ABSTRACT

Introduction: Prior to 1996, sporadic cases of cyclosporiasis in Canada were most often associated with foreign travel and outbreaks throughout the world were associated with contaminated drinking water. In May 1996, the North York Public Health Department was notified of three laboratory-confirmed cases of cyclosporiasis among persons who attended a luncheon at a religious institution. A ceremonial bath (mikvah) was initially identified as a possible source of exposure to contaminated water.

Methods: Guests of a luncheon were interviewed regarding food, beverage and water exposure. The institution kitchen and water sources were inspected and environmental testing was performed.

Results: Eating strawberry flan, decorated with raspberries and blueberries, was associated with developing illness (relative risk =2.13, $p=0.02$). There was no evidence that water exposure was associated with illness.

Discussion: This event was the index Canadian cluster of a widespread North American outbreak associated with imported Guatemalan raspberries. The local investigation highlights the role of public health departments in multijurisdictional food-borne outbreaks of emerging pathogens.

ABRÉGÉ

Introduction : Avant 1996, le cyclosporiasis au Canada a été le plus souvent associé aux voyages à l'étranger. Les manifestations précédentes ailleurs ont été associées à l'eau potable contaminée. En mai 1996, le bureau de santé publique de North York a enquêté sur la première manifestation signalée au Canada du cyclosporiasis.

Méthode : Les cas ont été confirmés à une institution où une exposition commune a eu lieu pour six cas de cyclosporiasis. On a sondé les invités à un déjeuner à propos de leur exposition à la nourriture. On a examiné la cuisine et les sources d'eau; on a fait des tests environnementaux.

Résultats : La consommation d'un flan à la fraise, qui contenait des fraises, des framboises et des bleuets, a été associée à l'attaque de la maladie (risque relatif =2,13, $p=0,02$). Il n'y avait pas d'évidence que l'eau de l'institution était associée à la maladie.

Discussion : Pendant l'enquête, il s'est avéré que cette manifestation représentait le groupe indicateur canadien d'une manifestation nord-américaine répandue, associée aux framboises importées du Guatemala. L'enquête locale fait apparaître le rôle des services de santé publique dans les flambées d'intoxications alimentaires dues à des pathogènes émergents qui couvrent plusieurs juridictions.

The First Reported Cluster of Food-borne Cyclosporiasis in Canada

D.G. Manuel,^{1,2} R. Shahin,¹ W. Lee,¹ M. Grmusa¹

Before 1996, gastroenteritis caused by *Cyclospora* sp. in Canada was infrequently reported and most often associated with foreign travel.¹ Prior to 1996, three outbreaks in the United States were reported; food-borne transmission was postulated, but drinking contaminated water was the only identified risk.²⁻⁴ Cyclosporiasis has a median incubation period of one week and presents with profuse watery stools, nausea, weight loss, fatigue, and low-grade fever. Protracted fatigue and relapsing episodes of watery stools can last up to six weeks in immunocompetent individuals and months in immunocompromised individuals;⁵ hospitalization is uncommon; and recommended treatment is with trimethoprim-sulfamethoxazole.⁶

We report the findings from the investigation conducted by the North York Public Health Department (NYPHD) of the first reported cluster of cyclosporiasis in Canada. During the investigation it became apparent that this event was the index Canadian cluster in an international outbreak of food-borne cyclosporiasis associated with Guatemalan raspberries.⁷ *Cyclospora* has now been definitively established as a food-borne pathogen in Canada and the United States. This report demonstrates the contribution of the local public health department to the investigation of multijurisdictional food-borne outbreaks of emerging diseases.

In late May 1996, a local physician notified the North York Public Health Department of a possible outbreak of

cyclosporiasis among 49 guests who had attended a private catered luncheon at a religious institution 11 days prior. *Cyclospora cayatanesis* was initially identified in routine stool samples from three family members who developed a diarrheal illness after the luncheon. The hostess of the luncheon had contacted approximately 15 guests, many of whom had a similar illness. All ill guests had attended only one common event. The caterer for this event prepared most of the cooked food at an off-site kitchen, the fresh food was prepared at the institution. Initial reports indicated that a religious ceremonial bath (a mikvah), containing rainwater, became brackish following a filtration pump failure at (or around) the time of the luncheon. We initially hypothesized that guests became ill through exposure to the mikvah water, directly or through food preparation.

METHODS

All 55 individuals (49 attendees, 2 relatives of attendees, and 4 catering staff) who were potentially exposed to food or drink from the luncheon were interviewed by phone between day 19 and day 28 regarding gastrointestinal symptoms, food and beverage consumption, water exposure, medical diagnosis and treatment, and demographic information. Guests were considered cases if they had: ≥ 3 loose or watery stools/day for ≥ 2 consecutive days; or, loss of appetite, fatigue, and abdominal pain, vomiting or bloating; or, a stool examination positive for *C. cayatanesis*. All attendees and staff were asked to supply stool samples, regardless of whether they were symptomatic.

The risk of developing illness from specific food items was assessed by comparing the

1. Toronto Public Health, Toronto, ON
2. Community Medicine Residency Program, University of Toronto, ON
Correspondence: Dr. R. Shahin, Toronto Public Health, North York District Office, 5100 Yonge Street, Toronto, ON, M2N 5V7

attack rate in the 49 attendees who reported eating the food item to those who did not eat the item. Including the relatives of attendees or staff did not change the conclusion of the analysis. A food item was considered to have a significant relative risk if the two-tailed p-value was < 0.05 (EpiInfo v6.03). The Fisher exact test was used when the numbers in any one category were small.

We attempted to identify all people who used the ceremonial bath during the month prior to or two weeks following the luncheon by posting notices in the institution and making announcements during institution gatherings requesting that ill mikvah patrons contact the health department. In addition, we interviewed employees of the institution to identify other ill persons and their exposures. As the school attached to the institution used, in part, the same water supply as the institution, we checked the school absentee records to determine whether absenteeism had increased surrounding the luncheon.

Hosts and hostesses of other events that had food prepared by the caterer during the period surrounding the index event were contacted and asked whether their guests became ill.

Stool specimens were collected in sodium acetate-acetic acid for direct microscopic identification after modified acid-fast staining. Initial specimens were diagnosed in a private laboratory. Subsequent specimens were confirmed by two reference laboratories, the provincial Public Health Laboratories, Etobicoke, or the Centres for Disease Control and Prevention, Atlanta, Georgia (for Americans visiting North York who became ill after returning home to the United States).

Environmental investigation

Staff from both the communicable disease and the environmental divisions of the NYPHD performed an onsite inspection of the institution. One litre water samples were taken on day 12-13 from water faucets and water traps in the kitchen, bathrooms, and from the mikvah and its rainwater collection system. Samples were tested for pathogenic organisms, including *Cyclospora*, at the provincial Public Health Laboratory, Etobicoke. The municipal

Clinical Symptoms	Frequency of Symptoms (%)	Median Duration (days)
Diarrhea	91	5
Fatigue	83	7
Nausea	77	5
Abdominal pain	74	6
Loss of appetite	74	9
Chills	54	2
Headache	46	3
Muscle aches	43	4
Gas or bloating	29	5
Vomiting	29	3
Fever	26	2

Food Item†	Attack Rate in the Exposed‡	Attack Rate in the Unexposed	Relative Risk	P-value
Strawberry flan	30/37=0.81	3/8=0.38	2.16	0.02*
Caesar salad	24/34=0.71	5/10=0.50	1.42	0.27*
Chulent (cooked beef)	20/26=0.77	14/22=0.64	1.21	0.32
Corned beef	17/22=0.77	17/26=0.65	1.18	0.37
Chicken	15/18=0.83	20/30=0.67	1.25	0.32*
Egg salad	15/21=0.71	20/28=0.71	1.00	1.00
Water	14/18=0.78	16/26=0.62	1.26	0.26
Tea	12/17=0.71	21/30=0.70	1.01	0.97
Tomato salad	04/06=0.67	29/40=0.73	0.92	1.00*

† Food items shown include all fresh produce and the cooked items with highest risk and statistical significance.
‡ Exposure means the number of people who recalled eating the food item. The food items are ranked by frequency of exposure in cases.
* Fisher exact P-value

street main and building connection were examined for a possible containment breach. The municipal plumbing inspector investigated the institution plumbing system for sites of cross contamination from the unpotable mikvah water or other sources of environment contamination. The mikvah was closed until inspections and repairs of the plumbing system were completed. The caterer's kitchen was in a neighbouring municipality and was investigated in a similar manner by the responsible Public Health Unit.

Food traceback

The Canadian Food Inspection Agency, Health Canada and the Public Health Branch, Ontario carried out traceback investigations with the assistance of the public health inspectors. Only the food items served at the luncheon that were significantly associated with illness were traced. The U.S. Food and Drug Administration and the CDC performed tracebacks for produce that was transported through the United States from Guatemalan exporters and farms.⁷

RESULTS

All 49 guests who attended the luncheon were interviewed; 35 became ill and met the case definition (attack rate 71%). Only symptomatic persons (n=22) submitted stool specimens for laboratory testing; of these, 13 (59%) were positive for *Cyclospora* oocysts. The most frequent reported symptoms were watery diarrhea, fatigue, nausea, abdominal pain, and loss of appetite (Table I). All age groups were affected (median age 25, range 4-76 years); there were no hospitalizations. The onsets of illness were closely clustered in time with a median incubation period of 8 days (range of 6 to 13 days) (Figure 1), in keeping with a point source outbreak. An additional 4 people became ill: two relatives of the guests who brought home food from the luncheon but did not attend the event and two catering staff. There were no secondary cases indicating person-to-person transmission.

Environmental investigation

A cross-contamination site was found between the mikvah water filtration system

Figure 1. Date of onset of symptoms for guests of the luncheon 35 cases (median incubation time 8 days)

and the institution's potable hot water line. Environmental testing of this mikvah and all other environmental sources did not reveal *Cyclospora* or other pathogenic species.

Risk associated with food ingestion and other exposures

The strawberry flan was the only exposure found to be a risk factor for developing illness (relative risk 2.16; $p=0.02$) (Table II). The caterer prepared all food items except for the strawberry flan which was bought from a local bakery. The strawberry flan consisted of a pastry cup filled with custard and topped with glazed sliced fresh strawberries. The caterer served the flan on individual plates surrounded by each of two or three fresh raspberries and blueberries on custard that was prepared and added on site. All berries were washed in a colander with fresh running water. Exposure to other water sources at the luncheon site (water fountain, bathroom use, and kitchen) was not associated with illness.

The local bakery supplied two other catered events with pastry cups using the same ingredients and prepared in the same manner as the strawberry flan. Approximately 70 guests attended these two events and none became ill.

Food traceback

All berries were traced back to the same large wholesale food distribution centre in Metropolitan Toronto. Strawberries were imported from California and raspberries were imported from Guatemala; blueberries could not be traced. It was not possible to trace forward the distribution of berries to other retailers/bakeries/restaurants from the distribution centre. Raspberries and blueberries purchased by the caterer were not used for other events. There was no unconsumed strawberry flan, berries or custard available for laboratory identification of *Cyclospora*.

DISCUSSION

The North York luncheon in May 1996 is the first reported cluster of cyclosporiasis in Canada. Subsequent investigations indicate that this was the index Canadian cluster of a widespread outbreak associated with Guatemalan raspberries.⁷ In our investigation, eating strawberry flan, decorated with strawberries, raspberries and blueberries, was the only exposure statistically associated with developing illness. Since almost identically produced pastry cups were not associated with illness, the likely source of cyclosporiasis was the raspberries, blueberries or custard used to decorate the dessert plate at the event. Unlike

previously reported outbreaks associated with contaminated water, this outbreak was food-borne. This was despite finding a potential contamination site of the institution's drinking water.

During investigation of the May cluster there were several events that suggested it was part of a larger, widespread *Cyclospora* outbreak. First, the NYPHD investigated a second unrelated enteric outbreak of a catered event in May. In this second outbreak, at least 17 of 50 people became ill, 6 people were laboratory-confirmed *Cyclospora* positive. Fresh berries were served at this event. Second, a private outpatient laboratory contacted the NYPHD to report an increase in stool specimens positive for *Cyclospora*. These cases were separate from the first two outbreaks identified and were not associated with foreign travel. This laboratory was unaware of the outbreak investigations that were underway. Finally, we became aware of a simultaneous berry-associated *Cyclospora* outbreak in Houston, Texas.

Subsequent to the first two outbreaks investigated in North York, increased surveillance coordinated by the Public Health Branch, Ministry of Health identified 6 additional event-associated clusters and 140 culture-positive sporadic cases in Ontario. A case-control study of these sporadic cases identified both raspberries and strawberries as significant risk factors.⁸ The Laboratory Centre for Disease Control, Ottawa, coordinated an increased surveillance for cyclosporiasis throughout Canada. By June, the Centers for Disease Control and Prevention in Atlanta, Georgia facilitated a coordinated investigation and traceback of fresh fruit from what was then an outbreak involving multiple states and provinces. Raspberries distributed from Guatemala were implicated as the source of the larger United States and Canadian outbreak from the combined investigations and berry traceback of 55 event-associated clusters, and 3 case-control studies of sporadic cases.⁷

Although results of the food exposure analysis from the luncheon strongly suggest an association of cyclosporiasis with consumption of strawberry flan, there are several limitations of the study. Recall history is frequently cited as a concern unless

attendees are interviewed promptly after the exposure. Cyclosporiasis has a longer incubation period than many intestinal infections, increasing the time between exposure and interview. However, the meal was a notable one for the guests because it was a special occasion, and most guests did not have difficulty recalling food items ingested. The natural history of *Cyclospora* infection has not been well described and could contribute to poor case ascertainment. For instance, children have been noted to have milder symptoms than adults do and therefore incomplete case ascertainment may have occurred if children were infected with *Cyclospora* but did not have sufficient symptoms or laboratory confirmation to meet the case definition.

These investigations described above along with many similar investigations at the local level are cornerstones of food safety. The era of increasing international food trade further challenges us to maintain systems of detecting and investigating food-borne illness that may be widespread throughout Canada (and the world). Outbreaks of food-borne illness will be reported to, and investigated by, local

health departments, whether they are from well-known or emerging pathogens. The ability of provincial and national public health departments to detect and investigate multi-jurisdiction outbreaks depends on the capacity of local health departments and vice versa. The chain of defense against existing and new food-borne health threats is only as strong as the weakest link in the health care system.

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