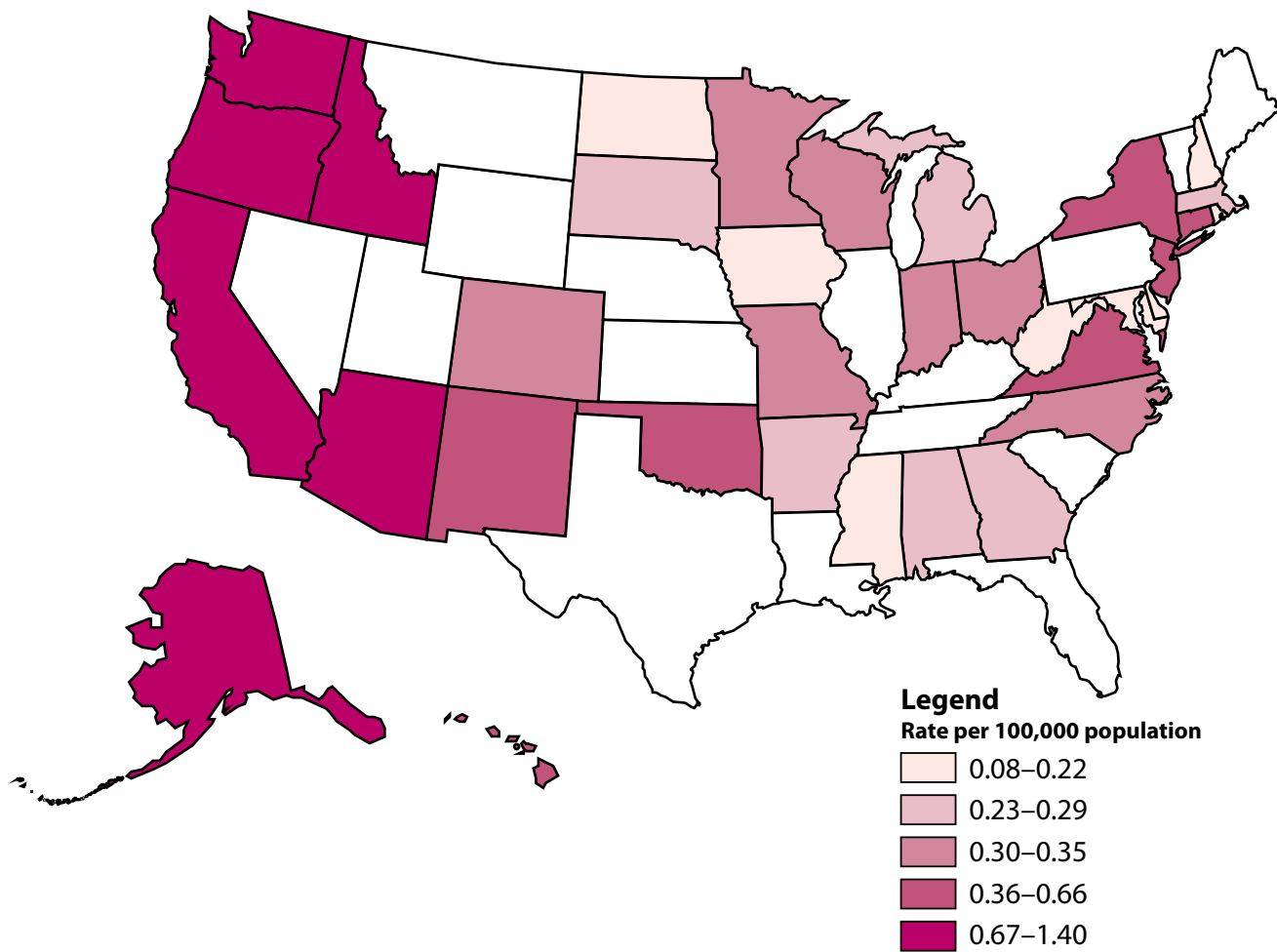
**Figure 2f.** Incidence rate of laboratory-confirmed human *Salmonella* serotype I,4,[5],12:i:- infection reported to CDC, by reporting jurisdiction, United States, 2010*



**Legend**

| | |
|---|---|
| ▨ | No infections reported |

**Rate per 100,000 population**

| | |
|---|---|
| | 0.06–0.14 |
| | 0.15–0.33 |
| | 0.34–0.58 |
| | 0.59–2.00 |
| | 2.01–6.03 |

*Unshaded reporting jurisdictions are those excluded from mapping because the number of laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of the number of salmonellosis cases reported to the National Notifiable Diseases Surveillance System (NNDSS) (Florida, Illinois, Kansas, Louisiana, Nevada, South Carolina, Tennessee, Vermont) or because the number of fully serotyped laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of *Salmonella* isolates reported to LEDS (Kentucky, Maine, Montana, Nebraska, Texas, Utah, Wyoming).  Reporting jurisdictions shaded with grey lines are those that were not excluded from mapping but that reported no infections with this serotype.

The  reporting jurisdictions with the highest reported incidence rates of serotype I,4,[5],12:i:- infection (cases per 100,000 population) were Iowa (1.4), Alabama (1.4) and Rhode Island (0.95).
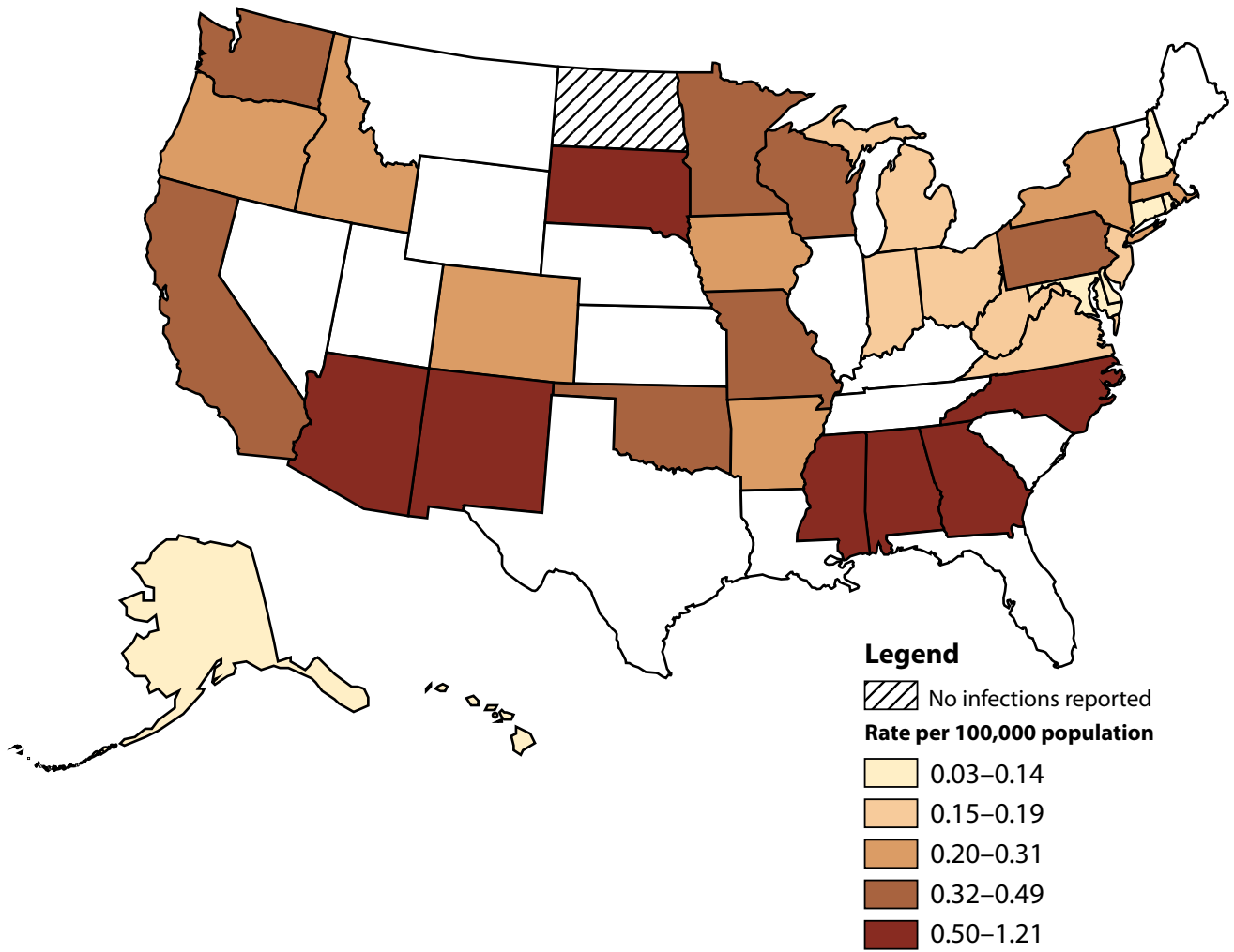
**Figure 2g.** Incidence rate of laboratory-confirmed human *Salmonella* serotype Heidelberg infection reported to CDC, by reporting jurisdiction, United States, 2010*



**Legend**
**Rate per 100,000 population**
- 0.08–0.22
- 0.23–0.29
- 0.30–0.35
- 0.36–0.66
- 0.67–1.40

*Unshaded reporting jurisdictions are those excluded from mapping because the number of laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of the number of salmonellosis cases reported to the National Notifiable Diseases Surveillance System (NNDSS) (Florida, Illinois, Kansas, Louisiana, Nevada, South Carolina, Tennessee, Vermont) or because the number of fully serotyped laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of *Salmonella* isolates reported to LEDS (Kentucky, Maine, Montana, Nebraska, Texas, Utah, Wyoming).

The reporting jurisdictions with the highest reported incidence rates of serotype Heidelberg infection (cases per 100,000 population) were Alaska (1.4), Arizona (1.0), and Idaho (0.95).

**Figure 2h.** Incidence rate of laboratory-confirmed human *Salmonella* serotype Montevideo infection reported to CDC, by reporting jurisdiction, United States, 2010*



**Legend**

- ▨ No infections reported

**Rate per 100,000 population**

- ▦ 0.03–0.14
- ▦ 0.15–0.19
- ▦ 0.20–0.31
- ▦ 0.32–0.49
- ▦ 0.50–1.21

*Unshaded reporting jurisdictions are those excluded from mapping because the number of laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of the number of salmonellosis cases reported to the National Notifiable Diseases Surveillance System (NNDSS) (Florida, Illinois, Kansas, Louisiana, Nevada, South Carolina, Tennessee, Vermont) or because the number of fully serotyped laboratory-confirmed human *Salmonella* isolates reported to LEDS was less than 20% of *Salmonella* isolates reported to LEDS (Kentucky, Maine, Montana, Nebraska, Texas, Utah, Wyoming). Reporting jurisdictions shaded with grey lines are those that were not excluded from mapping but that reported no infections with this serotype.

The reporting jurisdictions with the highest reported incidence rates of serotype Montevideo infection (cases per 100,000 population) were Mississippi (1.2), Alabama (1.1), and South Dakota (0.98).

**Figure 3.** Incidence rate of laboratory-confirmed human *Salmonella* infection reported to CDC, by age group and sex, United States, 2010 (n=46,339)
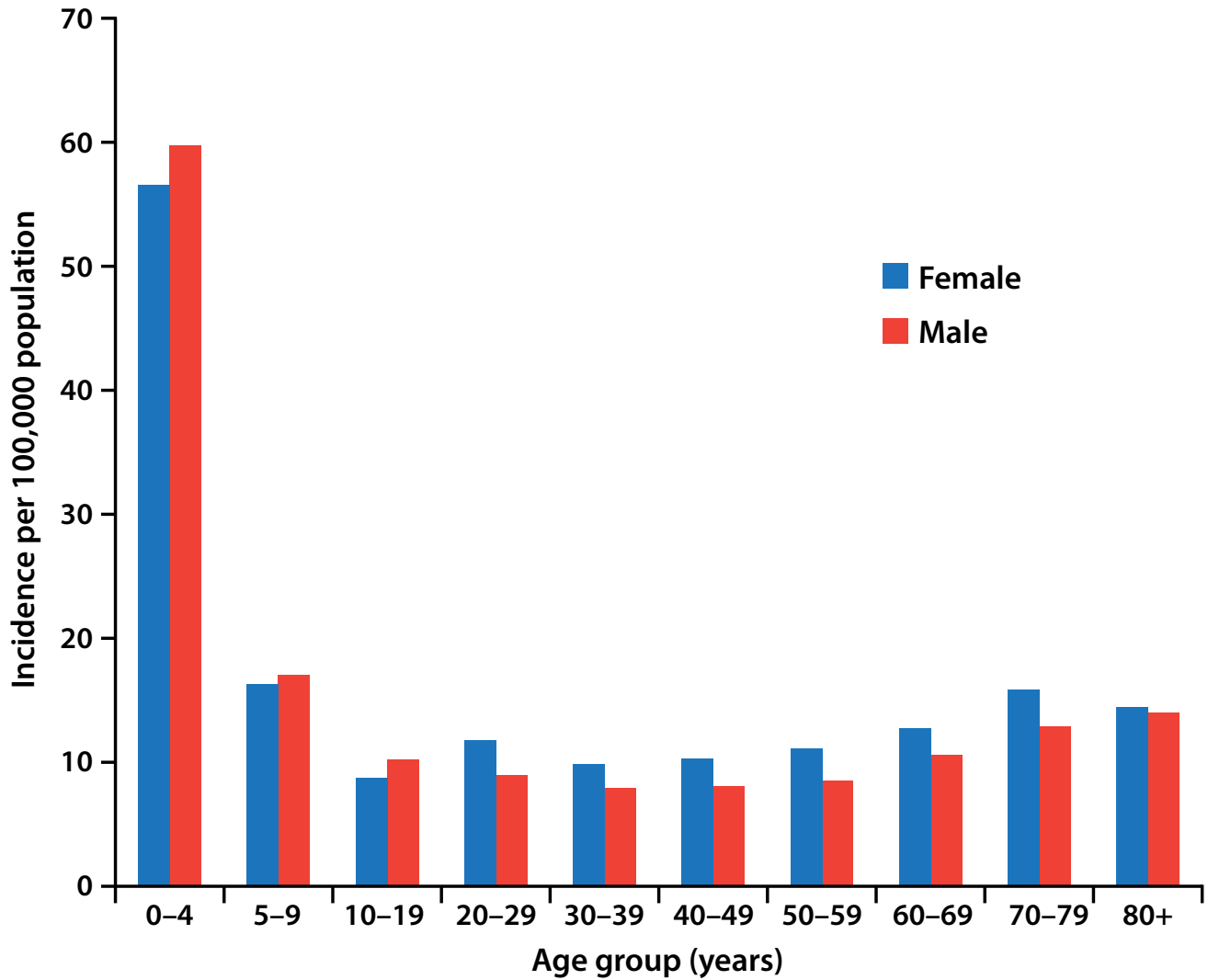


During 2010, the highest incidence rate of *Salmonella* infections was in children under 5 years old.  From ages 0 to 19, males had a higher incidence rate of *Salmonella*  infections than females; from age 20 to 80+, females had a higher incidence rate of *Salmonella* infections than males.

**Figure 4.** Number of laboratory-confirmed human *Salmonella* infections reported to CDC, by month of specimen collection, United States, 2010 and average number during 2000 to 2009
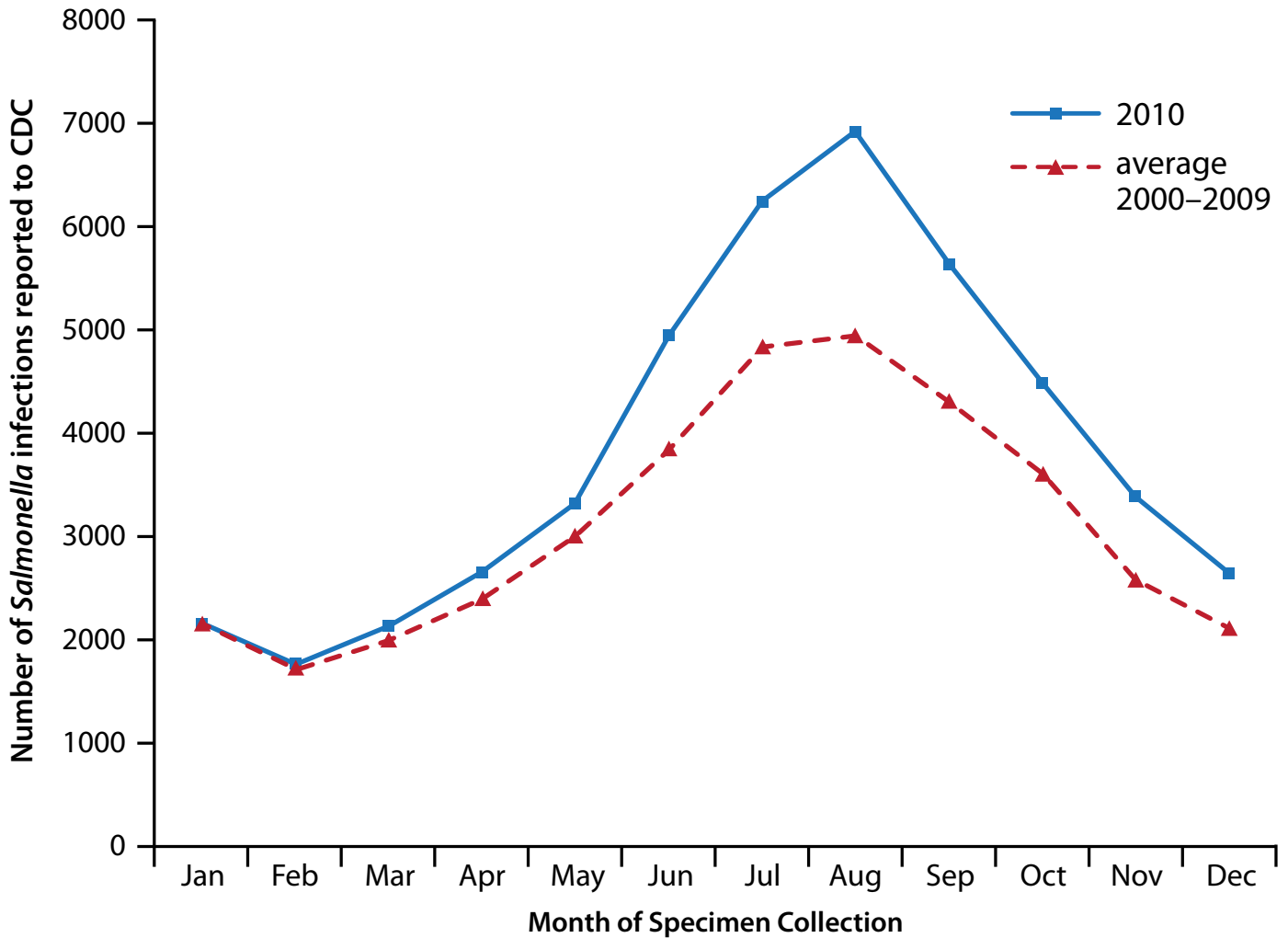


Compared with the previous 10 years (2000-2009), more *Salmonella* infections were reported in 2010. During 2010, reports of *Salmonella* infections showed seasonality similar to the average reported during 2000 to 2009, with a summer peak and the largest number of infections reported in August.

# Human Surveillance Data: National Notifiable Diseases Surveillance System (NNDSS)

The National Notifiable Disease Surveillance System (NNDSS) collects and compiles reports of nationally notifiable infectious diseases, including salmonellosis.  This system includes reports of laboratory-confirmed cases and probable cases (clinically compatible cases with an epidemiological link to a confirmed case).

The 2010 NNDSS report is available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5953a1.htm.

- A total of 47,150 confirmed cases of salmonellosis were reported to NNDSS during 2010; serotype information was not available in this system for 2010 (3).

# Human Antimicrobial Resistance Data: National Antimicrobial Resistance Monitoring System (NARMS)

The National Antimicrobial Resistance Monitoring System (NARMS) monitors antimicrobial resistance among enteric bacteria (including *Salmonella*) isolated from humans.  The 2010 NARMS report on human infections is available at http://www.cdc.gov/narms/pdf/2010-annual-report-narms.pdf  (4) and is excerpted below.

In the United States, fluoroquinolones (e.g., ciprofloxacin) and third-generation cephalosporins (e.g., ceftriaxone) are commonly used to treat severe *Salmonella* infections, including *Salmonella* serotype Typhi, the organism that causes typhoid fever.  In *Enterobacteriaceae*, resistance to nalidixic acid, an elementary quinolone, correlates with decreased susceptibility to ciprofloxacin (MIC ≥0.12 µg/mL) and possible fluoroquinolone treatment failure. Ceftiofur is a third-generation cephalosporin used in food animals in the United States; resistance to ceftiofur among *Enterobacteriaceae* correlates with resistance to ceftriaxone (MIC ≥4 µg/mL).

- 2.0% of nontyphoidal (nontyphoidal *Salmonella* refers to all *Salmonella* serotypes other than Typhi, Paratyphi A, Paratyphi B[1], and Paratyphi C) *Salmonella* infections were resistant to nalidixic acid, including

  » 5.2%  of serotype Enteritidis infections

  » The most common serotype among the nalidixic acid-resistant infections was Enteritidis (55.1%)

- 2.8% of nontyphoidal *Salmonella* infections were resistant to ceftriaxone, including

  » 24.2% of serotype Heidelberg infections ,

  » 7.2% of serotype Newport infections, and

  » 4.9% of serotype Typhimurium infections.

  » The most common serotype among the ceftriaxone-resistant infections was Newport (31.4%)

- 69.1% of serotype Typhi infections were resistant to nalidixic acid and 2.7% to ciprofloxacin

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[1] Two distinct pathotypes of *Salmonella* serotype Paratyphi B are recognized; one pathotype is associated with paratyphoid fever and the other is associated with uncomplicated gastroenteritis.  The two pathotypes are known to have distinct virulence characteristics, but are currently differentiated based on the ability to ferment tartrate.  The paratyphoidal pathotype is unable to ferment tartrate and is designated serotype Paratyphi B; the gastrointestinal pathotype ferments tartrate and is designated serotype Paratyphi B var. L(+) tartrate+.

Multidrug resistance is described in NARMS as resistance to three or more antimicrobial classes and also by specific co-resistant phenotypes. Classes of antimicrobial agents defined by the Clinical and Laboratory Standards Institute (CLSI) are used by NARMS.

- 11.3% of nontyphoidal *Salmonella* infections were resistant to two or more CLSI classes

- 9.1% were resistant to three or more CLSI classes. Those resistant to three or more classes included

    » 33.9% of serotype Heidelberg infections

    » 27.3% of serotype Typhimurium infections

    » 22.1% of serotype I,4,[5],12:i:- infections

- 44.4% of nontyphoidal *Salmonella* infections that were resistant to three or more classes were serotype Typhimurium.

## Human Outbreak Data: Foodborne Disease Outbreak Surveillance System (FDOSS) and Waterborne Disease Outbreak Surveillance System (WBDOSS)

The Foodborne Disease Outbreak Surveillance System (FDOSS) collects reports of foodborne disease outbreaks from local, state, and territorial public health agencies.  The 2009 to 2010 summary of foodborne disease outbreaks is available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6203a1.htm?s_cid=mm6203a1_w

- In 2010, 121 confirmed, single-etiology *Salmonella* outbreaks with 2,274 illnesses were reported (4).

    » The most common serotype causing confirmed, single-etiology *Salmonella* outbreaks was Enteritidis (76 outbreaks, 63%) (5).

- In 2010, 13 multistate outbreaks caused by *Salmonella* were reported.

The Waterborne Disease and Outbreak Surveillance System (WBDOSS) collects reports of waterborne disease outbreaks associated with drinking water and recreational water from local, state, tribal, and territorial public health agencies.  The report for 2010 was not available when this was written.  Reports are available at http://www.cdc.gov/healthywater/statistics/wbdoss/surveillance.html.

## Non-human Surveillance Data: National Veterinary Services Labortories (NVSL)

The data in tables 3, 4, and 5 come from the National Veterinary Services Laboratories (NVSL) of the United States Department of Agriculture's Animal and Plant Health Inspection Service (USDA-APHIS).  Isolates from *Salmonella* infections are submitted to NVSL by veterinary diagnostic laboratories throughout the United States for serotyping.  Clinical animal infections (referred to as "clinical/non-human") are *Salmonella* infections in animals with clinical signs of illness; "non-clinical/non-human" infections are *Salmonella* infections identified through herd and flock monitoring and surveillance, feed sample testing, environmental testing, and USDA-FSIS food testing programs.

**Table 3a.** Laboratory-confirmed *Salmonella* isolates from clinical non-human sources submitted to the National Veterinary Services Laboratories (NVSL) for typing, with the 20 most frequently reported serotypes listed individually, 2010

| | Clinical Non-human 2010 | | |
|---|---|---|---|
| **Rank** | **Serotype** | **Reported** | **Percent** |
| 1 | Typhimurium* | 953 | 20.1 |
| 2 | Dublin | 279 | 5.9 |
| 3 | Cerro | 228 | 4.8 |
| 4 | Newport | 211 | 4.4 |
| 5 | Agona | 207 | 4.4 |
| 6 | I 4,[5],12:i:- | 184 | 3.9 |
| 7 | Derby | 179 | 3.8 |
| 8 | Heidelberg | 158 | 3.3 |
| 9 | Montevideo | 155 | 3.3 |
| 10 | Senftenberg | 137 | 2.9 |
| 11 | Anatum | 135 | 2.8 |
| 12 | Javiana | 135 | 2.8 |
| 13 | Enteritidis | 134 | 2.8 |
| 14 | Kentucky | 97 | 2.0 |
| 15 | Infantis | 89 | 1.9 |
| 16 | Mbandaka | 76 | 1.6 |
| 17 | Worthington | 64 | 1.3 |
| 18 | Choleraesuis** | 53 | 1.1 |
| 19 | Oranienburg | 51 | 1.1 |
| 20 | Melagridis | 50 | 1.1 |
| | **Sub Total** | **3575** | **75.4** |
| | All Other Serotyped | 972 | 20.5 |
| | Unknown | 43 | 0.9 |
| | Rough, mucoid, and/or nonmotile isolates | 154 | 3.2 |
| | **Sub Total** | **1169** | **24.6** |
| | **Total** | **4744** | **100** |

Note:
  * Typhimurium includes var. 5- (formerly var. Copenhagen)
** Choleraesuis includes var. Decatur and Kunzendorf

**Table 3b.** Laboratory-confirmed *Salmonella* isolates from non-clinical non-human sources submitted to the National Veterinary Services Laboratories (NVSL) for typing, with the 20 most frequently reported serotypes listed individually, 2010

| Non-Clinical Non-human 2010 | | | |
|---|---|---|---|
| **Rank** | **Serotype** | **Reported** | **Percent** |
| 1 | Enteritidis | 1449 | 17.7 |
| 2 | Kentucky | 1116 | 13.6 |
| 3 | Senftenberg | 680 | 8.3 |
| 4 | Typhimurium* | 505 | 6.2 |
| 5 | Heidelberg | 323 | 3.9 |
| 6 | Montevideo | 323 | 3.9 |
| 7 | Cerro | 216 | 2.6 |
| 8 | Mbandaka | 209 | 2.6 |
| 9 | Infantis | 179 | 2.2 |
| 10 | Newport | 173 | 2.1 |
| 11 | Anatum | 161 | 2.0 |
| 12 | Agona | 129 | 1.6 |
| 13 | Tennessee | 117 | 1.4 |
| 14 | Hadar | 111 | 1.4 |
| 15 | Dublin | 95 | 1.2 |
| 16 | Braenderup | 94 | 1.1 |
| 17 | I 4,[5],12:i:- | 91 | 1.1 |
| 18 | Muenster | 86 | 1.1 |
| 19 | Worthington | 86 | 1.1 |
| 20 | Schwarzengrund | 78 | 1.0 |
| | **Sub Total** | **6221** | **76.0** |
| | All Other Serotyped | 1659 | 20.2 |
| | Rough, mucoid, and/or nonmotile isolates | 310 | 3.8 |
| | **Sub Total** | **1969** | **24.0** |
| | **Total** | **8190** | **100** |

Note:
* Typhimurium includes var. 5- (formerly var. Copenhagen)

**Table 4.** Laboratory-confirmed *Salmonella* isolates from clinical non-human animal sources (bovine, chicken, porcine, and turkey) submitted to the National Veterinary Services Laboratories (NVSL) for typing, for the top 4 serotypes causing human illness in 2010, by source.

| Serotype | Human Rank, 2010 | Non-Human (clinical) Sources | | | |
|---|---|---|---|---|---|
| | | Bovine (%) | Chicken (%) | Porcine (%) | Turkey (%) |
| Enteritidis | 1 | 4.5 | 78.4 | 4.5 | 0 |
| Typhimurium (including Typhimurium var. 5-) | 2 | 16.5 | 4.2 | 52.2 | 1.9 |
| Newport | 3 | 42.7 | 0 | 3.3 | 2.4 |
| Javiana | 4 | 1.5 | 0 | 0 | 0 |

**Table 5.** Laboratory-confirmed *Salmonella* isolates from non-clinical non-human animal sources (bovine, chicken, porcine, and turkey) submitted to the National Veterinary Services Laboratories (NVSL) for typing, for the top 4 serotypes causing human illness in 2010, by source.

| Serotype | Human Rank, 2010 | Non-Human (non-clinical) Sources | | | |
|---|---|---|---|---|---|
| | | Bovine (%) | Chicken (%) | Porcine (%) | Turkey (%) |
| Enteritidis | 1 | 0.1 | 96.3 | 0 | 0.2 |
| Typhimurium (including Typhimurium var. 5-) | 2 | 10.9 | 44.0 | 8.1 | 4.8 |
| Newport | 3 | 15.0 | 21.4 | 0.6 | 5.2 |
| Javiana | 4 | 2.0 | 12.0 | 0 | 0 |

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