

National Enteric Disease Surveillance: *Salmonella* Annual Summary, 2007

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An overview of National *Salmonella* Surveillance is available online at http://www.cdc.gov/nationalsurveillance/PDFs/NationalSalmSurveillOverview_508.pdf (1).

National Salmonella Surveillance Data (Laboratory-based Enteric Disease Surveillance, LEDS)

LEDS Data Tables for 2007 are available online at <http://www.cdc.gov/ncezid/dfwed/PDFs/SalmonellaAnnualSummaryTables2007.pdf>, pages 1-81.

- The top 20 *Salmonella* serotypes isolated from human sources reported to CDC in 2007 are shown in Table 1; the percent change in the number of these isolates over time, comparing 2007 with 1997 and with 2002, is shown in Table 1a.
 - During 2007, 39,970 laboratory-confirmed *Salmonella* isolates were reported to CDC through LEDS.
 - The top 4 serotypes in 2007 were Typhimurium (including Typhimurium var. 5-) (16%), Enteritidis (15%), Newport (9%) and Heidelberg (4%).
 - Serotype Tennessee had the largest increase (1,887%) since 1997 of any serotype; most of this increase occurred after 2002.
- The distribution of isolates by age group and sex during 2007 is shown in Table 2 and Figure 1.
 - In 2007, *Salmonella* was isolated most frequently from children under 5 years of age (35% of all isolates.)
 - The distribution of isolates by gender varied, with a greater number of isolates from male than female infants and children, and a smaller number of isolates from male than female adults.
- The number of isolates by serotype and year from 1997 to 2007 is shown in Tables 3 and 3a.
 - The number of unknown and partially serotyped isolates increased from 3% in 1997 to 13% in 2007.
 - From 1997-2006, <175 isolates of serotype Schwarzengrund were reported each year; 307 isolates were reported in 2007. This increase was due to a multistate outbreak associated with dry pet food that occurred from 2006 to 2008 (1).
 - From 1997-2006, ≤ 12 isolates of serotype Wandsworth were reported each year; 69 isolates were reported in 2007. This increase was due to an outbreak associated with a commercial vegetable-coated snack food (2).
 - From 1997-2005, ≤6 isolates of serotype Concord were reported each year; in 2006 and 2007, 17 and 20 isolates were reported, respectively. In the United States, serotype Concord infections are primarily reported in children adopted recently from Ethiopia (3).

- The geographic distribution of isolates is shown in Tables 4 and 5 and Figure 2
 - Serotype Enteritidis isolation rates (per 100,000 population) by region from 1970 to 2007 are shown in Figure 2; since the epidemic of serotype Enteritidis infections in the New England and Mid Atlantic regions in the early 1990s (4), isolation rates have decreased; in 2007, the Mid Atlantic region reported the highest isolation rates.
- The four *Salmonella* serotypes with the highest isolation rates from 1970 to 2007 were Typhimurium, Enteritidis, Heidelberg, and Newport, shown in Figure 3.
 - In 2007 these four serotypes represented 44% of all isolates
 - These four serotypes have been the most common serotypes each year since 1995, except during 2004 when Javiana replaced Heidelberg as the fourth most common serotype. This change in 2004 was likely due to a multistate outbreak of serotype Javiana infections transmitted by tomatoes that affected over 380 people (5).

NNDSS Data

The National Notifiable Disease Surveillance System (NNDSS) collects and compiles reports of nationally notifiable infectious diseases, including *Salmonella*. This system includes reports of laboratory-confirmed cases and probable cases (clinically compatible cases with an epidemiological link to a confirmed case). The 2007 NNDSS report is available at <http://www.cdc.gov/mmwr/PDF/wk/mm5653.pdf>.

- A total of 47,995 cases of salmonellosis were reported to NNDSS during 2007; serotype information was not available from this system for 2007 (6).

Antimicrobial Resistance Data

The National Antimicrobial Resistance Monitoring System (NARMS) monitors antimicrobial resistance among enteric bacteria (including *Salmonella*) from humans. The 2007 NARMS report on human isolates is available at <http://www.cdc.gov/narms/annual/2007/NARMSAnnualReport2007.pdf>.

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 $\mu\text{g/mL}$) 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 decreased susceptibility to ceftriaxone (MIC ≥ 2 $\mu\text{g/mL}$).

- 2.2% of nontyphoidal (nontyphoidal *Salmonella* refers to all *Salmonella* serotypes other than Typhi, Paratyphi A, Paratyphi B¹, and Paratyphi C) *Salmonella* isolates were resistant to nalidixic acid, including
 - 5.7% of serotype Enteritidis isolates.
 - 45.8% of nalidixic acid-resistant isolates were serotype Enteritidis.

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+.

- 3.3% of nontyphoidal *Salmonella* isolates were resistant to ceftiofur, including
 - 7.7% of serotype Newport isolates.
 - 35.7% of ceftiofur-resistant isolates were serotype Typhimurium.
- 62.3% of serotype Typhi isolates were resistant to nalidixic acid.

Multidrug resistance is described in NARMS as resistance to three or more classes of antimicrobial agents, as defined by the Clinical and Laboratory Standards Institute (CLSI).

- 18.9% of nontyphoidal *Salmonella* isolates were resistant to one or more CLSI classes
- 11.1% were resistant to three or more CLSI classes. Those resistant to three or more included
 - 34.2% of serotype Typhimurium isolates
 - 10.5% of serotype Newport isolates
 - 1.0% of serotype Enteritidis isolates.
- 57.7% of nontyphoidal *Salmonella* resistant to three or more classes were serotype Typhimurium.

Outbreak Data

The Foodborne Disease Outbreak Surveillance System (FDOSS) collects reports of foodborne disease outbreaks from local, state, tribal, and territorial public health agencies. The 2007 annual summary of foodborne disease outbreaks is available at

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5931a1.htm>.

- In 2007, 136 confirmed, single-etiology *Salmonella* outbreaks with 3465 illnesses were reported (8).
 - The most common serotype causing confirmed, single-etiology *Salmonella* outbreaks was Enteritidis (28 outbreaks) (8).
 - Serotype I 4,[5],12:i:- caused a large multi-state outbreak transmitted by frozen chicken pot pies, which were distributed nationally, with over 400 illnesses in 41 states (9).

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 2007 annual summary of waterborne disease outbreaks associated with drinking water is available at <http://www.cdc.gov/mmwr/pdf/ss/ss6012.pdf>

- In 2007, 20 waterborne disease outbreaks associated with drinking water were reported; two were caused by *Salmonella* (5):
 - An outbreak in Tennessee of *Salmonella* serotype Newport infections associated with well water caused 2 cases,
 - An outbreak in Wisconsin of infections due to multiple etiologies, including *Salmonella*, associated with well water caused 229 cases.

Non-human Data
(National Veterinary Services Laboratories, NVSL)

NVSL Data Tables for 2007 are available online at <http://www.cdc.gov/ncezid/dfwed/PDFs/SalmonellaAnnualSummaryTables2007.pdf>, pages 82-93.

The 20 most frequently reported *Salmonella* serotypes from clinical and non-clinical non-human sources reported to CDC and the National Veterinary Services Laboratories (NVSL) in the Animal and Plant Health Inspection Service (APHIS) of the United States Department of Agriculture (USDA) in 2007 are shown in Table 6.

Clinical animal isolates (referred to as “clinical/non-human”) are defined as *Salmonella* isolates from animals with signs of salmonellosis. On the other hand, *Salmonella* isolates identified through herd and flock monitoring and surveillance, feed sample testing, environmental testing, and USDA Food Safety and Inspection Service (FSIS) food testing programs are designated “non-clinical/non-human” isolates. Clinical/non-human and non-clinical/non-human *Salmonella* isolates reported NVSL by serotype and source in 2007 are shown in Tables 7 and 8.

- The most common clinical/non-human serotype reported to NVSL during 2007 was Typhimurium (including Typhimurium var. 5-, 22%).
- The most common non-clinical/non-human serotype reported to NVSL during 2007 was Kentucky (15%); the next most common was Heidelberg (9%).
- The following table summarizes the non-human animal sources (bovine, chicken, porcine, and turkey) for clinical isolates of the top 4 serotypes causing human illness in 2007.

Serotype	Human Rank, 2007	Non-Human (clinical) Sources			
		Bovine (%)	Chicken (%)	Porcine (%)	Turkey (%)
Typhimurium (including Typhimurium var. 5-)	1	29	0.8	48	0.8
Enteritidis	2	13	34	4	1
Newport	3	50	1	4	1
Heidelberg	4	5	5	66	3

- The following table summarizes the non-human animal sources (bovine, chicken, porcine, and turkey) for non-clinical isolates of the top 4 serotypes causing human illness in 2007.

Serotype	Human Rank, 2007	Non-Human (non-clinical) Sources			
		Bovine (%)	Chicken (%)	Porcine (%)	Turkey (%)
Typhimurium (including Typhimurium var. 5-)	1	13	31	37	6
Enteritidis	2	1	89	0.2	3
Newport	3	36	13	3	24
Heidelberg	4	0	85	1	7

References

- Behraves CB, Ferraro A, Deasy M 3rd, et al. [Human *Salmonella* infections linked to contaminated dry dog and cat food, 2006-2008](#). *Pediatrics*. 2010 Sep;126(3):477-83. Epub 2010 Aug 9.
- Sotir M., Ewald G., Kimura A.C., et al. Outbreak of *Salmonella* Wandsworth and Typhimurium infections in infants and toddlers traced to a commercial vegetable-coated snack food. *Pediatr Infect Dis J* 2009; 28(12): 1041-1046.
- Hendriksen R., Mikoleit M., Kornschöber C., et al. Emergence of multidrug-resistant *Salmonella* Concord infections in Europe and the United States in children adopted from Ethiopia, 2003-2007. *Pediatr Infect Dis J* 2009; 28(9): 814-818.
- Braden CR. *Salmonella* enterica serotype Enteritidis and eggs: a national epidemic in the United States. *Clin Infect Dis*. 2006 Aug 15;43(4):512-7.
- CDC. Outbreaks of *Salmonella* infections associated with eating Roma tomatoes --- United States and Canada, 2004. *MMWR* 2005; 54(13): 325-328.
- CDC. Summary of notifiable diseases—United States, 2007. *MMWR* 2009; 56(53): 1-94.
- CDC. National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS): Human isolates final report, 2007. Atlanta, GA: U.S. Department of Health and Human Services, CDC, 2009. Available at: <http://www.cdc.gov/narms/annual/2007/NARMSAnnualReport2007.pdf>
- CDC. Surveillance for foodborne disease outbreaks --- United States, 2007. *MMWR* 2010; 59(31):1277-1280
- CDC. Multistate outbreak of *Salmonella* infections associated with frozen pot pies --- United States, 2007. *MMWR* 2008;57(47):1277-1280.

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