

Salmonella Heidelberg

Background: *Salmonella enterica* subsp. *enterica* serovar Heidelberg (antigenic formula 1,4,[5],12:r:1,2) is a serovar of the O:4 (B) serogroup. *S. Heidelberg* is commonly found in poultry meat in North America. In the U.S. and Canada, it has caused numerous infections in chickens. In the U.S., this serovar has caused a number of outbreaks that included the recent outbreak (October, 2013), linked to [raw chicken](#); this outbreak was caused by a multidrug resistant *S. Heidelberg* strain (resistant to ampicillin, chloramphenicol, gentamicin, kanamycin, streptomycin, sulfisoxazole, and tetracycline). *S. Heidelberg* accounts for the 8.6% of ceftriaxone-resistant *Salmonella* isolated from humans in the U.S. Recently, a [phage typing scheme](#) was developed for serovar Heidelberg in Canada; this scheme recognizes 49 phage types.

Animal reservoir: *S. Heidelberg* is mostly found in chickens and turkeys.

Geographical distribution: Mostly reported from North America, serovar Heidelberg is the second and seventh most common serovar isolated from humans in Canada and in the U.S., respectively. In Europe this serovar is rare (approx. 180 cases/year).

Outbreaks: Multiple [Heidelberg outbreaks](#) have been linked to poultry, most of them in the U.S.

Year	Location	Associated source	Number of cases
2016	US-multistate	Contact with Dairy Calves	21
2013	US-multistate	Raw chicken	278
2011	US-multistate	Kosher Broiled Chicken Livers	190
2011	US-multistate	Ground turkey	136
2011	Europe	In-flight catering from Tanzania to Europe	22
2005	US-WI	Pig roast	25
2004	Canada	Food handler	45
2001	Australia	Eggs	12

Relevant genetic characteristics: Whole genome sequences for 15 strains of *S. Heidelberg* have been deposited at GenBank as of October, 2013. Genomic characteristics of the sequenced *S. Heidelberg* include (i) a genome size ranging from 4.73 to 4.98 Mb, (ii) a mol G+C% of 52.1, and (iii) 5,578 to 5,039 predicted genes. Many of these sequenced strains have been implicated in recent [outbreaks](#) (2011 and 2012), in the U.S. *Salmonella Heidelberg* str. [SARA33](#) is a multidrug resistant strain. This strain was found, *in silico*, to contain a novel integron cassette; in addition, it was found to carry the following resistance genes: *aac(6)-ly*, *aadA5*, *aadB*, *aa(6)-33*, and *aadA1*, *sul1* and *sul2*, *blaOXA-2* and *blaTEM*, *tetD*. Resistance genes in *S. Heidelberg* have been identified in the chromosome (resistant islands) and in plasmids. Different incompatibility types (A/C, FIB, HI2) have been identified in the [plasmids](#) that carried resistance genes in *S. Heidelberg*.

Phylogenetic and pan-genomic analyses that included two of the sequenced *S. Heidelberg* strains and other *Salmonella* serovars concluded that *S. Heidelberg* (i) belongs to clade A, according to [den Bakker et al. \(2011\)](#) classification, (ii) appears to have a single evolutionary origin, and (iii) contains 74 [g ene families](#) unique to this serovar.

Genome sequences available:

1. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. 41563 <http://www.ncbi.nlm.nih.gov/assembly/481988/>
2. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. 41565 <http://www.ncbi.nlm.nih.gov/assembly/482048/>
3. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. 41566 <http://www.ncbi.nlm.nih.gov/assembly/482028/>
4. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. 41573 <http://www.ncbi.nlm.nih.gov/assembly/482008/>
5. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. 41578 <http://www.ncbi.nlm.nih.gov/assembly/41121/>
6. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. 41579 <http://www.ncbi.nlm.nih.gov/assembly/481968/>
7. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. B182 <http://www.ncbi.nlm.nih.gov/assembly/377398/>
8. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. CFSAN002069 <http://www.ncbi.nlm.nih.gov/assembly/41111/>
9. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. CFSAN00322 <http://www.ncbi.nlm.nih.gov/assembly/493148/>
10. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. CFSAN00325 <http://www.ncbi.nlm.nih.gov/assembly/493168/>
11. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. CFSAN00326 <http://www.ncbi.nlm.nih.gov/assembly/493188/>
12. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. CFSAN00328 <http://www.ncbi.nlm.nih.gov/assembly/493208/>
13. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. SARA33 <http://www.ncbi.nlm.nih.gov/assembly/62751/>
14. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. SL476 <http://www.ncbi.nlm.nih.gov/assembly/41748/>
15. *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. SL486 <http://www.ncbi.nlm.nih.gov/assembly/210978/>

Relevant links and references:

1. <http://www.cdc.gov/salmonella/heidelberg-02-13/>
2. <http://www.cdc.gov/salmonella/heidelberg-10-13/index.html>
3. <http://jcm.asm.org/content/41/9/4279.full>
4. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3569330/>
5. <https://www.cdc.gov/salmonella/heidelberg-11-16/index.html>