Foodborne Illness in Toronto

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Authors:
Anne Arthur, MSc
Effie Gournis, MSc, MPH
David McKeown, MDCM, MHSc, FRCPC
Barbara Yaffe, MD, MHSc., FRCPC

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1.0 INTRODUCTION

Illness resulting from the ingestion of food is widespread and much of it is preventable. The most common symptoms of foodborne illness are gastrointestinal and include: loss of appetite, abdominal cramps, nausea, vomiting, diarrhoea of variable severity, and fever. Symptoms can resolve on their own or with treatment and can occur anywhere from hours to months after exposure. Infection from contaminated food may rarely lead to chronic or serious illness that can require hospitalization or lead to death. Morbidity and mortality associated with food results in significant social and economic costs through health care expenditures, lost productivity and the impact of reduced consumer confidence on the food industry.

Food consumption can lead to illness in three ways:

- biological - living organisms in food (bacteria, viruses, parasites, or fungi) are ingested by humans and lead to infection;
- chemical – environmental contaminants (e.g. heavy metal, PCBs) or toxins produced by bacteria, moulds, or shellfish are ingested in food and cause symptoms; and
- physical - pieces of plastic, metal or other foreign matter in food are ingested and cause injury.

This report focuses on foodborne illness acquired through the biological path, specifically diseases that cause infectious gastrointestinal illness designated as reportable under the Ontario *Health Protection and Promotion Act (HPPA)* (1). Information on the legal authority for collection of data and the information systems used to record data is included in Appendix A.

Infectious gastrointestinal illness is usually spread via food, water, or person-to-person by the fecal-oral route (and possibly by the respiratory route). Conducting surveillance for foodborne illness is challenging for several reasons. First, as many studies have shown, cases of foodborne illness are significantly underreported to public health authorities (2-5). This is due to a variety of factors related to illness severity, patterns of health care seeking behaviour, and a passive reporting system which primarily relies on physicians and laboratories to identify and report cases. In addition, many enteric pathogens transmitted through food can also be spread through water or person-to-person transmission, making it difficult to conclusively attribute a case of gastrointestinal illness to food.

The purpose of this report is to use current data to describe risk factors for acquiring foodborne illness, and to draw on published methods to estimate the total burden of foodborne illness in Toronto.

2.0 BACKGROUND AND CONTEXT

The *HPPA* designates communicable diseases that are reportable in Ontario, a number of which are foodborne and can lead to gastrointestinal illness. The *HPPA* requires confirmed and suspect cases of these diseases to be reported to the local Medical Officer of Health by physicians and other regulated health professionals, laboratories, and administrators of hospitals, schools, and institutions[1]. This is a passive surveillance system for case detection that relies on health care providers and institutions to recognize and report cases to local public health units.

[1] "Institutions" are congregate setting facilities as defined in the HPPA, including: long term care homes, correctional facilities, hospitals, and child care centres

Only a small proportion of reportable disease cases are related to infectious gastrointestinal illness resulting from foodborne transmission. The reportable diseases known to be efficiently and frequently transmitted through the ingestion of food considered in this report are: amebiasis, botulism, *Campylobacter* enteritis, cryptosporidiosis, cyclosporiasis, giardiasis, hepatitis A, listeriosis, paratyphoid fever, salmonellosis, shigellosis, typhoid fever, verotoxigenic *E.coli* and yersiniosis. In addition, cases of food poisoning and outbreaks of infectious gastrointestinal illness in institutions are reportable and are also included.

All reports of laboratory-confirmed communicable diseases within Toronto are investigated by Toronto Public Health (TPH) to determine the source of infection. For agents causing infectious gastrointestinal illness, TPH collects information specifically to determine whether the infection was transmitted through food. For instances of illness where food is suspected as a source, TPH collects information on the occupation of affected persons (to identify cases who may be handling food at work, or providing care to children or patients) and activities that may explain where and when a contaminated food was consumed (e.g. if there was recent travel or if others in the home have been ill with similar symptoms). Investigations are also conducted to determine if others may have been exposed and to ensure treatment is sought where necessary. TPH monitors for outbreaks and looks for potential commonalities between sporadic cases. Where these are found, a thorough epidemiological investigation is conducted to determine if cases are linked through a common source such as an event or a food item.

When a suspected outbreak or cluster of infectious gastrointestinal illness is reported for those in an institutional setting such as a long term care home, active case finding strategies are employed to detect other individuals who might have acquired the same illness. Stool specimens are collected and sent for laboratory identification of the etiologic agent. When an agent has been confirmed as the cause of an institutional outbreak, stool specimens are no longer collected as case confirmation is based on the appearance of clinical symptoms that meet the outbreak case definition. Investigation of outbreaks that are centred on a specific event (e.g. a picnic) entails finding and asking questions of all attendees concerning their health and food history and where cases are identified, requesting samples for laboratory testing.

Where illness is linked to a food premise, a specific food source, or manufactured food, an investigation proceeds that focuses on food safety and food handling practices which may involve a coordinated response involving several possible agencies and jurisdictions. A detailed review of these activities in Toronto is contained in a companion report, *Food Safety in Toronto* (6).

There are several factors that may influence whether episodes of infectious gastrointestinal illness are reported to public health. These include: mild illness for which individuals do not seek medical attention; illness for which lab specimens (usually a stool sample) are not requested by a physician; incomplete patient compliance with stool sample requests; stool samples which are analyzed but which do not contain a causative agent (as shedding of the organism may have passed); and a finding of pathogens or positive lab results is not reported (3). It can also be challenging to confirm that food is responsible for gastrointestinal illness with individuals who may not know if they acquired the illness through food, water, other sources (e.g. pets), or directly from someone else who was infected. Many of the pathogens that cause foodborne infectious gastrointestinal illness can also be transmitted person-to-person via the fecal-oral route through contaminated hands or sexual contact. Taken together, these factors result in substantial

underreporting of infectious gastrointestinal illness related to food and indicate that routine disease reporting rates underestimate the true impact of foodborne illness.

As not all cases of reportable diseases that can be foodborne are acquired through ingestion of food, only a subset of all confirmed reportable diseases possibly related to food are considered in this report. Attributing an instance of infectious gastrointestinal illness to ingestion of contaminated food is the first step in estimating the true burden of foodborne illness. For sporadic cases of disease, the number of reported cases attributed to food in this report was derived by examining each lab-confirmed case of disease that could be transmitted through food and analysing the risk factor and source of infection information provided during the course of the investigation. A food source was attributed to any cases with missing or unknown information in a proportion equivalent to the degree of foodborne transmission among those cases that were known. See the technical notes (Appendix B) for a complete description of the methods.

For outbreaks in institutional settings, the proportion of cases attributed to food was based on the published probability of foodborne transmission for a specific agent (see Appendix B). This method takes account of the epidemiology of the disease agents in many of these outbreaks, which are often viral in nature and can include a large amount of person-to-person transmission. All cases in community outbreaks that were known to be caused by contaminated food were counted and attributed to food.

Throughout this report, the term "foodborne illness" will be used to describe counts, rates and proportions of cases of infectious gastrointestinal illness attributed to foodborne transmission using the data sources and methods described in the technical notes (Appendix B), and limitations identified (Appendix C).

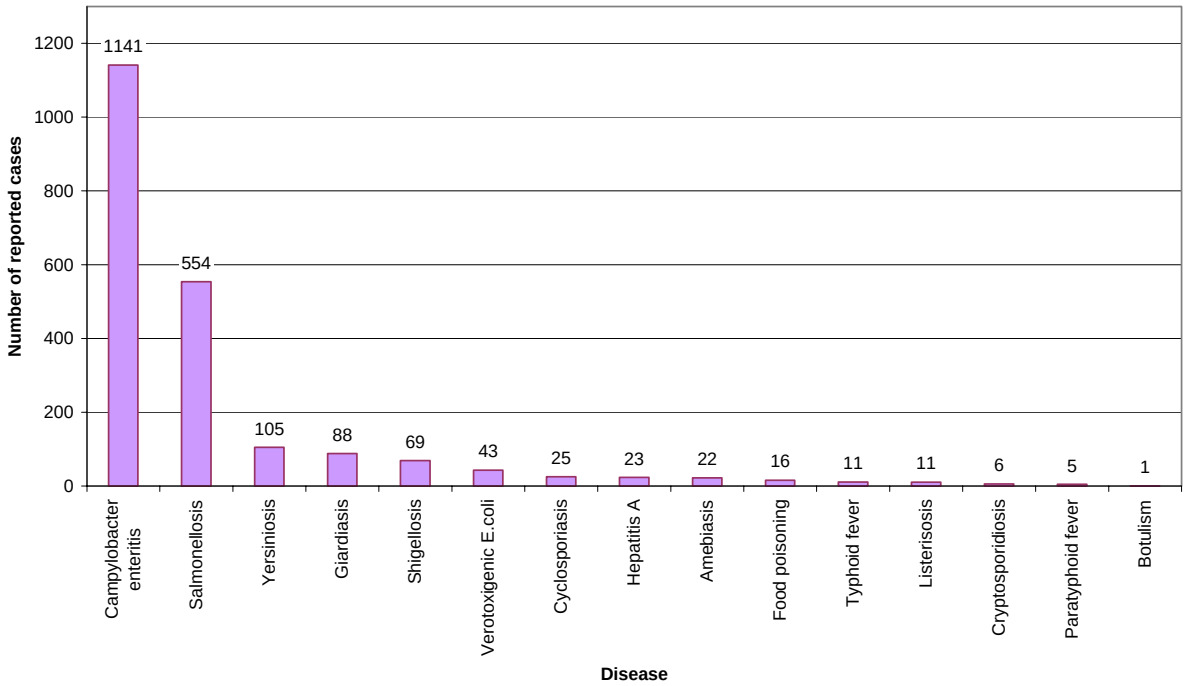
3.0 DESCRIPTIVE EPIDEMIOLOGY OF REPORTED FOODBORNE ILLNESS – SPORADIC CASES

This section of the report will describe what is known about sporadic cases of foodborne illness that were reported to TPH between 1998 and 2007. Sporadic cases are defined as those occurring among individuals not known to be associated with an outbreak of disease. A description of the methods used to estimate the number of foodborne cases for each agent is included in the technical notes (Appendix B). The reported cases described here represent a small proportion of all foodborne illness occurring in Toronto. Estimates of the true burden of foodborne illness are described later in this report.

3.1 Disease

With respect to specific disease agent, the largest contributors to the total number of foodborne infections were *Campylobacter* enteritis and salmonellosis, with an average annual count of 1,141 and 554 reported sporadic cases, respectively (Figure 1). Botulism is the most infrequently reported disease, with an average of one reported sporadic case each year.

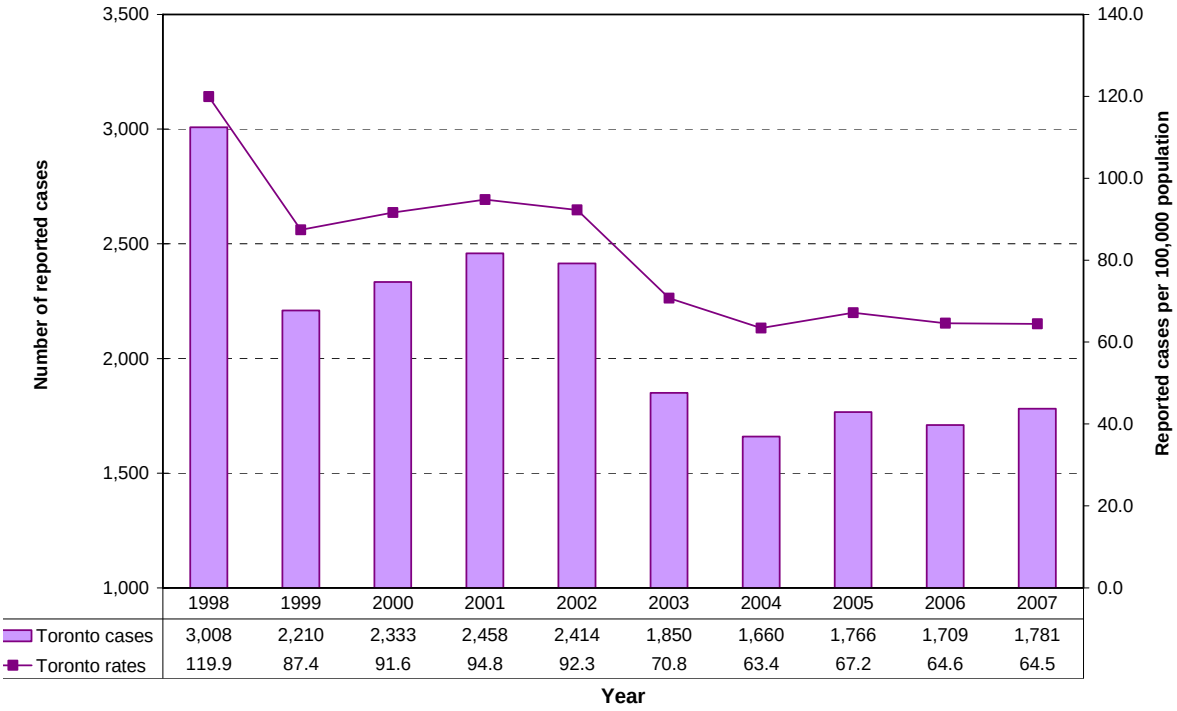
Figure 1. Average annual number of sporadic cases of foodborne illness, by disease. Toronto, 1998 to 2007.



3.2 Time Trends

Figure 2 shows the average annual number and incidence rates of sporadic cases of foodborne illness for Toronto in the ten year period to 2007. The number of cases in this period declined significantly from about 3,000 in 1998 to just below 1,800 cases annually for the five years from 2003 to 2007. It is noteworthy that the incidence between 2003 and 2007 was about 30% lower than it was between 1998 and 2002. The decrease coincided with the introduction in 2000/2001 of the TPH DineSafe restaurant inspection and disclosure program, which resulted in a dramatic increase in compliance with food safety regulations following an intense period of public scrutiny and sustained media coverage concerning poor enforcement and "dirty dining" habits of some Toronto restaurants. It is not possible to conclude definitively that the increased public attention paid to food safety and the program enhancements implemented by TPH during this period were responsible for the reduction in cases, but it is reasonable to suggest that these changes played a role. This period also saw a provincial decline in foodborne illness, though smaller than Toronto's, at approximately 20%. Sporadic cases of foodborne illness calculated by disease and year are shown in Table B (Appendix D).

Figure 2. Number and incidence of sporadic cases of foodborne illness, by year. Toronto, 1998 to 2007.



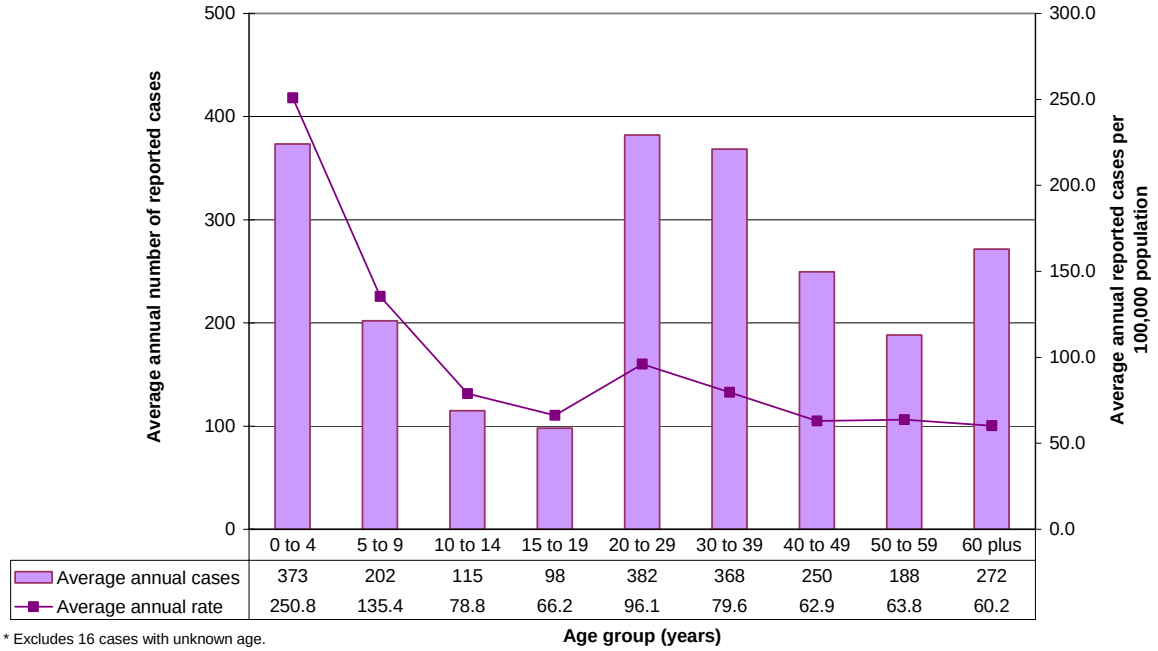
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Toronto cases	3,008	2,210	2,333	2,458	2,414	1,850	1,660	1,766	1,709	1,781
Toronto rates	119.9	87.4	91.6	94.8	92.3	70.8	63.4	67.2	64.6	64.5

Comparable time trend data for sporadic cases of foodborne illness for the rest of Ontario were not available for comparison. However, previously published rates comparing Toronto to the rest of Ontario for reportable diseases that cause infectious gastrointestinal illness show that Toronto consistently has higher rates of these reports (16). The difference may be accounted for by a number of factors including more complete reporting in Toronto due to a concentration of health care services and commercial food premises, and international travel patterns of Toronto residents. Further research would be required to better understand the contribution of these factors.

3.3 Age and Gender

Average annual numbers and rates for sporadic cases of foodborne illness by age group are shown in Figure 3. Seventeen percent of cases were reported among children under five years of age, whereas just 5.4% of the population is under five years of age (7). This disproportionate burden in young children is consistent with other published reports and is expected for most of the agents associated with foodborne illness (8, 9). Higher rates of illness among children can be attributed to several factors including: difficulty enforcing hand hygiene; immature and previously unexposed immune systems; and an increased likelihood of parents seeking medical attention for their children. Young children are also at an increased risk of severe illness as their immune and digestive systems are not fully developed, leaving them more vulnerable to foodborne pathogens (10, 11). Older individuals are also susceptible to increased morbidity from foodborne agents (12), but are more often reported to TPH as part of an outbreak in institutional settings such as a long term care home. A more detailed summary of outbreak-associated cases is included later in this report.

Figure 3. Average annual number of sporadic cases of foodborne illness and incidence rates, by age group*. Toronto, 1998 to 2007.

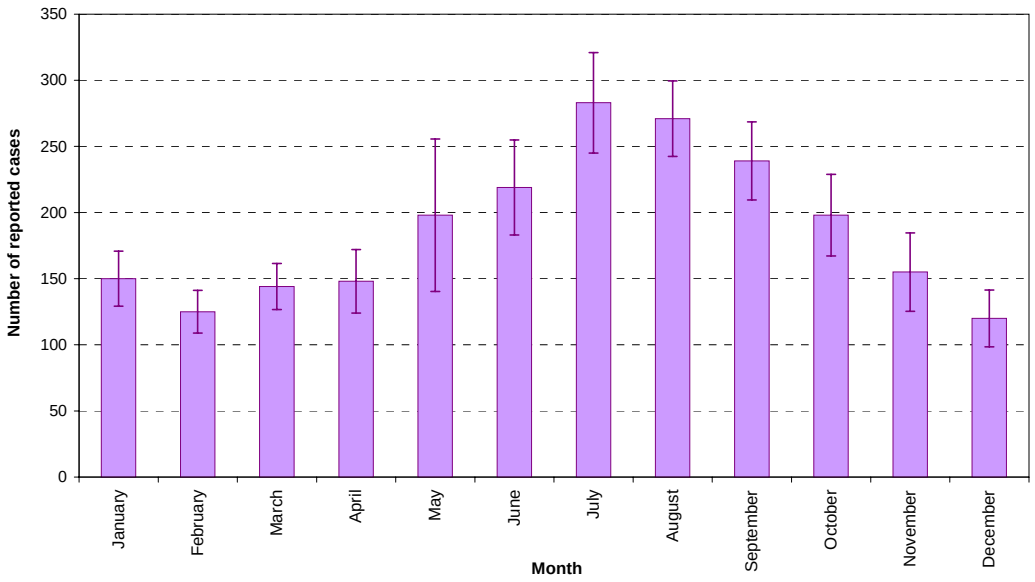


Average annual counts and rates by age group and sex are shown in Table C (Appendix D). Across all age groups, the incidence of foodborne illness among laboratory-confirmed reported cases was higher in males, who comprised 52% of foodborne illness reports in the 10-year period. The largest differences were observed among those between 5 and 19 years of age, and those between 40 and 49 years old. A recent study in Waterloo, ON found that males are more likely than females to consume foods associated with higher risk for transmission of enteric agents (e.g. undercooked eggs and ground beef products) (13). This may be further explained by observations in other studies that females are more likely to have better hygiene practices related to safe food handling than men (14).

3.4 Seasonality

Cases of infectious gastrointestinal illness are reported throughout the calendar year, but generally peak in the summer months (for bacterial causes) and the winter months (for viral causes) (15). For sporadic cases, July and August were the months with the highest number of reported cases of foodborne illness (Figure 4). The increase in reported foodborne illness in the summer months has been well documented, both in Toronto (16) and across Ontario (17). This trend may be explained by warmer ambient temperatures (i.e. faster micro-organism growth in the food), outdoor food preparation (e.g. picnics where food is kept out of refrigerators longer and there is less access to proper hand washing facilities), and the increase in barbecuing (with its higher risk of eating inadequately cooked meat).

Figure 4. Average number of sporadic foodborne illness cases, by month. Toronto, 1998 to 2007.

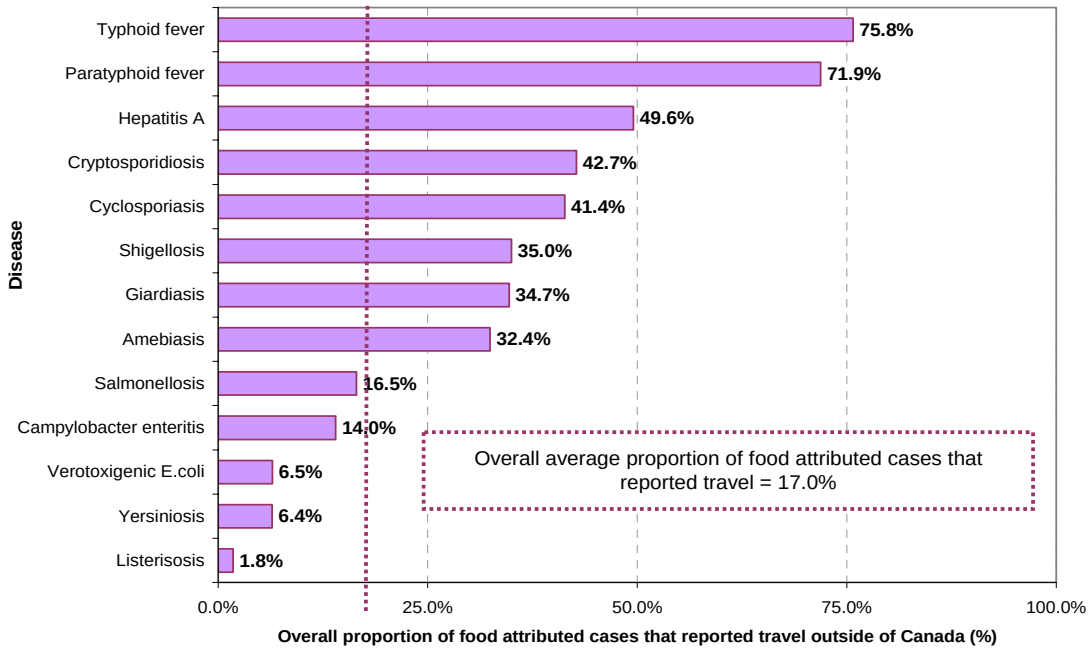


Error bars (I) denote 95% confidence intervals.

3.5 Travel

Travel is a significant risk factor for acquiring foodborne illness for residents of Toronto. Toronto data show that anywhere from 2% (for listeriosis) to almost 76% (for typhoid fever) of foodborne illness cases reported to public health were most likely acquired during travel outside of Canada (Figure 5). In about 17% of foodborne illness cases, travel outside Canada during the incubation period was reported.

Figure 5. Proportion of sporadic foodborne illness cases that reported travel outside of Canada, by disease*. Toronto, 1998 to 2007 combined.



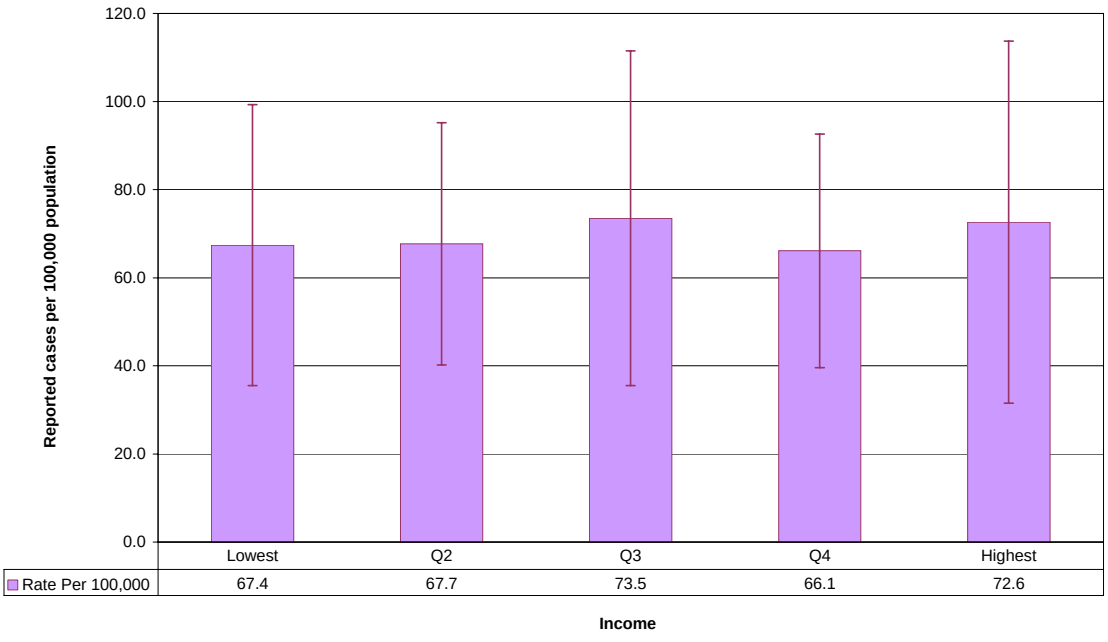
* Botulism and food poisoning are not included, as no reported cases were travel-related.

Toronto is a city of immigrants, with half the population having been born outside Canada (7). Those who retain strong links to their country of origin through travel are at higher risk of acquiring certain infections, including foodborne illnesses (18, 19). Travel to visit family and relatives (compared to tourism or business travel) is more likely to involve visits to rural areas, sometimes for extended periods, with more prolonged contact with local populations and exposure to local food sources. These travelers are also less likely to seek advice prior to travel or to take prophylactic measures (19). A recent study in Sweden, for example, found that the overall risk of giardiasis among returning travelers was highest among persons with family connections in the country to which they had travelled, and identified this as a high-risk group (20).

3.6 Income

To determine if health inequalities exist with respect to foodborne illness in Toronto, this report adopted the methodology of the recent report, *The Unequal City: Income and Health Inequalities in Toronto* (21). This entailed dividing the city into population income quintiles using the proportion of households living below the Statistics Canada Low Income (before taxes) cut-off (LICO) (22) in a given census tract. Quintile 1 includes the census tracts with the highest percent of households living with incomes below the LICO and is described in this report as the lowest income quintile. Quintile 5 represents the census tracts with the lowest proportion of households living below the LICO and is labelled as the highest income quintile. The data summarized in Figure 6 show that there is no significant correlation between income quintile and rates of reported foodborne illness in Toronto.

Figure 6. Average annual incidence rate of sporadic foodborne illness, by income level. Toronto, 2003 to 2007.



Error bars (I) denote 95% confidence intervals.

A survey of residents in Hamilton, ON found similar results, in that the prevalence of gastrointestinal illness was marginally associated with total household income (15). However, a significant pattern with income was recently reported from a study conducted in Denmark which found that higher income groups had increased risks of gastrointestinal illnesses caused by specific infectious agents. They attributed this to more travel among those with higher income, a higher

likelihood to seek medical care when ill, and a higher frequency of eating prepared food from outside the home, which may increase the likelihood of reporting an illness (23). Higher income groups in Canada do report eating outside of the home more frequently, as summarized in data from the Canadian Community Health Survey (24); and a U.S. study has shown that those with higher education are more likely to report gastrointestinal illness following a meal eaten outside of the home (25). These observations suggest that reporting trends and travel related exposures may offset an underlying gradient toward higher rates of locally acquired foodborne illness in lower income populations.

3.7 Commercial Food Preparation

The comparative risks involved with eating food prepared at home and eating food prepared outside the home (e.g. meals eaten in restaurants, prepared food eaten at home) is an important consideration when implementing and evaluating disease prevention programs, including education. A report on enteric illness in Ontario (17) found that approximately 50% of cases may be linked to a home setting; however, this estimate includes enteric illness from all causes, and is not specific to foodborne illness. There appear to be no published estimates describing risk attribution of foodborne illness based on the location of food preparation. This is a gap in the literature and further research on this relationship is warranted.

4.0 DESCRIPTIVE EPIDEMIOLOGY OF REPORTED FOODBORNE ILLNESS – OUTBREAK-ASSOCIATED CASES

While most cases of foodborne illness occur sporadically and are greatly underreported, foodborne disease outbreaks also occur regularly in Toronto. Outbreaks occur when a group of people consume the same contaminated food and subsequently two or more of them become ill with the same infection. Secondary person-to-person transmission may also occur during outbreaks of foodborne illness. Those affected may be a group of people who ate the same meal together, or they may have no connection other than they consumed the same contaminated item (e.g. from a grocery store or restaurant). Often, more than one factor increasing the risk of foodborne illness is present, with a combination of factors leading to the occurrence of an outbreak. For example, contaminated food may be left out at room temperature for many hours, allowing bacteria to multiply to high numbers, and then insufficient cooking fails to completely kill the bacteria.

Sporadic illness caused by some pathogens (e.g. *Clostridium perfringens*, *Staphylococcus aureus*) is not reportable to local public health units through the surveillance system; only cases related to outbreaks are reportable. This section includes reports of any communicable disease related to food that is reported as part of an outbreak. The number of outbreaks included corresponds to the total number of outbreaks known or suspected to be transmitted through food (e.g. acute gastroenteritis caused by norovirus).

Outbreaks of foodborne illness are detected in the community as well as in institutional settings (e.g. long term care homes, day nurseries). Since each setting has a unique set of factors affecting the risk of transmission and exposure to foodborne agents, data for various settings are differentiated where available and applicable.

Most community based outbreaks can be linked to a common food source, usually associated with a catered or organized event. Institutional outbreaks, however, are more likely to involve person-to-person transmission rather than to be related to exposure to a single foodborne source. As such,

it is not possible to determine the number of outbreaks in institutions that were food-related. This is supported by the epidemiology of Toronto outbreaks over time, which shows a propagated pattern of transmission (rather than single event exposures).

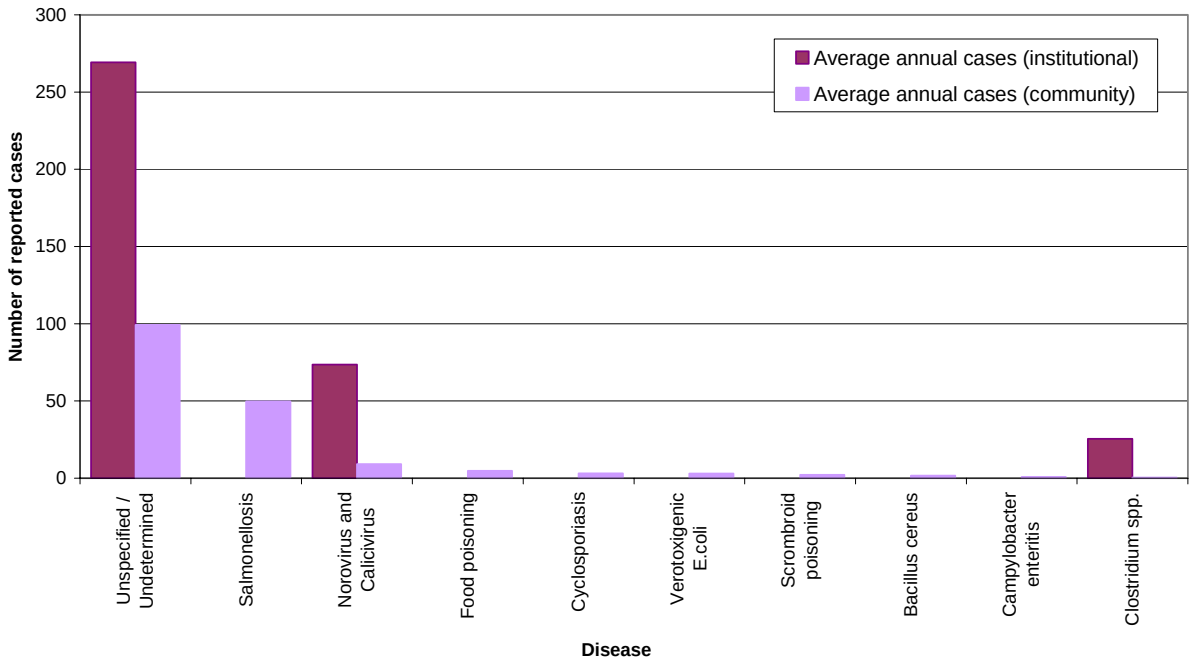
The methods used to determine the number of outbreak-associated cases that were foodborne, and the specific diseases involved, are described in the technical notes (Appendix B).

4.1 Disease

Among community outbreaks of foodborne illness, the largest number of cases relate to outbreaks for which an etiologic agent was unknown or undetermined. This finding is consistent with what has been reported elsewhere (4). This may be due to informing public health late in the progression of the outbreak (i.e. after illness has resolved), small numbers of specimens collected for laboratory testing and/or an inability to positively identify a specific agent. *Salmonella* was the most commonly identified cause of outbreak associated foodborne illness, comprising approximately 29% of all community outbreak cases of foodborne illness (Figure 7).

Among cases of foodborne illness occurring in institutional settings, the etiologic agent responsible for the majority of cases (62%) was also unknown or undetermined. Norovirus and calicivirus accounted for the majority of the remaining cases (38%). Less than 1% of foodborne cases in institutional settings were caused by *Clostridium* spp.

Figure 7. Average annual number of outbreak-associated cases of foodborne illness in institutional and community settings, by disease*. Toronto, 2003 to 2007.



* Diseases with an average annual reported numbers less than 1 are not shown: botulism, shigellosis, hepatitis A, cryptosporidiosis, and giardiasis.

4.2 Time Trends

The number of outbreaks and the number of foodborne cases occurring in community and institutional settings (e.g. chronic and acute care hospitals, long-term care homes (LTCH), and child care settings) from 2003 to 2007 is shown in Table 1. The number of outbreaks varied by

year, with an annual average of 163 outbreaks, and 544 cases attributed to foodborne illness. Institutional outbreaks comprise a large majority (91%) of infectious gastrointestinal illness outbreaks reported to public health.

Table 1. Total number of outbreaks of infectious gastrointestinal illness in community† and institutional‡ settings, and the number of foodborne outbreak-associated cases by year. Toronto 2003 to 2007.

		2003	2004	2005	2006	2007	2003-2007 Average
Community	**Outbreaks**	11	8	9	21	21	**14**
	Cases	167	71	208	196	236	**175**
Institutional	**Outbreaks**	95	162	126	194	169	**149**
	Cases	275	293	321	553	400	**368**
Overall Total	**Outbreaks**	106	170	135	215	190	**163**
	Cases	442	364	529	749	636	**544**

† Community outbreaks include those with primary causative agents: *B.cereus* , calicivirus, *Campylobacter* enteritis, *C.botulinum* , *Clostridium* spp. (excluding *C.botulinum*), cryptosporidiosis, cyclosporiasis, food poisoning, giardia, hepatitis A, norovirus, salmonellosis, scrombroid poisonong, shigellosis, verotoxigenic *E.coli* , and undetermined/specified gastroenteritis.

‡ Institutional outbreaks include those with primary causative agents: *Clostridium* spp. (excluding *C.botulinum*) calicivirus, norovirus,and undetermined/specified gastroenteritis.

4.3 Outbreak Setting

Outbreaks of infectious gastrointestinal illness occurred frequently in institutional settings, including long term care homes, child care centres, hospitals, and other settings. Table 2 shows the average annual number of outbreaks, and the number of foodborne cases (see Appendix B for methods). The average annual number of cases in a specific setting was highest among long term care homes and child care centres, with 212 and 124 cases, respectively. These settings also had the highest number of reported outbreaks due to disease agents commonly spread through contaminated food.

Table 2. Average annual number of outbreaks of infectious gastrointestinal illness (all sources, including food) and the number of cases of foodborne illness, by risk setting†. Toronto, 2003 to 2007.

	Institutional							
	Long term care home	**Child care center**	**Acute care hospital**	**Chronic care hospital**	**School / college / university**	**Other (e.g. group home, shelter)**	**Community**	**Overall total**
Average number of IGI outbreaks	57	73	10	6	2	1	14	**163**
Average number of cases attributed to food	212	124	17	8	4	4	175	**544**

† Includes institutional outbreaks with the following primary causative agents: *Clostridium* spp., Norovirus, Calicivirus, and undetermined/unspecified gastroenteritis. Community outbreaks include those with primary causative agents: B.cereus, calicivirus, Campylobacter enteritis, C.botulinum, Clostridium spp. (excluding C.botulinum), cryptosporidiosis, cyclosporiasis, food poisoning, giardia, hepatitis A, norovirus, salmonellosis, scrombroid poisonong, shigellosis, verotoxigenic E.coli, and undetermined/specified gastroenteritis.

4.4 Age Distribution

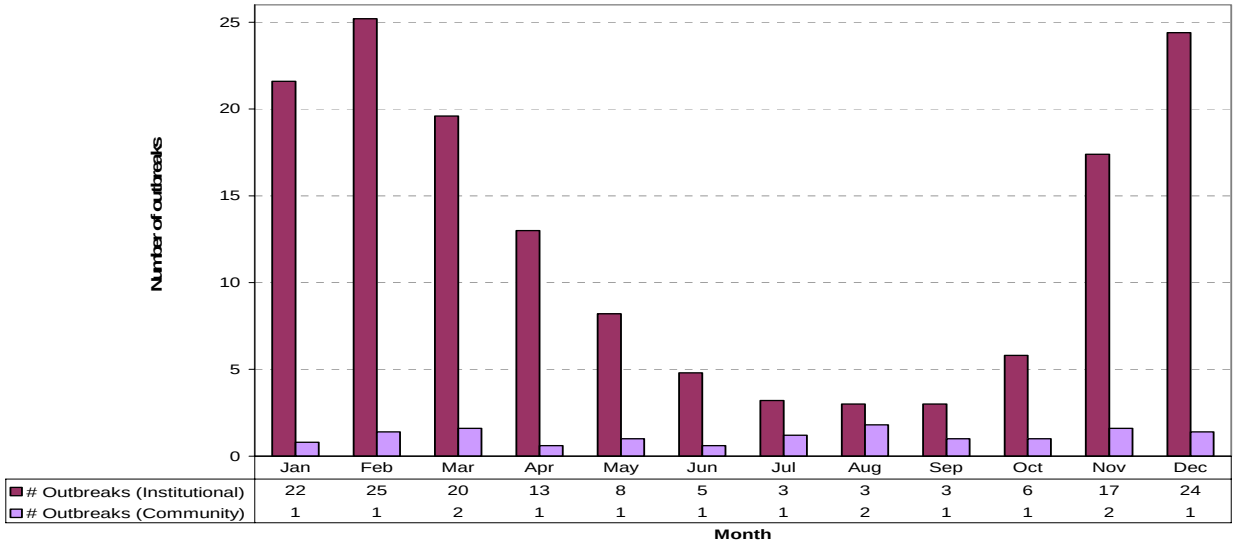
During public health investigations of outbreaks in institutional settings, data are recorded at an aggregate level. As a result, individual case level data on age and gender are not available and the age distribution of cases is inferred based on the type of institution in which the outbreak occurred.

A large number of outbreak-associated cases of foodborne illness are reported among children attending child care centres. For this reason, the age profile of outbreak-associated foodborne illness is similar to that observed for sporadic cases, with young children (<5 years of age) frequently affected. However, among outbreak-associated cases, proportionately more cases reported to public health occur among those living in long-term care homes, a population generally comprised of individuals 65 years of age and over. This is significant, as older individuals tend to suffer more severe health outcomes, including death, when they acquire foodborne illness. Reasons for increased susceptibility to foodborne illness include age-related changes in the gastrointestinal tract, an age-associated decrease in humoral and cellular immunity, malnutrition, lack of exercise, and excessive use of antibiotics (12, 27). Given an ageing population with about 14% aged 65 or older (7), an increased number of cases among older individuals can be expected in the future.

4.5 Seasonality

To examine seasonal trends of outbreak-associated cases occurring in institutional settings, all outbreaks of infectious gastrointestinal illness caused by agents that can be foodborne were included (see Appendix B for specific diseases). Outbreaks in institutional settings were reported to TPH throughout the calendar year, but peaked in the winter months; about 81% of all outbreaks were reported between November and April (Figure 8). This distribution can be explained by the large number of viral outbreaks, including norovirus, which typically occur in winter months and were commonly reported among residents of institutions (28). Outbreaks of foodborne illness in the community were most frequently associated with events occurring in the summer months or during the winter holiday season. Outbreaks occurring in the community did not show a distinct seasonal pattern (Figure 8).

Figure 8. Average annual number of infectious gastrointestinal illness outbreaks in community and institutional settings, by month. Toronto, 2003 to 2007.



5.0 TOTAL BURDEN OF FOODBORNE ILLNESS IN TORONTO

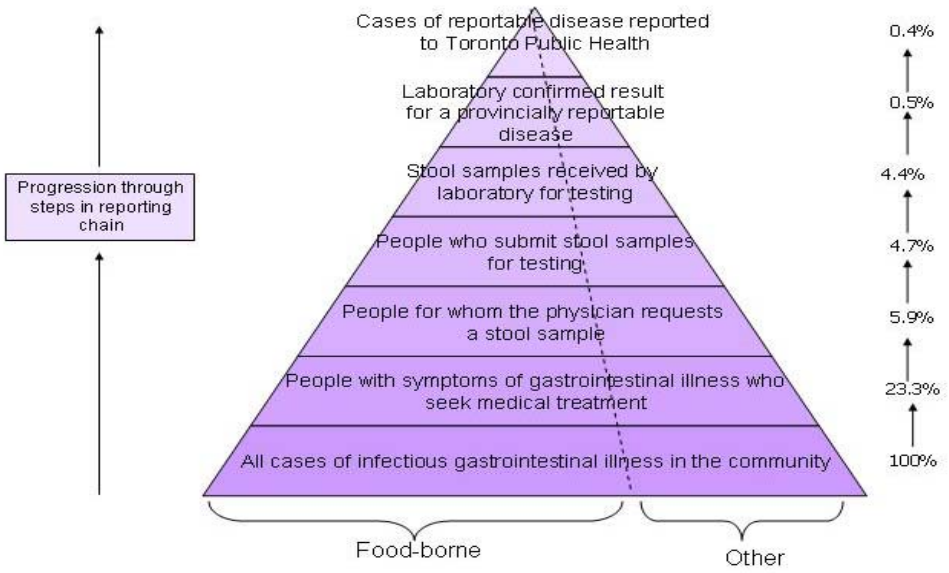
5.1 Methods for Estimating Infectious Gastrointestinal Illness

In 1999, the Public Health Agency of Canada (PHAC) developed the National Studies on Acute Gastrointestinal Illness (NGASI) initiative to address data gaps regarding the magnitude, distribution and burden of acute infectious gastrointestinal illness in Canada. One of the central objectives of this initiative was to quantify the underreporting of infectious gastrointestinal illness in Canada. The methods used have been described in detail elsewhere (29).

The approach used to estimate the underreporting of infectious gastrointestinal illness accounts for the processes of case detection, laboratory confirmation and reporting of cases. Estimates of illness can be derived by using probabilities and proportions of cases moving through the reporting chain. These probabilities include: 1) the proportion of symptomatic people seeking medical attention; 2) the proportion of patients for whom physicians request submission of a laboratory sample (usually a stool sample); 3) the proportion of patients who comply and submit the requested sample; 4) the sensitivity and specificity of laboratory tests used to identify pathogens; and 5) the proportion of those patients diagnosed with a reportable disease who are reported to public health (5, 29). Since none of these proportions is 100%, the underreporting of infectious gastrointestinal illness is compounded at each level. Estimates are calculated by extrapolating from the number of known cases reported to public health to the total number that is "missing" from routine TPH surveillance data.

Figure 9 shows the various steps and the estimated proportions of ill individuals at each step in the "reporting" cascades who reach the next step in reporting, starting from illness to a report made to TPH. These numbers are derived from: information collected from routine surveillance; knowledge gathered during public health investigations; data from population-based surveys, laboratory level surveys, and from the literature. The model can apply to estimating all infectious gastrointestinal illness or can be used to estimate a subset of infectious gastrointestinal illness diseases attributed to specific sources, such as food.

Figure 9. Estimated proportion of sporadic cases of infectious gastrointestinal illness captured at each step in the reporting chain.



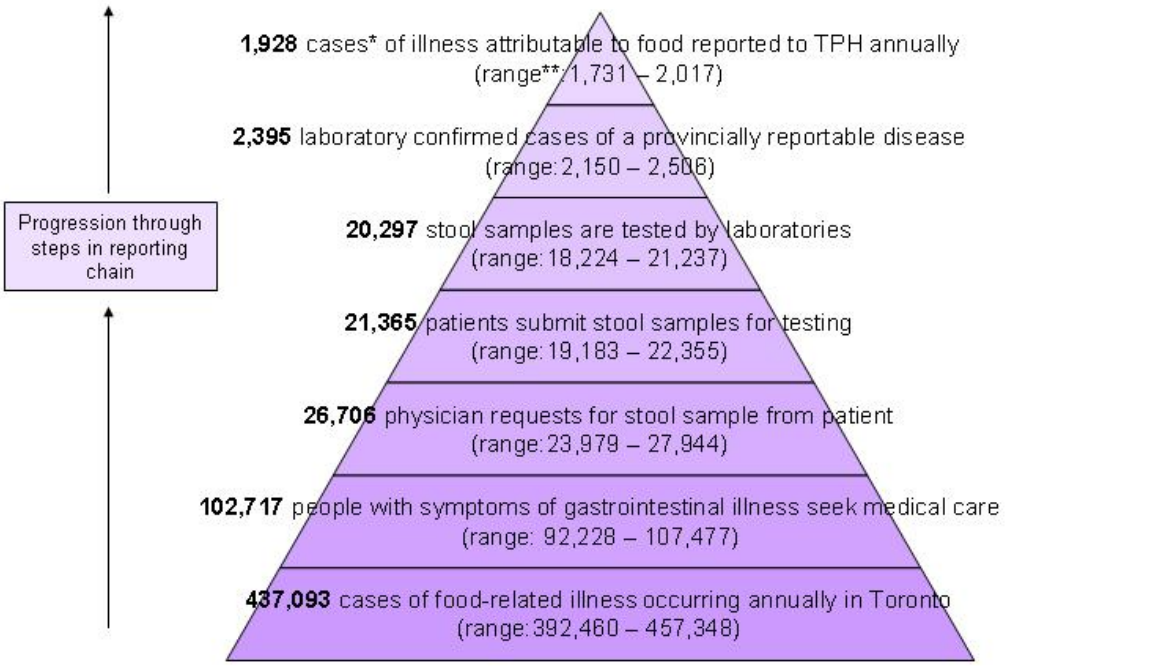
Source: Adapted from Majowicz, S.E. et al (2005) (5).

5.2 Estimating Foodborne Illness in Toronto

The estimated proportions used in Figure 9 were based on surveys of random samples of individuals in the community reporting symptoms of gastrointestinal illness. As such, the model was not based on data from cases affected by outbreaks of infectious gastrointestinal illness in institutional settings; the underreporting among the latter group cannot be estimated using this model. Since active case finding is part of a public health outbreak investigation, the proportion of cases who are known to become ill during an outbreak is likely much higher than what is known for sporadic cases. For this report, underreporting in institutional outbreaks is assumed to be minimal.

To calculate the total number of foodborne illness cases occurring in the community in Toronto between 2003 and 2007, the annual number of reportable sporadic cases of foodborne illness (Figure 2) was added across all years to the annual number of community outbreak associated cases of foodborne illness across all year (Table 1), and the five year average was calculated. This number, 1,928 cases, was multiplied by the proportion of reported cases at each step in the reporting chain (5), yielding the estimates shown in Figure 10. As well, a range of estimated values was calculated by using the minimum and maximum observed values in the five year period. Based on data for 2003 to 2007, the estimated annual number of cases of foodborne illness occurring in Toronto is 437,093.

Figure 10. Estimated† average annual number of sporadic and community outbreak-associated cases of foodborne illness. Toronto, 2003 to 2007.



† Calculated using mean proportions of underreporting at each step as described by Majowicz (2005).
* 2003-2007 average for sporadic cases of foodborne illness (n=1,753) and community outbreak associated cases of foodborne illness (n=175).
** Range refers to the range of estimated values over the 5-year time period, including sporadic and outbreak-associated community cases.

With an estimated 437,093 cases of foodborne illness occurring in Toronto annually, approximately one in six people (or 17% of all residents)[2] acquire a foodborne illness each year. Based on extrapolations from the best available evidence, for each case of foodborne illness reported to TPH there are an additional 227 cases of foodborne illness occurring in the community.

5.3 Disease-Specific Estimates

In addition to estimating the overall occurrence of foodborne illness from all reportable disease agents, specific estimates were calculated for three foodborne enteric pathogens of high public health importance – verotoxigenic *E.coli* , *Salmonellosis*, and *Campylobacter* enteritis. These estimates were calculated based on the five year average number of foodborne cases indicated above, applying pathogen-specific estimates of underreporting at each step using published estimates based on Canadian data (30).

The estimated annual number of cases and rates per 100,000 population in Toronto due to the three key pathogens are shown in Table 3. For each case of foodborne verotoxigenic *E.coli* reported to TPH, there were an estimated 27 cases annually in Toronto. Likewise, for each foodborne case of *Salmonella* and *Campylobacter* infection reported, there were an estimated 24 and 35 annual cases, respectively, among residents of Toronto.

Table 3. The median number of reported and estimated foodborne cases and incidence rates of VTEC, *Campylobacter spp*, and *Salmonella spp*. Toronto, based on 2003 to 2007 data.

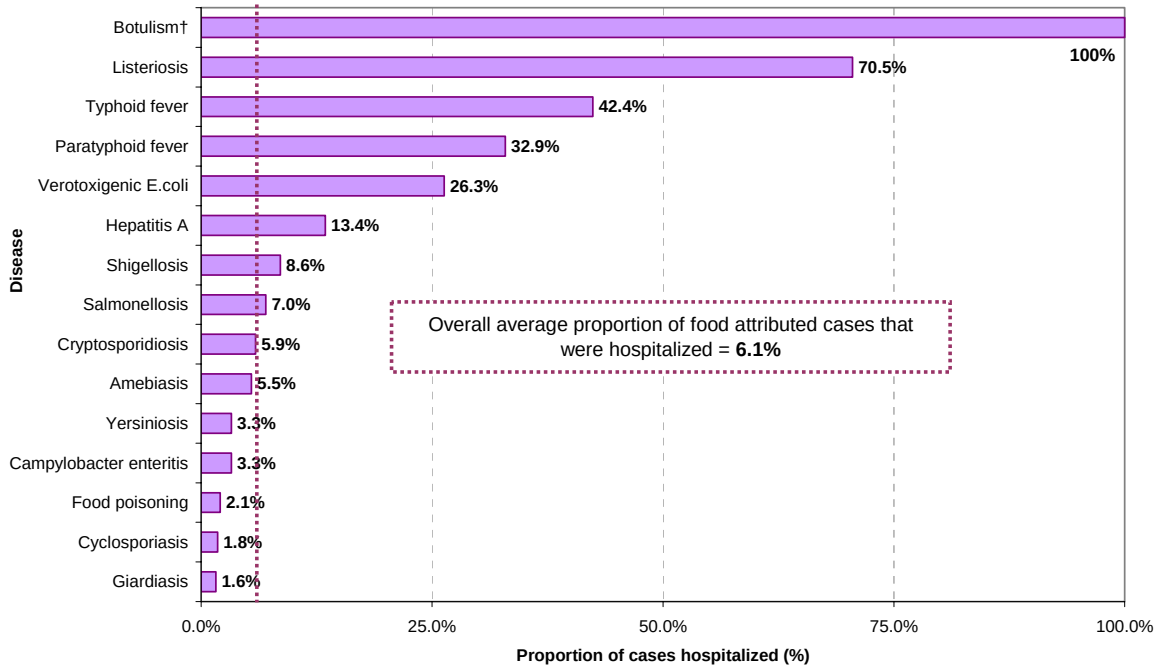
	Reported cases attributed to food		Median of estimated cases attributed to food	
Pathogen	Number of cases	Rate per 100,000 population	Number of cases	Rate per 100,000 population
Verotoxigenic *E.coli*	35	1.3	938	35.6
Salmonellosis	466	17.7	11,300	429.4
Campylobacter enteritis	913	34.7	31,882	1211.4

5.4 Morbidity and Mortality

Data on morbidity and mortality of all cases of reportable foodborne illness are routinely collected by TPH during the course of public health investigations. While cases are only followed up for a short period of time around the date they are reported, TPH data are the most comprehensive available for the health outcome of Toronto cases. The proportions of sporadic and select outbreak-associated cases of foodborne illness that were hospitalized, by disease, are shown in Figure 11. Approximately 6% of reported cases of foodborne illness required hospitalization. As only the most severely ill cases require hospitalization, these data represent the proportion of Toronto cases who became severely ill. Individuals with botulism, listeriosis, typhoid fever, paratyphoid fever, and verotoxigenic *E. coli* experienced the highest rates of severe illness.

[2] Based on population estimates from 2006 Census

Figure 11. Average annual proportion of sporadic and outbreak-associated cases* of foodborne illness that were hospitalized, by disease. Toronto, 1998 to 2007.



* Excludes agents that are only reportable as part of an outbreak.
† One botulism case without hospitalization data was excluded.

Over the 5-year period between 2003 and 2007, an average of 173 reported foodborne cases were hospitalized as a result of their illness. It is likely that most of those hospitalized due to a foodborne illness were reported to public health (i.e. the disease agent was identified when determining the treatment plan); however, unreported cases of foodborne illness may also have required hospitalization for their illness. Based on the average annual number of foodborne illness cases estimated in the previous section (Figure 10) for the same time period, approximately 0.04% of people who acquire a foodborne illness require hospitalization. This translates to one person hospitalized for every 2,500 cases of estimated foodborne illness.

Among outbreak-associated cases of enteric illness between 2003 and 2007, less than 0.5% of cases died as a result of the acquired illness. All deaths occurred in institutional settings, where affected individuals are more likely to have poor overall health, which predisposes them to more severe outcomes.

5.5 Past Outbreaks of Significance

In recent years, several large scale foodborne outbreaks have occurred in Toronto, highlighting various important components of food safety. Table 4 provides a summary of some of the most significant outbreaks of foodborne illness that have affected Toronto since 1998. Each outbreak highlights an aspect of food safety where preventive interventions are possible - either through policy changes at the municipal, provincial or federal level or through enhanced training and awareness among food handlers (6)

Table 4. Summary of selected significant foodborne illness outbreaks. Toronto, 1998 to 2008.

Outbreak Year	Disease	Number of Toronto cases	Outbreak details	Critical food safety issues
1998	Cyclosporiasis	29	Toronto cases represented one of twelve clusters investigated provincially linked to contaminated raspberries imported from Guatemala.	Globalization of food supply
2002	Hepatitis A	2	Food handler worked at downtown supermarket during infectious period. 18,000 Toronto residents were vaccinated as a protective public health measure.	Ill food handler
	Shigellosis	218	A province-wide outbreak linked to contaminated Greek pasta salad distributed by Toronto-based manufacturer	Mass production of food
2005	Cyclosporiasis	16	Pasta salad containing contaminated basil imported from Central America.	Globalization of food supply
	Salmonellosis	172	*Salmonella* enteritidis PT13 contamination of mung bean sprouts resulted in 522 cases provincially.	Contamination of food during production
2006	Botulism	2	Consumption of contaminated unpasteurized carrot juice distributed across North America. Four additional cases occurred in the United States.	Globalization of food supply, lack of pasteurization
2007	Verotoxigenic *E.coli*	51	Cross-contamination between raw and cooked food items at a catered picnic.	Food safety at large events, food handler training
2008	Listeriosis	9	National outbreak associated with contaminated deli meats produced by a processing plant in Toronto.	Contamination of nationally distributed product in a large scale production plant

5.6 Economic Impact

Foodborne illness constitutes a significant economic burden. Although most foodborne illnesses are clinically mild and the associated mortality is very low, the number of people affected is large. As such, the resulting morbidity and economic burden associated with treatment and recovery for these cases is high. Estimates of the economic burden of gastroenteritis need to account for medical care, including emergency room visits and physician visits, the cost of specimen testing, treatment (prescription and over the counter drugs) costs, and days of paid employment missed by cases or their caregivers. Estimates of the total economic burden and costs associated with gastroenteritis were recently calculated in two community-based studies conducted in Hamilton (31) and British Columbia (32), which estimated average annual costs of $1,089 and $1,343 per case of illness, respectively. The estimates were based on costs of health care visits, diagnostic testing, medication, and days of missed work. In each study, survey respondents were identified

based on random selection of residential telephone numbers. Cases occurring in institutional settings are not included in these cost estimates.

With the assumption that the cost per foodborne illness case is comparable to the cost per case of all gastrointestinal illness, and that these costs can be extrapolated to the number of reported and estimated cases calculated in this report, an estimate of the economic impact of foodborne illness in Toronto was calculated. Using the estimated number of cases of foodborne illness calculated in this report (Figure 10), the direct and indirect costs are estimated to be between $476 million and $587 million.

6.0 SUMMARY

The incidence of sporadic cases of foodborne illness has declined in the most recent five year period, coinciding with the increased compliance with food safety regulations resulting from the introduction of the TPH DineSafe program. Young children under the age of five and seniors are at highest risk for acquiring foodborne illness. A significant number of enteric illnesses are acquired through travel outside Canada, as Toronto residents visit friends and relatives in their country of origin. Reports of foodborne illness are highest in the summer months and early fall for sporadic cases, and in the winter months for outbreak-associated cases.

Significant foodborne outbreaks have continued to occur in Toronto in recent years, and their causes highlight the need for enhanced efforts in food safety.

Only one out of every 2,500 cases of estimated foodborne illness required hospitalization, but high rates of hospitalization are reported for cases of foodborne illness caused by certain agents. Among reported foodborne cases the likelihood of hospitalization was highest among those with botulism, listeriosis, and typhoid fever. Illness resulting in death occurred in rare cases involving outbreaks in institutional settings where affected individuals are more likely to have poor overall health, predisposing them to more severe outcomes.

The number of cases of foodborne illness identified through the current public health surveillance systems is a significant underestimate of the true burden of illness. Using reportable disease data in Toronto, together with estimates from Canadian surveys and other research, this report estimates the burden of foodborne diseases in Toronto to be an average of 437,093 cases per year in Toronto, or one case among every six residents.

The annual economic impact of foodborne illness in Toronto is estimated to range from $476 million to $587 million each year, including direct health care costs and loss of productivity.

Appendix A: Data Sources

1. Legal authority to collect

Reports of communicable disease for Toronto included in this report were collected by TPH under the authority of the Health Protection and Promotion Act, Ontario Regulations 559/91, which mandates notification of all confirmed or suspect reportable diseases to the local Medical Officer of Health. Reports of diseases summarized in this report are for individuals who lived in Toronto at the time of their illness.

2. Information systems

Data used in this report were collected and recorded in three different information systems.

a. Reportable Disease Information System (RDIS)

Prior to adopting iPHIS, each public health unit in Ontario used the Ministry of Health and Long-Term Care's (MOHTLC) Reportable Disease Information System (RDIS) to record and transmit aggregate-level information to the Province's Infectious Disease Branch for the purpose of provincial and national surveillance. RDIS was first introduced in Ontario in 1990 and had been used to store all reportable disease information for the city of Toronto up until and including November 27, 2005. This system was used to record information for all reportable diseases except SARS.

b. Integrated Public Health Information System (iPHIS)

TPH adopted the new mandatory provincial communicable disease information system, iPHIS, as of November 28, 2005. Each public health unit in Ontario utilizes iPHIS to record and share reportable disease data with the province's Infectious Disease Branch for the purpose of provincial, national and global surveillance.

c. Toronto Public Health's outbreak database

The TPH outbreak database was developed and implemented in 1998 when amalgamation of data from the six former health units that now comprise Toronto occurred. All outbreak information was collected and entered into the outbreak database to facilitate the creation of aggregate reports. This database was replaced by iPHIS in 2007.

Appendix B: Technical Notes and Calculations

1. Categorizing sporadic and outbreak-associated cases of illness

Cases of enteric illness were separated into two categories: sporadic (i.e. non outbreak-associated) cases and outbreak-associated cases. Outbreak-associated cases were identified by using the outbreak number associated with the case in iPHIS, and included any outbreaks that occurred in Toronto or involved Toronto residents.

2. Determination of risk factors for reported cases of sporadic enteric illness

All available risk factor and exposure data for cases of infectious gastrointestinal illness reported between 1998 and 2007 were analyzed and cases were categorized as follows:

- Cases reporting a risk factor of food – Cases reporting food as a risk factor, with or without any other risk factor;
- Cases with "other" risk factor – Cases reporting a risk factor not related to food (e.g. sexual contact, other person-to-person transmission, water, etc);
- Cases with missing or unknown risk factors – Cases with missing risk factor data, or who were identified only with a risk of "unknown".

Secondary cases of disease that were acquired from a case of food-related illness were excluded.

3. Proportion of foodborne illness among reported cases of sporadic enteric illness

For each disease, data for the 10-year period from 1998 to 2007 were analyzed to provide an overall estimate of the proportion of foodborne cases. The following calculation was used:

$$\frac{\text{Total \# of cases reporting food as a risk factor}}{\text{Total \# of cases reporting either food or "other" as a risk factor}} \times 100\%$$

This provided an estimate, for each disease, of the proportion of cases attributed to food among cases with an identified risk factor. Cases with a missing or unknown risk factor were excluded from the calculation to ensure that initial rates were based on only known data. Disease-specific estimates were validated by comparison to values published in the literature and also assessed against the known epidemiology of the organism.

Table A shows the average proportions resulting from these methods and validates our strategy for which risk factor information to use for ascertaining the number of reported foodborne cases. The average proportions of foodborne transmission by disease reported to TPH over the previous 10-year period were comparable to what has been reported elsewhere in the literature (4), with a few exceptions. Proportions of amebiasis, cryptosporidiosis and giardiasis cases thought to be foodborne in Toronto were lower than generally observed. These findings were expected for a large urban city like Toronto, as these are diseases that are also known to be transmitted sexually among men who have sex with men (MSM). This finding is consistent with what was previously published in Ontario (16).

Table A. Average proportion of foodborne transmission, by disease. Toronto, 1998 to 2007.

Disease	Foodborne transmission (%) Average	Minimum*	Maximum*
Botulism	100%	100%	100%
Food poisoning	100%	100%	100%
Cyclosporiasis	95%	67%	100%
Listerisosis	95%	100%	100%
Campylobacter enteritis	91%	88%	95%
Salmonellosis	89%	82%	93%
Yersiniosis	86%	67%	100%
VTEC	82%	65%	94%
Shigellosis	55%	25%	75%
Paratyphoid fever	50%	20%	100%
Typhoid fever	43%	20%	100%
Hepatitis A	38%	19%	60%
Giardiasis	15%	8%	26%
Cryptosporidiosis	12%	8%	25%
Amebiasis	5%	1%	23%
OVERALL	**65%**	**-**	**-**

* Minimum and maximum values are the highest and lowest non-zero values observed in the 10-year period.

4. Estimating the number of cases of sporadic enteric illness attributed to foodborne transmission

For each disease considered, the following calculation was applied to estimate the total number of foodborne cases, by disease and year:

All sporadic cases reporting food as a risk factor
+
(All sporadic cases with missing or unknown risk factor information
*
Disease specific probability of foodborne transmission from Table A)

Using salmonellosis counts for 2007 as an example, there were 93 cases with a reported food risk, 16 cases with an 'other' risk factor identified, and 478 cases with missing or unknown risk factor information:

Number of foodborne salmonellosis cases in 2007 = 93 + (478 * 89%) = 518 cases

This method was used to calculate counts, proportions, and incidence rates for the following analyses:

- Average annual number of sporadic foodborne illness cases, by disease. (Figure 1)
- Number of sporadic foodborne illness cases and incidence rates, by year, for Toronto (Figure 2).
- Proportion of sporadic foodborne illness cases that reported travel outside of Canada, by disease. (Figure 5)
- Number of sporadic foodborne cases, by disease and year. (Appendix D, Table B)

- Number of cases of foodborne illness associated with community outbreaks. (Table 1, Table 2)

a. Proportion of foodborne illness among those reporting travel during the incubation period for their disease

For each disease, data for the 10-year period were analyzed to provide an overall estimate of the number of sporadic foodborne illness cases that had also reported travel outside of Canada during the incubation period for their disease.

Cases were considered to be associated with travel outside of Canada as follows:

i. For cases recorded in RDIS - where the exposure setting was "Travel or lived in an endemic country"
ii. For cases recorded in iPHIS – where the exposure setting was "Travel" and the exposure setting detail was "Out of Canada".

The proportion of foodborne cases of disease who reported travel during the incubation period for their disease was calculated using the following formula:

$$\frac{\text{Number of sporadic foodborne illness cases who reported travel outside of Canada}}{\text{Total number of sporadic foodborne illness cases (both travel and non-travel)}} \times 100\%$$

b. Foodborne cases of sporadic enteric illness used for analyses of socio-demographic factors and calculating hospitalization rates

Analyses presented in this report focus on socio-demographic factors such as measures of neighbourhood income, age group, and gender. For these analyses, diseases were categorized as either high probability of foodborne transmission or low probability of foodborne transmission. These categories were based on the proportions of foodborne transmission calculated using Toronto data (Table A, Appendix B) and published estimates of the likelihood of foodborne transmission (4). The following diseases were attributed to each corresponding category:

- High probability diseases: Botulism, *Campylobacter* enteritis, cyclosporiasis, hepatitis A virus, listeriosis , salmonellosis, shigellosis, VTEC, typhoid fever, paratyphoid fever, and yersiniosis.
- Low probability diseases: Amebiasis, cryptosporidiosis, and giardiasis.

Analyses of diseases with a high probability of foodborne transmission included *all* cases of reported disease less the number of cases with a non-food risk factor recorded (e.g. cases in the "other" risk category). All cases with missing or unknown risk factor information were included.

Analyses of diseases with a low probability of foodborne transmission included only cases which had specifically reported a food-related risk factor. All cases with missing or unknown risk factor information were excluded.

This subset of cases was used to calculate counts, proportions, and incidence rates for the following analyses:

- Average annual number of foodborne cases and incidence rates, by age group. (Figure 3)
- Average number of foodborne cases, by month. (Figure 4)
- Average number of foodborne cases of by income level. (Figure 6)
- Average annual proportion of all foodborne cases that were hospitalized. (Figure 11)
- Average annual number of foodborne cases and incidence rates, by age group and gender. (Appendix D, Table C)

5. Low income cut-off before taxes (LICO)

To determine neighbourhood socioeconomic status, this report uses a measure of income, more specifically, the low-income cut-off before taxes (LICO) indicator for analysis. This method has been used previously to report on health inequalities in Toronto (21). The city was divided into population quintiles using the prevalence of people living below the LICO in census tracts. Quintile 1 includes the census tracts with the highest percent of people living below the LICO and is described in this report as the "most disadvantaged" quintile. Quintile 5 is described as the "least disadvantaged". The LICO was selected since not only is income a determinant of health, it takes into consideration the number of people that income supports and the size of the municipality. More information on the LICO scale can be found in Statistics Canada's 2006 Census Dictionary (22).

6. Estimation of foodborne cases occurring within community enteric outbreaks

Community outbreaks included those who were not part of an institutional outbreak with primary causative agents: *B.cereus,* calicivirus, *Campylobacter* enteritis*, *Clostridium* spp. (including *C.botulinum**), cryptosporidiosis*, cyclosporiasis*, food poisoning*, giardiasis*, hepatitis A*, norovirus, salmonellosis*, scrombroid poisonong, shigellosis*, verotoxigenic *E.coli**, and undetermined/specified gastroenteritis. Case level data are recorded for diseases marked with '*', and only aggregate level data are recorded for the remaining disease.

The number of cases of foodborne illness occurring within community-based outbreaks was calculated using two methods:

1. For cases of diseases that are also reportable individually (e.g. Salmonellosis), we used the method for sporadic individual cases described previously in the sporadic section.
2. For cases of diseases that are only reportable as part of an outbreak (e.g. norovirus) and collected at the aggregate level, the proportion of foodborne cases was calculated by multiplying the total number of cases for a disease agent by the probability of foodborne transmission for that specific agent based on previous reports (4, 33).

Outbreak-associated community cases of gastroenteritis that were of an undetermined etiology were all considered to be foodborne given the assumption that an event with shared food was the reason these cases were deemed to be part of a single outbreak.

The specific probabilities used in this calculation were (4, 33):

Bacillus cereus = 100% probability of foodborne transmission
Calicivirus = 40% probability of foodborne transmission
Clostridium spp = 100% probability of foodborne transmission
Norovirus = 40% probability of foodborne transmission
Scrombroid poisoning = 100% probability of foodborne transmission.
Undetermined gastroenteritis = 100% probability foodborne transmission

7. Estimation of foodborne illness cases occurring within institutional enteric outbreaks

The following disease agents are known to be transmitted through food and were included when estimating foodborne illness cases: Calicivirus, *Clostridium* spp, Norovirus, and undetermined or unspecified gastroenteritis.

To calculate the proportion of foodborne cases, the number attributed to each disease agent among residents was multiplied by the probability of foodborne transmission for that specific agent based on previous reports (4, 33).

The specific probabilities used in this calculation were:
Calicivirus = 6.6% probability of foodborne transmission
Clostridium spp = 100% probability of foodborne transmission
Norovirus = 6.6% probability of foodborne transmission
Undetermined gastroenteritis = 14.8% probability foodborne transmission

Appendix C: Limitations

1. Assumptions of comparability

Estimation of the underreporting of foodborne illness using proportions published by the National Studies on Acute Gastrointestinal Illness (NSGAI) (29) was undertaken with the assumption that the underreporting of enteric illness with a source of food is comparable to the underreporting of all infectious gastrointestinal illnesses. This choice would assume that characteristics of foodborne illness that may affect behaviours captured along the reporting chain (e.g. severity of illness) do not differ from those characteristics for all-cause gastrointestinal illness.

The proportions of underreporting occurring at each stage of the reporting chain were calculated based on population based surveys (to estimate the true number of infectious gastrointestinal illness cases in the community), physician surveys, and laboratory surveys. These surveys were administered between the years 2000 and 2002. As estimates for Toronto were calculated using data corresponding to the years 2003 to 2007 it is possible that there were changes to sampling protocols used by physicians, or that laboratory testing and reporting methods could have changed.

2. Impact of low-risk enteric follow-up procedure on risk factor data

All analyses in this report are based on risk factor data collected from cases reported to TPH. For the five diseases that are classified as low-risk enteric diseases - amebiasis, *Campylobacter* enteritis, giardiasis, salmonellosis, and yersiniosis – the follow-up investigation is conducted through a questionnaire mailed to the client. As this is how risk factor information is collected, including travel during the incubation period, the proportion of cases for these diseases with missing risk factor information is high. This may impact the data quality by increasing the number of cases with unknown risk factor data. Based on the results of an internal evaluation conducted in 2005, there were no differences in the age or gender distribution of cases that responded to the questionnaire compared to those that did not respond. The proportion of cases with missing or unknown risk factor data were approximately 10% higher among those who received a questionnaire in the mail as compared to those who were contacted by investigators on the phone.

3. Accuracy of reported risk factor information

Cases of enteric illness can be transmitted through several transmission modes, including foodborne, waterborne and person-to-person transmission. Frequently, food and beverages (water and other beverages containing water) are consumed together, which can confound the relationship between illness and foodborne transmission.

4. Impact of extrapolating from known risk factors to unknown/missing risk factors

The decision to use the proportion of all known risk factor responses that were food related and extrapolate it to the large number of unknown and missing risk factor instances assumes the risks for foodborne illness between clients with a known and unknown risk do not differ.

5. Impact of categorizing cases into high probability and low probability disease groups for analysis

Including all cases from the high probability disease group (with the exception of those with a specified risk factor of 'other'), and only including cases reporting food as a risk factor from the low probability disease group may result in both overestimating (in the high probability group) and underestimating (in the low probability group) the total number of foodborne illness.

Appendix D: Additional Data

Table B. Number of sporadic foodborne illness cases, by disease and year. Toronto, 1998 to 2007.

Disease	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average annual reported cases
Campylobacter enteritis	1636	1208	1350	1422	1229	1014	883	913	873	883	**1141**
Salmonellosis	843	582	596	620	565	480	417	455	461	518	**554**
Yersiniosis	108	123	121	111	128	109	77	103	91	74	**105**
Giardiasis	87	98	79	109	91	72	79	93	83	91	**88**
Shigellosis	82	54	54	42	234	44	43	58	33	43	**69**
Verotoxigenic E.coli	63	54	50	50	36	45	38	30	34	30	**43**
Cyclosporiasis	74	4	4	17	27	13	28	28	22	33	**25**
Hepatitis A	42	36	21	20	22	12	17	18	28	14	**23**
Amebiasis	27	27	23	18	22	18	17	20	23	29	**22**
Food poisoning	18	2	8	19	29	16	17	15	13	22	**16**
Typhoid fever	9	7	10	14	11	8	13	10	15	16	**11**
Listerisosis	13	6	10	9	13	8	14	11	12	11	**11**
Cryptosporidiosis	3	5	5	4	3	5	8	5	12	7	**6**
Paratyphoid fever	2	4	2	3	4	4	7	7	8	10	**5**
Botulism	1	0	0	0	0	2	2	0	1	0	**1**
TOTAL	**3008**	**2210**	**2333**	**2458**	**2414**	**1850**	**1660**	**1766**	**1709**	**1781**	**2119**

Table C. Number of reported sporadic cases of foodborne illness and incidence rates, by age group and sex*. Toronto, 1998 to 2007.

Age Group		Female	Male	Total	OR†	95% CI
0-4	#	171	202	373	1.13	0.92, 1.40
	Rate	234.9	265.7	250.6		
5-9	#	88	114	202	1.25	0.93, 1.66
	Rate	120.0	150.0	135.3		
10-14	#	45	70	115	1.47	0.99, 2.17
	Rate	63.0	93.6	78.7		
15-19	#	42	56	98	1.25	0.83, 1.91
	Rate	59.0	73.0	66.2		
20-29	#	193	189	382	1.00	0.82, 1.23
	Rate	95.8	96.3	96.0		
30-39	#	172	197	369	1.14	0.93, 1.40
	Rate	74.4	84.7	79.7		
40-49	#	112	138	250	1.27	0.98, 1.63
	Rate	55.5	70.5	63.1		
50-59	#	92	97	189	1.16	0.86, 1.56
	Rate	59.3	68.7	64.0		
60 plus	#	152	119	271	1.02	0.80, 1.30
	Rate	59.7	60.9	60.1		
Total	#	1,065	1,182	2,249	1.17	1.08, 1.27
	Rate	80.1	93.4	86.6		

* Excludes 32 cases with unknown age and/or sex.

† Females used as referent category.

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