

FOODNET CANADA SHORT REPORT 2015



PROTECTING AND EMPOWERING CANADIANS TO IMPROVE THEIR HEALTH



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TO PROMOTE AND PROTECT THE HEALTH OF CANADIANS THROUGH LEADERSHIP, PARTNERSHIP,
INNOVATION AND ACTION IN PUBLIC HEALTH.

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INTRODUCTION

The Public Health Agency of Canada's (PHAC) FoodNet Canada (FNC) integrated enteric pathogen surveillance system is based on a sentinel site surveillance model, which collects information on cases of infectious gastrointestinal illness and sources of exposure within defined communities. These data are analyzed to assist in determining what food and other sources are making Canadians ill and to accurately track disease with time. FNC's primary objectives are to (1) determine what food and other sources are making Canadians ill; (2) determine significant risk factors for enteric illness; (3) accurately track disease rates and risks over time; (4) provide practical prevention information to prioritize risks, compare interventions, direct actions, advance policy, and assess effectiveness of food safety activities and public health interventions and measure performance.

In 2015, the PHAC FNC surveillance system consisted of three sentinel sites; the Ontario (ON) site in the Middlesex-London Health Unit (MLHU) (FNC site period: Aug 2014–ongoing); the Alberta (AB) site in the Calgary and Central Zones of Alberta Health Services (AHS) (FNC site period: Jun 2014–ongoing); as well as the British Columbia (BC) site in the Fraser Health Authority (FHA) of lower mainland British Columbia (FNC site period: April 2010–ongoing). For the purpose of yearly comparisons in this report, non-human data (2006–Mar 2014) from the ON pilot sentinel site (Region of Waterloo) have been included. In each sentinel site, enhanced human disease surveillance is performed in parallel with active surveillance of enteric pathogens in retail, animals and water sources.

This report presents the preliminary findings from the 2015 surveillance year across all sentinel sites. To be nationally representative, PHAC's FNC is designed to have five sites encompassing approximately 10% of the Canadian population. Note that FNC data need to be considered in the context of three active sentinel sites. This report will be followed by a comprehensive annual report, which will include more extensive analyses of temporal trends and subtyping information for an integrated perspective on enteric disease from exposure to illness.

For further information about FNC or FNC's sampling methodologies, please contact:
phac-FoodNet.Canada-aspc@phac-aspc.gc.ca

Integration with PHAC's Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

PHAC's CIPARS monitors trends and the relationship between antimicrobial use and antimicrobial resistance in selected bacterial organisms from human, animal, and food sources across Canada to inform evidence-based policy decision making to contain the emergence and spread of resistant bacteria. Efforts have been ongoing towards better integrating PHAC's FNC and CIPARS. This includes the streamlining and sharing of sampling and sampling sites, retrospective and prospective testing of antimicrobial resistance in selected bacteria isolated from FNC samples, and improving data management mechanisms to maximize data linkages. For further information about CIPARS, please refer to the program's website (www.phac-aspc.gc.ca/cipars-picra/index-eng.php).

HUMAN CASE SUMMARY

The enhanced human disease surveillance component of PHAC's FNC is fully active in all three sentinel sites: BC, AB and ON. The FNC program was officially launched in the AB site in June 2014 and in the new ON site in August 2014. Since only partial year data are available for the ON and AB sites in 2014, comparisons were not made between the 2015 and 2014 rates for these sites.

PHAC's FoodNet Canada cases are classified into one of five groups - Endemic, Travel, Outbreak, Non-Endemic or Lost to Follow-Up (LTF):

Endemic cases: Reported cases of infection that are considered sporadic and domestically acquired (i.e., within Canada).

Travel-related cases: Reported sporadic cases that have travelled outside of Canada prior to onset of illness and the travel time overlapped with the expected disease incubation period (varies depending on the pathogen).

Outbreak-related cases: Reported cases found to be associated with a sudden increased occurrence of an infectious disease and whose illnesses are confirmed through a public health partner (AB, BC and ON sites) on the basis of laboratory and/or epidemiological evidence. This classification includes both domestically-associated outbreak cases and international travel-associated outbreak cases.

Non-endemic cases: Includes immigration-related cases where illness was acquired outside of Canada.

Lost to Follow-up (LTF): Reported cases that could not be followed-up with an interview by public health.

In 2015, campylobacteriosis, salmonellosis and giardiasis were the most commonly reported enteric diseases in FNC sentinel sites (Table 1).

Travel continues to be an important factor in the burden of enteric disease. In 2015, approximately 25% of all cases of enteric disease were associated with travel outside of Canada.

In 2015, a total of 47 outbreak-associated cases were reported in the sites: 33 *Salmonella* cases, 10 Verotoxigenic *E. coli* (VTEC) cases, two *Campylobacter* cases and one case each of *Shigella* and *Cyclospora*. Of the 47 outbreak-associated cases, two cases were associated with international travel.

TABLE 1: Disease-specific annual incidence rates (new cases/100,000 person-years) in the ON, AB, and BC sites in 2015 compared with 2014, and 2014 National Notifiable Disease incidence rates where available

		ON Site	AB Site	BC Site			National
		2015	2015	2014	2015		2014
		Incidence Rate	Incidence Rate	Incidence Rate	Incidence Rate	Incidence Rate Ratio ^a	Incidence Rate
Amoebiasis ^b	Total	2.73		0.00	0.00	.	--
	Endemic	1.26		0.00	0.00	.	
	Travel	0.63		0.00	0.00	.	
	Outbreak	0.00		0.00	0.00	.	
	Non-Endemic	0.00		0.00	0.00	.	
	LTF	0.84		0.00	0.00	.	
Campylobacteriosis	Total	20.34	24.97	36.13	32.10	0.89	28.44
	Endemic	10.07	15.85	24.59	21.90	0.89	
	Travel	5.24	5.25	8.34	6.38	0.76	
	Outbreak ⁱ	0.42	0.00	0.00	0.00	.	
	Non-Endemic	0.00	0.00	0.21	0.00	.	
	LTF	4.61	3.86	2.99	3.83	1.28	
Cryptosporidiosis	Total	3.57	3.86	1.92	1.70	0.88	2.50
	Endemic	1.89	2.58	1.50	0.85	0.57	
	Travel	1.26	0.99	0.43	0.64	1.49	
	Outbreak	0.00	0.00	0.00	0.00	.	
	Non-Endemic	0.00	0.00	0.00	0.00	.	
	LTF	0.42	0.30	0.00	0.21	.	
Cyclosporiasis	Total	1.68	0.20	1.28	1.28	0.99	0.65
	Endemic	0.21	0.00	0.21	0.00	.	
	Travel	1.26	0.20	0.86	1.28	1.49	
	Outbreak	0.21	0.00	0.21	0.00	.	
	Non-Endemic	0.00	0.00	0.00	0.00	.	
	LTF	0.00	0.00	0.00	0.00	.	
Giardiasis	Total	10.91	10.70	9.83	10.21	1.04	10.26
	Endemic	5.87	4.46	5.56	5.53	0.99	
	Travel	1.68	3.47	2.99	2.34	0.78	
	Outbreak	0.00	0.00	0.00	0.00	.	
	Non-Endemic	0.42	2.08	0.00	0.85	.	
	LTF	2.94	0.69	1.28	1.49	1.16	

		ON Site	AB Site	BC Site			National
		2015	2015	2014	2015		2014
		Incidence Rate	Incidence Rate	Incidence Rate	Incidence Rate	Incidence Rate Ratio ^a	Incidence Rate
Listeriosis	Total	0.00	0.10	0.64	0.00	.	0.41
	Endemic	0.00	0.10	0.64	0.00	.	
	Travel	0.00	0.00	0.00	0.00	.	
	Outbreak	0.00	0.00	0.00	0.00	.	
	Non-Endemic	0.00	0.00	0.00	0.00	.	
	LTF	0.00	0.00	0.00	0.00	.	
Salmonellosisc ^{c,d}	Total	16.78	27.65	33.57	28.49	0.85	21.45
	Endemic	10.49	16.05	20.95	17.43	0.83	
	Travel	5.45	6.34	7.27	6.59	0.91	
	Outbreak	0.84	2.48	2.14	0.85	0.40	
	Non-Endemic	0.00	0.30	0.00	0.43	.	
	LTF	0.00	2.48	3.21	3.19	0.99	
Shigellosis	Total	0.84	2.28	3.42	3.83	1.12	2.21
	Endemic	0.00	0.40	1.07	1.28	1.19	
	Travel	0.42	1.68	1.92	1.49	0.77	
	Outbreak	0.00	0.00	0.21	0.21	0.99	
	Non-Endemic	0.00	0.00	0.00	0.00	.	
	LTF	0.42	0.20	0.21	0.85	3.98	
Verotoxigenic <i>E. coli</i> (VTEC)	Total	1.89	4.36	2.35	2.76	1.18	1.82
	Endemic	1.26	2.58	2.14	2.34	1.09	
	Travel	0.21	0.69	0.21	0.43	1.99	
	Outbreak	0.42	0.79	0.00	0.00	.	
	Non-Endemic	0.00	0.00	0.00	0.00	.	
	LTF	0.00	0.30	0.00	0.00	.	
Yersiniosis ^e	Total	1.05	1.98	5.56	5.74	1.03	--
	Endemic	0.42	1.29	3.63	4.68	1.29	
	Travel	0.42	0.40	0.86	0.64	0.75	
	Outbreak	0.00	0.00	0.00	0.00	.	
	Non-Endemic	0.00	0.00	0.00	0.00	.	
	LTF	0.21	0.30	1.07	0.43	0.40	

		ON Site	AB Site	BC Site			
		2015	2015	2014	2015		
Total Case Counts	Total	285	768	443	405		
	Endemic	150	437	282	254		
	Travel	79	192	107	93		
	Outbreak	9	33	12	5		
	Non-Endemic	2	24	1	6		
	LTF	45	82	41	47		

NOTE 1: Population estimates obtained from the Ontario Ministry of Health and Long-Term Care, Population Projections 2015, IntelliHEALTH Ontario for the ON site; the BC Ministry of Finance and Corporate Relations, BC Stats, Population Extrapolation for Organizational Planning with Less Error (P.E.O.P.L.E.), 2014–2015, for the BC site; and Alberta Health Services (2015 population data) for the AB site. National 2014 data from Canadian Notifiable Disease Surveillance System (CNDSS), Surveillance and Epidemiology Division, Centre for Communicable Diseases and Infection Control, PHAC (2014).

NOTE 2: · = Not applicable

^a A value of 1 indicates no change in disease incidence rate; a value <1 indicates a decrease in disease incidence rate; a value >1 indicates an increase in disease incidence rate (2015 vs 2014). Significant differences from 1 are as follows: *** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ based on measures of association between 2015 and 2014 (Fisher's exact test). Calculated using non-rounded incidence rates.

^b Amoebiasis is reported as *Entamoeba histolytica/dispar* by the ON site and as *Entamoeba histolytica* by the BC site (Data collection began October 2014). In the BC site, lab testing is conducted on preserved stool to determine if presumptive positive for *histolytica/dispar*. To confirm species (i.e. *histolytica*), an antigen test is conducted on unpreserved stool, often requiring the case to resubmit a specimen. Given low submission rates, confirmed counts may be underrepresented. The AB site does not report on Amoebiasis. Amoebiasis is not nationally notifiable.

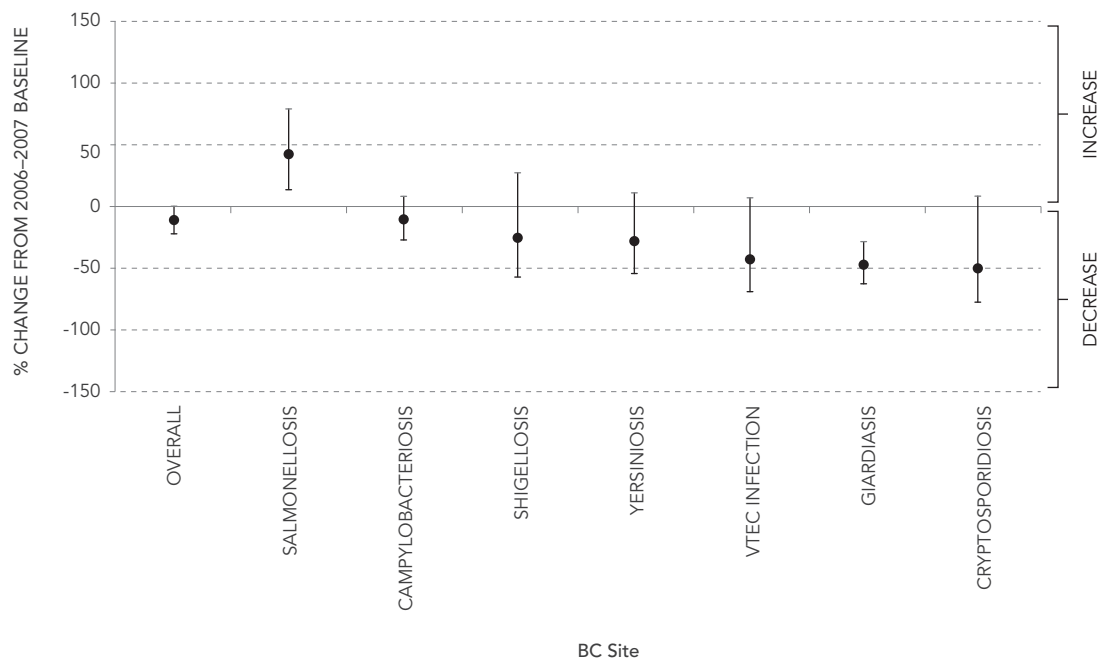
^c Typhi and Paratyphi (except Paratyphi B var Java) not reported by AB site.

^d Salmonellosis includes non-typhoid salmonellosis only for CNDSS data.

^e AB site does not follow-up with *Yersinia Intermedia* cases.

It is also important to monitor longer-term disease trends over time when the historic data are available. The data were available for the BC site which includes all cases (endemic, travel, outbreak, non-endemic, and those lost to follow-up). The incidence rate of salmonellosis showed a statistically significant increase (43%) in 2015 compared with the 2006–2007 rate (Figure 1). The incidence rate of giardiasis showed a statistically significant decrease (48%) in 2015 compared with the 2006–2007 rate.

FIGURE 1: Estimated percent change (with 95% confidence interval) in annual incidence rates of reportable enteric disease cases^a in the BC site in 2015, compared with the average annual incidence rate during 2006–2007, by pathogen



NOTE: Changes are not statistically significant if zero is within the estimate's 95% confidence interval; changes are statistically significant if zero is not within the confidence interval. Baseline 2006–2007 data from the BC site was provided by the FHA.

^a Listeriosis was not included due to low case counts.

RETAIL COMPONENT

Retail foods are recognized as an important source of human exposure to enteric pathogens. Core surveillance activities monitor the presence of major pathogens in retail chicken and beef on an annual basis. Targeted surveillance focuses on select items that are considered to be likely sources of human exposure, and may differ from year to year. In 2015, the targeted surveillance included chicken nuggets, fresh berries and fresh herbs.

Core Surveillance Activities

ON Site

In 2014, retail sampling concluded at the end of March in the pilot ON site (Region of Waterloo), while sampling in the new site (MLHU) began in July. In 2015 sampling took place in the new ON site all year. In 2015, *Campylobacter* was the most commonly found pathogen on chicken breasts (40%, 54/135), followed by *Salmonella* spp. (19%, 26/135) and *Listeria monocytogenes* (13%, 17/135) (Table 2). In ground beef, *Listeria monocytogenes* was the most commonly found pathogen (20%, 27/135) with both VTEC (2.2%, 3/135) and *Salmonella* (1.5%, 2/135) following at a relatively low prevalence. There was no significant difference in the prevalence for any of the pathogens between 2014 and 2015 when both ON sites are combined. However, within the new ON site, there was a significant increase in *Listeria monocytogenes* prevalence in ground beef in 2015 (25%, 16/63) compared with 2014 (9.5%, 6/63) between July to December ($P = 0.03$).

TABLE 2: Pathogen detection on retail meat samples collected in the ON sites (combined), 2014 and 2015

PATHOGENS TESTED	SKINLESS CHICKEN BREAST		GROUND BEEF	
	2014 ^{a†} (n=96)	2015 (n=135)	2014 ^{a†} (n=96)	2015 (n=135)
	percent positive (number positive)			
<i>Campylobacter</i>	49% (47)	40% (54)	.	0% (0)
<i>Salmonella</i>	21% (20)	19% (26)	.	1.5% (2)
VTEC	.	.	2.1% (2)	2.2% (3)
<i>Listeria monocytogenes</i>	17% (16)	13% (17)	13% (12)	20% (27)

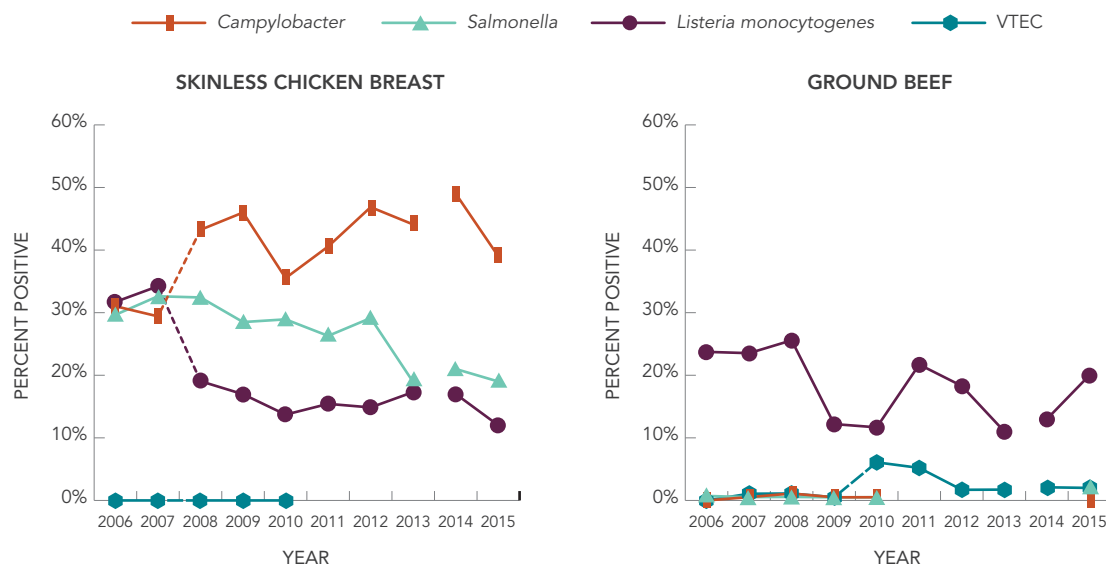
. Not Tested.

^a In 2014, samples were collected in ON from the pilot site from January to March as well as the new site from July to December.

[†] Reference group.

*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared to the reference group (Fisher's exact test).

FIGURE 2: Yearly distribution of pathogen contamination on retail meat in the ON sites, 2006 to 2015



NOTE: Dashed lines indicate a laboratory or sampling method change. All data from 2006 to 2013 are from the pilot ON site and capture the whole year. In 2014 there was a site change in ON; the pilot ON site was sampled from January to March and the new ON site was sampled from July to December, representing only partial year data for each ON site.

BC Site

Retail sampling was implemented in BC in January 2011 and has been ongoing ever since. In 2015, *Campylobacter* was the most commonly found pathogen on chicken breasts (43%, 58/135), followed by *Salmonella* spp. (33%, 45/135,) and *Listeria monocytogenes* (18%, 24/135) (Table 3). No significant differences in the prevalence of any of the pathogens on the chicken breasts were observed when comparing 2015 with 2014. In 2015, *Listeria monocytogenes* was the most prevalent pathogen found on ground beef (35%, 47/129), while no *Campylobacter* was detected. *Salmonella* and VTEC were identified on ground beef at relatively low prevalence. A significantly higher prevalence of *Listeria monocytogenes* in ground beef samples was observed in 2015 compared with 2014.

TABLE 3: Pathogen detection on retail meat samples collected in the BC site, 2014–2015

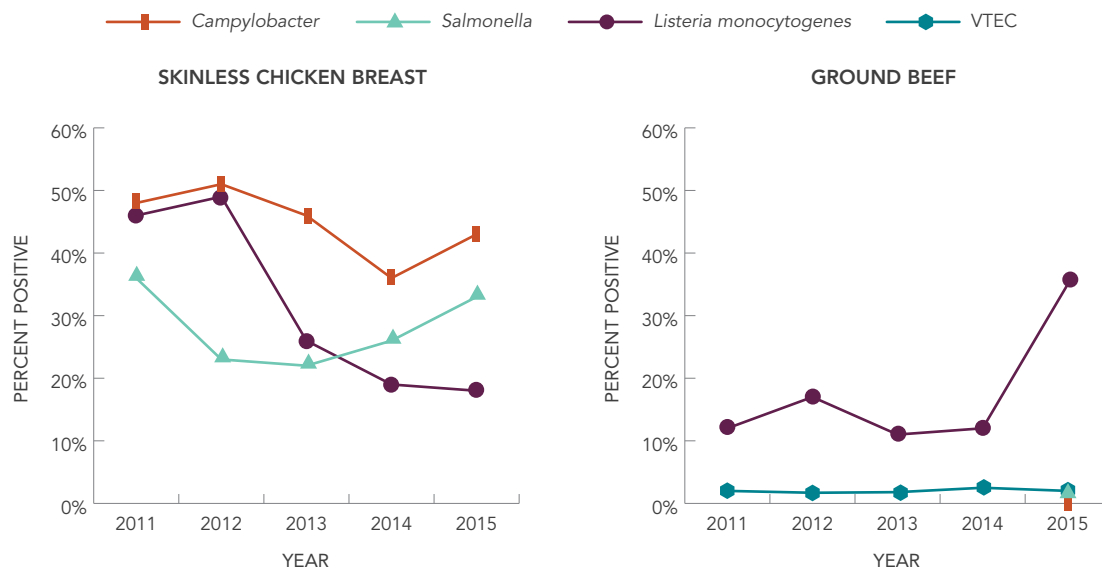
PATHOGENS TESTED	SKINLESS CHICKEN BREAST		GROUND BEEF	
	2014 [†]	2015 (n=135)	2014 [†]	2015 (n=129)
	percent positive (number positive)			
<i>Campylobacter</i>	36% (44/121)	43% (58/135)	.	0% (0/129)
<i>Salmonella</i>	26% (32/123)	33% (45/135)	.	1.5% (2/129)
VTEC	.	.	2.5% (3/122)	1.6% (2/129)
<i>Listeria monocytogenes</i>	19% (23/123)	18% (24/135)	12% (15/123)	35% (47/129)***

Not Tested

[†] Reference group.

*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared to the reference group (Fisher's exact test).

Prevalence of *Listeria monocytogenes* on retail chicken breasts significantly decreased in 2013 in comparison to 2012, remaining stable at this level over the last few years (Figure 3). In comparison, despite having a significant drop in prevalence between 2011 and 2012, the prevalence of *Salmonella* detected on chicken breasts has been slowly increasing since 2013. Among ground beef samples, VTEC prevalence has remained stable while a significant increase in *Listeria monocytogenes* was observed in 2015 compared to 2014.

FIGURE 3: Yearly distribution of pathogen contamination on retail meat samples collected in the BC site, 2011 to 2015

AB Site

Retail sampling began in the AB site in May 2014 (Table 4) and continued throughout 2015. In 2015, *Campylobacter* was the most commonly found pathogen on chicken breasts (38%, 49/130), followed by *Salmonella* (17%, 22/130) and *Listeria monocytogenes* (12%, 15/130). In ground beef, *Listeria monocytogenes* was the most commonly isolated pathogen (31%, 41/132) with all other pathogens occurring with a relatively low prevalence. There was a significant increase in *Listeria monocytogenes* isolated in ground beef samples in 2015 compared with 2014.

TABLE 4: Pathogen detection on retail meat samples collected in the AB site, 2014 and 2015

PATHOGENS TESTED	SKINLESS CHICKEN BREAST		GROUND BEEF	
	2014 [†] (n=79)	2015 (n=130)	2014 [†] (n=78)	2015 (n=132)
	percent positive (number positive)			
<i>Campylobacter</i>	47% (37)	38% (49)	.	0.8% (1)
<i>Salmonella</i>	15% (12)	17% (22)	.	2% (3)
VTEC	.	.	0% (0)	3% (4)
<i>Listeria monocytogenes</i>	11% (9)	12% (15)	9.0% (7)	31% (41)***

. Not Tested

[†] Reference group. Data was collected in 2014 for May to December only.

*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared to the reference group (Fisher's exact test). Only May to December months in 2015 are used so that the estimates are comparable between the two years.

Targeted Retail Surveillance

RETAIL MEAT

In 2015, raw/uncooked frozen chicken nuggets continued to be sampled as part of the targeted retail meat surveillance in all sites. Frozen chicken nuggets sampled were labelled “Raw” or “Uncooked” and included chicken strips and nuggets (including breaded filets, processed meats or shaped meats, but excluding burgers).

ON Site

In 2015, *Salmonella* was the most commonly found pathogen on chicken nuggets (23%, 31/135). There were no significant differences found in the prevalence of either *Salmonella* or *Listeria monocytogenes* on chicken nuggets in 2015 compared with 2014 (Table 5).

TABLE 5: Pathogen detection in frozen chicken nuggets collected in the ON site, 2014 to 2015

PATHOGENS TESTED	CHICKEN NUGGETS	
	2014 ^{a†} (n=96)	2015 (n=135)
	percent positive (number positive)	
<i>Salmonella</i>	28% (27)	23% (31)
<i>Listeria monocytogenes</i>	16% (15)	12% (16)

[†] Reference group (new ON site only and using the same months of sampling as in 2014, see footnote “a”).

*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared with the reference group (Fisher's exact test).

^a In 2014 samples were collected in ON from the pilot site from January to March as well as the current site from July to December.

BC Site

Salmonella was the most commonly found pathogen on chicken nuggets (34%, 46/135) and comparing 2014 and 2015 there were no significant differences in the prevalence of either *Salmonella* or *Listeria monocytogenes* on this product (Table 6).

TABLE 6: Pathogen detection in frozen chicken nuggets collected in the BC site, 2014 to 2015

PATHOGENS TESTED	CHICKEN NUGGETS	
	2014 [†] (n=123)	2015 (n=135)
	percent positive (number positive)	
<i>Salmonella</i>	28% (34)	34% (46)
<i>Listeria monocytogenes</i>	8.9% (11)	24% (19)

[†] Reference group.

*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared with the reference group (Fisher's exact test).

AB Site

Targeted sampling of frozen chicken nuggets began in May 2014 and continued throughout 2015. *Salmonella* and *Listeria monocytogenes* were found on 27% (35/132) and 17% (22/132) of samples, respectively (Table 7). Comparing 2014 and 2015, there were no significant differences in the prevalence of either *Salmonella* or *Listeria monocytogenes* on this product (Table 7).

TABLE 7: Pathogen detection on frozen chicken nuggets collected in the AB site, 2014–2015

PATHOGENS TESTED	CHICKEN NUGGETS	
	2014 ^{†, a} (n=78)	2015 (n=132)
	percent positive (number positive)	
<i>Salmonella</i>	29% (23)	27% (35)
<i>Listeria monocytogenes</i>	23% (18)	17% (22)

[†] Reference group.

^a In 2014 samples were collected from May to December.

PRODUCE

In 2015, a variety of fresh berries (e.g., raspberries, blueberries, blackberries etc.) and fresh herbs (e.g., parsley, dill, mint etc.) were collected from retail stores in all sentinel sites and tested for parasites, viruses, and bacteria (Table 8). In 2011, fresh berries were collected from the pilot ON site and BC, while in 2012 fresh herb samples were collected from these same two sites. In 2015, 100 berry samples (12 domestic, 84 imported, 4 unknown origin) and 110 herb samples (14 domestic, 68 imported, 28 unknown origin) were collected and tested in the ON site, 100 berry samples (6 domestic, 94 imported) and 110 herb samples (31 domestic, 74 imported, 5 unknown origin) in the BC site, and 100 berry samples (7 domestic, 90 imported, 3 unknown origin) and 112 herb samples (19 domestic, 74 imported, and 19 unknown origin) in the AB site. There were no positive samples among products labelled 'domestic'.

A significant decrease in *Giardia* isolated from soft berries was seen in 2015 compared to 2011 (Table 8). A significant decrease in both *Giardia* and norovirus was also seen in fresh herbs in 2015 compared to 2012. Among the fresh berry samples, only one sample was found to be positive for *Cryptosporidium* (0.3%, 1/300). *Cyclospora* (0.3%, 1/332) and Hepatitis A (1.1%, 1/91) were the only organisms found among the herb samples collected. Since the parasites and viruses were all tested using PCR methodology, the viability of these detected pathogens and the subsequent potential risk to consumers, is unknown.

TABLE 8: Pathogen detection on fresh berries and fresh herbs in all sites (ON, BC, and AB), 2015

PATHOGEN TESTED ^a	BERRIES		HERBS	
	2011 ^{b,†} (n=599)	2015 ^a (n=300)	2012 ^{b,†} (n=598)	2015 ^a (n=332)
	percent positive (number positive)			
<i>Cryptosporidium</i>	0.33% (2)	0.34% (1)	0% (0)	0% (0)
<i>Giardia</i>	9.0% (54)	0 % (0) ^{***}	1.0% (6)	0% (0) [*]
<i>Cyclospora</i>	1.0% (6)	0% (0)	0% (0)	0.3% (1)
Norovirus	0.50% (3)	0% (0)	1.3% (8)	0% (0) [*]
Rotavirus	0.17% (1)	0% (0)	0% (0)	0% (0)
Hepatitis A	.	0% (0)	.	1.1% (1)
Hepatitis E	.	0% (0)	.	0% (0)
<i>Listeria monocytogenes</i>	.	0% (0)	.	0% (0)

^a Samples testing positive in 2015—for *Cryptosporidium*: 1 raspberry sample (BC); *Cyclospora*: 1 dill sample (BC); Hepatitis A: 1 mint sample (AB).

^b In 2011 and 2012 berries and herbs, respectively, were only sampled in the pilot ON site and BC.

[†] Reference group.

^{***} $P \leq 0.01$, ^{**} $0.01 < P \leq 0.05$, ^{*} $0.05 < P \leq 0.1$ indicate statistically significant estimates compared with the reference group (Fisher's exact test).

AGRICULTURAL COMPONENT

Farms represent environmental and food-chain exposure sources of enteric pathogens. Farms are sampled by veterinarians throughout the year in conjunction with the CIPARS program with the aim of sampling approximately 30 farms within each site per commodity per year for FNC. In 2015, broiler chicken, swine, and turkey farms were sampled. For the broiler chicken and turkey farms, four fresh pooled manure samples were collected from each flock from different areas of the same barn. Both broiler chicken and turkey flocks were sampled within one week of transport for slaughter. Swine farms had a total of six fresh pooled samples from different pens collected per farm. Results are presented at the individual sample-level and at the farm-level to account for within-farm differences (some pathogens may be found at different prevalence rates within each farm and this may impact any comparisons based only on their sample-level results).

ON Site

In 2015 in ON, manure from broiler chickens and swine in the new site was collected and tested for *Campylobacter* (broiler chickens only) and *Salmonella* (broiler chickens and swine) (Table 9 and 10). Due to an avian influenza outbreak in ON in 2015, broiler chicken sampling was delayed until August. In 2014 in ON, broiler chicken sampling took place in the pilot site from January to March and in the new site from August to December. However, for comparison purposes, only the broiler chicken samples collected in 2014 from the new site are included here. Swine sampling took place all year in both 2014 and 2015 in ON. There was a significant increase in the prevalence of *Campylobacter* in broiler chicken manure at the sample-level in 2015 compared with 2014 and a significant decrease in the prevalence of *Salmonella* in swine manure at the sample-level in 2015 (Table 9). There were no significant differences at the farm-level in 2015 (Table 10). However, it is interesting to note that there appears to be more clustering at the farm-level in broilers than in swine.

TABLE 9: Pathogen detection (sample-level) in manure from farms in the ON site, 2014 and 2015

PATHOGENS TESTED	BROILER CHICKENS ^a		SWINE	
	2014 [†] (n=52)	2015 (n=88)	2014 [†] (n=156)	2015 (n=150)
	percent positive (number positive)			
<i>Campylobacter</i>	7.7% (4)	24% (21)**	.	.
<i>Salmonella</i>	31% (16)	45% (40)	39% (61)	29% (43)*

· Not Tested.

[†] Reference group.*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared with the reference group (Fisher's exact test).^a In 2014 and 2015 broiler chicken samples were collected in the new ON site from August to December.**TABLE 10:** Pathogen detection (farm-level) in manure from farms in the ON site, 2014 and 2015

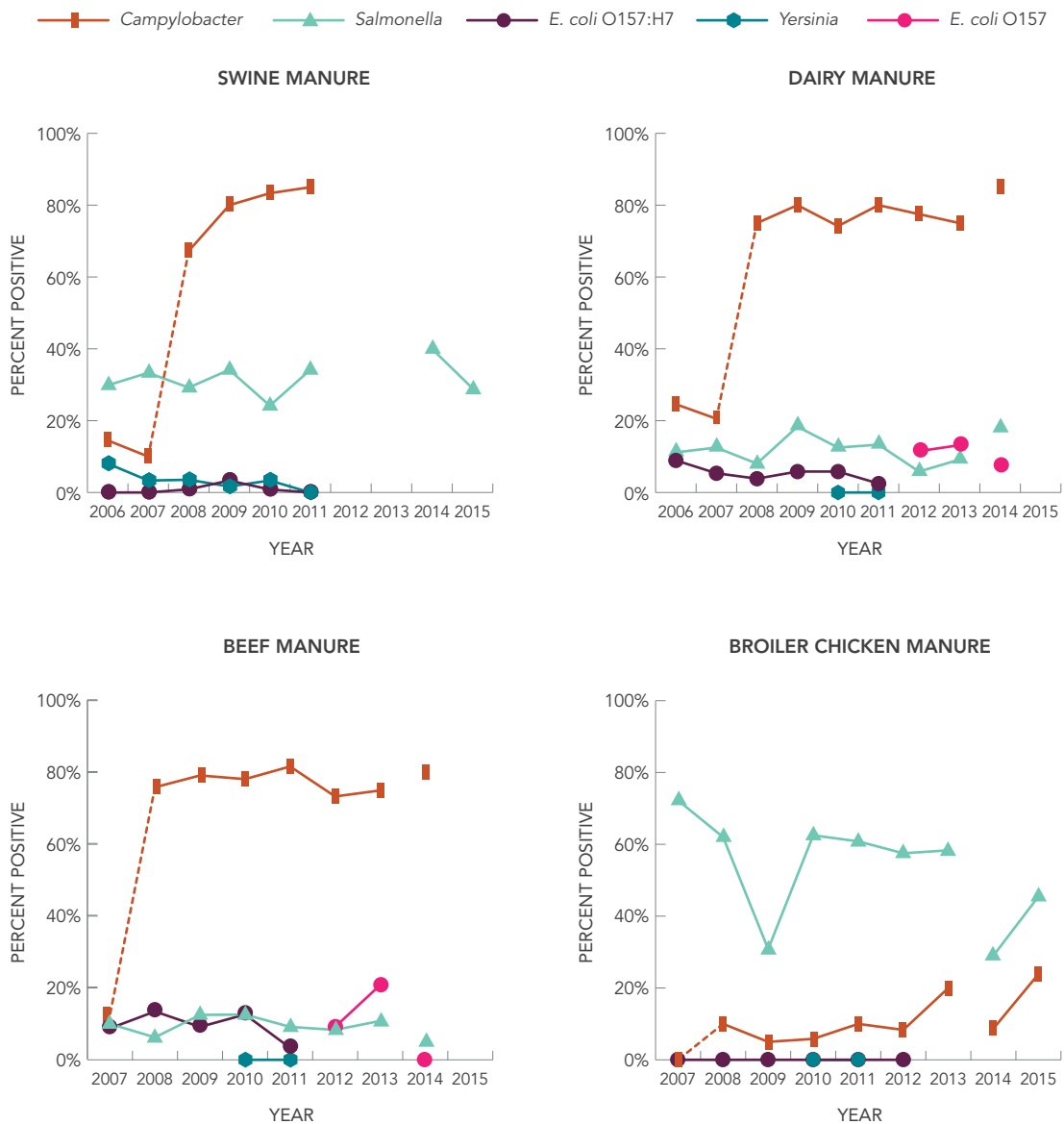
PATHOGENS TESTED	BROILER CHICKENS ^a		SWINE	
	2014 [†] (n=13)	2015 (n=22)	2014 [†] (n=26)	2015 (n=25)
	percent positive (number positive)			
<i>Campylobacter</i>	7.7% (1)	27% (6)	.	.
<i>Salmonella</i>	38% (5)	59% (13)	62% (16)	44% (11)

· Not Tested.

[†] Reference group.*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared with the reference group (Fisher's exact test).^a In 2014 and 2015 broiler chicken samples were collected in the new ON site from August to December.

It is difficult to interpret trends in 2015 due to the change of site in 2014 (Figure 4). However, the prevalence of some of the pathogens in 2015 appears similar to those seen in previous years. Dairy and beef were not sampled in ON in 2015 but are included here for reference.

FIGURE 4: Pathogen detection (sample-level) in manure from farms in the ON site, 2006 to 2015



NOTE: Dashed lines indicate a laboratory or sampling method change. All data from 2006 to 2013 are from the pilot ON site. In 2014, there was a site change in ON; the pilot ON site was sampled from January to March for beef, broiler chickens, and dairy and the new ON site was sampled from August to December for broiler chickens and all year for swine. In 2015, the new ON site was sampled from August to December for broiler chickens and all year for swine. Beef and dairy were not sampled in ON in 2015.

BC Site

In the BC site in 2015, manure from broiler chickens and turkey was collected and tested for *Campylobacter* and *Salmonella*, as in previous years (Table 11 and 12). However, due to an avian influenza outbreak in BC in 2015, both broiler chicken and turkey sampling was not initiated until September 2015. In 2014, broiler chicken and turkey samples were collected throughout the year. In turkey, there was a significant increase at the sample-level in the prevalence of both *Campylobacter* and *Salmonella* in 2015 compared with 2014 (Table 11). However, this increase may be due to a seasonal effect, particularly for *Campylobacter*, as in previous years FNC has often found *Campylobacter* prevalence in broiler chickens to be highest in the fall and this may be similar for turkey (2013 FNC Annual Report). When results from 2015 are compared with the same months in 2014 (September to December), the difference in prevalence is no longer significant for *Campylobacter*; however, the prevalence in 2014 remains similar for September to December (75%, 39/52) vs the entire year (73%, 85/116). *Salmonella* prevalence in turkey in 2014 for September to December is only 17% (9/52) vs 23%, (27/116) all year with a significant increase observed in 2015 relative to 2014 when the same months of 2014 are compared. At the farm-level, there was a significant increase in the prevalence of *Salmonella* in broiler chickens in 2015 compared with 2014, with almost all farms testing positive in 2015 (Table 12).

TABLE 11: Pathogen detection (sample-level) in manure from farms in the BC site, 2014 and 2015

PATHOGENS TESTED	BROILER CHICKENS		TURKEY	
	2014 [†] (n=116)	2015 ^a (n=100)	2014 [†] (n=116)	2015 ^a (n=120)
	percent positive (number positive)			
<i>Campylobacter</i>	22% (26)	25% (25)	73% (85)	86% (103)**
<i>Salmonella</i>	64% (74)	72% (72)	23% (27)	39% (47)**

[†] Reference group.

*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared with the reference group (Fisher's exact test).

^a In 2015 broiler chicken and turkey samples were collected in the BC site from September to December.

TABLE 12: Pathogen detection (farm-level) in manure from farms in the BC site, 2014 and 2015

PATHOGENS TESTED	BROILER CHICKENS		TURKEY	
	2014 [†] (n=30)	2015 ^a (n=25)	2014 [†] (n=29)	2015 ^a (n=30)
	percent positive (number positive)			
<i>Campylobacter</i>	27% (8)	28% (7)	79% (23)	90% (27)
<i>Salmonella</i>	73% (22)	92% (23)*	38% (11)	53% (16)

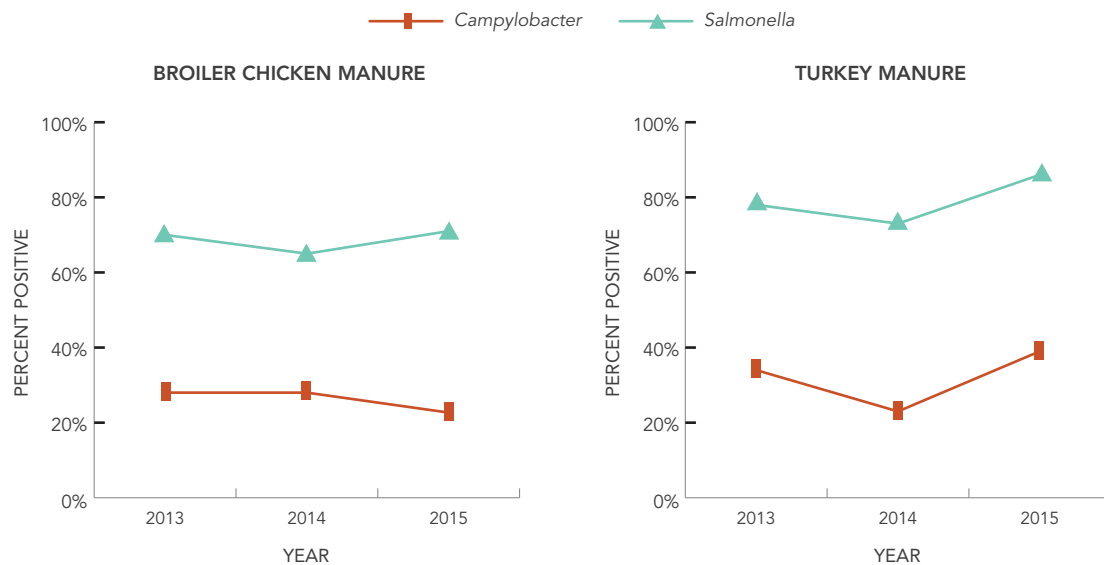
[†] Reference group.

*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared with the reference group (Fisher's exact test).

^a In 2015 broiler chicken and turkey samples were collected in the BC site from September to December.

2015 is the first year where data from the BC site has been presented in a temporal figure (Figure 5). Over the last three years, the prevalence of *Campylobacter* and *Salmonella* in both broiler chickens and turkey has been relatively stable.

FIGURE 5: Pathogen detection (sample-level) in manure from farms in the BC site, 2013 to 2015



AB Site

In 2015 in the AB site, manure from broiler chickens and swine was collected and tested for *Campylobacter* (broiler chickens only) and *Salmonella* (broiler chickens and swine) (Table 13 and 14). Both of these commodities were sampled all year. At the sample-level, the prevalence of both *Campylobacter* and *Salmonella* was significantly higher in broiler chickens in 2015 compared to 2014 (Table 13). However, at the farm-level, this increase was only significant for *Campylobacter* (Table 14). There was no significant increase or decrease at either the sample- or farm-level in swine. However, one interesting finding is that the prevalence of *Salmonella* in swine appears to be lower in the AB site than in the ON site. This difference between the sites may be due to factors such as the distance between herds, age of the barns and other herd management factors.

TABLE 13: Pathogen detection (sample-level) in manure from farms in the AB site, 2014 and 2015

PATHOGENS TESTED	BROILER CHICKENS		SWINE	
	2014 [†] (n=120)	2015 (n=120)	2014 [†] (n=108)	2015 (n=108)
	percent positive (number positive)			
<i>Campylobacter</i>	9.2% (11)	34% (41)***	.	.
<i>Salmonella</i>	37% (44)	52% (62)**	5.6% (6)	2.8% (3)

· Not Tested.

[†] Reference group.*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared with the reference group (Fisher's exact test).**TABLE 14:** Pathogen detection (farm-level) in manure from farms in the AB site, 2014 and 2015

PATHOGENS TESTED	BROILER CHICKENS		SWINE	
	2014 [†] (n=30)	2015 (n=30)	2014 [†] (n=18)	2015 (n=18)
	percent positive (number positive)			
<i>Campylobacter</i>	13% (4)	37% (11)*	.	.
<i>Salmonella</i>	57% (17)	77% (23)	5.6% (1)	17% (3)

· Not Tested.

[†] Reference group.*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared with the reference group (Fisher's exact test).

WATER COMPONENT

Surface and Irrigation Water

Water is another environmental source of enteric pathogens, through activities such as swimming or contamination of produce. In 2015, water samples were collected in all three sites. 2015 was the first year that water samples were collected in the new ON site. Surface water was collected approximately bi-weekly from six locations in the Ausable Bayfield Conservation Authority (a watershed adjacent to the new ON site) from July to November and tested for VTEC (Table 15).

TABLE 15: Pathogen detection in surface water samples in the ON site, 2015

PATHOGENS TESTED	SURFACE WATER	
	2015 (n=59)	
	percent positive (number positive)	
VTEC	39% (23)	

In BC in 2015, as in 2014, irrigation water was sampled from five locations in the Sumas and Matsqui watersheds approximately bi-weekly throughout the year and tested for *Campylobacter*, *Salmonella*, and VTEC (Table 16). In BC, with all locations combined, the prevalence of *Campylobacter* was significantly lower in 2015 compared with 2014 (Table 16).

TABLE 16: Pathogen detection in irrigation water samples in the BC site, 2014 and 2015

PATHOGENS TESTED	IRRIGATION CANALS/CREEKS	
	2014 [†]	2015
	percent positive (number positive/number tested)	
<i>Campylobacter</i>	38% (38/101)	21% (16/75)**
<i>Salmonella</i>	9.9% (10/101)	11% (8/75)
VTEC	28% (28/101)	24% (23/94)

[†] Reference group.

*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared with the reference group (Fisher's exact test).

In the AB site, irrigation water was collected approximately bi-weekly from 10 locations in the Western Irrigation District during the summer months (June to September in 2014 and June to August in 2015) and tested for *Campylobacter*, *Salmonella*, and VTEC (Table 17). In 2015, some of the samples were tested for *Campylobacter* using two different methods (in general, one method used 100mL of water while the other used 1L of water). Results from both of these methods combined are presented here. In the AB site, with all 10 locations combined, *Salmonella* was found to be significantly higher in 2015 compared with 2014 (Table 17).

TABLE 17: Pathogen detection in irrigation water samples in the AB site, 2014 and 2015

PATHOGENS TESTED	IRRIGATION CANALS/CREEKS	
	2014 [†] (n=48)	2015
	percent positive (number positive)	
<i>Campylobacter</i>	0% (0)	4.9% (2/41)
<i>Salmonella</i>	0% (0)	9.8% (4/41)**
VTEC	27% (13)	42% (14/33)

[†] Reference group.

*** $P \leq 0.01$, ** $0.01 < P \leq 0.05$, * $0.05 < P \leq 0.1$ indicate statistically significant estimates compared with the reference group (Fisher's exact test).

SUMMARY

2015 marks the 10th anniversary of PHAC's FoodNet Canada surveillance system. Over this time, PHAC's FNC has provided valuable information on enteric illness in Canada that has helped contribute in many different ways to food safety interventions and policy. With the expansion to three sites in 2014 and the continuation of this surveillance in 2015, PHAC is now able to provide even more information on some of the leading sources of food-borne illness in Canada.

According to FoodNet Canada data, in 2015, *Campylobacter*, *Salmonella*, and *Giardia* remained the most common causes of human enteric illness in the sentinel sites. Although travel was an important factor with many pathogens, the majority of campylobacteriosis and salmonellosis cases were endemic. For *Campylobacter*, *Salmonella*, and VTEC, the incidence for travel related cases were similar across the sites but the incidence for endemic cases was higher in the western sites.

When looking at longer term changes in rates, salmonellosis rates in 2015 were shown to be significantly higher than ten years ago in the BC site. According to PHAC's National Enteric Surveillance Program (NESP) data, *S. Enteritidis* (SE) is driving the higher rates of salmonellosis with 1955 cases of SE reported in 2009 in Canada compared to 3337 cases reported in 2014.¹ This increase in rates will be described further in FoodNet Canada's comprehensive annual report.

In retail samples in 2015, *Campylobacter* continued to be the most commonly found pathogen on skinless chicken breasts in all three sites (38–43% positive), followed by *Salmonella*, which had a significantly higher prevalence in the BC site (33%) compared to the ON (19%) and AB (17%) sites. For chicken nuggets, *Salmonella* was the most common pathogen with a significantly higher prevalence in the BC site, with 34% of samples testing positive, compared to the ON site (23%). One particularly notable finding in 2015 was the significantly higher levels of *Listeria monocytogenes* found on ground beef in all three sites compared with 2014, with up to 35% of samples now testing positive.

In produce, very few samples of fresh berries and herbs were positive for the pathogens of interest, suggesting a more limited contribution of these sources to human enteric illness in Canada.

On farm, *Salmonella* was once again found to be the most common pathogen in the broiler chickens, with a significantly higher prevalence in the BC site, with 72% of manure samples testing positive, compared to the ON (45%) and AB (52%) sites. In turkey, *Campylobacter* remained the most prevalent pathogen. The prevalence of *Salmonella* in swine manure samples varied across the two sites with available information with 2.8% positive from the AB site and 29% positive from the ON site. The prevalence of all pathogens at the farm-level was higher than at the sample-level in all commodities, which is important to note when deciding on management practices for the control of these pathogens on the farm.

¹ Government of Canada. National Enteric Surveillance Program Annual Summary 2014: Public Health Agency of Canada, Guelph, 2016

In water, VTEC was found to be the most common pathogen in the irrigation water samples from both BC and AB. The VTEC prevalence was also found to be similar in surface water from ON (where only VTEC was assessed). *Campylobacter* and *Salmonella* were also found in the irrigation water samples in 2015 in BC and AB. More research is needed to understand the impact on human health.

Continued surveillance of important enteric pathogens in PHAC's FNC three sentinel sites suggests that many of the sources tested remain important contributors to human illness. For example, poultry and poultry products appear to be important sources of both *Campylobacter* and *Salmonella* for humans. Environmental sources (e.g. surface water), could also have an impact on human enteric illness. Continued monitoring of potentially emerging issues, such as *Listeria monocytogenes* in ground beef, is also important. PHAC's FNC surveillance information continues to help protect Canadians and direct future food and water safety policies.

Special Update:

As *Salmonella* Enteritidis (SE) has been of increased concern in recent years, FNC implemented expedited subtyping of retail and on-farm samples in 2015 to provide more timely information. In 2015, the difference in rates of endemic salmonellosis across the sites was driven primarily by SE rates—3, 9 and 9/100,000 respectively for ON, AB and BC sites. SE prevalence in chicken manure at the farm level differed as well—0%, 8% and 27% respectively for ON, AB and BC sites. This was also reflected on chicken breasts at the retail level—1%, 8% and 23% respectively for ON, AB and BC sites. There was little difference on chicken nuggets at the retail level—9%, 12% and 14% respectively for ON, AB and BC sites. These data support national initiatives for pathogen reduction and identification of points of interventions which can vary across the sites.