2013
SHORT REPORT

FOODNET CANADA
CANADA'S NATIONAL INTEGRATED ENTERIC PATHOGEN SURVEILLANCE SYSTEM



PROTECTING CANADIANS FROM ILLNESS

Public Health Agency of Canada
Agence de la santé publique du Canada

Canada

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

—Public Health Agency of Canada

Également disponible en français sous le titre :
2013 Rapport Sommaire
FoodNet Canada
Programme de Surveillance Nationale Intégrée des Agents Pathogènes Entériques du Canada

To obtain additional information, please contact:

Public Health Agency of Canada
Address Locator 0900C2
Ottawa, ON K1A 0K9
Tel.: 613-957-2991
Toll free: 1-866-225-0709
Fax: 613-941-5366
TTY: 1-800-465-7735
E-mail: publications@hc-sc.gc.ca

This publication can be made available in alternative formats upon request.

Publication date: September 2014

Cat.: HP37-17/1-2013E-PDF
ISSN: 2292-8073
Pub.: 140176

2013
SHORT REPORT
FOODNET CANADA
CANADA'S NATIONAL INTEGRATED ENTERIC PATHOGEN SURVEILLANCE SYSTEM

ACKNOWLEDGMENTS

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

TABLE OF CONTENTS

INTRODUCTION

FoodNet Canada is an integrated enteric pathogen surveillance system based on a sentinel site surveillance model that collects information on both 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 over time. FoodNet Canada's primary objectives are to: detect changes in trends in human enteric disease and levels of pathogen exposure from food, animal, and water sources in a defined population, strengthen source attribution efforts in Canada by determining significant exposure factors for enteric illness, and provide practical preventive information to prioritize risks, compare interventions and direct actions, and to assess the effectiveness of food safety programs and targeted interventions.

In 2013, FoodNet Canada had two sentinel sites in operation: the Region of Waterloo Public Health in Ontario (ON) since 2005, and the Fraser Health Authority of lower mainland British Columbia (BC) since 2010. 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 2013 surveillance year in both sentinel sites. Note that FoodNet Canada data need to be considered in the context of two sentinel sites, thus major conclusions cannot yet be extrapolated nationally. FoodNet Canada is designed to have five sites encompassing about 10% of the Canadian population. 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 the FoodNet Canada program or sampling methodologies, please refer to our website (www.phac-aspc.gc.ca/foodnetcanada/index-eng.php).

Integration with CIPARS

Efforts have also been ongoing towards better integrating FoodNet Canada 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 FoodNet Canada 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

In 2013, campylobacteriosis, salmonellosis, and giardiasis 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 decreased in the BC site in 2013 compared with 2012. In the ON site, outbreak-related salmonellosis significantly increased in 2013 compared with 2012. The incidence rate of verotoxigenic *E. coli* (VTEC) significantly decreased in the ON site, but increased significantly in the BC site in 2013 compared with 2012.

Travel continues to be an important factor in the burden of enteric disease. In 2013, approximately 28% of all cases of enteric disease were associated with travel outside of Canada, in both the ON and BC sites. The proportion of travel-related cases, compared with sporadic endemic cases, was higher for shigellosis in both sites (68%) and for cyclosporiasis in the BC site (100%).

In 2013, a total of 15 outbreak-associated cases were reported in the ON and BC sites: 11 *Salmonella* cases, two VTEC cases, and one case each of *Campylobacter* and *Listeria*. Of the 11 *Salmonella* cases, five were associated with international travel.

TABLE 1: Disease-specific annual incidence rates (new cases/100,000 person-years) in the ON and BC sites in 2013 compared with 2012, and 2012 National Notifiable Disease incidence rates

DISEASE AND CASE CLASSIFICATION		ON Site			BC Site			National
		2012	2013		2012	2013		2012
		Incidence Rate[a]	Incidence Rate[a]	Incidence Rate Ratio[b]	Incidence Rate[a]	Incidence Rate[a]	Incidence Rate Ratio[b]	Incidence Rate[c]
Amoebiasis[d]	Total	6.68	4.96	0.74				.
	Endemic[e]	3.53	2.76	0.78				
	Travel[f]	2.04	0.74	0.36				
	LTF[h]	1.11	1.47	1.32				
Campylobacteriosis	Total	27.09	27.93	1.03	36.97	36.43	0.99	29.30
	Endemic	18.74	19.66	1.05	24.87	26.15	1.05	
	Travel	5.01	4.59	0.92	7.35	7.72	1.05	
	Outbreak[g]	0	0.18	.	0	0	.	
	LTF	3.34	3.49	1.05	4.76	2.57	0.54	
Cryptosporidiosis	Total	2.41	3.49	1.45	2.38	1.29	0.54	1.56
	Endemic	0.93	1.47	1.58	1.30	0.86	0.66	
	Travel	1.30	1.65	1.27	0.43	0.43	0.99	
	LTF	0.19	0.37	1.98	0.65	0	.	
Cyclosporiasis	Total	0.56	0.37	0.66	0.22	0.43	1.98	0.32
	Endemic	0	0.37	.	0	0	.	
	Travel	0.37	0	.	0.22	0.43	1.98	
	LTF	0.19	0	.	0	0	.	
Giardiasis	Total	11.13	14.33	1.29	12.32	10.50	0.85	11.12
	Endemic	5.57	6.43	1.16	5.19	4.71	0.91	
	Travel	4.64	4.78	1.03	4.76	4.71	0.99	
	LTF	0.93	3.12	3.36	2.38	1.07	0.45	
Listeriosis	Total	0.19	0.92	4.95	0.43	0.43	0.99	0.36
	Endemic	0.19	0.74	3.96	0.22	0.21	0.99	
	Travel	0	0	.	0.22	0	.	
	Outbreak	0	0.18	.	0	0	.	
	LTF	0	0	.	0	0.21	.	
Salmonellosis	Total	22.08	24.81	1.12	22.05	14.14	0.64***	19.67
	Endemic	12.06	12.50	1.04	12.11	6.86	0.57**	
	Travel	7.24	7.17	0.99	7.78	5.79	0.74	
	Outbreak	0.19	1.65	8.68**	0.43	0.43	0.99	
	LTF	2.60	3.49	1.34	1.73	1.07	0.62	

DISEASE AND CASE CLASSIFICATION		ON Site			BC Site			National
		2012	2013		2012	2013		2012
		Incidence Rate[a]	Incidence Rate[a]	Incidence Rate Ratio[b]	Incidence Rate[a]	Incidence Rate[a]	Incidence Rate Ratio[b]	Incidence Rate[c]
Shigellosis	Total	1.30	2.02	1.56	2.81	3.00	1.07	3.08
	Endemic	0.56	0.74	1.32	1.08	0.64	0.59	
	Travel	0.56	1.10	1.98	1.51	2.36	1.56	
	LTF	0.19	0.18	0.99	0.22	0	.	
Verotoxigenic *E. coli* (VTEC)	Total	4.27	1.10	0.26***	1.95	4.29	2.20*	1.94
	Endemic	2.41	1.10	0.46	1.51	3.21	2.12	
	Travel	0.19	0	.	0.22	0.64	2.97	
	Outbreak	1.67	0	.	0.22	0.43	1.98	
	LTF	0	0	.	0	0		
Yersiniosis	Total	0.93	0.55	0.59	4.76	6.22	1.31	.
	Endemic	0.37	0.18	0.50	3.03	4.07	1.35	
	Travel	0.56	0.37	0.66	0.43	1.07	2.48	
	LTF	0	0	.	1.30	1.07	0.83	

		ON Site		BC Site	
		2012	2013	2012	2013
TOTAL CASE COUNTS	Endemic	239	250	228	218
	Travel	118	111	106	108
	Outbreak	10	11	3	4
	LTF	46	66	51	28

[a] Population estimates for ROW obtained from Ontario Ministry of Health and Long-Term Care, Population Projections 2012-2013, IntelliHEALTH Ontario, Extracted on: February 19, 2012 and November 21, 2013. Population estimates for FHA obtained from BC Ministry of Finance and Corporate Relations. BC Stats, P.E.O.P.L.E. 2012-2013 (Population Extrapolation for Organizational Planning with Less Error), Sep 2012 and Sep 2013.

[b] 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 (2013 vs 2012). 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 2013 and 2012 (Fisher's exact test).

[c] Canadian Notifiable Disease Surveillance System (CNDSS), Surveillance and Epidemiology Division, Centre for Communicable Diseases and Infection Control, PHAC (2012). Salmonellosis includes non-typhoid salmonellosis only.

[d] Amoebiasis is reported as *Entamoeba histolytica/dispar*.

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

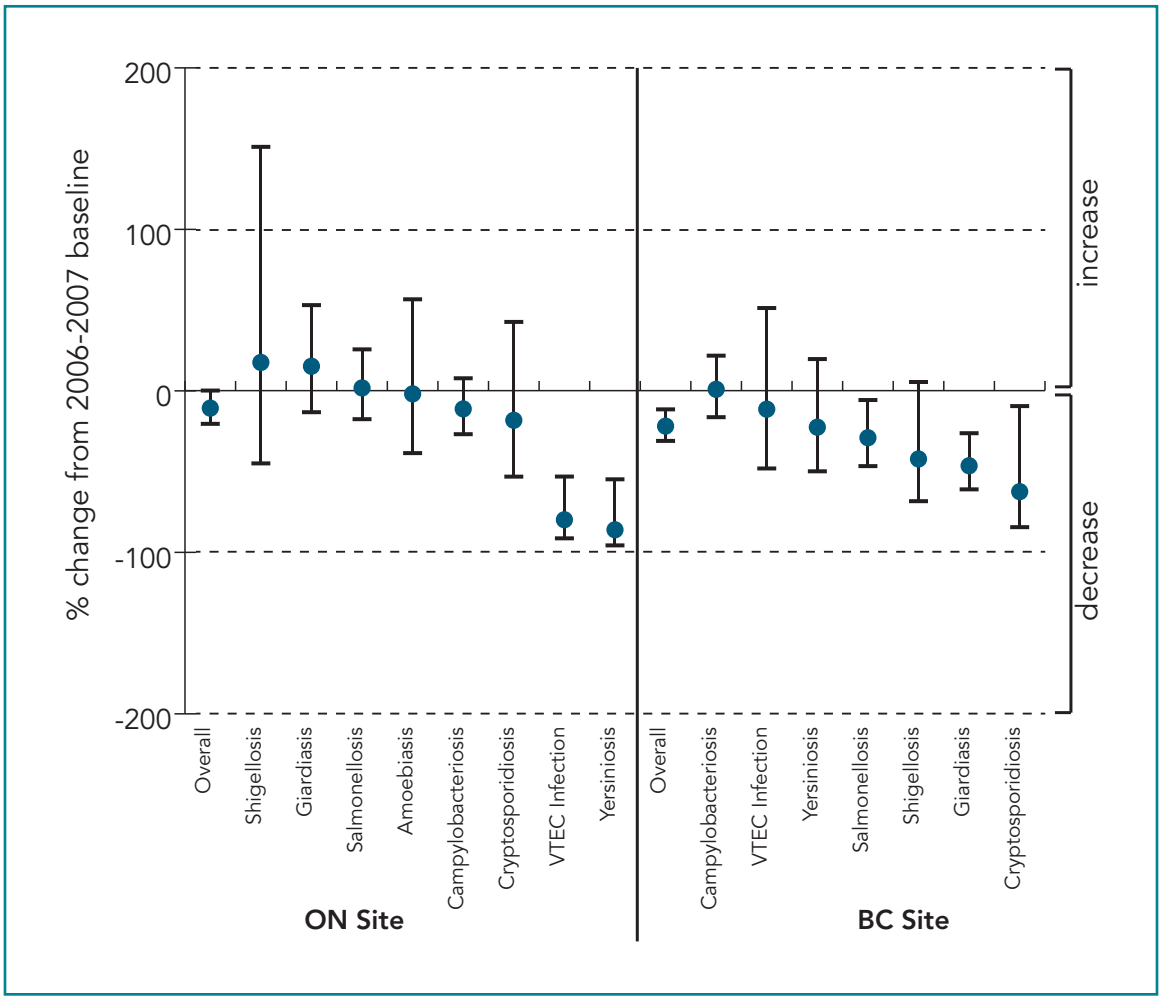
[f] Travel-related cases include individuals that have travelled outside of Canada in the relevant time frame before onset of illness.

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

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

It is also important to monitor longer-term disease trends over time. The data include all cases (endemic, travel, outbreak, and those lost to follow-up). In general, there has been a decreasing trend in overall reported enteric illnesses from 2006/2007 to 2013 (Figure 1). In the ON site, the incidence rates of yersiniosis and VTEC infections showed a statistically significant decrease (86% and 80%, respectively) in 2013 compared with the 2006/2007 rates. In the BC site, the incidence rates of cryptosporidiosis, giardiasis, and salmonellosis showed a statistically significant decrease (62%, 46%, and 29%, respectively) in 2013 compared with the 2006/2007 rates.

FIGURE 1: Estimated percent change (with 95% confidence interval) in annual incidence rates of all reportable enteric disease cases in the ON and BC sites in 2013, 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 Fraser Health Authority.

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 have high chances of human exposure and may differ from year to year.

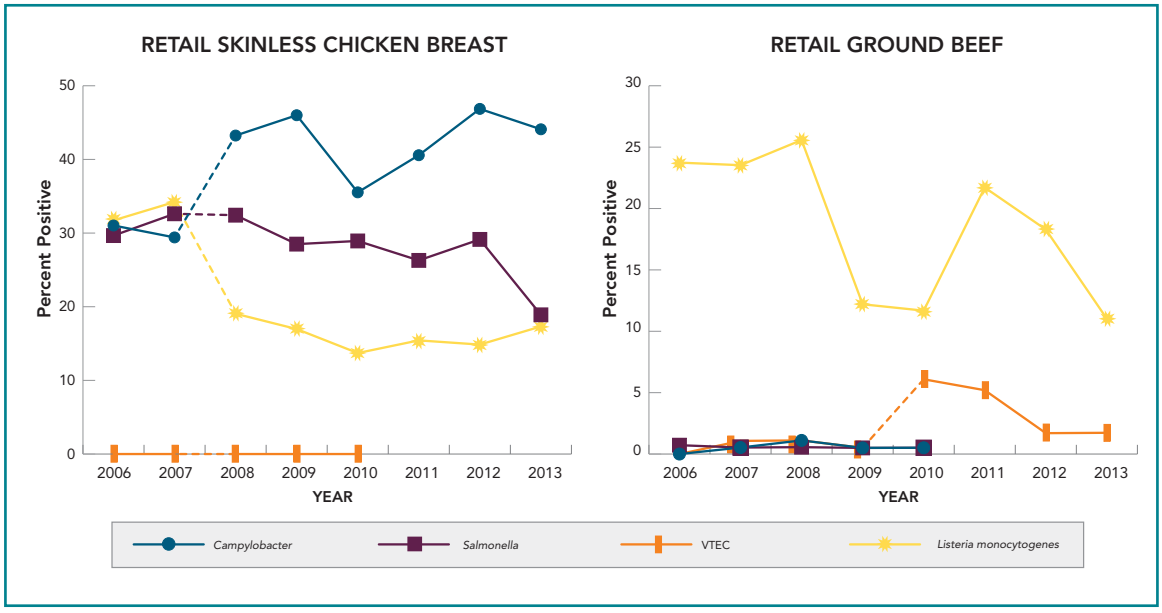
Core Surveillance Activities

Ontario Site

Since mid-2005, FoodNet Canada has systematically sampled fresh chicken breasts and ground beef from randomly selected grocery stores within the ON site on a weekly basis. During 2013, reduced sampling occurred from June 17 to September 13. During this period, chicken breasts were not sampled and ground beef was tested for the presence of VTEC only.

On chicken breasts, *Campylobacter* levels decreased in 2010 but have increased since then (Figure 2). The prevalence of *Salmonella* in chicken breasts decreased significantly in 2013 (19%, 24/127) compared with 2012 (29%, 51/175) (Table 2). This decrease was not due to the lack of chicken breast sampling during the summer months. In 2013, *Listeria monocytogenes* was detected on ground beef at a low prevalence (11%, 14/127) not seen since 2009/2010 (Figure 2, Table 2). VTEC prevalence on ground beef decreased in 2012, but did not change in 2013 (1.7%, 3/173) (Figure 2, Table 2).

FIGURE 2: Yearly distribution of pathogen contamination on retail meat in the ON site, 2006 to 2013



NOTE: Dashed lines indicate a laboratory or sampling method change. Chicken breast samples with skin were tested in 2006 and 2007. Starting in 2008, skinless chicken breast samples were tested. Testing for *Campylobacter* and *Salmonella* on ground beef samples was discontinued in 2011. Testing for VTEC on chicken breast samples was discontinued in 2011.

TABLE 2: Pathogen detection on retail meat in the ON site, 2012 and 2013

PATHOGEN DETECTION ON RETAIL MEAT	Skinless Chicken Breast		Ground Beef	
	2012†	2013	2012†	2013
	percent positive (number positive/number tested)			
Campylobacter	47% (82/175)	44% (56/127)	.	.
Salmonella	29% (51/175)	19% (24/127)**	.	.
VTEC	.	.	1.7% (3/175)	1.7% (3/173)
Listeria monocytogenes	15% (26/175)	17% (22/127)	18% (32/175)	11% (14/127)

. 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)

British Columbia Site

In January 2011, core retail sampling was initiated in the BC site with identical sampling and laboratory procedures as in the ON site. For the most part, pathogen prevalences in 2013 in BC were similar to those in 2012 (Table 3). However, there was a statistically significant decrease in *Listeria monocytogenes* on chicken breasts in 2013 (26%, 34/129) compared with 2012 (49%, 86/175).

TABLE 3: Pathogen detection on retail meat in the BC site, 2012 and 2013

PATHOGEN DETECTION ON RETAIL MEAT	Skinless Chicken Breast		Ground Beef	
	2012†	2013	2012†	2013
	percent positive (number positive/number tested)			
Campylobacter	51% (88/174)	46% (59/129)	.	.
Salmonella	23% (41/175)	22% (29/129)	.	.
VTEC	.	.	1.7% (3/175)	1.8% (3/167)
Listeria monocytogenes	49% (86/175)	26% (34/129)***	17% (30/175)	11% (14/130)

. 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)

Targeted Retail Surveillance

Poultry

A targeted retail poultry study, started in 2011, was conducted in both sites (Tables 4 and 5). At each store visit, in addition to core retail meat sampling, ground chicken and uncooked frozen chicken nugget samples were collected. In 2013, sampling took place all year, excluding the period between June 17 to September 13.

Campylobacter, *Salmonella*, and *Listeria monocytogenes* prevalences on both ground chicken and frozen chicken nuggets sampled in the ON site were generally stable from 2012 to 2013 (Table 4). There was a small but statistically significant decrease in *Salmonella* in ground chicken in 2013 (54%, 55/102) compared with 2012 (66%, 95/144), which was not due to the lack of sampling during the summer months.

In the BC site, there was a decrease in the prevalence of *Salmonella* on frozen chicken nuggets in 2013 (29%, 25/87) compared with 2012 (45%, 53/117) (Table 5). This decrease was also not associated with the lack of sampling of the targeted products during the summer months. The prevalences of the other pathogens on both ground chicken and frozen chicken nuggets remained about the same between 2012 and 2013.

TABLE 4: Pathogen detection on ground chicken and frozen chicken nuggets in the ON site, 2012 to 2013

PATHOGEN DETECTION ON RETAIL MEAT	Ground Chicken		Frozen Chicken Nuggets	
	2012†	2013	2012†	2013
	percent positive (number positive/number tested)			
Campylobacter	20% (29/142)	17% (17/102)	0% (0/29)[a]	.
Salmonella	66% (95/144)	54% (55/102)*	41% (59/144)	39% (40/102)
Listeria monocytogenes	35% (51/144)	31% (32/102)	20% (29/144)	17% (17/102)

. Not tested

[a] Testing ended in March 2012

† 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 5: Pathogen detection on ground chicken and frozen chicken nuggets in the BC site, 2012 to 2013

PATHOGEN DETECTION ON RETAIL MEAT	Ground Chicken		Frozen Chicken Nuggets	
	2012†	2013	2012†	2013
	percent positive (number positive/number tested)			
Campylobacter	56% (66/117)	46% (40/87)	0% (0/24)[a]	.
Salmonella	65% (76/117)	68% (59/87)	45% (53/117)	29% (25/87)**
Listeria monocytogenes	40% (47/117)	44% (38/87)	20% (23/117)	17% (15/87)

. Not tested

[a] Testing ended in March 2012

† 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)

Produce

In 2013, a variety of leafy greens were collected from retail stores in both sentinel sites and tested for parasites, viruses, and bacteria (Table 6). FoodNet Canada previously sampled leafy greens in 2010. In 2013, 296 samples (36 domestic, 260 imported) were collected in the ON site and 295 samples (2 domestic, 285 imported, 8 unknown) were collected in the BC site.

In 2013, all assessed pathogens except rotavirus were detected on produce from both sites (Table 6). *Giardia* was the most frequently detected parasite and was more frequently detected in 2013 compared with 2010 in both sentinel sites. *Cryptosporidium* had the second highest prevalence of all of the pathogens tested and also had a statistically significant increase in 2013 compared with 2010 in both sites. *Cyclospora* and norovirus were detected at low levels in samples from both sites. Rotavirus was also detected at low levels but only in produce from the BC site. Since the parasites and viruses were all tested using PCR methodology, the viability of the pathogens and therefore the potential risk to consumers is unknown[1]. *Listeria monocytogenes* was detected at low levels in both sites.

The small number of domestic products collected made meaningful comparisons to imported products difficult (Table 7). However, *Listeria monocytogenes* was detected at a significantly higher prevalence in domestic produce (7.9%, 3/38) compared with imported produce (0.18%, 1/544). It is important to note that the types of products sampled can vary from year to year due to availability or consumer preference.

TABLE 6: Pathogen detection on leafy greens in the ON and BC sites, 2010 and 2013

PATHOGEN DETECTION ON LEAFY GREENS[a]	ON Site		BC Site	
	2010[†]	2013	2010[†]	2013
	percent positive (number positive/number tested)			
Cryptosporidium	0% (0/372)	3.8% (11/293)[b]***	0% (0/202)	2.4% (7/294)[c]**
Giardia	3.0% (11/372)	8.5% (25/296)***	2.0% (4/202)	5.4% (16/295)*
Cyclospora	0% (0/372)	0.34% (1/296)	0% (0/202)	0.34% (1/295)
Norovirus	0.54% (2/372)	0.68% (2/296)	0.50% (1/202)	0.68% (2/294)
Rotavirus	0% (0/372)	0% (0/296)	0% (0/202)	0.34% (1/294)
Listeria monocytogenes	2.4% (9/372)	1.0% (3/296)	0% (0/202)	0.34% (1/294)

[a] (2013) 58 arugula, 7 kale, 6 green leaf lettuce, 14 iceberg lettuce, 99 romaine lettuce, 1 mache, 274 mixed salad/mixed greens, 132 spinach. Samples testing positive for *Cryptosporidium*: ON (1 arugula, 7 mixed salad/mixed greens, 3 spinach), BC (1 romaine lettuce, 5 mixed salad/mixed greens, 1 spinach); *Giardia*: ON (5 arugula, 3 kale, 2 green leaf lettuce, 3 romaine lettuce, 9 mixed salad/mixed greens, 3 spinach), BC (1 arugula, 4 romaine lettuce, 8 mixed salad/mixed greens, 3 spinach); *Cyclospora*: ON (1 mixed salad/mixed greens) BC (1 spinach); Norovirus: ON (1 iceberg lettuce, 1 mixed salad/mixed greens), BC (1 mixed salad/mixed greens, 1 spinach); Rotavirus: BC (1 mixed salad/mixed greens)

[b] 3 "presumptive positive" not included in analysis

[c] 1 "presumptive positive" not included in analysis

[†] 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)

[1] No known outbreaks were attributed to the consumption of these products.

TABLE 7: Pathogen detection on leafy greens in the ON and BC sites, imported versus domestic, 2013

PATHOGEN DETECTION ON LEAFY GREENS[a]	Imported[†]	Domestic
	percent positive (number positive/number tested)	
Cryptosporidium	2.6% (14/541)[b]	5.3% (2/38)
Giardia	7.0% (38/545)	7.9% (3/38)
Cyclospora	0.37% (2/545)	0% (0/38)
Norovirus	0.74% (4/544)	0% (0/38)
Rotavirus	0.18% (1/544)	0% (0/38)
Listeria monocytogenes	0.18% (1/544)	7.9% (3/38)***

[†] Reference group

[a] 8 samples were excluded from analysis because country of origin was unknown, 2 of which were samples that were positive for *Cryptosporidium*.

[b] 4 "presumptive positive" not included in analysis

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

AGRICULTURE COMPONENT

Farms are possible environmental and food chain exposure sources and so are monitored for their levels of enteric pathogens. In 2013 in the ON site, manure from three commodity groups (dairy, beef, and broiler chickens) was sampled for three pathogens (*Campylobacter*, *Salmonella*, and *E. coli* O157). In the BC site, sampling of farms began in 2013 with manure from two commodity groups (broiler chickens and turkey) sampled for two pathogens (*Campylobacter* and *Salmonella*). Also, this is the first year that FoodNet Canada has sampled turkey farms. Farms are sampled throughout the year by visiting and enrolling two or three farms per commodity per month for a total of approximately 30 farms per commodity per year.

Three fresh pooled manure samples from different age groups of animals and one stored manure sample were collected at each dairy and beef visit. Broiler flocks were sampled within one week of transport for slaughter. 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).

In the ON site, the levels of *Campylobacter* and *Salmonella* in manure from dairy and beef cattle remained relatively stable between 2012 and 2013 (Tables 8 and 10). The prevalence of *E. coli* O157 increased in manure from beef at both the individual sample and farm level in 2013 compared with 2012 (Tables 8 and 10). In manure from broiler chickens, there was a statistically significant increase in the level of *Campylobacter* at the individual sample level in 2013 (20%, 24/120) compared with 2012 (8.3%, 10/120) (Table 8).

In the BC site, turkey manure was found to have a high prevalence of *Campylobacter* at both the individual sample and farm levels (79%, 88/112 and 82%, 23/28, respectively) (Tables 9 and 11). Broiler chicken manure samples in BC were found to have a high prevalence of *Salmonella* at both the individual sample and farm levels (Tables 9 and 11).

TABLE 8: Pathogen detection from individual manure samples in the ON site, 2012 and 2013

PATHOGEN DETECTION ON FARMS	Dairy		Beef		Broiler Chickens	
	2012†	2013	2012†	2013	2012†	2013
	percent positive (number positive/number tested)					
Campylobacter	78% (93/120)	75% (90/120)	73% (88/120)	75% (90/120)	8.3% (10/120)	20% (24/120)**
Salmonella	5.8% (7/120)	9.2% (11/120)	8.3% (10/120)	11% (13/120)	58% (69/120)	58% (70/120)
***E. coli* O157**	12% (14/120)	13% (16/120)	9.2% (11/120)	21% (25/120)**	.	.

. 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 9: Pathogen detection from individual manure samples in the BC site, 2013

PATHOGEN DETECTION ON FARMS	Broiler Chickens	Turkeys
	2013	2013
	percent positive (number positive/number tested)	
Campylobacter	28% (27/96)	79% (88/112)
Salmonella	71% (68/96)	35% (39/112)

TABLE 10: Pathogen detection at the farm level in the ON site, 2012 and 2013

PATHOGEN DETECTION ON FARMS	Dairy		Beef		Broiler Chickens	
	2012†	2013	2012†	2013	2012†	2013
	percent positive (number positive/farms tested)					
Campylobacter	97% (29/30)	97% (29/30)	97% (29/30)	100% (30/30)	10% (3/30)	20% (6/30)
Salmonella	20% (6/30)	17% (5/30)	17% (5/30)	23% (7/30)	67% (20/30)	67% (20/30)
E. coli O157	27% (8/30)	37% (11/30)	20% (6/30)	47% (14/30)*	.	.

. Not tested

† Reference group

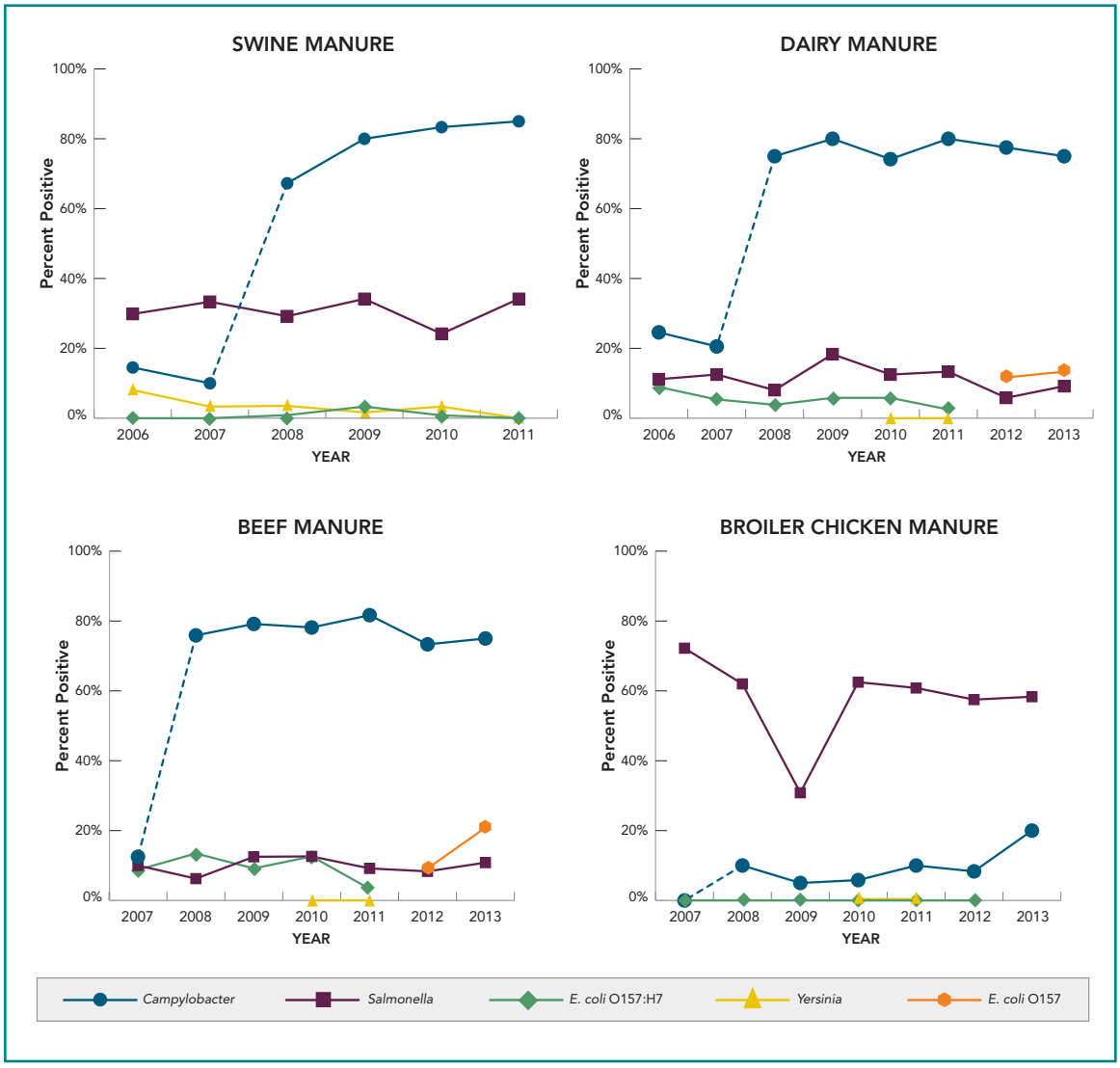
*** P ≤ 0.01, ** 0.01 < P ≤ 0.05, * 0.05 < P ≤ 0.1 indicate statistically significant estimates compared to the reference group (Fisher's exact test)

TABLE 11: Pathogen detection at the farm level in the BC site, 2013

PATHOGEN DETECTION ON FARMS	Broiler Chickens	Turkeys
	2013	2013
	percent positive (number positive/farms tested)	
Campylobacter	42% (10/24)	82% (23/28)
Salmonella	83% (20/24)	61% (17/28)

The pathogen prevalences in the ON site have remained relatively stable from 2006 to 2013 (Figure 3). Some exceptions to this are in broiler chickens where the prevalence of *Salmonella* briefly dropped to about 31% in 2009 and where the prevalence of *Campylobacter* has increased slightly from approximately 10% historically to 20% in 2013 (Figure 3).

FIGURE 3: Pathogen detection (sample level) from manure samples in the ON site, 2006 to 2013



NOTE: Dashed lines indicate a laboratory or sampling method change.

WATER COMPONENT

Untreated Surface Water and Recreational Beaches

During 2013, surveillance in the ON site along the Grand River watershed continued at the same five sampling locations. During the summer months (June to September), sampling was re-directed to three recreational beach locations to assess the load of pathogens at local swimming venues. These data are presented separately from the routine surveillance results of untreated surface water from the Grand River.

In the untreated surface water samples from the ON site, the prevalence of *Salmonella* increased in 2013 (49%, 46/93) compared with 2012 (34%, 32/94) (Table 12). This increase continues the trend of increasing *Salmonella* prevalence in these samples since 2006 (Figure 4). The prevalence of *Cryptosporidium*, however, decreased significantly in 2013 (36%, 4/11) compared with 2012 (100%, 6/6) (Figure 4, Table 12). The levels of the other pathogens remained relatively stable in 2013 compared to previous years (Figure 4, Table 12).

There was an increase in VTEC in the beach samples collected in the ON site in 2013 (42%, 10/24) compared to 2012 (8.0%, 2/24) (Table 12). There was a significant decrease in the prevalence of parasites in 2013 compared with 2012, with *Cryptosporidium* decreasing to 8.3% (1/12) from 92% (11/12) and *Giardia* decreasing to 42% (5/12) from 83% (10/12) (Table 12).

Irrigation Ditches

In 2013, sampling of irrigation ditches was initiated in the BC site. From May to December, five locations were sampled and tested for *Campylobacter*, *Salmonella*, and VTEC (Table 12). Among all sites combined, the prevalence of *Campylobacter* was the highest (52%, 26/50), followed by VTEC (31%, 14/45), and lastly *Salmonella* (10%, 5/50). The *Campylobacter* spp. results are presumptive, and will be confirmed by molecular methods and released in the comprehensive annual report.

TABLE 12: Pathogen detection in untreated surface water and recreational beaches (ON), and in irrigation ditches (BC), 2012 and 2013

PATHOGEN DETECTION IN WATER	Untreated Surface Water (5 locations, ON)		Recreational Beaches (3 locations, ON)		Irrigation Ditches (5 locations, BC)
	2012†	2013	2012†	2013	2013
	percent positive (number positive/number tested)				
Campylobacter	14% (11/76)	16% (12/77)	17% (2/12)	46% (11/24)[a]	52% (26/50)
Salmonella	34% (32/94)	49% (46/93)**	8.0% (2/24)	21% (5/24)	10% (5/50)
Verotoxigenic *E. coli*	40% (37/93)	53% (49/93)	8.0% (2/24)	42% (10/24)**	31% (14/45)
Cryptosporidium	100% (6/6)	36% (4/11)**	92% (11/12)	8.3% (1/12)***	.
Giardia	100% (6/6)	100% (11/11)	83% (10/12)	42% (5/12)*	.

PATHOGEN DETECTION IN WATER	Untreated Surface Water (ON), 2013				
	A	B	C	D	E
	percent positive (number positive/number tested)				
Campylobacter	19% (3/16)	38% (6/16)	23% (3/13)	0% (0/16)	0% (0/16)
Salmonella	44% (7/16)	31% (5/16)	38% (5/13)	46% (11/24)	75% (18/24)
Verotoxigenic *E. coli*	38% (6/16)	56% (9/16)	23% (3/13)	54% (13/24)	75% (18/24)
Cryptosporidium	.	.	.	0% (0/3)	50% (4/8)
Giardia	.	.	.	100% (3/3)	100% (8/8)

PATHOGEN DETECTION IN WATER	Recreational Beaches (ON), 2013		
	Elora Gorge	Laurel Creek	Shade's Mills
	percent positive (number positive/number tested)		
Campylobacter	63% (5/8)[a]	25% (2/8)[a]	50% (4/8)[a]
Salmonella	38% (3/8)	13% (1/8)	13% (1/8)
Verotoxigenic *E. coli*	63% (5/8)	50% (4/8)	13% (1/8)
Cryptosporidium	25% (1/4)	0% (0/4)	0% (0/4)
Giardia	75% (3/4)	0% (0/4)	50% (2/4)

PATHOGEN DETECTION IN WATER	Irrigation Ditches (BC), 2013				
	F	G	H	I	J
	percent positive (number positive/number tested)				
Campylobacter	40% (4/10)	30% (3/10)	60% (6/10)	70% (7/10)	60% (6/10)
Salmonella	30% (3/10)	10% (1/10)	0% (0/10)	0% (0/10)	10% (1/10)
Verotoxigenic *E. coli*	33% (3/9)	89% (8/9)	22% (2/9)	11% (1/9)	0% (0/9)
Cryptosporidium	.	.	.	.	.
Giardia	.	.	.	.	.

SAMPLE SITE LEGEND:	
A - Canagagigue Creek	F - Matsqui, downstream
B - Conestogo River	G - Matsqui, midstream
C - Upper Grand River	H - Sumas, downstream
D - Grand River, near drinking water intake	I - Sumas, upstream (east)
E - Grand River, near one waste water treatment plant effluent	J - Sumas, upstream (west)

NOTE: the methods used to detect *Cryptosporidium* were microscopy and genotyping based on sequencing and the method used to detect *Giardia* was microscopy.

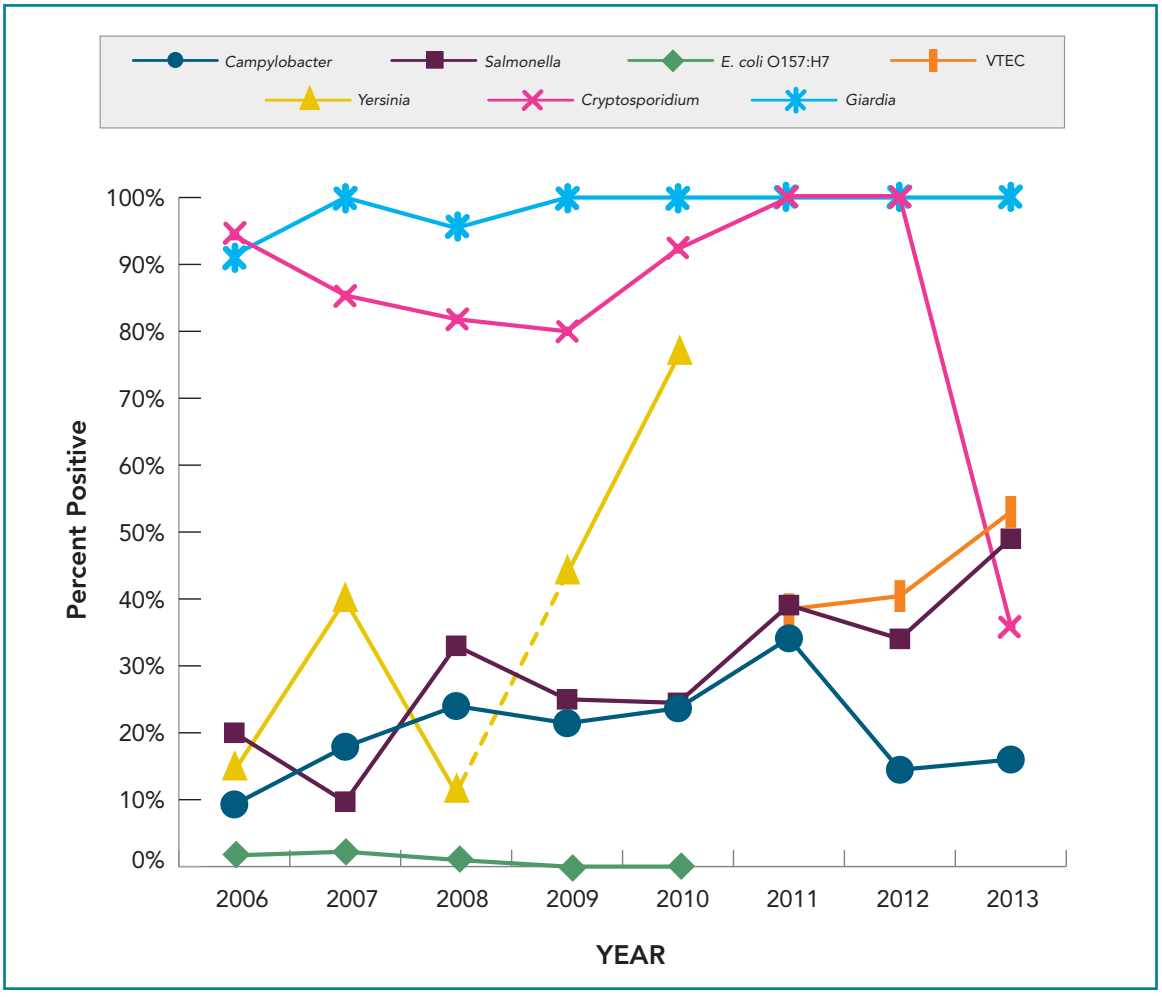
[a] *Campylobacter* MPN method

. 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)

FIGURE 4: Proportion of positive untreated surface water (non-beach) samples tested in the ON site between 2006 and 2013 for select enteric pathogens



NOTE: Dashed lines indicate a change in laboratory detection method at some point during surveillance year(s). *Yersinia* not tested after 2010.

SUMMARY

With eight years of data from two different sentinel sites, FoodNet Canada continues to provide important information on enteric disease in Canada. This information is essential to the development of robust food and water safety policies in Canada. In general, the incidence rates of reportable enteric diseases have decreased over the past seven years. In 2013, *Campylobacter* and *Salmonella* remained the most common causes of human enteric illness in the sentinel sites (Table 1), and across Canada. Information gained from the exposure surveillance within FoodNet Canada (retail, farm, and water) provide insight into the potential sources and routes of exposure for both of these pathogens.

Campylobacter, *Salmonella*, and *Listeria monocytogenes* continue to be commonly found on skinless chicken breasts sold at retail in both sentinel sites (Tables 2 and 3), as well as on processed chicken products such as ground chicken and frozen chicken nuggets (Tables 4 and 5). *Listeria monocytogenes* has also consistently been found on ground beef, although at lower levels than in the retail chicken products (Tables 2 and 3).

Interestingly, all of the parasites and viruses that have been tested for were detected on leafy greens sold at retail in both sentinel sites (Table 6). This information is shared with food safety partners in industry, Health Canada and the Canadian Food Inspection Agency in an ongoing effort to inform food safety policy. Because these pathogens were detected by molecular approaches, their viability is unknown. Further research in this area would be helpful to estimate the risks to humans.

At the farm level, *Campylobacter* remains the most frequently detected pathogen in cattle manure and also appears to be common in turkeys (Tables 8-11). In broiler chickens, *Salmonella* is the most commonly detected enteric pathogen (Tables 8-11).

Campylobacter, *Salmonella*, and VTEC continue to be found in untreated surface water in both rural and urban areas, at freshwater beaches, larger and small reaches of the Grand River, and in irrigation canals and ditches in the two watersheds in the BC site (Table 12 and Figure 4).

Exposure to retail meat products remains a potential source of infection for human enteric illness. Other exposure sources, however, such as the farm environment and water, are also possible. Continued monitoring of human illness and the potential exposures is important to ensure the continued health and safety of Canadians.