



British Columbia Integrated Surveillance of Foodborne Pathogens (BCISFP) Annual Summary of *Salmonella* Findings

2016

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Introduction

BC Integrated Surveillance of Foodborne Pathogens (BCISFP) was initiated in October 2006. The mission is to provide surveillance along the food chain for safer food and healthy people in British Columbia (BC). *Salmonella* is an ideal candidate for integrated surveillance because it is cultured within all sectors (animal, food and humans), is recovered at high rates, has several subtyping methods available, and affects a great variety of food commodities. For more information please visit: www.bccdc.ca/integratedfoodchainsurveillance.

This is the seventh annual summary. The purpose of the summary is to provide integrated information about the occurrence of *Salmonella* in BC among humans and at select points along the food chain. Data are sourced from four distinct sectors: human, animal (farm, domestic, and wild life), abattoir and food. Details about the data sources and how they are integrated are described in the [BC Integrated Surveillance of Foodborne Pathogens Methods](#) available at www.bccdc.ca/integratedfoodchainsurveillance.

Results – overview

In 2016, 1256 human isolates tested *Salmonella* positive of which 602 were locally-acquired infections. In addition, *Salmonella* was found in 175 food, 34 abattoir and 862 animal specimens (Table 1). A total of 78 serotypes were observed. Twenty-one serotypes were common across two or more sectors while 57 were observed in only one sector each. Three serotypes (*S. Enteritidis*, *S. Infantis* and *S. Heidelberg*) were found in all 4 sectors (human, animal, abattoir and food); seven serotypes were found in three sectors and 11 serotypes in two sectors. As in previous years, serotypes overlapped primarily between humans, chicken/turkey meat and samples from on-farm chickens and their environments, likely due to the large number of isolates from these sources.

In 2016, the most commonly detected serotype in BC was *S. Enteritidis*. *S. Enteritidis* has been the most common serotype historically in BC and within all sectors. It was the most common serotype for locally-acquired human infections, chicken meat, chicken nuggets, turkey meat, chicken in abattoir, chicken on-farm, domestic duck and goose and wildlife (see [Salmonella Enteritidis section](#)). The second most common serotype was *S. Kentucky*. This serotype is common in chickens and chicken meat, but rarely causes human illness; in 2016 there were no locally acquired human infections of *S. Kentucky*.

While *S. Enteritidis* was the most common serotype among turkey meat, turkey meat had a variety of distinct serotypes different than those detected in chicken meat.

In 2016, 24.2% of human *Salmonella* were associated with travel outside of Canada. The most common serotypes among travel-related infections of *Salmonella* included: Enteritidis (138), Typhi (23), Paratyphi (19), Agona (14), and Infantis (13).

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Table 1. *Salmonella* serotypes reported in two or more sectors (human, food, abattoir, animal) in BC, 2016

Serotype	Locally-acquired human infections	Food				Abattoir		Animal							Total	
		Fresh Chicken	Chicken Nuggets	Pork	Shrimp	Turkey	Chicken	Cattle	Chicken ¹	Domestic Duck/Goose	Exotic /Zoo ²	Swine	Turkey ³	Wildlife ⁴		Other ⁵
Enteritidis	402	54	17	1		13	25		325	37	1	1	1	22	4	903
Kentucky		23	4				3		221							251
Typhimurium	39		1		1			5	20			2		5		73
Infantis	26	11	2			3	1		21			1		1	1	67
Hadar	8	1				8			2	8			33			60
Heidelberg	21		7			1	1	6	6	1						43
4,5,12:i:-	17								5			1	1		1	25
Braenderup	5						1		13							20
Agona	3											14				17
Liverpool							1		15				1			17
Senftenberg						2			6				5			13
Berta	3					2			2				1			8
Anatum	3								1				3			7
Mbandaka	2	2							3							7
Reading	2					5										7
Schwarzengrund		5				1			1							7
Thompson	4	1	2													7
Worthington						1			2			2	1			6
Brandenburg	4												1			5
Give	1								2							3
Rissen	1			1								1				3
Other	61	4	1			1	2	6	38		6	2	2		1	124
Total	602	101	34	2	1	37	34	17	683	46	7	10	63	28	8	1673

1. Samples taken from on -farm chickens and their environments. These include 158 diagnostic isolates, 452 environmental isolates taken from chicken hatcheries/farms, and 73 CIPARS/FoodNet Canada farm isolates (pre-harvest only).
2. Exotic/Zoo includes 5 snakes, 1 iguana, and 1 mouse.
3. The turkey isolates include 21 diagnostic isolates and 42 CIPARS/FoodNet Canada farm isolates (pre-harvest only).
4. Wildlife includes 20 birds (6 songbirds, 10 game birds, 4 birds of prey), 6 land mammals (2 rabbits/hares, 3 mice, 1 squirrel), and 2 marine mammals.
5. Other animals include 1 cat, 1 horse, 2 sheep, 4 minks.

Salmonella Enteritidis

BC has been experiencing an *S. Enteritidis* outbreak since 2008. This outbreak continued in 2016, where the BC human incidence (15.0/100,000) was similar to 2015 and notably higher than incidence reported between 2001-2007 which ranged between 2.9-7.0/100,000 population. In 2016, there were 6 *S. Enteritidis* human clusters of illness investigated between March and July. Five of them were reported in the lower mainland and one in the Interior. Four were associated with food service establishments, one with a daycare and one with a residential facility. Eggs were reported as the likely source in three of them, and ungraded eggs were identified in two investigations. Chicken meat was identified as the suspected source in two of them and the source was unknown for one investigation.

The incidence of human *S. Enteritidis* in BC is notably higher than the national average (Figure 1). The trends seen in the national incidence are the same as seen in BC over time, suggesting that the rates of *S. Enteritidis* in BC are likely having an impact on the overall national incidence.

In 2016, 72.4% of locally-acquired human cases of *S. Enteritidis* reported consumption of chicken meat, 64.2% reported consumption of eggs and 10.1% reported live poultry contact in the three days prior to onset of symptoms. Further analysis of human *S. Enteritidis* reported between 2014-2016 identified that cases were more likely to consume chicken meat than the healthy population (76% of cases vs 69% of controls, $p < 0.001$) and more likely to consume eggs than the healthy population (69% of cases vs 54% of controls, $p < 0.001$). Enteritidis cases were also more likely to have had contact with live poultry than the healthy population (11% of cases vs 3% of controls, $p < 0.001$). (1)

S. Enteritidis continues to be the most commonly detected serotype of *Salmonella* in poultry meat (i.e., chicken, turkey and chicken nuggets), in samples taken from chicken at abattoirs, and in samples from on-farm chickens and their environments. There have been similar trends over time in the human and chicken meat (Figure 2), suggesting an association between the level of *S. Enteritidis* contamination in chicken meat and human disease rates.

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Figure 1. *Salmonella* Enteritidis human incidence (all), Canada vs. BC, 2008-2016

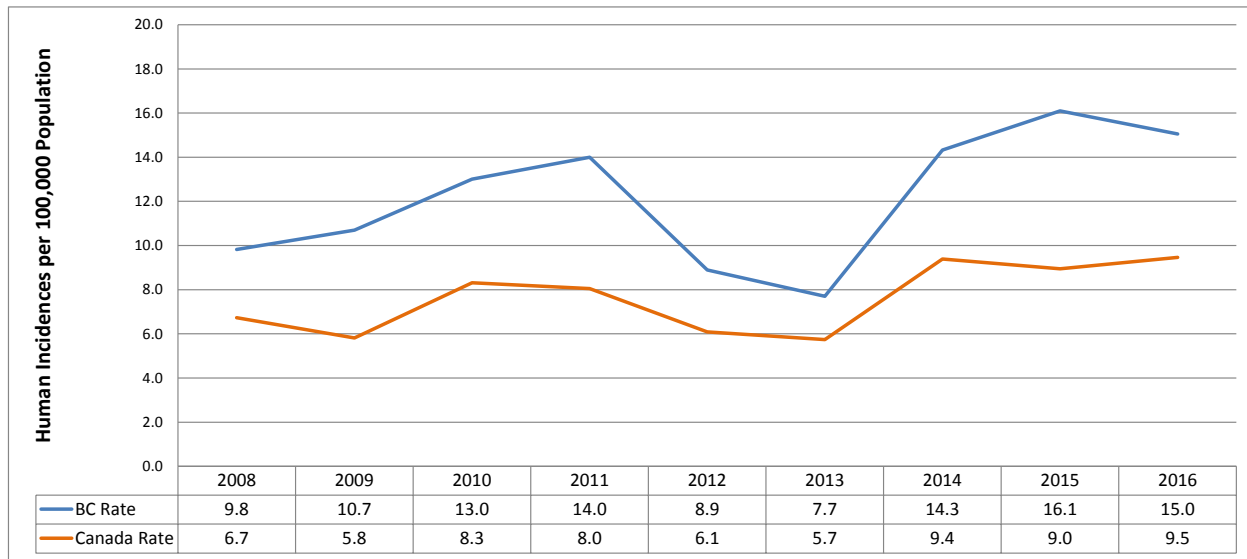
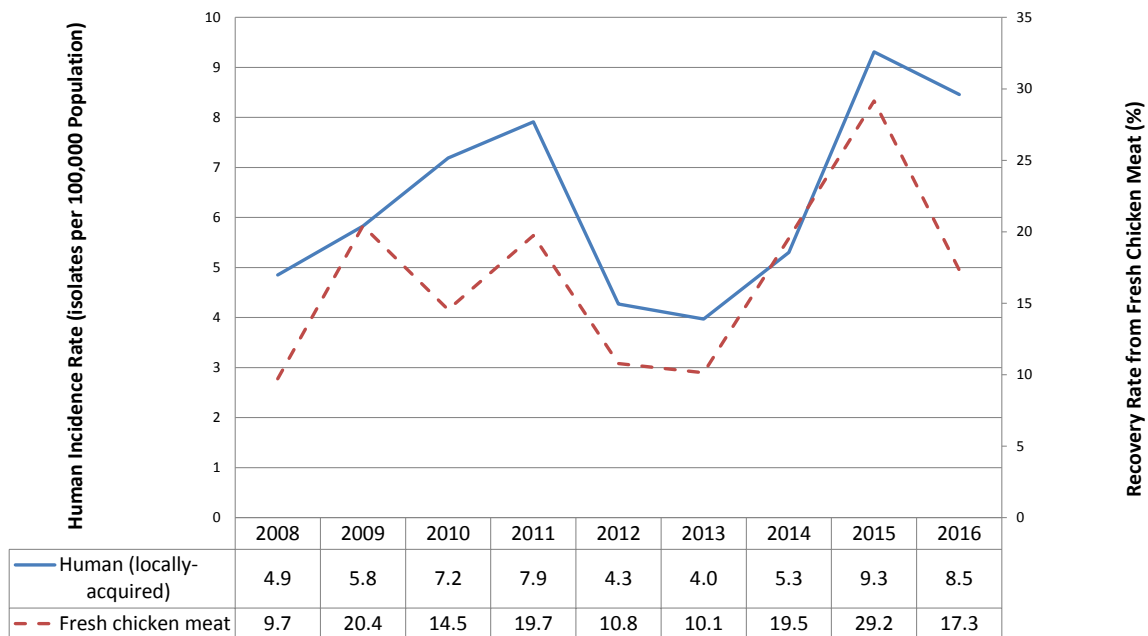
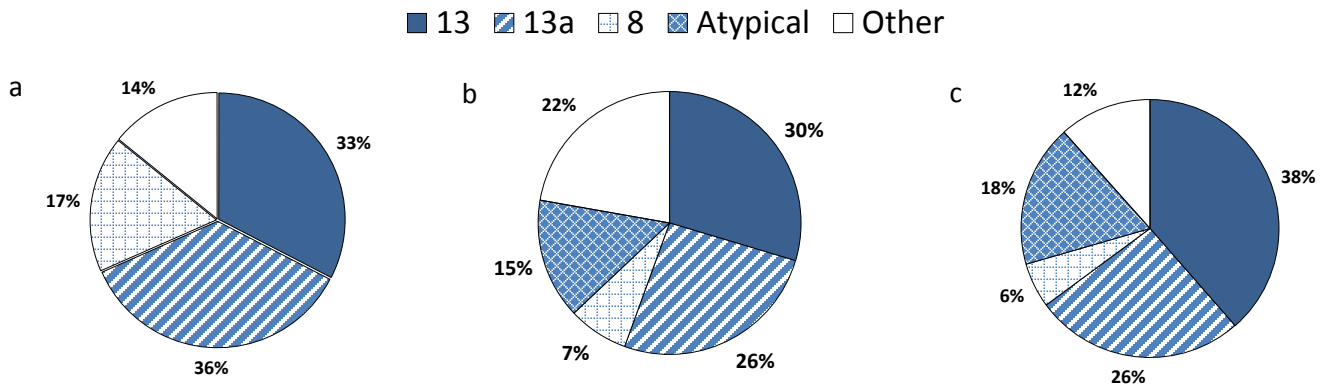


Figure 2. *Salmonella* Enteritidis human incidence (locally-acquired) and recovery rate from chicken meat, BC, 2008-2016



S. Enteritidis isolates are characterized into distinct strains, called phage types (PTs). The PTs most frequently identified in human infections in 2016 were the same as those identified in chicken meat and on-farm chickens and their environments: PTs 13 and 13a (Figure 3). These PTs have been the most common since 2015. Further breakdown of the on-farm data into layer and broiler sectors is not currently possible. These results reinforce the close connection between human health, animal health and food safety in British Columbia.

Figure 3. *Salmonella* Enteritidis phage type distribution among locally-acquired human cases (a), chicken meat (b), and on-farm chickens and their environments (c), BC, 2016



- a. Locally-acquired human cases (N=402)
- b. Chicken meat (N=54)
- c. On-farm chickens and their environments (N=325)

Other interesting trends

Salmonella Heidelberg

S. Heidelberg was the sixth most common serotype, with a total of 43 isolates; 21 from locally-acquired human cases, 8 from food, 1 from abattoir and 13 from animals (Table 1). As in previous years, the majority of the food *S. Heidelberg* isolates were from chicken nuggets (n=7; 88%).

In animals and food products from animals, *S. Heidelberg* in BC and across Canada is most commonly identified in chickens and chicken meat. In general, *S. Heidelberg* is less common in BC than in other parts of Canada (Table 2). For the first time in BC (at least since 2007), *S. Heidelberg* was detected in cattle and represented 35% of all *Salmonella* from cattle in the province in 2016.

It is possible that the lower proportion of *S. Heidelberg* in BC chicken is in part due to the high levels of *S. Enteritidis* in BC.

Table 2: Number (%) of 2016 *Salmonella* isolates from chicken sources that were *S. Heidelberg*

	Animal - Diagnostic	Animal - Farm	Abattoir	Food
BC	1 (<1%)	73 (5%)	34 (3%)	225 (3%)
Canada (excluding BC) (2)	12 (31%)	26 (14%)	10 (12%)	33 (8%)

Salmonella 4,5,12:i:-

S. 4,5,12:i:- was the seventh most common serotype reported in two or more sectors in 2016. There was a total of 25 isolates; 17 from locally-acquired human cases and 8 from animals (Table 1). Five (62.5%) of the animal isolates were from chicken. Strains are not typically compared across sectors because PFGE is conducted on human isolates of *S. 4,5,12:i:-* and PT is conducted on animal or food isolates.

An outbreak of human *S. 4,5,12:i:-* occurred in 2016. Four human cases with the same PFGE pattern were reported between November 2015 and March 2016. All of them had pet cats or dogs and all of them used pet food containing raw meat. This was a higher proportion than expected compared to healthy population controls, where the exposure to raw pet food is 4.8% (p<0.001) (3). Three of the four pet foods included raw chicken but there was no common pet food brand or chicken source among all four cases.

Conclusion

Ongoing monitoring across sectors is important in order to assess changes and trends in *Salmonella* strains over time to improve our knowledge about *Salmonella* across the farm to fork continuum in BC.

The current model of integrated surveillance in BC continues to be a good platform for data sharing, integration and analysis across human, food and animal sectors for *Salmonella*. Successful surveillance depends on a strong and supported network of individuals and agencies. The connectivity among partners in this system supports surveillance of *Salmonella* and sharing of data and information.

Identification of new data sources and partnerships will help to provide a more complete and representative picture of *Salmonella* in BC.

References:

1. *Salmonella* Enteritidis in British Columbia. Provincial Control Strategy. *Salmonella* Enteritidis Working Group. July 27, 2017.
2. Canadian Integrated Program for Antimicrobial Resistance Surveillance and FoodNet Canada. 2016
3. Public Health Agency of Canada. Foodbook Report. 2015. <https://www.canada.ca/content/dam/canada/health-canada/migration/healthy-canadians/publications/eating-nutrition/foodbook-2015/alt/pub-eng.pdf>