FOODNET CANADA SHORT REPORT 2014



PROTECTING CANADIANS FROM ILLNESS

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FoodNet Canada acknowledges the significant investments made by our partners in all sentinel sites, our provincial and federal government agency colleagues, and academic and industry collaborators who help to make this program a continued success.

INTRODUCTION

FoodNet Canada (FNC) is an integrated enteric pathogen surveillance system 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) detect changes in trends in human enteric disease and levels of pathogen exposure from food, animal, and water sources in a defined population; (2) strengthen source attribution efforts in Canada by determining significant exposure factors for enteric illness; and (3) provide practical preventive information to prioritize risks, compare interventions and direct actions, and to assess the effectiveness of food safety programs and targeted interventions.

2014 was a transition year for FNC with the conclusion of sampling and enhanced human disease surveillance in the pilot Ontario (ON) site (the Region of Waterloo [ROW]) in March (FNC site period: Jun 2005–Mar 2014), the creation of a new ON site in the Middlesex-London Health Unit (MLHU) (FNC site period: Aug 2014-ongoing), and the expansion of FNC into Alberta (AB). The new AB site was created in the Calgary—East Central area of the province in coordination with Alberta Health Services (AHS) (FNC site period: Jun 2014–ongoing). Sampling in the Fraser Health Authority (FHA) of lower mainland British Columbia (BC) continued as usual in 2014 (FNC site period: April 2010-ongoing). In each sentinel site, enhanced human disease surveillance is performed in parallel with active surveillance of enteric pathogens in various exposure sources.

The purpose of this report is to present the preliminary findings from the 2014 surveillance year in all sentinel sites. To be nationally representative, FNC is designed to have five sites encompassing about 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 Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

Efforts have also been ongoing towards better integrating FNC and the Canadian Integrated Program for Antimicrobial Resistance Surveillance (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. 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. 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 of FNC has been fully implemented in the 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. FNC's pilot ON site officially concluded in March 2014. Therefore, results presented for the AB and ON sites only include partial year data and do not accurately reflect expected annual incidence rates due to seasonality and related practices and resulting impact on disease rates. In addition, the combined 2014 data for the ON site need to be interpreted with caution as the incidence rates do not accurately reflect the rates in one region during one year. The combined ON site incidence rates include data from FNC's pilot ON site from January to March and from FNC's new ON site from August to December. No data were collected from April to July. Comparisons, therefore, cannot be made among the sites for 2014.

In 2014, campylobacteriosis and salmonellosis were the most commonly reported enteric diseases in FoodNet Canada's sentinel sites (Table 1). The total overall incidence rate of salmonellosis, as well as sporadic, endemic salmonellosis, significantly increased in the BC site in 2014 compared to 2013.

Travel continues to be an important factor in the burden of enteric disease. In 2014, approximately 21% of all cases of enteric disease were associated with travel outside of Canada. However, since only partial year data were available for the AB and ON sites, this number is lower than typically reported by FNC. For example, periods of high travel may not have been captured given the time of year that the sites were implemented.

In 2014, a total of 76 outbreak-associated cases were reported: 25 *Salmonella* cases, 49 Verotoxigenic *E. coli* (VTEC) cases and 1 case each of *Cyclospora* and *Shigella*. Of the 76 outbreak-associated cases, four were associated with international travel. In the summer of 2014, FNC's new ON site identified a cluster of *Salmonella* Thompson cases and conducted a local investigation. Five FNC cases were linked to this outbreak.

In 2014, an *E. coli* O157:H7 outbreak was declared in AB. The source of the outbreak was linked back to contaminated pork products produced, distributed, and sold in AB. The *E. coli* contaminated products that were identified during investigation were removed from the market and do not present an ongoing risk. There were 119 cases confirmed as linked to this outbreak with 44 of these cases within the FNC AB site.

TABLE 1: Disease-specific annual incidence rates (new cases/100,000 person-years) in the ON, AB, and BC sites in 2014 compared with 2013, and 2013 National Notifiable Disease incidence rates where available

		ON Pilot Site	New ON Site	Combined	AB Site	BC Site			National
		2014 (Jan–Mar)	2014 (Aug–Dec)	2014 (Jan–Mar Aug–Dec)	2014 (Jun–Dec)	2013	2014		2013
		Incidence Rate	Incidence Rate	Incidence Rate	Incidence Rate	Incidence Rate	Incidence Rate	Incidence Rate Ratio[a]	Incidence Rate
Amoebiasis[b]	Total	1.45	7.50	4.93			0.00		--
	Endemic[c]	0.00	1.61	0.92			0.00		
	Travel[d]	0.73	2.68	1.85			0.00		
	Outbreak[e]	0.00	0.00	0.00			0.00		
	Non-Endemic[f]	0.00	0.54	0.31			0.00		
	LTF[g]	0.73	2.68	1.85			0.00		
Campylobacteriosis	Total	18.86	26.26	23.11	30.16	36.43	36.13	0.99	29.13
	Endemic	10.88	17.15	14.48	23.23	26.15	24.59	0.94	
	Travel	5.80	5.36	5.55	3.81	7.72	8.34	1.08	
	Outbreak	0.00	0.00	0.00	0.00	0.00	0.00	--	
	Non-Endemic	0.00	0.54	0.31	0.52	0.00	0.21	--	
	LTF	2.18	3.22	2.77	2.60	2.57	2.99	1.16	
Cryptosporidiosis	Total	1.45	2.14	1.85	4.68	1.29	1.92	1.50	2.36
	Endemic	0.00	1.61	0.92	3.47	0.86	1.50	1.75	
	Travel	1.45	0.00	0.62	1.04	0.43	0.43	1.00	
	Outbreak	0.00	0.00	0.00	0.00	0.00	0.00	--	
	Non-Endemic	0.00	0.00	0.00	0.00	0.00	0.00	--	
	LTF	0.00	0.54	0.31	0.17	0.00	0.00	--	
Cyclosporiasis	Total	0.00	0.00	0.00	0.00	0.43	1.28	2.99	0.42
	Endemic	0.00	0.00	0.00	0.00	0.00	0.21	--	
	Travel	0.00	0.00	0.00	0.00	0.43	0.86	2.00	
	Outbreak	0.00	0.00	0.00	0.00	0.00	0.21	--	
	Non-Endemic	0.00	0.00	0.00	0.00	0.00	0.00	--	
	LTF	0.00	0.00	0.00	0.00	0.00	0.00	--	
Giardiasis	Total	7.25	6.43	6.78	12.31	10.50	9.83	0.94	10.79
	Endemic	2.90	3.75	3.39	3.99	4.71	5.56	1.18	
	Travel	2.18	0.54	1.23	3.81	4.07	2.99	0.74	
	Outbreak	0.00	0.00	0.00	0.00	0.00	0.00	--	
	Non-Endemic	0.73	1.07	0.92	3.12	0.64	0.00	0.00	
	LTF	1.45	1.07	1.23	1.39	1.07	1.28	1.20	

		ON Pilot Site	New ON Site	Combined	AB Site	BC Site			National
		2014 (Jan–Mar)	2014 (Aug–Dec)	2014 (Jan–Mar Aug–Dec)	2014 (Jun–Dec)	2013	2014		2013
		Incidence Rate	Incidence Rate	Incidence Rate	Incidence Rate	Incidence Rate	Incidence Rate	Incidence Rate Ratio[a]	Incidence Rate
Listeriosis	Total	0.00	0.54	0.31	0.17	0.43	0.64	1.50	0.36
	Endemic	0.00	0.54	0.31	0.17	0.21	0.64	2.99	
	Travel	0.00	0.00	0.00	0.00	0.00	0.00	--	
	Outbreak	0.00	0.00	0.00	0.00	0.00	0.00	--	
	Non-Endemic	0.00	0.00	0.00	0.00	0.00	0.00	--	
	LTF	0.00	0.00	0.00	0.00	0.21	0.00	0.00	
Salmonellosis[h,i]	Total	25.38	19.83	22.19	22.01	14.14	33.57	2.37***	17.57
	Endemic	11.60	10.18	10.79	14.56	6.86	20.95	3.06***	
	Travel	10.88	3.22	6.47	3.64	5.57	7.27	1.30	
	Outbreak	0.73	4.29	2.77	1.04	0.43	2.14	4.99**	
	Non-Endemic	0.00	0.00	0.00	0.00	0.21	0.00	0.00	
	LTF	2.18	2.14	2.16	2.77	1.07	3.21	2.99**	
Shigellosis	Total	2.18	0.54	1.23	1.73	3.00	3.42	1.14	1.94
	Endemic	0.73	0.00	0.31	0.87	0.64	1.07	1.66	
	Travel	1.45	0.54	0.92	0.52	2.36	1.92	0.82	
	Outbreak	0.00	0.00	0.00	0.00	0.00	0.21	--	
	Non-Endemic	0.00	0.00	0.00	0.17	0.00	0.00	--	
	LTF	0.00	0.00	0.00	0.17	0.00	0.21	--	
Verotoxigenic *E. coli* (VTEC)	Total	1.45	2.14	1.85	11.79	4.29	2.35	0.55	1.80
	Endemic	1.45	2.14	1.85	2.43	3.21	2.14	0.67	
	Travel	0.00	0.00	0.00	0.69	0.64	0.21	0.33	
	Outbreak	0.00	0.00	0.00	8.49	0.43	0.00	0.00	
	Non-Endemic	0.00	0.00	0.00	0.00	0.00	0.00	--	
	LTF	0.00	0.00	0.00	0.17	0.00	0.00	--	
Yersiniosis[j]	Total	0.73	0.00	0.31	1.04	6.22	5.56	0.89	--
	Endemic	0.00	0.00	0.00	0.69	4.07	3.63	0.89	
	Travel	0.73	0.00	0.31	0.17	1.07	0.86	0.80	
	Outbreak	0.00	0.00	0.00	0.00	0.00	0.00	--	
	Non-Endemic	0.00	0.00	0.00	0.00	0.00	0.00	--	
	LTF	0.00	0.00	0.00	0.17	1.07	1.07	1.00	

		ON Pilot Site	New ON Site	Combined	AB Site	BC Site	
		2014 (Jan–Mar)	2014 (Aug–Dec)	2014 (Jan–Mar Aug–Dec)	2014 (Jun–Dec)	2013	2014
TOTAL CASE COUNTS	Total	81	122	203	484	358	443
	Endemic	38	69	107	285	218	282
	Travel	32	23	55	79	104	107
	Outbreak	1	8	9	55	4	12
	Non-Endemic	1	4	5	22	4	1
	LTF	9	18	27	43	28	41

NOTE: Population estimates for MLHU and ROW obtained from Ontario Ministry of Health and Long-Term Care, Population Projections 2014, IntelliHEALTH Ontario. Population estimates for FHA obtained from BC Ministry of Finance and Corporate Relations. BC Stats, P.E.O.P.L.E. 2013–2014 (Population Extrapolation for Organizational Planning with Less Error). Population estimates for AB obtained from Alberta Health Services (2014 population data). 2013 National data from Canadian Notifiable Disease Surveillance System (CNDSS), Surveillance and Epidemiology Division, Centre for Communicable Diseases and Infection Control, PHAC (2013).

[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 (2014 vs 2013). 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 2014 and 2013 (Fisher's exact test).

[b] Amoebiasis is reported as *Entamoeba histolytica/dispar* by the ON site and as *Entamoeba histolytica* by the BC site. Data collection began in October in the BC site. The AB site does not report on Amoebiasis.

[c] Endemic cases include reported cases of infection that occur sporadically within the sentinel site.

[d] Travel-related cases include individuals that have travelled outside of Canada in the relevant time frame before onset of illness.

[e] Includes domestically associated and international travel associated cases.

[f] Non-endemic includes immigration-related cases where illness was acquired outside of Canada.

[g] Lost To Follow-up (LTF) includes cases that could not be followed-up with an interview.

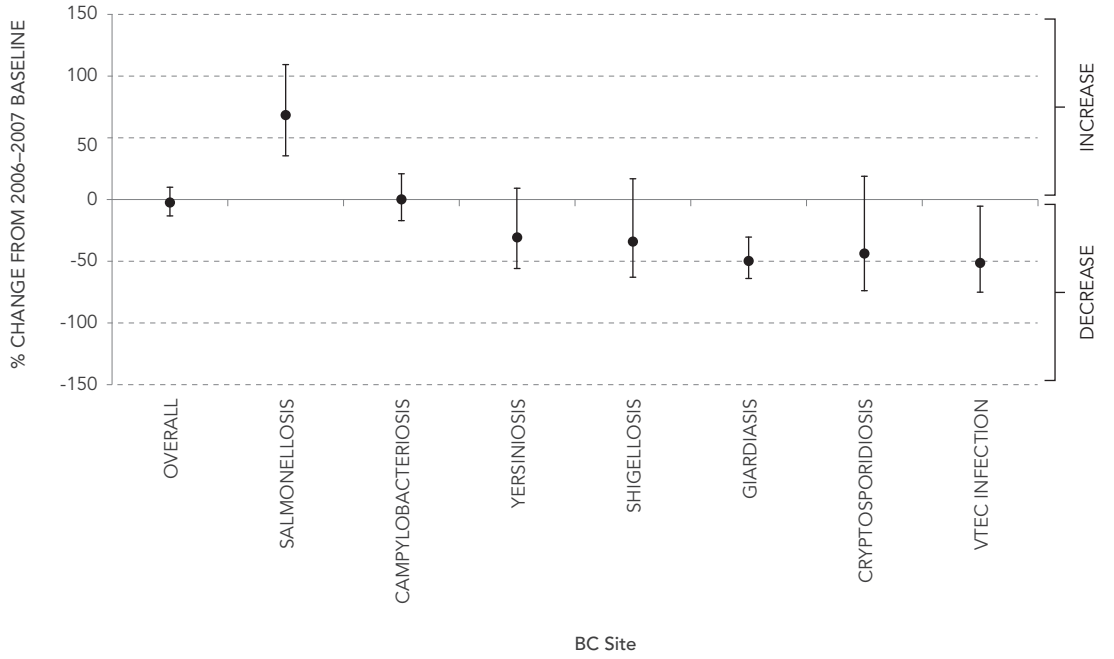
[h] Typhi and Paratyphi (except Paratyphi B var Java) not reported by AB site

[i] Salmonellosis includes non-typhoid salmonellosis only for CNDSS data.

[j] AB Site does not follow-up with *Yersinia* Intermedia cases.

It is also important to monitor longer-term disease trends with time. For the BC site, the data include all cases (endemic, travel, outbreak, non-endemic, and those lost to follow-up). The incidence rate of salmonellosis showed a statistically significant increase (68%) in 2014 compared with the 2006–2007 rates (Figure 1). The incidence rates of giardiasis and VTEC showed statistically significant decreases (50% and 51%, respectively) in 2014 compared with the 2006–2007 rates.

FIGURE 1: Estimated percent change (with 95% confidence interval) in annual incidence rates of reportable enteric disease cases[a] in the BC site in 2014, 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 food continues to be an important human exposure source for enteric pathogens. Core surveillance activities monitor retail chicken and beef for major pathogens every year. Targeted surveillance focuses on select items that are likely sources of human exposure, and may differ from year to year.

Core Surveillance Activities

ON Site

In 2014, retail sampling concluded in the pilot ON site, with sampling conducted until the end of March. Retail sampling began in the new ON site in July. In both sites, FNC sampled fresh skinless chicken breasts and ground beef from randomly selected grocery stores on a weekly basis.

In 2014, with results from both sites combined, *Campylobacter* was the most commonly found pathogen on chicken breasts (49%, 47/96), followed by *Salmonella* (21%, 20/96) and *Listeria monocytogenes* (17%, 16/96) (Table 2). In ground beef, *Listeria monocytogenes* and VTEC were found at a relatively low prevalence (13%, 12/96 and 2.1%, 2/96, respectively). These results are similar to what has been seen in the past (Figure 2).

TABLE 2: Pathogen detection on meat in the ON sites (combined), 2013 and 2014

PATHOGEN DETECTION ON RETAIL MEAT	SKINLESS CHICKEN BREAST		GROUND BEEF	
	2013† (n=85)	2014[a] (n=96)	2013† (n=84)	2014[a] (n=96)
	percent positive (number positive)			
Campylobacter	48% (41)	49% (47)	.	.
Salmonella	19% (16)	21% (20)	.	.
VTEC	.	.	1.6% (2)[b]	2.1% (2)
Listeria monocytogenes	19% (16)	17% (16)	9.5% (8)	13% (12)

· Not Tested

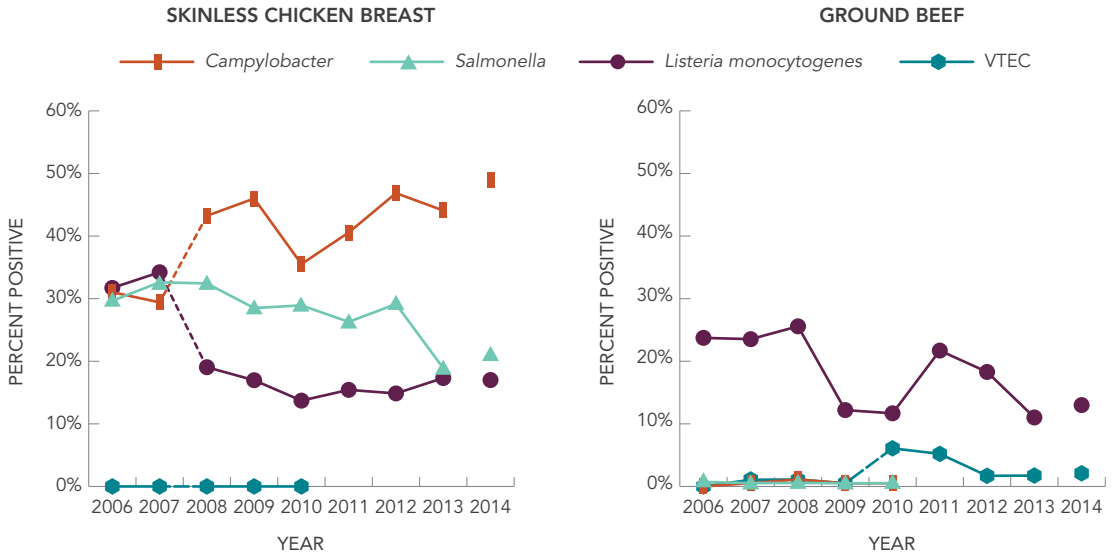
† Reference group (pilot ON site only and using the same months of sampling as in 2014, see footnote "a")

*** P ≤ 0.01, ** 0.01 < P ≤ 0.05, * 0.05 < P ≤ 0.1 indicate statistically significant estimates compared to 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 new site from July to December

[b] n=129

FIGURE 2: Yearly distribution of pathogen contamination on meat in the ON site, 2006 to 2014



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, and therefore is only partial year data.

BC Site

In 2014, *Campylobacter* was the most commonly found pathogen on chicken breasts (36%, 44/121), followed by *Salmonella* (26%, 32/123,) and *Listeria monocytogenes* (19%, 23/123) (Table 3). There was no significant difference in the prevalence of any of the pathogens on the chicken breast or ground beef in 2014 compared to 2013.

TABLE 3: Pathogen detection on meat in the BC site, 2013 and 2014

PATHOGEN DETECTION ON RETAIL MEAT	SKINLESS CHICKEN BREAST		GROUND BEEF	
	2013†	2014	2013†	2014
	percent positive (number positive/number tested)			
Campylobacter	46% (60/130)	36% (44/121)	.	.
Salmonella	23% (30/130)	26% (32/123)	.	.
VTEC	.	.	1.8% (3/168)	2.5% (3/122)
Listeria monocytogenes	26% (34/131)	19% (23/123)	11% (14/131)	12% (15/123)

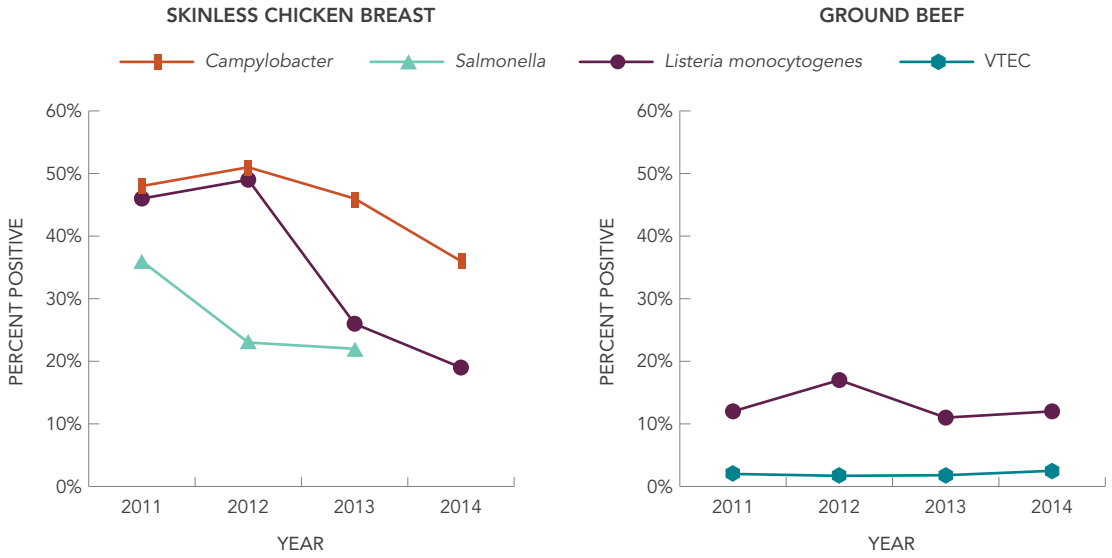
· Not Tested

† Reference group

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

Since sampling in the BC site began in January 2011, there has been a decreasing trend in the prevalence of *Campylobacter* and *Listeria monocytogenes* on chicken breasts (p≤0.05) (Figure 3). The prevalence of *Salmonella* on chicken breasts, and VTEC and *Listeria monocytogenes* in ground beef, appears to be fairly steady from 2011 to 2014.

FIGURE 3: Yearly distribution of pathogen contamination on meat in the BC site, 2011 to 2014



AB Site

Retail sampling began in the AB site in May 2014 (Table 4). Sampling and laboratory procedures were the same as in the other sites. Similar to the other sites, *Campylobacter* was the most commonly found pathogen on chicken breasts (47%, 37/79), followed by *Salmonella* (15%, 12/79) and *Listeria monocytogenes* (11%, 9/79). No VTEC was found in ground beef. Continued surveillance in this site will help to provide greater insight on long-term trends.

TABLE 4: Pathogen detection on meat in the AB site, 2014

PATHOGEN DETECTION ON RETAIL MEAT	SKINLESS CHICKEN BREAST	GROUND BEEF
	2014[a] (n=79)	2014[a] (n=78)
	percent positive (number positive)	
Campylobacter	47% (37)	.
Salmonella	15% (12)	.
VTEC	.	0% (0)
Listeria monocytogenes	11% (9)	9.0% (7)

· Not Tested

[a] In 2014, samples were collected from May to December

Targeted Retail Surveillance

Retail Meat

In 2014, the targeted retail meat surveillance sampled raw/uncooked frozen chicken nuggets[1] and fresh pork chops in all sites.

ON Site

In ON, chicken nuggets had previously been sampled in 2013 and pork chops in 2010. In 2014 *Salmonella* was the most commonly found pathogen on chicken nuggets (28%, 27/96). There were no significant differences found in the prevalence of either *Salmonella* or *Listeria monocytogenes* on chicken nuggets in 2014 compared to 2013 (Table 5). On pork chops in 2014, *Salmonella* and *Listeria monocytogenes* were found at a relatively low prevalence, and no *Campylobacter* was found. These results were not significantly different than those found in 2010.

TABLE 5: Pathogen detection in frozen chicken nuggets and pork chops in the ON sites (combined), 2010/2013 and 2014

PATHOGEN DETECTION ON RETAIL MEAT	CHICKEN NUGGETS		PORK CHOPS	
	2013† (n=67)	2014[a] (n=96)	2010† (n=146)	2014[a] (n=96)
	percent positive (number positive)			
Campylobacter	.	.	1.4% (2)	0% (0)[b]
Salmonella	36% (24)	28% (27)	2.1% (3)	1.0% (1)
Listeria monocytogenes	18% (12)	16% (15)	6.2% (9)	8.3% (8)

· Not Tested

† Reference group (pilot ON site only and using the same months of sampling as in 2014, see footnote "a")
*** P ≤ 0.01, ** 0.01 < P ≤ 0.05, * 0.05 < P ≤ 0.1 indicate statistically significant estimates compared to 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 new site from July to December

[b] n=95

BC Site

Sampling in the BC site continued throughout 2014. *Salmonella* was the most commonly found pathogen on chicken nuggets (28%, 34/123) and between 2013 and 2014 there were no significant differences in the prevalence of either *Salmonella* or *Listeria monocytogenes* on this product (Table 6). The pathogen prevalence on pork chops was relatively low.

[1] Frozen chicken nuggets sampled were labelled "Raw" or "Uncooked" and included chicken strips and nuggets (including breaded filets, processed meats or shaped meats, but excluded burgers).

TABLE 6: Pathogen detection in frozen chicken nuggets and pork chops in the BC site, 2013 and 2014

PATHOGEN DETECTION ON RETAIL MEAT	CHICKEN NUGGETS		PORK CHOPS
	2013† (n=87)	2014 (n=123)	2014 (n=123)
	percent positive (number positive)		
Campylobacter	.	.	0% (0)
Salmonella	30% (26)	28% (34)	0.81% (1)
Listeria monocytogenes	17% (15)	8.9% (11)	3.3% (4)

· Not Tested

† Reference group

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

AB Site

Targeted meat sampling began in May in the AB site alongside the core surveillance activities. On chicken nuggets, *Salmonella* was found on 29% (23/78) of samples and *Listeria monocytogenes* was found on 23% (18/78) of samples (Table 7). The pathogen prevalence on pork chops, as in the other sites, was quite low.

TABLE 7: Pathogen detection on frozen chicken nuggets and pork chops in the AB site, 2014

PATHOGEN DETECTION ON RETAIL MEAT	CHICKEN NUGGETS	PORK CHOPS
	2014[a] (n=78)	2014[a] (n=78)
	percent positive (number positive)	
Campylobacter	.	0% (0)
Salmonella	29% (23)	0% (0)
Listeria monocytogenes	23% (18)	6.4% (5)

· Not Tested

[a] In 2014, samples were collected from May to December

Produce

In 2014, a variety of fresh-cut fruit (i.e., any fresh fruit that has been processed [cut, washed] before the time of purchase) were collected from retail stores in all sentinel sites and tested for parasites, viruses, and bacteria (Table 8). This is the first time FNC has sampled fresh-cut fruit. There was no *Cyclospora*, rotavirus, hepatitis A, or hepatitis E found on the fresh cut fruit in any of the sites. The other pathogens tested were found at very low levels with 1.4% of samples positive for *Cryptosporidium* (6/431), and 0.23% positive for *Giardia* (1/431), norovirus (1/431), and *Listeria monocytogenes* (1/431). Since the parasites and viruses were all tested using PCR methodology, the viability of *Cryptosporidium*, *Giardia*, and norovirus, and the subsequent potential risk to consumers, is unknown.

Packages of fresh-cut fruit were often not clearly labelled with information regarding domestic or imported sources (Table 9). This information is therefore missing (unknown origin) for a number of the samples. In 2014, 130 samples (20 domestic, 19 imported, 91 unknown origin) were collected and tested in the ON site, 217 samples (2 domestic, 129 imported, 86 unknown origin) in the BC site, and 84 samples (0 domestic, 31 imported, 53 unknown origin) in the AB site. Where this information was recorded, the majority of the samples were imported. There were no positive samples among products labelled domestic and there were no significant differences between the pathogen prevalence on the imported versus the domestic products.

TABLE 8: Pathogen detection on fresh-cut fruit in all sites (ON, BC, and AB), 2014

PATHOGEN DETECTION ON FRESH CUT FRUIT	ALL SITES (n=431)
	percent positive (number positive/number tested)
Cryptosporidium	1.4% (6)
Giardia	0.23% (1)
Cyclospora	0% (0)
Norovirus	0.23% (1)
Rotavirus	0% (0)
Hepatitis A virus	0% (0)
Hepatitis E virus	0% (0)
Listeria monocytogenes	0.23% (1)

[a] 48 apple, 35 cantaloupe, 15 honeydew, 34 mango, 150 mixed fruits, 1 papaya, 1 peach, 94 pineapple, 2 pomegranate, 3 strawberry, 48 watermelon. Samples testing positive for *Cryptosporidium*: 1 apple (BC), 2 mixed fruits (ON), 2 pineapple (ON), 1 watermelon (ON); *Giardia*: 1 mixed fruits (BC); Norovirus: 1 watermelon (BC); *Listeria monocytogenes*: 1 mixed fruits (ON).

TABLE 9: Pathogen detection on fresh-cut fruit in all sites (ON, BC, and AB), imported, domestic, and unknown/mixed origin, 2014

PATHOGEN DETECTION ON FRESH CUT FRUIT	DOMESTIC† (n=22)	IMPORTED (n=179)	UNKNOWN/ MIXED ORIGIN (n=230)
	percent positive (number positive)		
Cryptosporidium	0% (0)	1.1% (2)	1.7% (4)
Giardia	0% (0)	0% (0)	0.43% (1)
Cyclospora	0% (0)	0% (0)	0% (0)
Norovirus	0% (0)	0.56% (1)	0% (0)
Rotavirus	0% (0)	0% (0)	0% (0)
Hepatitis A virus	0% (0)	0% (0)	0% (0)
Hepatitis E virus	0% (0)	0% (0)	0% (0)
Listeria monocytogenes	0% (0)	0% (0)	0.43% (1)

† Reference group

AGRICULTURE COMPONENT

Farms are environmental and food-chain exposure sources of enteric pathogens. Farms are sampled throughout the year by visiting two or three enrolled farms per commodity per month for a total of approximately 30 farms within each site per commodity per year. Three fresh pooled manure samples from different age groups of animals and one stored manure sample were collected at each beef and dairy visit. Four fresh pooled manure samples were collected from each broiler chicken and turkey flock from different areas of the barn. Swine farms had a total of six fresh pooled samples from different pens collected per farm. Broiler flocks were sampled within one week of transport for slaughter.

FNC exclusive farm sampling concluded at the end of March 2014. Now all FNC farm samples are collected in conjunction with the CIPARS program. In 2014, this enabled adding additional commodities to FoodNet Canada and allowed for the use of an entire year of farm results for some commodities. 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 2014 in ON, manure from dairy, beef, broiler chickens, and swine was sampled from the pilot and new site and tested for up to three pathogens (*Campylobacter*, *Salmonella*, and *E. coli* O157) (Table 10). There was a significant decrease in the level of *E. coli* O157 in beef and dairy manure in 2014. There was also a significant decrease in the level of *Salmonella* in broiler chicken manure in 2014 compared to 2013 and a significant increase in the level of *Salmonella* in dairy manure in 2014. There were no significant differences at the farm level in 2014 (Table 11). Due to the collection of farm samples from two different sites and from different time periods in ON in 2014, these results should be interpreted with caution.

TABLE 10: Pathogen detection from individual manure samples in the ON site, 2013 and 2014

PATHOGEN DETECTION ON FARMS	BEEF		BROILER CHICKENS		DAIRY		SWINE
	2013† (n=32)	2014[a] (n=40)	2013† (n=68)	2014[b] (n=92)	2013† (n=24)	2014[a] (n=40)	2014[c] (n=156)
	percent positive (number positive)						
Campylobacter	84% (27)	80% (32)	12% (8)	8.7% (8)	79% (19)	85% (34)	.
Salmonella	0% (0)	5.0% (2)	46% (31)	29% (27)**	0% (0)	18% (7)**	40% (62)
E. coli O157	9.4% (3)	0% (0)*	.	.	25% (6)	7.5% (3)*	.

· Not Tested

† Reference group (pilot ON site only and using the same months of sampling as in 2014, see footnotes "a-c")
*** P ≤ 0.01, ** 0.01 < P ≤ 0.05, * 0.05 < P ≤ 0.1 indicate statistically significant estimates compared to the reference group (Fisher's exact test)

[a] In 2014, beef and dairy samples were collected from the pilot ON site only from January to March

[b] In 2014, broiler chicken samples were collected from the pilot ON site from January to March, and in the new ON site from August to December

[c] In 2014, swine samples were collected in conjunction with the CIPARS program and are therefore from all of ON and for the entire year

TABLE 11: Pathogen detection at the farm level in the ON site, 2013 and 2014

PATHOGEN DETECTION ON FARMS	BEEF		BROILER CHICKENS		DAIRY		SWINE
	2013† (n=8)	2014[a] (n=10)	2013† (n=17)	2014[b] (n=23)	2013† (n=6)	2014[a] (n=10)	2014[c] (n=26)
	percent positive (number positive)						
Campylobacter	100% (8)	100% (10)	12% (2)	8.7% (2)	100% (6)	100% (10)	.
Salmonella	0% (0)	10% (1)	53% (9)	39% (9)	0% (0)	30% (3)	62% (16)
E. coli O157	13% (1)	0% (0)	.	.	33% (2)	10% (1)	.

· Not Tested

† Reference group (pilot ON site only and using the same months of sampling as in 2014, see footnote "a")
*** P ≤ 0.01, ** 0.01 < P ≤ 0.05, * 0.05 < P ≤ 0.1 indicate statistically significant estimates compared to the reference group (Fisher's exact test)

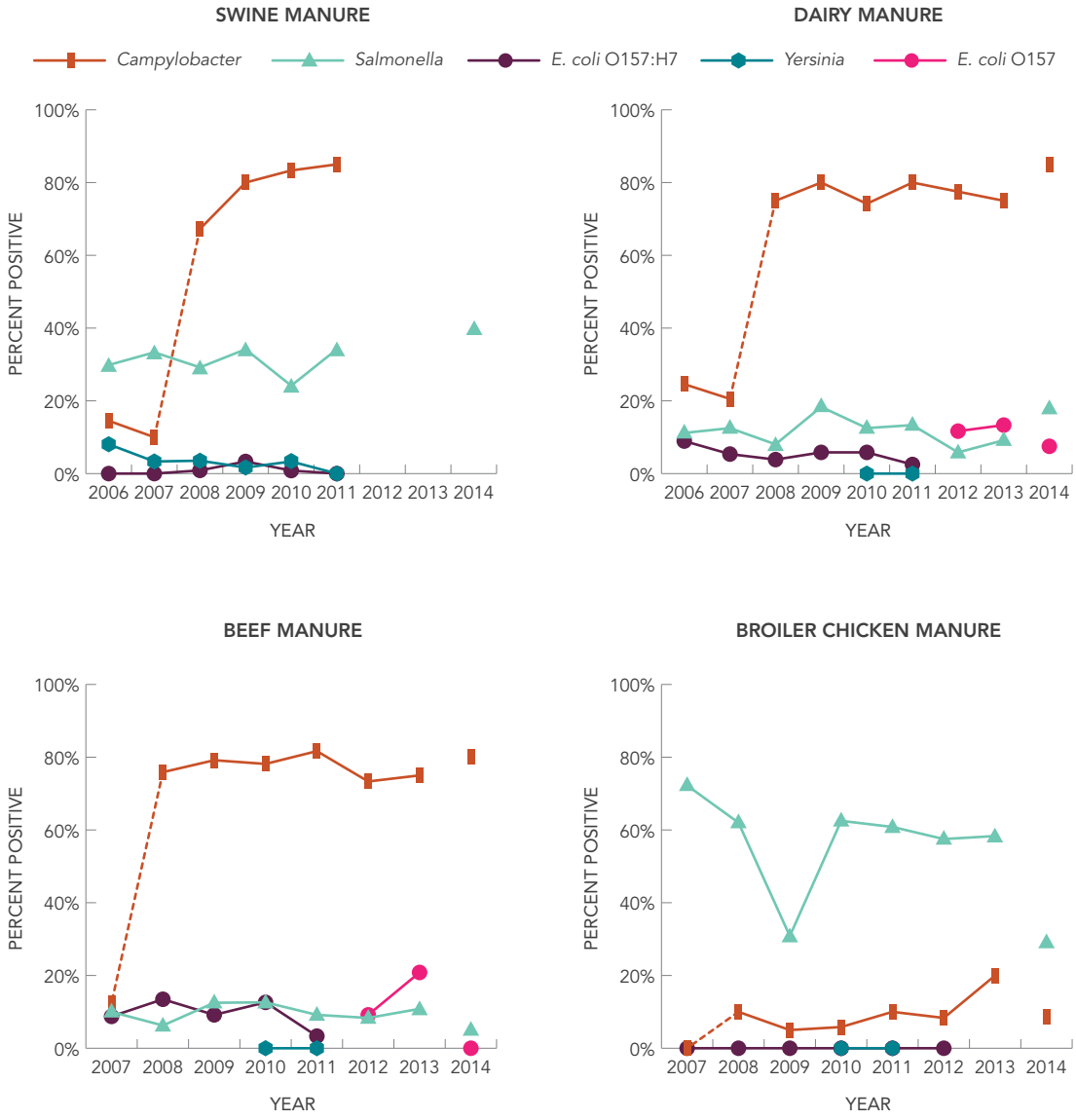
[a] In 2014, beef and dairy samples were collected from the pilot ON site only from January to March

[b] In 2014, broiler chicken samples were collected from the pilot ON site from January to March, and in the new ON site from August to December

[c] In 2014, swine samples were collected in conjunction with the CIPARS program and are therefore from all of ON and for the entire year

It is difficult to interpret trends in 2014 due to the change of site (Figure 4). However, the prevalence of some of the pathogens in 2014 appears similar to those previously seen from the pilot ON site only.

FIGURE 4: Pathogen detection (sample level) from manure samples in the ON site, 2006 to 2014



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 all year for swine and August to December for broiler chickens.

BC Site

In the BC site, collection continued as in 2013 (initiated April 2013) with manure from two commodity groups (broiler chickens and turkey) sampled for two pathogens (*Campylobacter* and *Salmonella*). The prevalence of *Campylobacter* and *Salmonella* in the broiler chicken and turkey manure in 2014 was similar to that found in 2013 at the individual sample and farm levels (Table 12 and 13). However, there was a slightly significant decrease in the prevalence of *Salmonella* in turkey manure at the sample level in 2014 compared to 2013 (23%, 27/116 and 35%, 39/112, respectively) (Table 12). This significant difference was not seen at the farm level.

TABLE 12: Pathogen detection from individual manure samples in the BC site, 2014

PATHOGEN DETECTION ON FARMS	BROILER CHICKENS		TURKEY	
	2013† (n=96)	2014 (n=116)	2013† (n=112)	2014 (n=116)
	percent positive (number positive)			
Campylobacter	28% (27)	22% (26)	79% (88)	73% (85)
Salmonella	71% (68)	64% (74)	35% (39)	23% (27)*

· Not Tested

† Reference group

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

TABLE 13: Pathogen detection at the farm level in the BC site, 2014

PATHOGEN DETECTION ON FARMS	BROILER CHICKENS		TURKEY	
	2013† (n=24)	2014 (n=29)	2013† (n=29)	2014 (n=29)
	percent positive (number positive)			
Campylobacter	42% (10)	24% (7)	79% (23)	79% (23)
Salmonella	79% (19)	72% (21)	62% (18)	38% (11)

· Not Tested

† Reference group

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

AB Site

Farm sampling was also initiated in the AB site in 2014. Manure from broiler chickens was sampled for two pathogens (*Campylobacter* and *Salmonella*) and manure from swine was sampled and tested for *Salmonella*. Since sampling was done in conjunction with CIPARS, FNC was therefore able to take advantage of a full year of collection. As in the other sites, in the broiler chickens, *Salmonella* was the most commonly found pathogen at the individual sample and farm levels (Table 14 and 15).

TABLE 14: Pathogen detection from individual manure samples in the AB site, 2014

PATHOGEN DETECTION ON FARMS	BROILER CHICKENS	SWINE
	2014 (n=120)	2014 (n=107)
	percent positive (number positive)	
Campylobacter	9.2% (11)	.
Salmonella	37% (44)	5.6% (6)

· Not Tested

TABLE 15: Pathogen detection at the farm level in the AB site, 2014

PATHOGEN DETECTION ON FARMS	BROILER CHICKENS	SWINE
	2014 (n=30)	2014 (n=18)
	percent positive (number positive)	
Campylobacter	13% (4)	.
Salmonella	57% (17)	5.6% (1)

· Not Tested

WATER COMPONENT

Irrigation Water

Water is another environmental source of enteric pathogens, through activities such as swimming or contamination of produce. In 2014, as in 2013, irrigation water was sampled in the BC site approximately bi-weekly throughout the year. Irrigation water sampling was also initiated in the AB site from June to September. In the BC site, five locations were sampled and in the AB site, 10 locations were sampled. In both sites, samples were tested for *Campylobacter*, *Salmonella*, and VTEC (Table 16 and 17).

In the BC site in 2014, with all locations combined, VTEC was the most commonly found pathogen (28%, 28/101), followed by *Campylobacter* (38%, 38/101) and *Salmonella* (9.9%, 10/101) (Table 16). There was no significant difference in the prevalence of the pathogens in 2014 compared to 2013.

TABLE 16: Pathogen detection in irrigation water samples in the BC site, 2013 and 2014

PATHOGEN DETECTION IN WATER	IRRIGATION CANALS/CREEKS	
	2013† (n=50)	2014 (n=101)
	percent positive (number positive)	
Campylobacter	34% (17)	38% (38)
Salmonella	10% (5)	9.9% (10)
VTEC	32% (16)	28% (28)

† Reference group
*** P ≤ 0.01, ** 0.01 < P ≤ 0.05, * 0.05 < P ≤ 0.1 indicate statistically significant estimates compared to the reference group (Fisher's exact test)

In the AB site, with all locations combined, VTEC was found in 27% (13/48) of samples and was the only pathogen identified (Table 17).

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

PATHOGEN DETECTION IN WATER	IRRIGATION CANALS/CREEKS
	2014 (n=48)
	percent positive (number positive)
Campylobacter	0% (0)
Salmonella	0% (0)
VTEC	27% (13)

SUMMARY

With the expansion of FNC to three sites in 2014, FNC is able to provide more valuable information on enteric disease in Canada. This information on enteric disease continues to be essential to the development of robust food and water safety policies in Canada.

In 2014, *Campylobacter* and *Salmonella* remained the most common causes of human enteric illness in the sentinel sites.

Campylobacter was the most prevalent pathogen found on skinless chicken breast in all sites with close to one-half of all samples testing positive. Across all three sites, *Salmonella* is the most commonly found pathogen on chicken nuggets, with more than one-quarter of all samples testing positive. *Salmonella* prevalence on skinless chicken breast ranged across the sites from 15%–26%. In ground beef, VTEC remains at a low prevalence. Pork chops appear to contain the pathogens of interest (*Campylobacter*, *Salmonella*, and *Listeria monocytogenes*) at relatively low levels.

Fresh-cut fruit sampling showed that these products are rarely positive for the parasites, viruses, and bacteria tested.

On farm, *Salmonella* was commonly found in broiler chickens in all sites. *Salmonella* was also found in turkey in the BC site, but at a lower prevalence than in the broiler chickens. In turkey in the BC site, *Campylobacter* was again the most common pathogen found in 2014, as in 2013. *Campylobacter* was also commonly found in beef and dairy manure samples in the ON site, as in previous years. *Campylobacter* prevalence in broiler chickens was variable across the sites, ranging from 8.7%–22%.

VTEC was found in about one quarter of irrigation water samples in the BC and AB sites.

Results from the 2014 FNC sampling year have demonstrated that retail meat products, particularly chicken products, remain an important source of human enteric pathogens. Some of this contamination is likely due to high levels on farm and other points along the farm to store continuum. Fresh-cut fruit does not appear to be an important source of enteric disease for Canadians, while irrigation water has the potential to be a source of VTEC in particular. Continued monitoring of human cases and potential sources in the sentinel sites is important to help further understand enteric disease in Canada and detect emerging trends. This information will help protect Canadians and help to develop future public health policy.