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Research Paper

2015 Outbreak of Cyclosporiasis Linked to the Consumption of Imported Sugar Snap Peas in Ontario, Canada

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ABSTRACT

An outbreak of cyclosporiasis in Ontario, Canada, was investigated in the fall of 2015. Thirty-five confirmed and 10 probable cases were linked to the investigation. Epidemiological and food safety evidence implicated fresh sugar snap peas imported from Guatemala as the source of the outbreak. We describe here the first documented cyclosporiasis outbreak in Canada involving the consumption of sugar snap peas.

Key words: *Cyclospora*; Guatemala; Outbreak; Sugar snap peas

Cyclospora cayetanensis is a coccidian protozoan that is not endemic in Canada. Cyclosporiasis became a reportable disease in Ontario in 2001 following outbreaks in Canada and the United States. These outbreaks were attributed to the consumption of berries imported from Latin America *(1, 2)*. Since that time, other outbreaks of cyclosporiasis have been investigated in Ontario and British Columbia, Canada, including outbreaks in 2004, 2007, and 2010 in which imported basil, often consumed as pesto, was implicated *(10)*. Most sporadic cyclosporiasis cases in Ontario have been associated with travel to endemic countries, but seasonal increases in the number of non–travel-related cases usually occur between May and July every year *(15)*. Outbreaks in the United States and Canada have occurred primarily in the spring and early summer months *(3, 12)*.

Ontario's provincial health authorities received notification on 9 October 2015 from a local public health unit (PHU), Niagara Region Public Health, regarding a cluster of four confirmed and six probable non–travel-related cases of cyclosporiasis. Onset dates for these cases were 8 to 17 September. A review of the provincial reportable diseases database revealed four additional non–travel-related cases from other jurisdictions with onsets in the same time frame as the Niagara Region cluster. These findings led to further investigation of the reported illnesses by Public Health Ontario (PHO) with support from public health and food safety partners at the local, provincial, and national levels.

This report describes the first outbreak of cyclosporiasis in Canada involving the consumption of sugar snap peas and highlights the value of epidemiological evidence (i.e., food exposure histories) for attributing exposures to disease-causing agents for which there are no readily available subtyping methodologies for linking cases.

MATERIALS AND METHODS

Case finding. A public health alert was issued by PHO on 9 October 2015 to support case finding and reporting of cyclosporiasis cases from other Canadian provinces and territories with a history of travel to Ontario. An enhanced surveillance directive was also issued by PHO to local Ontario PHUs on 16 October, reinforcing the requirement for PHUs to report all cyclosporiasis cases via the integrated Public Health Information System (iPHIS), the provincial reportable diseases database, within one business day of notification and to complete and submit a provincial standardized cyclosporiasis case questionnaire.

A confirmed case was defined as illness of a resident of or visitor to Ontario with laboratory confirmation of *Cyclospora,* symptom onset from 8 August (the earliest onset date) onward, and no history of travel to an endemic country in the 14 days prior to illness onset. A probable case was defined as illness of a dining companion of a person with a confirmed case who developed clinically compatible signs and symptoms of cyclosporiasis within the same time frame and had no history of travel to an endemic country in the 14 days prior to illness onset.

All confirmed cases were diagnosed through microscopic demonstration of *Cyclospora* oocysts or through detection of *Cyclospora* DNA by PCR using published methods and appropriate specimens. Testing was conducted at both private and provincial laboratories where either of the two methods could be utilized. No subtyping methodologies are available for *Cyclospora* to assess whether affected persons could have been exposed to common sources of infection.

Food safety investigation. Data collected on food exposures and travel history were entered into iPHIS, with a supplementary questionnaire administered to ill persons to obtain more detailed food purchase histories, including brands, locations, and dates of

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purchase. During these interviews, consent was requested for shopper's card data to be accessed by PHO. Shopper's card programs offer customers discounts on purchases or allow customers to redeem points for future use. In turn, grocery retailers collect information on customer purchase patterns and trends, including specific items purchased and date and location of purchase. This information is helpful during foodborne investigations because it enhances food history recall, assists in outbreak hypothesis generation, and provides detailed product information for further food safety follow-up (e.g., traceback). Food purchase records received by PHO were used to supplement food recall histories and enhance the food traceback investigation, which was coordinated by the Canadian Food Inspection Agency (CFIA). The CFIA laboratory used a real-time PCR assay *(4, 7)* to test one food sample that was collected by local investigators from a case's home.

PHO prepared a summary of the evidence from the case and food safety investigations for review by the Public Health Agency of Canada and then submitted a report to Health Canada for a health risk assessment. A health risk assessment on a specific food product weighs the available food safety, epidemiological, and laboratory evidence, determines the risk that the product poses to consumers, and helps agencies decide the level of public health action to be taken.

Data analysis. Cyclosporiasis cases were characterized in terms of person (age and sex), place (PHU of residence), and time (onset of illness). Frequencies were calculated for reported exposures and were compared with the expected consumption frequencies for the Ontario general population obtained from the Canadian Foodbook survey *(11)*. Descriptive analyses were performed and figures were constructed using Excel (version 2010, Microsoft, Redmond, WA).

RESULTS

Case findings. Thirty-five non–travel-related cyclosporiasis cases met the outbreak definition of a confirmed case. The outbreak cases occurred in 14 of the 36 PHUs in Ontario, and the largest number of cases was reported in the Niagara Region *(6)*. Cases were 2 to 66 years of age (median, 41 years), and the majority (60%) were female. Episode dates (i.e., the earliest symptom onset, specimen collection, or reported date) were 8 August to 16 November 2015 (Fig. 1). An additional 10 cyclosporiasis cases were classified as probable, having an epidemiologic link to three confirmed outbreak cases. All 10 probable cases fell ill within the period reported for the confirmed cases and were reported by PHUs with confirmed cases. No hospitalizations or deaths occurred among the persons with confirmed and probable cases.

Exposure history. Exposure information was available for 29 (83%) of 35 outbreak confirmed cases. During the initial interviews with the standardized cyclosporiasis case investigation questionnaire, consumption of fresh peas (shelled or in pods) was reported by 24 (89%) of 27 cases asked about this exposure. Additional details obtained from this and the focused questionnaire indicated that sugar snap peas were consumed by 23 (96%) cases, and 21 (91%) of them purchased the peas at multiple locations of the same retail chain (retailer A) (Table 1). The observed frequency of consumption of fresh sugar snap peas (96%) was significantly higher than the expected frequency for the Ontario general population (28%) *(12)*. Other than sugar snap peas, no significant commonalities were reported for food items consumed by at least 40% of cases (i.e., no common item type, supplier, brand, or place of purchase).

Among the 10 probable cases, 9 were epidemiologically linked to three separate confirmed cases, all of whom resided in the same PHU and purchased sugar snap peas from the same location of retailer A. The 10th probable case reported dining with a confirmed case and consuming sugar snap peas at various food premises in the PHU in which the cluster was first reported.

Food safety investigation. Of the eight cases who permitted authorized access to their purchase records from retailer A, seven bought sugar snap peas prior to symptom onset. The eighth case noted that sugar snap peas were not indicated in her purchase records because her spouse used a different shopper's card at the time of purchase. The seven records revealed that sugar snap peas were purchased between 14 August and 5 September 2015. The CFIA was notified of the findings and in response initiated a traceback investigation that focused on the purchasing and distribution records for sugar snap peas sold by retailer A. The investigation revealed that sugar snap peas came from Guatemala and were sold under a single brand name that was exclusively distributed to retailer A locations in Ontario beginning in May 2015 but were sold nowhere else in Canada.

The CFIA PCR assay did not detect *Cyclospora* in an unopened package of sugar snap peas that was obtained from a case's home.

Public health action. Based on the weight of the evidence gathered, Health Canada's health risk assessment team determined that there was strong evidence that sugar snap peas were the source of the outbreak. A food recall warning was issued to the public by the CFIA, and the retailer announced a voluntary recall of the product on 17 October 2015. The CFIA also notified the Guatemalan government of the recall and requested that the supplier conduct a root cause analysis and develop a plan for corrective actions to mitigate the possibility of similar outbreaks. After the recall of the sugar snap peas, no further cases linked to the outbreak were detected.

DISCUSSION

This report provides details of the first documented outbreak of cyclosporiasis in Canada linked to the consumption of imported sugar snap peas. An outbreak in Sweden in 2009 also was associated with Guatemalan sugar snap peas *(6)*. In 2004, an outbreak of cyclosporiasis in the United States was linked to Guatemalan snow peas, which are similar to sugar snap peas in appearance *(2)*. Outbreaks of cyclosporiasis in Ontario occurred from 1996 to 1999 and were either associated with or suspected to have been acquired from contaminated berries imported from Guatemala *(9)*.

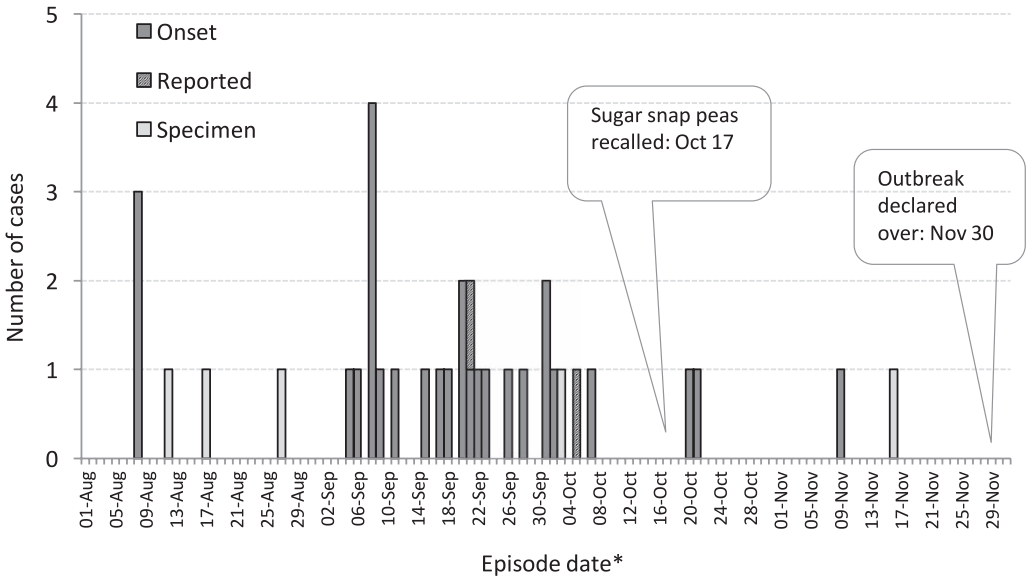

FIGURE 1. *Number of outbreak-confirmed cyclosporiasis cases listed by episode date, Ontario: 8 August to 23 November 2015.* Episode date is the earliest date known to investigators for symptom onset, specimen collection, or reported date for each case.*

One sample of Guatemalan sugar snap peas from a case's home tested negative for *Cyclospora*. To our knowledge, in only a few reported cyclosporiasis outbreaks has the pathogen been identified in a suspected or implicated food sample *(5, 8)*. In the absence of a point source or other clustering of cases, identification of the source of an outbreak involving this parasite can be challenging. Laboratory methods for the identification of *Cyclospora* and other parasites have lagged behind those for pathogenic viruses and bacteria. The current lack of subtyping methods also exacerbates the difficulty of identifying outbreaks and hinders the implementation of effective source-based preventive measures. Therefore, other non–travel-related cases reported prior to this outbreak could have been associated with sugar snap peas. A separate investigation of an increase in non–travel-related cyclosporiasis cases reported in the months prior to the identification of this outbreak revealed that the likely source was imported fresh produce *(12)*; however, the source was not confirmed. In the outbreak in the present report, laboratory subtyping methods could have enhanced the detection of outbreak-related cases by improving the linkage between cases and between cases and exposures (i.e., sugar snap peas).

TABLE 1. *Food items consumed by at least 40% of confirmed cyclosporiasis outbreak cases, 8 August to 23 November 2015*

Food item	No. (%) of yes responses[a]	Canadian Food Consumption Survey reference population value (%)[b]
Any raw vegetable	25 (96)	NA
Peas (shelled or in pods)	24 (89)	28
Sugar snap peas	23 (96)	28
Any raw fruit	22 (92)	NA
Strawberries	20 (77)	40
Romaine lettuce	19 (70)	53
Blueberries	15 (58)	37
Raspberries	13 (59)	20
Fresh herbs	11 (46)	46
Spinach	11 (41)	26

[a] Denominator varies based on sum of yes and no responses; $n = 29$.

[b] Reference values as obtained from "Foodbook Report" *(11)*. NA, not available.

The recall of the fresh sugar snap peas was supported by strong epidemiological and food safety evidence. One advantage in this investigation was that the majority of cases were localized to one PHU in Ontario, and thus were interviewed by the same interviewer using the cyclosporiasis standardized case questionnaire introduced by the province in 2014. This was beneficial in rapidly identifying potential common exposures among the earlier cases, which in turn informed the collection of exposure data from subsequent cases. The use of the standardized case questionnaire for all interviewed cases also contributed to the rapid identification of the outbreak.

The food safety investigation was aided by information gathered from shopper's cards. Since 2014, Public Health Ontario has been collaborating with the retail industry to obtain purchase histories from clients who are linked to outbreak investigations. These histories are valuable for supporting food safety activities and assist in hypothesis generation and food history recall by cases. Shopper's card data have also been useful for supporting previous outbreak investigations involving cyclosporiasis and other pathogens in Canada *(13, 14)*.

Currently, solving outbreaks of cyclosporiasis relies on the expertise of public health practitioners, the application of epidemiological approaches such as use of a common questionnaire, and confirmation of purchase history through shoppers' records or other similar sources of exposure data. The detection and source determination of future outbreaks will also benefit from the development and implementation of subtyping methodologies for *Cyclospora*.

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