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REPORTABLE WATERBORNE ENTERIC DISEASE IN ONTARIO, 1996 TO 2000

Introduction

The World Health Organization estimates that some 20 million people die of waterborne disease annually.[1] Traditionally, waterborne enteric illnesses are associated with areas of poor sanitation, and rural or untreated water supplies.[2] Without proper treatment of Ontario's private, recreational, and municipal water sources, individuals and whole communities risk becoming ill with one or more of the many waterborne illnesses prevalent in Ontario. Such illnesses include *E.coli* (VTEC), as well as campylobacteriosis, cryptosporidiosis, salmonellosis, amebiasis, shigellosis, and giardiasis.

In attempts to reduce the incidence of such illnesses, the Ontario government published Ontario Regulation 459/00: *Drinking Water Protection*, under the *Ontario Water Resources Act*.[3] This regulation ensures that public water treatment systems take the proper precautions to produce safe drinking water for the public. Ensuring that drinking water supplies meet these minimum requirements can reduce the incidence of outbreaks and sporadic cases of enteric waterborne illnesses.

The Centers for Disease Control in Atlanta state that detection of waterborne diseases depends on a combination of the following factors: public education, local reporting

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requirements, available laboratory testing, consultation with physicians, and disease surveillance.[4] Although the reporting of various waterborne diseases is mandated, health officials have commented, "for every case detected by the national laboratory surveillance system, there are 136 in the community, a 0.7% detection rate."[5] Sporadic cases of waterborne illness go undetected by the public and health authorities due to the large number of asymptomatic cases, in conjunction with the inability to accurately identify water as the true source for disease. Undiagnosed and/or undetected individuals can be a potential source for person-to-person transmission in outbreaks and sporadic cases of enteric diseases.

Under the *Health Protection and Promotion Act*,[6] a number of potential waterborne pathogens are classified as Reportable Diseases. Reporting and investigation of these diseases are conducted, as part of the *Mandatory Health Programs and Services Guidelines*,[7] to identify both the source of illness and to follow-up on treatment of individual cases. In Ontario, local health units report outbreaks and sporadic cases of Reportable Diseases to the Ministry of Health and Long-Term Care through the Reportable Disease Information System (RDIS). This paper presents findings from data pertaining to waterborne enteric diseases acquired in Ontario.[8]

Methods

Sporadic case reports and outbreak module data for 1996 to 2000 were considered for analysis from RDIS. The 1996 Census Population Data from Statistics Canada were used for calculating rates in health units.[9] The 1998 Statistics Canada population data were used to calculate age-specific rates.[10]

Definitions - Reported Waterborne Enteric Sporadic Diseases (RDIS Data)

Waterborne diseases are diseases acquired through consumption or ingestion of contaminated water. Thirteen Reportable Diseases were chosen for their potential to cause waterborne illness. These diseases include: amebiasis, campylobacter enteritis, cholera, cryptosporidiosis, giardiasis, hepatitis A, listeriosis, paratyphoid, salmonellosis, shigellosis, typhoid, verotoxigenic *E.coli* (VTEC), and yersiniosis.

The variables "Source", "Source Name", "Risk Factor1", "Risk Factor2", '"Specific Risk", "Travel1", and "Travel2" were considered to determine if the mode of transmission was: 'waterborne', 'waterborne-travel', 'other', 'unknown', or 'missing'. 'Waterborne' is defined as a waterborne disease that was acquired in Ontario. 'Waterborne-travel' is defined as a waterborne disease that was acquired outside of Ontario. 'Other' is defined as all other modes of transmission that were not waterborne, and included 'person-to-person', 'animal contact', 'food', 'travel-associated', and 'sexual contact'.

Definitions - Reported Waterborne Enteric Outbreaks (RDIS Outbreak Module)

All outbreaks reported in the outbreak module were considered for analysis during the five-year period. An enteric outbreak is defined by the occurrence of two or more cases of enteric illness linked in terms of time, exposure to source, and most often location. For the purpose of this paper, a waterborne enteric outbreak is defined as an enteric outbreak in which the mode of transmission was reported as water with the exposure occurring in Ontario. The RDIS variable "Outbreak Vehicle" was used to determine the mode of transmission. The RDIS variable "Agent/Organism" provided the specific pathogen or symptomatology.

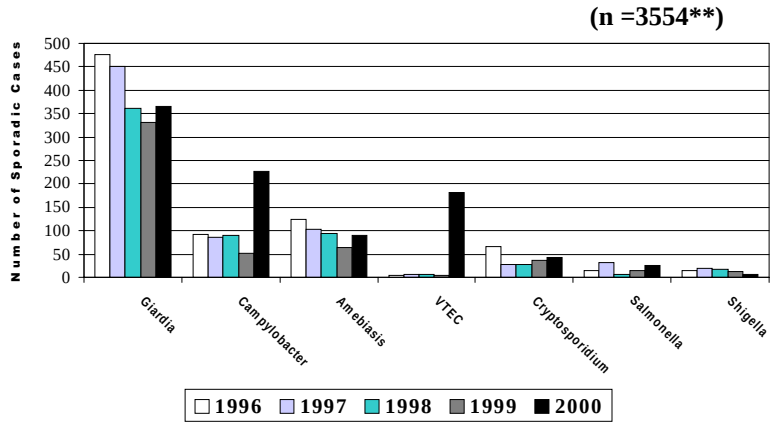
Results - Reported Waterborne Enteric Sporadic Diseases (RDIS Data)

There were 62,153 cases of enteric illness reported in Ontario from 1996 to 2000. Of the 62,153 cases, waterborne cases acquired in Ontario accounted for 3,632 (5.8%) cases. Waterborne cases acquired outside of Ontario accounted for 5,267 (8.5%), while 'other' accounted for 21,776 (35.0%), 'unknown' accounted for 30,173 (48.5%), and 'missing' accounted for 4,940 (8.0%).

There were two cases of cholera, 184 cases of typhoid, and 54 cases of paratyphoid in Ontario during the five-year period. None of the cases of cholera and paratyphoid were acquired in Ontario via waterborne transmission. There was one reported case of typhoid in which waterborne transmission in Ontario was not dismissed as a mode of transmission. Therefore, cholera, typhoid and paratyphoid are not included in the following results.

The annual number of Ontario-acquired waterborne cases from 1996 to 2000 was 819, 729, 610, 523, and 951, respectively. Giardia was the most frequently reported pathogen (Figure 1). The geographic distribution, showing the average annual rate of reported sporadic waterborne enteric illness by health units in Ontario, is shown in Figure 2.

Figure 1. Selected Reportable Waterborne Enteric Diseases, Ontario, 1996-2000.



**This figure does not include listeria, hepatitis A, or yersinia, which each had less than 50 cases in the five-year period.

The mean, median, mode and age range was 27, 27, 2, and 0 to 94 years. The '0-4 year old' age group had the highest age-specific rate (Figure 3). Males accounted for 2,003 (55%) of the cases acquired in Ontario.

Of the 3,632 cases that acquired their illness in Ontario, there were 53 (1.5%) individuals admitted to hospital as in-patients and 53 (1.5%) individuals treated as out-patients. There were 681 (19%) cases reported not to have visited a hospital. Seventy-eight percent of the cases had missing data for hospital status.

Results - Reported Waterborne Enteric Outbreaks (RDIS Outbreak Module)

There were 1,637 enteric outbreaks reported in Ontario between 1996 and 2000. Of the 1,637 outbreaks, 16 (1%) were waterborne. 'Gastroenteritis' was reported to be the "Agent/Organism" for five outbreaks (1996, 1997, three in 1998). Cryptosporidium was reported for four outbreaks (four in 1996), giardia for three outbreaks (1998, two in 1999), *E.coli* (VTEC) for two (1999, 2000), campylobacter for one (2000), and Norwalk was reported for one outbreak (1996).

The number of outbreaks, by size of outbreak, was: five outbreaks with '*less than ten persons'*, four with '*10 to 19 persons*', one with '*20 to 29 persons*', two with '*39 to 39 persons*' and two with '*40 or more persons*'. Two of the 16 outbreaks did not report the number of persons affected.

York Region and Simcoe County Health Units each reported four of the 16 outbreaks, while Kingston-Frontenac Health Unit reported three of the outbreaks. The following health units each reported one waterborne outbreak: Brant County, Grey-Bruce, Niagara, Peterborough, and City of Toronto Public Health.

The reported type of establishments for the 16 waterborne outbreaks are as follows: healthcare establishment (6), private home (4), restaurant (1), other (3), and missing (2). The source for the outbreaks was reported to be community/ municipal water for eight outbreaks, lake/ well water from camping/cottaging for four outbreaks, and four outbreaks contained missing data.

Discussion - Reported Waterborne Enteric Sporadic Diseases (RDIS Data)

The mode of transmission for approximately half (48.5%) of the enteric illnesses for the five-year period was unknown. It is therefore difficult to determine how these cases would be categorized by mode of transmission. In addition to the 3,632 waterborne cases reported in Ontario, the number of waterborne cases that would be included in the unknown category is difficult to determine as well. However, given that waterborne diseases are difficult to identify, the number of 'unknown' cases might be greater than expected.

It is interesting to note that the number of waterborne illnesses acquired outside of Ontario (5,267) is greater than the number acquired within Ontario (3,632). The number of illnesses acquired outside of Ontario represents a significant burden of illness to the healthcare system similar to the burden described for travel-associated enteric illnesses reported in Ontario in 1999.

None of the reported cholera, typhoid or paratyphoid cases were deemed to be definitively acquired in Ontario during the five-year period. The last report of one of these pathogens determined to be acquired through any mode of transmission in Ontario occurred in 1990 in which seven cases of typhoid were reported from consuming Lapis, a type of shellfish, contaminated

Name	id	Rate
Algoma	34	0.0
Brant	9	7.0
Bruce-Grey	13	44.1
Chatham-Kent	2	1.5
Durham	21	1.6
Eastern Ontario	28	4.1
Elgin-St. Thomas	4	3.3
Haldimand-Norfolk	7	5.5
Haliburton-Kawartha	22	9.9
Halton	16	7.4
Hamilton-Wentworth	15	1.4
Hastings-Prince Edward	24	7.4
Huron	6	6.6
Kingston	25	5.6
Lambton	3	3.3
Leeds, Grenville, Lanark	26	5.3
Middlesex-London	5	3.7
Muskoka-Parry Sound	30	9.7
Niagara	14	2.5
North Bay	31	18.2
Northwestern	37	2.3
Ottawa-Carleton	27	0.0
Oxford	8	6.4
Peel	17	16.0
Perth	10	8.0
Peterborough	23	4.1
Porcupine	35	6.0
Renfrew	29	4.6
Simcoe	20	9.1
Sudbury	33	9.8
Thunder Bay	36	8.1
Timiskaming	32	6.9
Toronto	18	5.6
Waterloo	11	4.9
Wellington-Dufferin	12	10.5
Windsor-Essex	1	5.0
York	19	8.5

Figure 2 - Average Annual Rate of Sporadic Cases of Waterborne Enteric Illness per 100,000 Individuals: 1996 to 2000

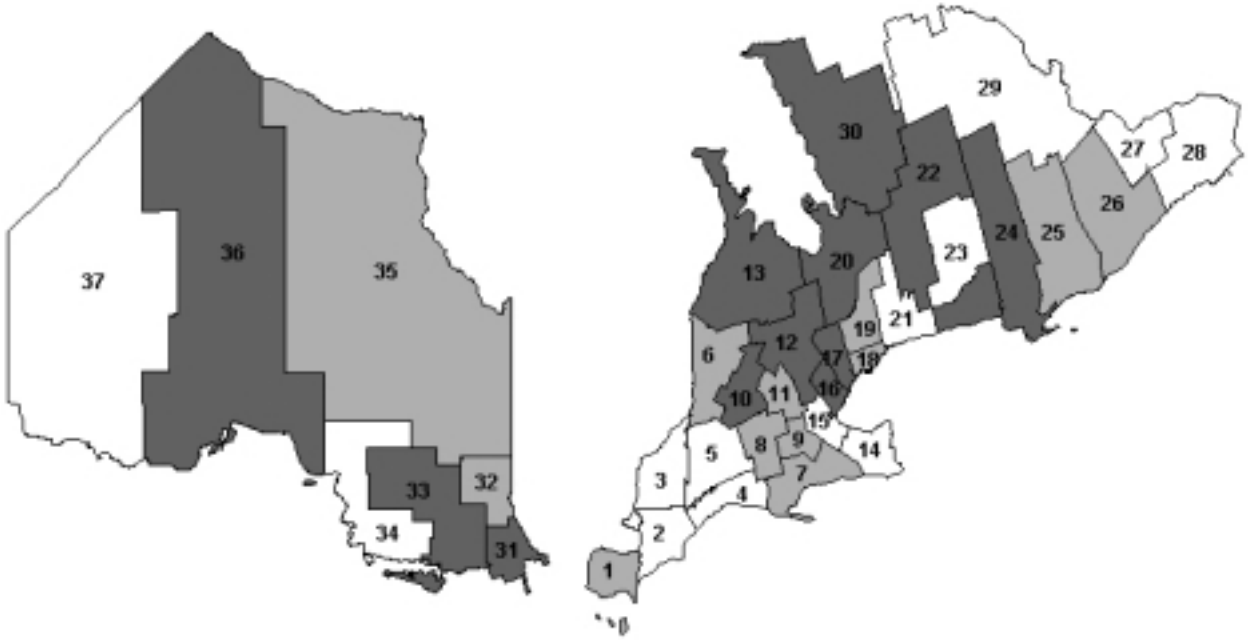
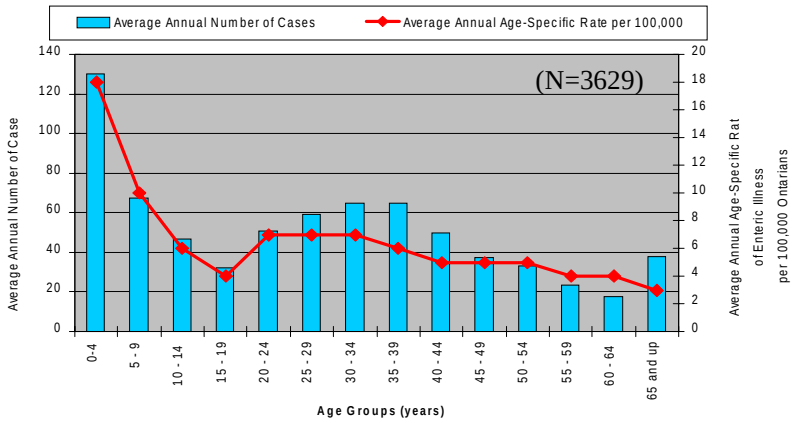


Figure 3. Average Annual Number of Cases and Age-Specific Rates of Selected Reportable Waterborne Enteric Disease, Ontario, 1996-2000.



with *Salmonella typhi*.[12] While cholera is traditionally considered waterborne, typhoid is predominantly associated with water and food, such as shellfish and raw fruits/vegetables, contaminated by the fecal matter of infected individuals.

A downward trend in the number of waterborne sporadic cases occurred between 1996 and 1999. However, the trend was interrupted by a marked increase in the number of cases in 2000. The increase in 2000 was due to the large number of VTEC and campylobacter cases reported to be associated with a large waterborne outbreak in Walkerton, Ontario. A report on the Walkerton outbreak indicated that more than 2,300 persons became ill from exposure to the contaminated municipal water supply in Walkerton.[13]

Giardia was the most frequently reported waterborne parasite and pathogen. These findings are consistent with findings worldwide identifying giardia as "the most commonly reported intestinal parasite." [14] Moreover, giardia showed the most marked decline in the number of cases over the five-year period.

The average annual rate of sporadic cases of waterborne illnesses in the Grey-Bruce area (44.1 per 100,000 persons) was markedly greater than the next highest geographic jurisdiction. The high rate in Grey-Bruce was attributable to the large number of cases that occurred in the Walkerton outbreak in 2000.

The '0-4 year old' age category showed the highest average annual rate (18 per 100,000 persons 0-4 years of age). This is consistent with age distributions observed in other enteric disease reports.[15]

Three percent of waterborne cases acquired in Ontario reported visiting a hospital and 19% reported not visiting a hospital. The large amount of missing data (78%) makes interpretation of these data difficult.

Discussion - Reported Waterborne Enteric Outbreaks (RDIS Outbreak Module)

The 16 reported waterborne outbreaks did not represent a large number of outbreaks in the five-year period. This number likely under-represents the true number of waterborne outbreaks because of the difficulty in identifying waterborne cases.

The outbreaks of cryptosporidium were reported as four different outbreaks that all occurred in the Simcoe County Health Unit during March 1996. However, they were all associated with exposures to the parasites contaminating the municipal water supply.

Nine of the 16 outbreaks affected less than 20 persons. There were two outbreaks with more than 40 persons affected. One was that of *E.coli* in Walkerton, in which 1,346 individuals were reported ill. The other outbreak was a gastroenteritis outbreak that occurred in the Kingston, Frontenac, Lennox and Addington Health Unit, in which 56 individuals were reported ill.

Six of the outbreaks reported occurrences in health care institutions. This is of concern because of the potential for a higher than expected attack rate in the population due to a contaminated water source. Eight outbreaks were reported to have been associated with community/ municipal water systems. These eight community/ municipal water system outbreaks raise concern as well, due to the large numbers of individuals that potentially could be exposed.

Conclusions

Linking an enteric illness to water is likely more difficult than linking an illness to food or person-to-

person transmission because of the many traditionally food-associated pathogens such as campylobacter, salmonella, and *E.coli*. Furthermore, waterborne illnesses do not occur as frequently as foodborne illnesses. For these reasons, a bias towards linking enteric illnesses with food sources may occur. In addition to identifying a waterborne illness, the number of waterborne outbreaks was likely under-reported. Under-reporting was suggested in another report on enteric outbreaks in Ontario.[16]

"Low levels of enteric disease over many years from exposure to waterborne microbes can place a much larger health burden on a community than disease associated with the detected outbreak."[17] The Walkerton outbreak notwithstanding, the Ontario findings for 1996 to 2000 support this statement in that there was a far greater number of reported sporadic cases compared to the total number of individuals reporting illness as a result of all reported waterborne outbreaks combined.

With respect to recreational and drinking water supplies, bacteria such as campylobacter and *E.coli* are killed by chlorination, the traditional method of water purification. However, parasites such as cryptosporidium and giardia are more resistant to the chemical disinfectants used to purify drinking water. Only water filtration units with a pore sensitivity of at least *0.1 to 1.0 µm* in diameter are considered capable of removing cryptosporidium oocysts, the infectious state of the smaller of the two parasites.[18] This presents a challenge to the state of water treatment systems in Ontario as this level of treatment, known as 'Secondary Treatment', is not standard in all water treatment systems across Ontario.

Recently, associations have been established in North America and Europe between outbreaks of waterborne enteric illness and periods of heavy rainfall and flooding causing the overflow of mammalian fecal contamination into drinking water supplies.[19] This association attributes a significant proportion of waterborne illness and outbreaks to climate and weather changes. One of the contributing factors noted in the Walkerton outbreak report was "heavy rains accompanied by flooding".[20]

The number of sporadic waterborne cases reported in Ontario represents a significant burden of illness to the population. While the number of reported outbreaks was not large, the potential to affect many people was demonstrated by the number of people affected by the Walkerton outbreak. Undeniably, it was the Walkerton outbreak that brought the issues surrounding the safety and security of our water supplies to the forefront of public health.

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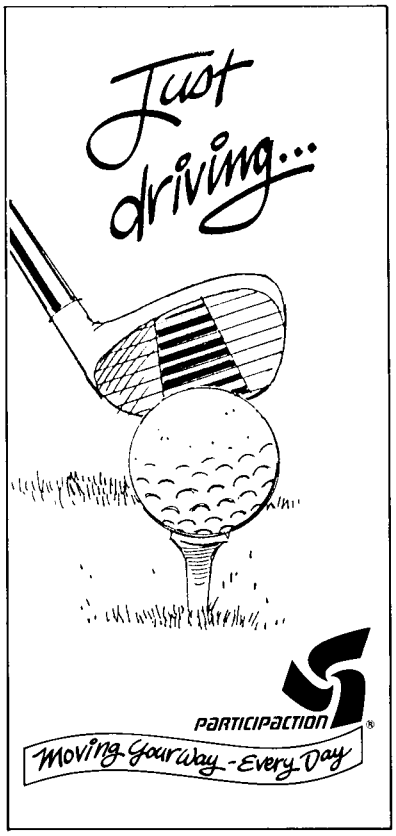

READY-TO-EAT MEATS: POTENTIAL FOR CONTAMINATION

Introduction

Ready-to-eat meats (RTE) are cooked, sliced and/or prepared meats ready for use in sandwiches or for other uses and are sold at delicatessens, butcher shops and supermarkets. In premises where both RTE and raw meat are sold, potential exists for contact between the two types of meat. Public health practice indicates that raw and RTE food products, handled by the same food handler, present a high risk for cross contamination.

In 1997, City of Hamilton Health Unit staff thought that this pathway was responsible for the illness experienced by a number of individuals in that community. Enteric pathogens were confirmed in the stools obtained from these individuals and the Environmental Health Branch conducted a study to investigate this possibility. In 1999, the data from the study were reviewed and analysed. An updated review of the literature was undertaken to make recommendations for further study or action.

This article describes a study to determine the following:

1. What is the incidence of bacterial contamination in store-sliced, RTE, uncured meat products sold from butcher shops in Hamilton-Wentworth where food handlers serve both raw and ready-to-eat meats?
2. What are the food handling practices at butcher shops?
3. Could poor food handling techniques be a source of bacterial pathogenic contamination of the RTE meat(s) products?

Methods

A literature review was conducted using the following keywords: TOPIC (and) TARGETS: food handling and premises (butcher shops, delicatessen shop, grocery store, food store, supermarket) or foods (cold cuts, delicatessen meat(s), processed meat(s), raw beef, raw meat(s), raw pork, raw poultry, RTE food, RTE meat(s), store sliced meat(s), uncooked meat(s), uncured meat(s)) or microbiological indicators (*E.coli* 0157:H7, Listeria, Salmonella, foodborne illness) and databases: Medline, Biosis, Embase, Food Science & Technology, Food Legislation, Toxline. The search was not limited by year.

The population for the study included butcher shops located within the geographical boundaries of the Regional Municipality of Hamilton-Wentworth using the definition from the Computerized Inspection Services System (CISS) as "a premise where raw meat (including poultry and fish) is received in carcass quantity or portion thereof, which requires further portioning and packaging for retail".

Butcher shops were included if they also sold RTE meat products that were custom sliced on site by employees who also handled raw meat. Butcher shops were excluded if they did not sell raw meats and RTE products that are handled by the same food handler; if there had been a reported or suspected foodborne illness associated with the premise in the past year; and if they were listed as "food stores" or "supermarkets".

The sample chosen for the pilot study was randomly selected from CISS using Epi Info 6. Sixty-nine of 128 (54%) randomly selected butcher shops met the inclusion criteria.

Sample and Data Collection

A public health inspector who did not identify him/herself, visited the establishment and purchased one hundred grams of RTE products (roast beef, cooked chicken breast, or cooked turkey breast). Only one sample was purchased on each visit. Approximately four samples were collected from each of the selected and eligible butcher shops. The samples were delivered directly to the Provincial Public Health Laboratory in Hamilton or refrigerated until the next day for delivery. The meats which were purchased were selected because they have similar water activity and pH ranges, factors which are known to affect bacterial growth or survival. At the time of the purchase, the inspector also observed food handling practices and recorded this information on a data collection form.

The data collection tools were developed and pretested by City of Hamilton Health Unit staff in butcher shops. The pretest included sending three different pairs of observers on three different occasions to complete the data collection tool. Each pair compared their records and no discrepancies were found.

Food Sample Microbiological Analysis

The Provincial Public Health Laboratory in Hamilton utilized their Standard Method as if the sample was part of a meal that was suspected to have caused illness. The exceedences of acceptable microbiological standards are listed on Table 1.

Data Management

In 1997, a data set was created in Epi Info 6 for each butcher shop and the data on food handling techniques were entered. In 1999 the data were entered into SPSS for analysis. Associations were tested using chi-square with a significance level set at 0.01 to adjust for multiple tests.

Results

A total of 128 samples were collected from 36 different premises. The number of samples per premise ranged from 1 to 5. The RTE samples consisted of roast beef (45.3%), chicken (18.8%) or turkey (35.9%). Eighty percent of the meat purchased was regular price, that is, not on sale or on special discount.

Eighty (63%) samples from 32 (89%) premises exceeded the acceptable limits for either aerobic plate count (APC), coliforms, *E.coli*, or gram negative bacteria. Each sample was also swabbed for *Clostridium perfringens, Bacillus cereus, Staphylococcus aureus, Salmonella spp., Campylobacter spp.* and *E.coli*

Table 1 Analysis of samples

	Unacceptable Limits
Aerobic Plate Count	> 10^5 per gram
Coliforms	> 10^3 per gram
E. coli	> 3 per gram
Total Gram Negatives	> 10^3 per gram
Clostridium perfringens	> 100 per gram
Bacillus cereus	> 10^3 per gram
Staph. aureus	> 10^3 per gram
Salmonella	ANY DETECTED
E. coli 0157:H7	ANY DETECTED
Campylobacter	ANY DETECTED

Aerobic Plate Count (APC) = improper cooking, poor food handling, temperature abuse or improper storage condition

Coliforms = inadequate processing or post processing contaminationtamination resulting from poor food handling

***E. coli* =** direct or indirect contamination with faecal material; enteric pathogens may also be present

Total Gram Negative = same as coliforms

***Clostridium perfringens* =** indicative of time and temperature abuse

***Bacillus cereus* =** improper food handling techniques

***Salmonella* and *E. coli* 0157:H7 =** should not be present/definite health hazard

***Campylobacter* =** under processing or re-contamination of foods

Table 2. Hand washing and contaminated samples

Observed Food Handling Practices	Contaminated* Samples	Not Contaminated Samples	Total
Washed Hands	10 (66%)† (12%)‡	5 (34%)† (10%)‡	15 (12%)
Did Not Wash Hands	70 (62%)† (88%)‡	43 (38%)† (89%)‡	113 (88%)
Total	80 (63%)	48 (38%)	128 (100.0%)

*numbers represent samples with any unacceptable result
†numbers represent row percentages
‡numbers represent column percentages

Table 3. Unacceptable samples by contaminant

	Total Coliforms (4)*	E. Coli (4)*	Gram Negative (12)*	APC (77)*
Did not wash hands	4	3	11	68
"Other" barrier technique	4	4	8	66
Touched weigh scale	0	0	2	11
Roast beef samples	3	2	9	41
On sale/special	2	2	3	23

* numbers represent samples with unacceptable results

0157:H7 but these organisms were not found. Approximately 60% of all samples exceeded acceptable APC limits, 9% exceeded total gram negative limits, and 3% exceeded coliform and *E.coli* limits. Of the 4 samples which were contaminated with coliform bacteria, 2 of these also had *E.coli* contamination. An additional 2 samples had *E.coli* contamination only. Analysis showed that only 3 of 14 samples with gram negative or coliform bacteria or *E.coli* were within acceptable APC limits.

Only 15 (12%) of the samples were purchased from a food handler who was observed to have practised hand washing prior to the transaction. Techniques to prevent contamination were observed for 92% of samples. Gloves or utensils were used as a barrier in 28% of the transactions while the use of other techniques such as paper or a cellophane sheet was observed in 64%. However, for 18% of the samples, gloves were not changed prior to the transaction. In 13% of the samples, the meat touched the weigh scales directly.

Comparisons of food handling practices with contamination of samples showed mixed results. Observed lack of hand washing was not statistically associated with overall contamination (Table 2), but the samples where hand washing did not occur were more likely to have total coliforms (4/4), *E.coli* (3/4) and/or gram negative bacteria (11/12). (Table 3)

Barrier Techniques

Where no barrier technique was used, higher levels of contamination were observed (not statistically

Table 4. Observed food handling practices and contaminated samples

Barrier Technique to Reduce Transmission	Contaminated* Samples	No Contaminated Samples	Total
Gloves and/or Utensils	18 (50%)	18 (50%)	36 (100%)
Other Technique	54 (66%)	28 (34%)	82 (100%)
No Technique	8 (80%)	2 (20%)	10 (100%)
Total	80 (63%)	48 (37%)	128 (100%)

*numbers represent samples with any unacceptable result

Table 5. Type of Meat and Contaminated Samples

Type of Meat	Contaminated* Samples	No Contaminated Samples	Total
Roast Beef	42 (72%)† (52%)‡	16 (28%)† (33%)‡	58 (100%)
Chicken	11 (46%)† (14%)‡	13 (54%)† (27%)‡	24 (100%)
Turkey	27 (59%)† (34%)‡	19 (41%)† (40%)‡	46 (100%)
Total	80 (63%)	48 (37%)	128 (100%)

*numbers represent samples with any unacceptable result
†numbers represent row percentages
‡numbers represent column percentages

significant) compared to those where an alternative barrier such as a cellophane sheet or wax paper was used. These, in turn, had more contamination than the samples collected where gloves were used (Table 4). However, samples with "other technique" had total coliforms (4/4), *E.coli* (4/4) and/or gram negative bacteria (8/12) more often. (Table 3)

Those samples which touched the weigh scale were more likely to be contaminated (13/17 or 76%) than those which did not (61%) (not statistically significant). (Table 3)

The type of meat purchased indicated a possible association with contamination with roast beef representing 52% of the contaminated samples but only 45% of the total samples (not significant; Table 5). The beef samples were also more likely to have total coliforms (3/4), *E.coli* (2/4) and/or gram negative bacteria (9/12). (Table 3)

The price of meat was statistically ($p<0.01$) associated with contamination of on sale/special samples (23/27 or 85%) (Table 6). However, the on sale/special samples

Table 6. Price of Meat and Contaminated Samples			
Price of Meat	**Contaminated* Samples**	**No Contaminated Samples**	**Total**
On Sale/Special	23 (85%)	4 (15%)	27 (100%)
Not On Sale/Special	57 (56%)	44 (44%)	101 (100%)
Total	80 (63%)	48 (37%)	128 (100%)
*numbers represent samples with any unacceptable result			

were not more likely to have total coliforms (2/4), *E.coli* (2/4) and/or gram negative bacteria (3/12). (Table 3)

Discussion

This pilot study demonstrated poor food handling practices and unacceptable contamination in RTE meats as evidenced by the poor use of hand washing or barrier techniques. There was not any evidence of specific foodborne pathogens (e.g. *E.coli* 0157:H7, *Salmonella spp*.) in the samples taken. The meats placed on special discount or on sale were more likely to be contaminated than those of regular price. The contaminated samples were not significantly associated with poorer food handling techniques and with type of meat. Roast beef had a greater contamination than the other types of meat. It was assumed that the meats selected did not differ in susceptibility but the results suggest that roast beef may be more susceptible to contamination than chicken and turkey. It remains to be seen whether there would be a statistically significant difference if there was increased power.

Since there were no samples of RTE meat taken where the potential for cross contamination was not possible, it is unclear whether the contamination of the meat came from poor food handling or from cross contamination from raw meats. If it is the former then all RTE meats handled by premise staff may be at risk.

The results of the study analysis provide limited answers due to the small sample size and limited premise selection. When the sample population for the study was randomly selected only those premises that met the CISS definition of a butcher shop were included. The definition excluded "food stores" and "supermarkets", both of which also serve both raw and RTE meat, and thus these premises were not considered. It is recommended that these premises be included in any future studies.

High APC counts are typically associated with improper cooking, poor food handling, temperature abuse or improper storage conditions. Total coliform, *E.coli* and gram negative bacteria contamination are also associated with poor food handling.[1] The presence of each of these contaminants, in the majority of the products purchased, suggests that the potential for contamination exists through handling pathways. Due to the small sample size we chose not to conduct statistical tests on specific contaminants.

Through the literature review, eleven documents were retrieved but only two[2,3] of them were found to be directly relevant to this project. In both studies, environmental samples were taken from premises where both raw and RTE meats were sold. The study by Hudson only analyzed the environmental samples for *Listeria monocytogenes, Motile aeromonads, and Yersinia enterocolitica*. The Tebbutt study tested the samples for *Staphylococcus aureus, E.coli, Streptococcus faecalis, Clostridium perfringens and Salmonella spp.* The samples for this study were taken from towels, nail brushes, tongs, blades of food-slicing machines, wiping cloths, sliced meat, and finger-rinse samples from food handlers. Food handlers were also asked whether they had training in food hygiene. The study results indicated that a potential for cross-

contamination exists through handling pathways. Another aspect of this study was that environmental health officers conducted a visual inspection of the premise. Results of the visual inspection correlated with sample results.

Comparison between this study and those in the literature indicates that the scope of the pilot study was appropriate, given its objectives. Other questions that were raised in the literature and remain unanswered with respect to this study include:

- Are foodhandlers aware of the potential RTE contamination pathways that exist in these premises?
- If so, are they aware of precautions that can be taken to avoid RTE contamination?
- Is the potential for RTE contamination greater in smaller premises where separate areas and personnel cannot be provided for raw and cooked meats?
- What is the burden of illness associated with contaminated RTE meats?
- Is the potential for contamination of RTE meats reduced where the over-the-counter service of RTE meats is separate from the over-the-counter service of raw meats?

Further research could assist in answering these questions. These findings warrant further investigation into the potential for cross-contamination between raw and RTE meats. The pilot study results indicated that this is an area where an educational intervention is appropriate. The HWSPHS has plans to develop and evaluate a self-education program for foodhandlers who handle both raw and RTE meats.

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2. Hudson JA, Mott SJ. Presence of Listeria monocytogenes, motile aeromonads and Yersinia enterocolitica in environmental samples taken from a supermarket delicatessen. International Journal of Food Microbiology 1993; 18:333-337.
3. Tebbutt G. An evaluation of various working practices in shops selling raw and cooked meats. Journal of Hygiene, Camb 1986; 97:81-90.Table 4. Observed food handling practices and contaminated samples

Communiqué

Public Health Research, Education and Development Program

City of Hamilton Social and Public Health Services Department

SYSTEMATIC REVIEWS: WHY WOULD I BOTHER? AND WHICH ONES SHOULD I USE?

You are the manager of the sexual health program at your health department. One local high school has contacted you to offer a sexual health program in their school. They are concerned about the rates of pregnancy and of STDs. You guess that what they really want is an "abstinence" program. You decide to look in the literature to see if there is any evidence of effectiveness of sexual health programs generally, or abstinence programs, specifically. In PubMed, you search "sexual health", limiting the search to "humans", "English", "adolescents" and the publication dates of "January 1995 to April, 2001". You get 1590 hits. When you try adding "abstinence" you get no hits. The latter word alone gives you articles only related to alcohol use. When you limit the primary search further by methods terms, the addition of "review" reduces the hits to 160, and with "randomized trials", you get 52 hits. Over lunch, you explain your discouragement to your colleagues. So many articles! So little time! How can you possible be reasonably well prepared for the meeting at the school? One colleague tells you about a website where a systematic review was published on primary prevention of adolescent pregnancy! You are elated, because you can easily access the full review by DiCenso, Guyatt and Willan (1999) on-line and you don't have to retrieve and critically appraise 52-1590 articles!

The above scenario demonstrates the primary reason why you would use systematic reviews: they are efficient in terms of your access to and retrieval of large numbers of research reports; they overcome another obstacle of lack of time and sometimes lack of skills necessary to conduct the critical appraisal. But can you be confident in using all reviews? The search in the scenario above yielded 160 reviews - are they all of equal value? What do you do if they give you conflicting results?

1. What is a Systematic Review?

A systematic review is a summary of research evidence that relates to a specific question. It could involve causation, diagnosis, or prognosis but more frequently involves effectiveness of an intervention. Systematic reviews differ from an unsystematic narrative review in that they attempt to overcome possible biases that might occur, through following a rigorous methodology of search, retrieval, relevance and validity (quality) rating, data extraction, synthesis and report writing. Explicit pre-set criteria are used for relevance and validity. Two people independently conduct each stage, then compare results and discuss discrepancies before moving to the next stage. Explicit details of the methods used at every stage are recorded.

A meta-analysis is the quantitative combination of results of studies to get an overall summary statistic that represents the combined effect of the intervention across different study populations. The terms "systematic review" and "overview" are often used interchangeably.

Some common misconceptions of systematic reviews exist. Many readers think that they include only randomized trials; that they must adopt a biomedical model and that they have to have some statistical synthesis (Petticrew, 2001). If this were true, there would be few reviews of interest in public health, as many public health questions have not been or cannot be addressed by randomized trials. Fortunately, review methods are advancing for the inclusion of non-randomized studies such as cohort studies, for using a population health model, and for synthesis which does not always include meta-analysis. The Cochrane Collaboration Health Promotion/Public Health Field has been a leader in promoting the methods, conducting and using of systematic reviews and doing meta-analysis in public health. The Ontario Public Health Research, Education and Development (PHRED) program and the Effective Public Health Practice Project have been active participants in the Health Promotion/Public Health Field and a provider of systematic reviews relevant to public health.

2. How Do I Know if the Review is of Sufficient High Quality to be Useful?

Here we will look at how to critically appraise systematic reviews to decide if the methods have sufficient rigor for the results to be applied to client or management decisions. The same major questions used for evaluation of primary treatment or prevention studies can be used to evaluate systematic reviews. They are:

Are the results valid? What are the results? and Will the results help me in improving the health of clients? (see Table 1) (Oxman, Cook, Guyatt, 1994). This paper will appraise the review of DiCenso, Guyatt and Willan (1999) to apply these appraisal questions.

1. Are the Results Valid?

a) Did the overview address a focussed clinical question?

The review by DiCenso et al narrowed the focus of their review question from our starting point scenario of sexual health. They wanted to know if primary prevention programmes are effective in "delaying sexual intercourse, in improving birth control use and in reducing incidence of pregnancy" in adolescents (DiCenso, et al, 1999, p 8). This review had a clear and focussed question.

b) Were the criteria used to select articles for inclusion appropriate?

The criteria for study selection included: target population- adolescents 18 years of age or less; intervention- any primary prevention strategy (e.g., sex education classes, school-based clinics, community-based programs); outcome measure- behavioural (e.g., initiation of sexual intercourse, birth control use, pregnancy); study design- randomized controlled trials; and language- English, or any language for which translator was available (DiCenso, et al, 1999, p 8). Exclusion criteria included if the study was targeted to pregnant teens, high risk populations or the outcome of AIDS prevention, or if it was conducted in a developing country (DiCenso, et al, 1999, p 9). These criteria are explicit and help to ensure that appropriate studies will be included.

c) Was the search strategy thorough?

The search strategy was extensive involving the search of 12 electronic data bases back to 1970. The number of databases is not as crucial as knowing which databases are important to include. For this topic, one would expect to get as many important articles from ERIC (which contains more studies of curriculum and interventions done in a formal education setting) as from MEDLINE. In addition, hand searching of nine journals in the area of health promotion, health education, adolescents and public health was done. Hand searching adds another level of thoroughness because sometimes articles are incorrectly key-worded in an electronic database and would, therefore, be missed if one relied only on electronic searching.

As a final step to ensure that all possible studies are included, and in order to minimize publication bias (Dickersin, 1990), experts were asked for copies of any unpublished studies (DiCenso, et al, 1999, p 8). Thus, this review had a very extensive and thorough search.

Table 1

How to critically appraise review articles.*

1. Are the study results valid?
   - a) Did the overview address a focussed clinical question?
   - b) Were the criteria used to select articles for inclusion appropriate?
   - c) Was the search strategy thorough?
   - d) Was the validity (quality) of the studies appraised?
2. What are the results?
   - a) What are the overall results?
   - b) If there is a meta-analysis, how precise are the results?
3. Will the results help me in improving the health of clients?
   - a) Can the results be applied in the setting where I am working?
   - b) Were all the clinically important outcomes considered?
   - c) Are the benefits worth the harms and costs?

*Based on Oxman, Cook, & Guyatt, 1994.

d) Was the validity (quality) of the studies appraised?

The appraisal tool used in the review, for validity (quality) rating is included in the report. The tool includes ratings of the appropriateness of method of randomization, data collection was unbiased and levels of withdrawals and drop-outs (DiCenso, et al, 1999, p 9).

2. What are the Results?

a) What are the overall results?

DiCenso's review found that some programs have been effective in delaying initiation of intercourse, improving birth control use and reducing pregnancies; they do not result in an increase in sexual activity; and abstinence-only programs have not shown delay in onset of intercourse or reduced pregnancies (DiCenso, et al, 1999, p 3). Thus these results are directly applicable to the introductory scenario.

b) If there is a meta-analysis, how precise are the results?

No meta-analysis was done on the data from the DiCenso et al study (1999). However, this criteria relates to the reporting of relative risk (RR) or odds ratios (OR). In a study such as prevention of pregnancy, you would consider the outcome of pregnancy and an RR or OR of <1 represents a beneficial treatment. Precision of the results would be estimated by calculating confidence intervals. Wide confidence intervals indicates less precision in the estimated effect of the intervention.

Table 2

Sources of systematic reviews related to public health practice

1. Effective Public Health Practice Project
   - involves PRHEDs across Ontario co-ordinated through PHRED at City of Hamilton Health Services
   - examples of topics: food safety, low birth weight, cervicial cancer screening, needle exchange programs
   - website http://www.health.hamilton-went.on.ca/CSARB/EPHPP/ephppSumRev.htm
   - PHRED website
2. The Cochrane Collaboration
   - an international organization whose goals are to prepare, maintain and disseminate systematic review on all aspects of health care
   - examples of relevance to public health include smoking cessation in the workplace, parent training for improving maternal psychosocial health, prevention of falls in the elderly
   - the Cochrane Library currently has over 1400 completed reviews, a database abstracts of over 2500 reviews published elsewhere, and a repository of over 300,000 controlled clinical trials
   - website http://www.update-software.com/cochrane/cochrane-frame.html
3. Health Development Agency (formerly the Health Education Authority)
   - funded by the UK, National Health Services
   - publishes several high quality reviews related to health promotion topics
   - examples: video for health education, mental health promotion, interventions to promote healthy eating, oral health promotion, health promotion interventions in the workplace
   - summaries of methods and findings are available on-line, along with information for ordering the full review
   - website http://www.hda-online.org.uk/indicators.htm
4. Other journals - can be searched by the text word 'review', 'systematic review', 'meta-analysis' or by the method terms of 'review' or 'meta-analysis'

Table 3

Useful sources for critical appraisal of systematic reviews

Books

- McKibbon, A., Eady, A., & Marks, S. (1999). PDQ Evidence-Based Principles and Practice. Hamilton: BC Decker.
- Sackett, D.L., Strauss, S.E., Richardson, W.S., Rosenberg, W., & Haynes, R.B. (2000) Evidence Based Medicine: How to Practice and Teach EBM. London: Churchill Livingstone.

Articles

- Greenhalgh, T. (1997). How to read a paper: Papers that summarise other papers
- (systematic reviews and meta-analyses). BMJ, 315, 672-75.
- also available on-line www.bmj.com/cgi/content/full/315/7109/672
- Oxman, A.D., Cook, D.J., & Guyatt, G.H. (1994). Users' guides to the medical literature: VI How to use an overview. JAMA, 272(17), 1367-71.

3. Will the Results Help Me in Improving the Health of Clients?

a) Can the results be applied in the setting where I am working?

b) Were all the clinically important outcomes considered?

c) Are the benefits worth the harms and costs?

These three questions have to be answered by the practitioner in the context of their own situation. In relation to the example scenario, the results can certainly be applied to the school request. Within the review question, all clinically important outcomes were considered both positive and negative (DiCenso, et al, 1999). For example, the authors collected data on whether or not primary prevention programs would likely result in an increase in sexual activity - a prime concern of parents and school boards!

Conclusion

The criteria of Oxman, Cook and Guyatt, (1994) can provide a guide to decide if the results of a systematic review can be confidently used in practice. There are some sites for accessing high-quality systematic reviews relevant to public health (see Table 2). Also, there are resources for skill-building in critical appraisal of reviews (see Table 3). For more information, contact any PHRED in Ontario.

❑

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Summary of Reportable Diseases in May, 2001

Health Units by Region	1996 Population	AIDS	Campylo.	Chicken-pox	Chlamydia	Enceph./ Meningitis	GAS	Gonorrhea
Algoma	123,953			8	18			
North Bay	93,841			7	9			
Northwestern	80,235		4	10	23			1
Porcupine	97,437			4	15			
Sudbury	201,154		2		21	1	1	1
Thunder Bay	161,187				32			4
Timiskaming	38,847				2			
Total - Northern	**796,654**		**6**	**29**	**120**	**1**	**1**	**6**
Eastern Ontario	185,314		3		1	1		
Hastings-Prince Edward	143,790		3	21	3			
Kingston-Frontenac	175,568		3		12	1		
Leeds-Grenville and Lanark	156,129		1	33	5		1	
Ottawa	721,136		19	87	72		3	4
Renfrew	97,634				10			
Total- Eastern	**1,479,571**		**29**	**141**	**103**	**2**	**4**	**4**
Durham Region	458,616		5	113	47	4	1	8
Haliburton-Kawartha	165,039				10		1	
Muskoka-Parry Sound	78,675			1				
Peel Region	852,526		30	185	67	3	1	24
Peterborough	123,448		3	27	12			
Simcoe County	329,865		3	35	16		1	1
Toronto City - total	2,385,421	3	124	294	438	7	5	167
North	*589,653*		*24*	*54*	*99*	*2*		*33*
South	*653,734*	*2*	*52*	*41*	*160*	*2*	*4*	*85*
West	*475,252*		*26*	*145*	*115*	*3*	*1*	*24*
East	*666,782*	*1*	*22*	*54*	*64*			*25*
York Region	592,445		22	49	9			
Total - Central East	**4,986,035**	**3**	**187**	**704**	**599**	**14**	**9**	**200**
Grey-Bruce	153,312		4		5	1		
Elgin-St. Thomas	79,159		1	26	9			1
Huron	60,220		2	54	2			
Chatham-Kent	109,650		1	11	11			
Lambton	128,975		1		1			
Middlesex-London	389,616		2			6		
Oxford	97,142				8			
Perth	72,106		4	28				
Windsor-Essex	350,329		14		55	4		8
Total - Southwest	**1,440,509**		**29**	**119**	**91**	**11**		**9**
Brant	114,564		1	7	17		1	1
Haldimand-Norfolk	102,575		2	34	6			
Halton Region	339,875		9		17	3		3
Hamilton	467,799		12	5	61	1	3	9
Niagara Region	403,504		10		35		4	1
Waterloo Region	405,435		5		61		8	6
Wellington-Dufferin-Guelph	217,052		5	55	6		1	
Total - Central West	**2,050,804**		**44**	**101**	**203**	**4**	**17**	**20**
May 2001	**10,753,573**	**3**	**295**	**1,094**	**1,116**	**32**	**31**	**239**
*** Total YTD 2001**	**-**	**20**	**1,247**	**3,049**	**6,264**	**147**	**179**	**1,147**
*** Total YTD 2000**	**-**	**30**	**1,413**	**16,659**	**6,068**	**125**	**223**	**1,214**

The Toronto City regions above are now defined as: North - former North York; South - former City of Toronto; West - former Etobicoke and City of York; East - former Scarborough and East York

* Adjusted for deletions and late reports.

Summary of Reportable Diseases in May, 2001

Health Units by Region	1996 Population	PPNG	Hepatitis A	Hepatitis B	Hepatitis C	Hib	Influenza	Measles	Meningo-coccal
Algoma	123,953				11				
North Bay	93,841				2		2		
Northwestern	80,235				3				
Porcupine	97,437				2				
Sudbury	201,154				10		2		1
Thunder Bay	161,187				9				
Timiskaming	38,847				1				
Total - Northern	**796,654**				**38**		**4**		**1**
Eastern Ontario	185,314				2				
Hastings-Prince Edward	143,790								
Kingston-Frontenac	175,568								
Leeds-Grenville and Lanark	156,129			1	9				
Ottawa	721,136		1		23		1		
Renfrew	97,634								
Total- Eastern	**1,479,571**		**1**	**1**	**34**		**1**		
Durham Region	458,616	1							
Haliburton-Kawartha	165,039				9				
Muskoka-Parry Sound	78,675				3				
Peel Region	852,526	1	4		20				
Peterborough	123,448				6				
Simcoe County	329,865								1
Toronto City - total	2,385,421	6	4	7	132				4
North	*589,653*	*2*	*2*		*37*				*1*
South	*653,734*	*2*	*1*	*6*	*64*				*1*
West	*475,252*	*1*	*1*		*18*				*2*
East	*666,782*	*1*		*1*	*13*				
York Region	592,445		2		5				
Total - Central East	**4,986,035**	**8**	**10**	**7**	**175**				**5**
Grey-Bruce	153,312				1				
Elgin-St. Thomas	79,159	1			4				
Huron	60,220				1				
Chatham-Kent	109,650						1		
Lambton	128,975		2		1				
Middlesex-London	389,616				9				2
Oxford	97,142								1
Perth	72,106				2				
Windsor-Essex	350,329				10				
Total - Southwest	**1,440,509**	**1**	**2**		**28**		**1**		**3**
Brant	114,564								
Haldimand-Norfolk	102,575				2				
Halton Region	339,875				3				
Hamilton	467,799				26				
Niagara Region	403,504		1		22				
Waterloo Region	405,435				15				1
Wellington-Dufferin-Guelph	217,052				2				
Total - Central West	**2,050,804**		**1**		**70**				**1**
May 2001	**10,753,573**	**9**	**14**	**8**	**345**		**6**		**10**
*** Total YTD 2001**	**-**	**64**	**63**	**70**	**1,967**	**2**	**747**	**6**	**56**
*** Total YTD 2000**	**-**	**85**	**55**	**77**	**2,526**	**4**	**1,519**	**4**	**42**

The Toronto City regions above are now defined as: North - former North York; South - former City of Toronto; West - former Etobicoke and City of York; East - former Scarborough and East York

* Adjusted for deletions and late reports.

Summary of Reportable Diseases in May, 2001

Health Units by Region	1996 Population	Mumps	Pertussis	Rubella	Salmon.	Shigellosis	Syphilis (Prim/Sec)	VTEC
Algoma	123,953							1
North Bay	93,841				2			
Northwestern	80,235				2			
Porcupine	97,437							
Sudbury	201,154		2					
Thunder Bay	161,187				2			
Timiskaming	38,847							
Total - Northern	**796,654**		**2**		**6**			**1**
Eastern Ontario	185,314				2	1		3
Hastings-Prince Edward	143,790				6	1		
Kingston-Frontenac	175,568							
Leeds-Grenville and Lanark	156,129		1					
Ottawa	721,136		2		15	4		5
Renfrew	97,634							
Total- Eastern	**1,479,571**		**3**		**23**	**6**		**8**
Durham Region	458,616		1		3			
Haliburton-Kawartha	165,039		1	1	1			1
Muskoka-Parry Sound	78,675				1			
Peel Region	852,526				17	7		1
Peterborough	123,448		5		1			
Simcoe County	329,865				4	1		
Toronto City - total	2,385,421		3	1	48	6		7
North	*589,653*		*2*		*4*			*2*
South	*653,734*		*1*		*19*	*4*		*2*
West	*475,252*				*15*			*2*
East	*666,782*			*1*	*10*	*2*		*1*
York Region	592,445		3		16			3
Total - Central East	**4,986,035**		**13**	**2**	**91**	**14**		**12**
Grey-Bruce	153,312				2	1		
Elgin-St. Thomas	79,159				1			
Huron	60,220							
Chatham-Kent	109,650		1					
Lambton	128,975				3			1
Middlesex-London	389,616				2			
Oxford	97,142							1
Perth	72,106					1		2
Windsor-Essex	350,329		11		7	1		
Total - Southwest	**1,440,509**		**12**		**15**	**3**		**4**
Brant	114,564				3			
Haldimand-Norfolk	102,575				2			
Halton Region	339,875				3	1		
Hamilton	467,799				9			4
Niagara Region	403,504		1		8			
Waterloo Region	405,435				4			
Wellington-Dufferin-Guelph	217,052		1		6			2
Total - Central West	**2,050,804**		**2**		**35**	**1**		**6**
May 2001	**10,753,573**		**32**	**2**	**170**	**24**		**31**
*** Total YTD 2001**	**-**	**1**	**186**	**13**	**910**	**96**	**3**	**87**
*** Total YTD 2000**	**-**	**21**	**194**	**4**	**816**	**134**	**8**	**271**

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* Adjusted for deletions and late reports.

Summary of Reportable Diseases in June, 2001

Health Units by Region	1996 Population	AIDS	Campylo.	Chicken-pox	Chlamydia	Enceph./ Meningitis	GAS	Gonorrhea
Algoma	123,953			34	8		1	
North Bay	93,841		1	57	9			3
Northwestern	80,235			49	19	1		1
Porcupine	97,437			1	12			
Sudbury	201,154		2		19			
Thunder Bay	161,187		6	7	31			2
Timiskaming	38,847				2			
Total - Northern	**796,654**		**9**	**148**	**100**	**1**	**1**	**6**
Eastern Ontario	185,314		7		5			
Hastings-Prince Edward	143,790		4	29	3			1
Kingston-Frontenac	175,568		7		12	1		
Leeds-Grenville and Lanark	156,129		1	1	4	1		
Ottawa	721,136		10	45	77	2		9
Renfrew	97,634		3		2			
Total- Eastern	**1,479,571**		**32**	**75**	**103**	**4**		**10**
Durham Region	458,616		9	253	50	1		10
Haliburton-Kawartha	165,039		5		5			
Muskoka-Parry Sound	78,675							
Peel Region	852,526		42	404	69	3	1	9
Peterborough	123,448		8		11	1		
Simcoe County	329,865		3	27	32	1		2
Toronto City - total	2,385,421	1	140	412	478	4	5	155
North	*589,653*		*37*	*62*	*94*			*29*
South	*653,734*	*1*	*52*	*90*	*193*	*2*	*3*	*75*
West	*475,252*		*28*	*69*	*122*	*2*	*2*	*31*
East	*666,782*		*23*	*191*	*69*			*20*
York Region	592,445		30	77	13	3	1	1
Total - Central East	**4,986,035**	**1**	**237**	**1,173**	**658**	**13**	**7**	**177**
Grey-Bruce	153,312		5		5			2
Elgin-St. Thomas	79,159		3	20	9	2		
Huron	60,220		2	2	1			
Chatham-Kent	109,650		9	5	11			
Lambton	128,975		2		5			1
Middlesex-London	389,616		13		23	1		4
Oxford	97,142		2		3			
Perth	72,106		6	16	1	2		
Windsor-Essex	350,329		27		33	1		3
Total - Southwest	**1,440,509**		**69**	**43**	**91**	**6**		**10**
Brant	114,564		5		22		1	2
Haldimand-Norfolk	102,575		1	2	6			
Halton Region	339,875		9		15	35		2
Hamilton	467,799		9	16	65		2	9
Niagara Region	403,504		29		40		1	4
Waterloo Region	405,435		19		45	1	1	6
Wellington-Dufferin-Guelph	217,052		7	11	9		2	
Total - Central West	**2,050,804**		**79**	**29**	**202**	**36**	**7**	**23**
June 2001	**10,753,573**	**1**	**426**	**1,468**	**1,154**	**60**	**15**	**226**
*** Total YTD 2001**	**-**	**31**	**1,738**	**7,095**	**7,641**	**214**	**201**	**1,389**
*** Total YTD 2000**	**-**	**44**	**2,040**	**20,451**	**7,279**	**154**	**269**	**1,438**

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* Adjusted for deletions and late reports.

Summary of Reportable Diseases in June, 2001

Health Units by Region	1996 Population	PPNG	Hepatitis A	Hepatitis B	Hepatitis C	Hib	Influenza	Measles	Meningo-coccal
Algoma	123,953				9				
North Bay	93,841				4				
Northwestern	80,235				1				
Porcupine	97,437				3				
Sudbury	201,154				4				
Thunder Bay	161,187				6				
Timiskaming	38,847				1				
Total - Northern	**796,654**				**28**				
Eastern Ontario	185,314				4				
Hastings-Prince Edward	143,790		2						
Kingston-Frontenac	175,568				11				
Leeds-Grenville and Lanark	156,129			1	3				1
Ottawa	721,136		1		30				
Renfrew	97,634								
Total- Eastern	**1,479,571**		**3**	**1**	**48**				**1**
Durham Region	458,616								
Haliburton-Kawartha	165,039			1	5				
Muskoka-Parry Sound	78,675								
Peel Region	852,526	1	2	1	23				
Peterborough	123,448				8				
Simcoe County	329,865	1	1						
Toronto City - total	2,385,421	18	6		105	2			5
North	*589,653*	*3*	*1*		*25*				*1*
South	*653,734*	*14*	*4*		*53*	*1*			*2*
West	*475,252*	*1*	*1*		*15*	*1*			*1*
East	*666,782*				*12*				*1*
York Region	592,445	1			4				
Total - Central East	**4,986,035**	**21**	**9**	**2**	**145**	**2**			**5**
Grey-Bruce	153,312				1				
Elgin-St. Thomas	79,159				2				
Huron	60,220				1				
Chatham-Kent	109,650				3				
Lambton	128,975	1			9				
Middlesex-London	389,616	2			9				2
Oxford	97,142				1				
Perth	72,106								
Windsor-Essex	350,329								
Total - Southwest	**1,440,509**	**3**			**26**				**2**
Brant	114,564								
Haldimand-Norfolk	102,575								
Halton Region	339,875				4				1
Hamilton	467,799	1			27				
Niagara Region	403,504		1	1	17				
Waterloo Region	405,435		1		16				
Wellington-Dufferin-Guelph	217,052				5				1
Total - Central West	**2,050,804**	**1**	**2**	**1**	**69**				**2**
June 2001	**10,753,573**	**25**	**14**	**4**	**316**	**2**			**10**
*** Total YTD 2001**	**-**	**91**	**79**	**78**	**2,373**	**4**	**752**	**6**	**67**
*** Total YTD 2000**	**-**	**95**	**59**	**85**	**3,008**	**4**	**1,521**	**8**	**49**

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Summary of Reportable Diseases in June, 2001

Health Units by Region	1996 Population	Mumps	Pertussis	Rubella	Salmon.	Shigellosis	Syphilis (Prim/Sec)	VTEC
Algoma	123,953							
North Bay	93,841				1			
Northwestern	80,235							1
Porcupine	97,437							
Sudbury	201,154				1			
Thunder Bay	161,187				2			1
Timiskaming	38,847							1
Total - Northern	**796,654**				**4**			**3**
Eastern Ontario	185,314				3			
Hastings-Prince Edward	143,790				8			
Kingston-Frontenac	175,568				4			
Leeds-Grenville and Lanark	156,129		1					
Ottawa	721,136				14	2		3
Renfrew	97,634				1	1		
Total- Eastern	**1,479,571**		**1**		**30**	**3**		**3**
Durham Region	458,616		3		3			
Haliburton-Kawartha	165,039				3			
Muskoka-Parry Sound	78,675							2
Peel Region	852,526				24	2		2
Peterborough	123,448		2		5			
Simcoe County	329,865							
Toronto City - total	2,385,421		5	1	57	2		4
North	*589,653*			*1*	*13*			*1*
South	*653,734*		*3*		*13*	*2*		*3*
West	*475,252*		*2*		*13*			
East	*666,782*				*18*			
York Region	592,445		1		16	1		
Total - Central East	**4,986,035**		**11**	**1**	**108**	**5**		**8**
Grey-Bruce	153,312				1			
Elgin-St. Thomas	79,159							
Huron	60,220							3
Chatham-Kent	109,650				1			
Lambton	128,975							
Middlesex-London	389,616				5			2
Oxford	97,142							
Perth	72,106				3	1		
Windsor-Essex	350,329		8		3			3
Total - Southwest	**1,440,509**		**8**		**13**	**1**		**8**
Brant	114,564				1			
Haldimand-Norfolk	102,575							
Halton Region	339,875				2			1
Hamilton	467,799				4			
Niagara Region	403,504		1		5			
Waterloo Region	405,435				4			3
Wellington-Dufferin-Guelph	217,052		1					2
Total - Central West	**2,050,804**		**2**		**16**			**6**
June 2001	**10,753,573**		**22**	**1**	**171**	**9**		**28**
*** Total YTD 2001**	**-**	**1**	**216**	**15**	**1,128**	**115**	**3**	**117**
*** Total YTD 2000**	**-**	**23**	**242**	**6**	**1,071**	**153**	**12**	**330**

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