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Immunization Coverage Assessment of Children in Ontario: 1999-2000 to 2001-02

Introduction

Immunization against vaccine preventable diseases is supported by Canada's National Advisory Committee on Immunization (NACI), and implemented through routine programs within each provincial jurisdiction. Under the *Immunization of School Pupils Act* (ISPA), parents are required to have their children immunized against tetanus, diphtheria, polio, measles, mumps, rubella, and any other diseases as prescribed by the Minister of Health and Long-Term Care.[1] Failure to maintain adequate immunization status may result in suspension from school by the local medical officer of health, unless a statement of exemption has been received (i.e., medical reason, proof of prior immunity, or religious/philosophical grounds).

Since 1992, health units in Ontario have collected immunization information for children in the Immunization Record Information System (IRIS). This computerized system facilitates the assessment of immunization coverage through the generation of customized reports. The immunization status of each student is updated periodically during the school year, and school enrollment data are provided by boards of education. Data are also collected from private schools, as well as licensed day-care facilities; however, the completeness of data collection in these facilities may vary among the 37 local public health units.

Mailing Label Goes Here

The routine assessment of provincial immunization coverage for vaccine preventable diseases has been recommended by Health Canada to facilitate the identification of under-vaccinated populations, monitor immunization trends over time, and determine the impact of public health efforts geared towards increasing immunization coverage.[2] Periodic reviews of immunization coverage may also assist in measuring progress towards achieving programmatic objectives, and the identification of quality-related issues in immunization data. The following report provides immunization coverage estimates for Ontario children aged seven to seventeen, based on IRIS data for the school-years 1999/2000, 2000/2001, and 2001/2002.

Methods

Immunization coverage data were obtained from local public health units, based on IRIS coverage reports for the above-mentioned three school years. The IRIS reports were compiled as of the end of the school-year (i.e., June 30), and they cover the following birth years: students born between 1982 to 1997 are included in the 1999-2000 school year report, 1983 to 1998 in the 2000-01 school year, and birth years 1984 to 1999 in 2001-02. The IRIS coverage reports were based on *complete-for-age* coverage data, which is defined as the number of children in each birth year who were immunized according to the appropriate schedule for their age. For example, two students of the same age, who started their immunizations at different times, may have received a different number of injections, but both may be considered *complete-for-age*. Nevertheless, students with an exemption or deficient for one or more antigens were considered as *incomplete*.

Coverage data for the following five antigens/antigen combinations were provided:

(1) DPT (Diphtheria, Pertussis, Tetanus)-Polio, and MMR (Mumps, Measles, Rubella) − all;
(2) DPT Combination − separately;
(3) MMR − separately;
(4) Polio − separately;
(5) Haemophilus influenzae type B − separately.

Records of students who moved out of a health unit's jurisdiction, or whose whereabouts were unknown were moved to what is referred to as a 'holding school.' Data for students 18 years of age and older were archived and, therefore, not readily available. Data contained in the holding schools and archived data were not included in the analyses for the present report. Data analysis was performed using Microsoft Excel '97. Overall, average, age-specific, and incomplete immunization coverage rates were calculated as follows and the results were expressed as percentages:

Overall Immunization Coverage Rate: $A \div B$

Where A = Total number of children from all health units in a given school year who had been vaccinated, and B = Total number of children from all health units enrolled in the corresponding school year

Multi-year Immunization Coverage Rate: $C \div D$

Where C = Total number of children from all health units in all school years who had been vaccinated, and D = Total number of children from all health units enrolled in the corresponding school years

Age-specific Immunization Coverage Rate: $E \div F$

Where E= Sum of children from all health units in the appropriate birth year who had been immunized, and F = Sum of the total number of enrolled children from all health units in the corresponding birth year

Overall Rate of Incomplete vaccination: $G \div B$

Where G = Total number of students from all health units in a given school year with incomplete vaccination.

Ninety-five percent confidence intervals were calculated for overall, average, and incomplete immunization coverage rates. For children with incomplete vaccinations, IRIS data were broken down to indicate the reason vaccination was not carried out. Possible conditions include the granting of an exemption, no exemption granted, and no information. Due to variability among local health units in the level of completeness of the data collected for licensed day-care facilities, the analysis was limited to children aged seven to seventeen.

Results

Overall and Average Immunization Coverage Rates:

These coverage rates for complete vaccinations by school year and antigen are presented in Table 1, next page. Overall coverage rates were highest for the Hib vaccine, with an average provincial coverage rate of 96.7% over the three-year period. Hib immunization coverage was fairly constant across the three school years. Immunization coverage for MMR (two doses) averaged at 94.6% over the three school years, and also remained constant across the three-year period. A gradual increase in polio immunization coverage rates was observed over the three years, with an average of 85.9%. DPT combination immunization coverage averaged at 82.4%, also increasing steadily over the three school years. The lowest overall coverage rates were found with the DPT-Polio and MMR vaccine combination (80.1% average), with slight fluctuations in coverage seen over the three school years.

Table 1. Overall and Average Immunization Rates for Complete Vaccinations by School Year and Antigen, Ontario 1999/2000 to 2001/2002, Ages 7 to 17

School Year	1999-2000		2000-2001		2001-2002		Multi-year	
Antigen	Rate (%)	95% CI	Rate (%)	95% CI	Rate (%)	95% CI	Rate (%)	95% CI
DPT-Polio & MMR	79.92	(79.85, 79.98)	81.00	(80.94, 81.06)	79.57	(79.51, 79.63)	80.14	(80.11, 80.18)
DPT Combination	81.53	(81.47, 81.59)	82.30	(82.25, 82.36)	83.36	(83.30, 83.41)	82.44	(82.41, 82.47)
MMR	94.25	(94.21, 94.29)	94.54	(94.51, 94.57)	94.83	(94.80, 94.86)	94.55	(94.53, 94.57)
Polio	83.72	(83.66, 83.78)	86.02	(85.97, 86.07)	87.76	(87.71, 87.81)	85.93	(85.90, 85.96)
Hib	96.34	(96.31, 96.37)	96.72	(96.69, 96.75)	96.62	(96.59, 96.65)	96.57	(96.55, 96.58)

* CI : Confidence interval

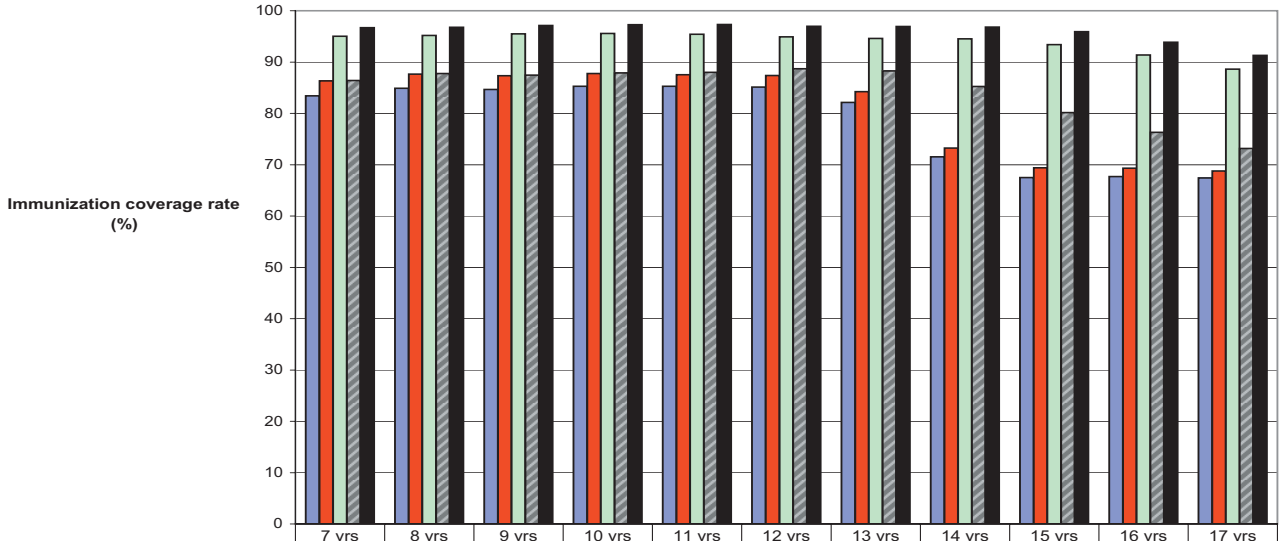
Age-Specific Coverage Rates

Age-specific coverage rates in children aged 7 to 17 for the five antigens/antigen-combinations based on an average of the three school years are presented in Figure 1. Immunization coverage rates were highest for the Hib antigen across all ages (91.5 % in 17 year olds, 97.3% in 10 and 11 year olds). High immunization coverage was also seen for the MMR vaccine, ranging from 88.6 % in 17 year olds to 95.6% in 10 year olds. Immunization coverage for the DPT combination and the Polio vaccine was similar among children aged 7 to 12 years old, with the highest coverage seen in 10 year olds for the DPT combination (87.8%), and in 12 year olds for the Polio vaccine (88.7%). The lowest coverage rates were seen in the 17 year old age group (DPT combination - 68.8%, Polio - 73.1%). Coverage of DPT-Polio-MMR antigen was low, ranging from 67.4% in 17 year olds to 85.3% in 10 and 11 year olds.

Coverage Rates for Incomplete Vaccinations

Overall and average rates for incomplete vaccinations by school year and antigen are presented in Table 2. Overall rates for incomplete vaccinations were highest for the DPT-Polio and MMR antigen combination over the three-year period (19.9% average), followed by the DPT combination (17.6% average), Polio (14.1%), MMR (5.5%), and Hib antigens (3.4%). Rates of incomplete vaccination declined for the DPT combination, polio, and MMR antigens over the three school years. Slight fluctuations in incomplete

Figure 1. Immunization Coverage Rates of Children in Ontario, 1999/01 to 2001/02: Age Specific, Multi-Year Rates by Antigen



	7 yrs	8 yrs	9 yrs	10 yrs	11 yrs	12 yrs	13 yrs	14 yrs	15 yrs	16 yrs	17 yrs
DPT-Polio & MMR VACCINE	83.4	84.9	84.7	85.3	85.3	85.1	82.1	71.5	67.5	67.7	67.4
DPT COMBINATION VACCINE	86.3	87.6	87.3	87.8	87.5	87.4	84.2	73.3	69.4	69.3	68.8
MMR VACCINE	95.0	95.2	95.5	95.6	95.4	94.9	94.6	94.5	93.4	91.4	88.6
POLIO IPV/OPV VACCINE	86.4	87.7	87.4	87.9	88.0	88.7	88.3	85.2	80.1	76.3	73.1
Hib VACCINE	96.7	96.8	97.1	97.3	97.3	97.0	96.9	96.8	95.9	93.8	91.3

vaccination rates were seen in Hib and the DPT-Polio and MMR combination over the three-year period.

Figure 2, next page, displays information regarding the reasons for incomplete vaccinations. For each of the antigens, the average percentage of children over the three school years with incomplete vaccination who were missing information was as follows: DPT-Polio and MMR: 4.0%; DPT Combination: 4.0%; MMR: 4.1%; Polio: 3.1%; and Hib: 3.0%. The three-year means of the percentage of children who received an exemption by antigen were DPT-Polio and MMR – 1.7%, DPT Combination – 1.7%, MMR – 1.3%; Polio – 1.1%; and Hib – 0.1%. For all antigens other than MMR and Hib, children with no exemption accounted for the majority of incomplete vaccinations. For DPT-Polio and MMR, an average of 13.8% of children over the three-year period had no exemption. The corresponding values for DPT and polio were 11.8% and 9.5%, respectively, while for MMR and Hib the values were 0.1% and 0.3%, respectively.

Table 2. Overall and Average Rates for Incomplete Vaccinations by School Year and Antigen, Ontario 1999/2000 to 2001/2002, Ages 7 to 17

School Year	1999-2000		2000-2001		2001-2002		Multi-year	
Antigen	Rate (%)	95% CI	Rate (%)	95% CI	Rate (%)	95% CI	Rate (%)	95% CI
DPT-Polio & MMR	20.08	(20.03, 20.14)	19.00	(18.95, 19.05)	20.43	(20.38, 20.48)	19.86	(19.82, 19.89)
DPT Combination	18.47	(18.42, 18.52)	17.70	(17.65, 17.74)	16.64	(16.59, 16.69)	17.56	(17.53, 17.59)
MMR	5.75	(5.72, 5.78)	5.46	(5.43, 5.49)	5.17	(5.14, 5.20)	5.45	(5.43, 5.47)
Polio	16.28	(16.23, 16.33)	13.98	(13.94, 14.02)	12.24	(12.20, 12.28)	14.07	(14.04, 14.10)
Hib	3.66	(3.64, 3.68)	3.28	(3.26, 3.30)	3.38	(3.36, 3.40)	3.43	(3.42, 3.45)

* CI : Confidence interval

Discussion

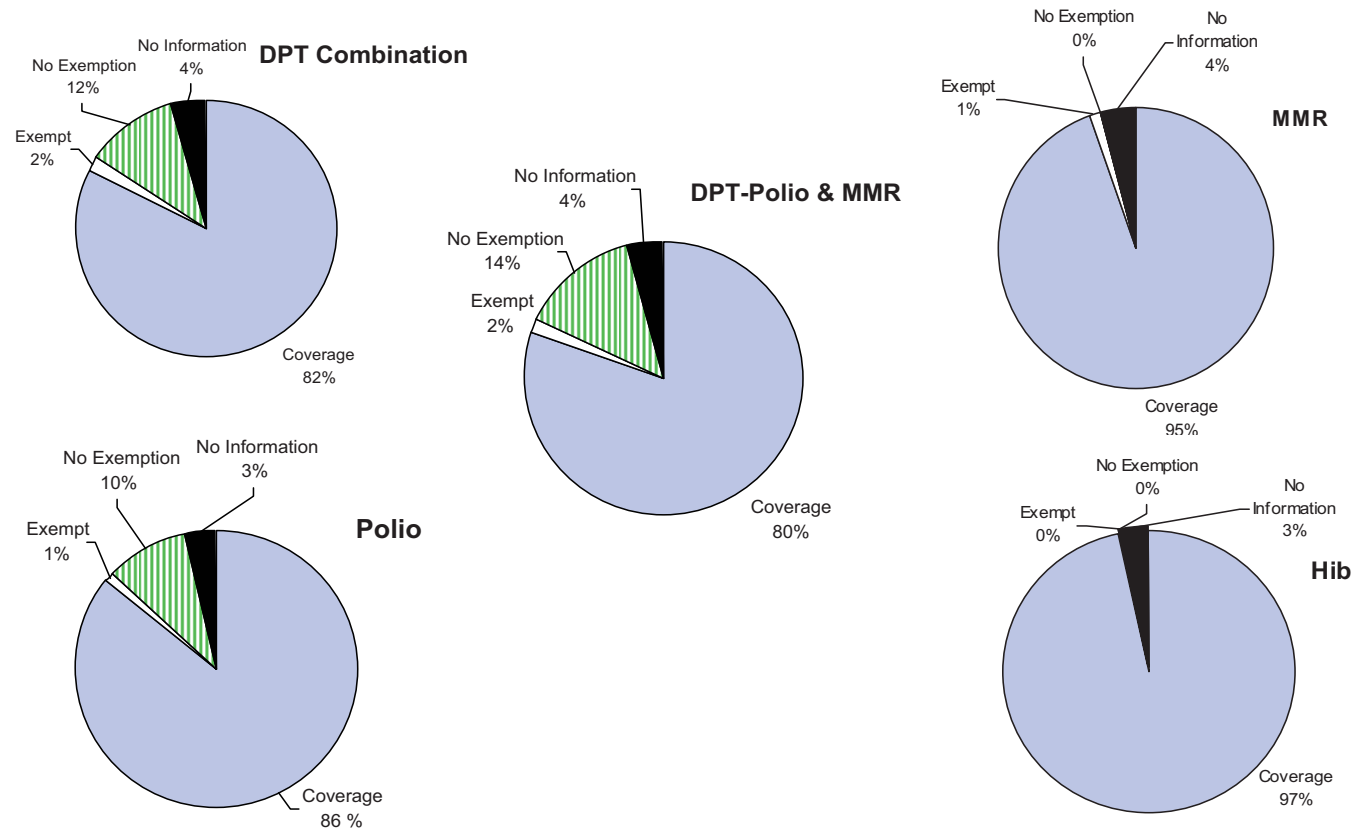
Results of the analysis demonstrate that overall coverage rates were highest for the Hib vaccine. Coverage rates declined in the following order for the remaining antigens: MMR, Polio, and DPT. The present findings are consistent with those of a previous assessment of immunization coverage in Ontario for 1998 based on IRIS data.[3] Overall coverage in 1998 for the DPT-Polio and MMR combination was 81%. Estimated coverage for the MMR, DPT, and Polio antigens was 96%, 82% and 82% respectively.

A number of factors may have contributed to the high coverage estimates observed for the Hib vaccine. In 1986, a change in reporting was implemented to include all cases of invasive Hib disease, whereas only Hib meningitis was previously reported. Consequently, an increase in the incidence of reported Hib cases was seen, particularly in children under 5 years (1.35 per 100,000 in 1980 to 2.25 per 100,000 in 1986).[4] The introduction of polysaccharide and conjugate Hib vaccines also occurred around this time period. These factors may have resulted in increased awareness of Hib disease amongst physicians and the public, resulting in an increased demand for protection against Hib disease.

Low immunization coverage for the DPT-Polio and MMR antigen combination in the present analysis may have been due in part to the 'complete for age' criterion. Students who missed a dose in any antigen series (DPT, polio, or MMR) would not be captured in the coverage rate. This was reflected in a recent national telephone survey that showed a gradual decline in immunization coverage with each booster dose required to complete the immunization series.[5] While the DPT combination and polio vaccines are usually administered during the same visit, estimated coverage for DPT was consistently lower than polio. It is plausible that rates of DPT coverage would be lower if a decline in booster doses was observed due to adverse effects related to any of the antigens.

In the present report, immunization coverage was highest in the 10 year old birth cohort for all antigens/antigen combinations except Polio (88.7% in 12 year olds). The 1998 analysis of Ontario immunization data[3] examined coverage in children aged 6-16 years old. Coverage for DPT-Polio and MMR combination was highest at age 13 (91%). For the individual antigens, coverage rates were highest in 10 to 13 year olds (MMR: 97%, Polio: 90%, DPT 90%). Hib immunization coverage was highest in the 6 year old population, estimated at 93%.

Figure 2. Multi-year Rates for Incomplete Vaccinations in 7 to 17-year old Children, Ontario, 1999/200 to 2001/2002



Those who did not receive an exemption and for whom information was missing comprise the vast majority of children with incomplete vaccination over the three school years. The overall percentage of children who received an exemption was low, comprising the smallest component of incomplete vaccinations for all antigens except MMR.

Limitations

A number of data limitations should be considered when reviewing the present report. IRIS data are collected retrospectively from parents, often several years after vaccination and, therefore, are subject to inaccurate recall.[6] Heavy staff workload in some health units may contribute to delays in data entry thereby lowering reported vaccine coverage rates. In addition, only 85% of students have unique identifiers (health card numbers), which may lead to the duplication of entries when students move between health units.

The enrollment data supplied by the boards of education, individual schools and day-care facilities are also subject to a number of limitations.[6] Not all facilities are able to supply immunization data in an electronic format. As a result, data must be entered manually by health unit staff – a process which potentially introduces keying errors. During the data importation process, a significant proportion of student records must also be reconciled and merged manually thereby resulting in incorrect matches. In addition, the frequency with which information is provided to the health units by the boards of education varies greatly. Often it is done once each year. The data provided may not be current and, when forwarded to the health units, may override existing information.

Summary

Ontario's immunization objectives include 95% vaccine coverage for up-to-date vaccination against diphtheria, pertussis, polio, tetanus, Hib, measles, mumps, and rubella by the second birthday; and 95% vaccine coverage for up-to-date vaccination against diphtheria, pertussis, polio, tetanus, measles, mumps, and rubella and second dose of measles by the seventh birthday.[7] Overall coverage rates demonstrate that these objectives have been met for MMR

and Hib; however, coverage rates for vaccination against diphtheria, pertussis, tetanus, and polio remain below the specified targets.

Acknowledgement

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Descriptive Epidemiology of Enteric Diseases in Ontario, 2002

Introduction

In Ontario, enteric diseases designated as Reportable under the *Health Protection and Promotion Act* are investigated by health units, and are reported to the Ontario Ministry of Health and Long Term Care (MOHLTC) through a public health monitoring system called the Reportable Diseases Information System (RDIS).[1]

The objective of this article is to provide descriptive epidemiological findings on the occurrence of ten enteric diseases for the calendar year 2002 in Ontario.

Materials and Methods

Data Sources

The RDIS database was accessed on May 5, 2004 to obtain records of ten enteric diseases for the year 2002. The diseases chosen for analysis include:

- Botulism
- Campylobacteriosis
- Hepatitis A
- Listeriosis
- Paratyphoid Fever
- Salmonellosis
- Shigellosis
- Typhoid Fever
- Verotoxin-producing *E.Coli* (VTEC)
- Yersiniosis

To more effectively describe the epidemiological findings pertaining to enteric illnesses acquired in Ontario, travel-associated cases were removed from the analysis so that only illnesses acquired in Ontario were considered. The remaining records in the module were considered for analysis if the "episode date" was in the year 2002. Data were analyzed using SPSS (version 12.0). The Ontario population data from the 2001 Canadian census was used to calculate age-specific incidence rates of enteric disease.

Definitions

A case was defined as travel-associated if the individual travelled to a destination outside of Ontario and had an onset of illness that was not more than 2 days after travel for *Clostridium botulinum,* 10 days for *Campylobacter*; 50 days for Hepatitis A, 70 days for *Listeria,* 3 months for Paratyphoid and Typhoid Fever, and 7 days for *Salmonella, Shigella, VTEC,* and *Yersinia.*

The selections within the variable "risk setting" were regrouped to include 'institutions' (hospital, medical office, day-care, school, residential facility, correctional facility), 'local travel' (including local camping, vacation property, travel within Ontario, pool/spa, lake/river/stream/pond, encounter, major event, meeting outside usual domicile), and 'other' (shelter/rooming house, facility for developmentally disabled).

Data Quality Evaluation

The percentage of missing and unspecified values was calculated for each variable (Table 1). Data completeness and internal consistency were assessed. Duplicate cases were checked by comparing the "episode date," "episode date type," "disease," "organism/agent," "subtype," "date of birth," and "gender." Findings presented in the Results section of the report do not include missing data.

Table 1. Number and percentage of missing and unspecified values by variable for enteric disease cases reported in Ontario, 2002 (N = 7,470)

Variable	No. missing[a]	No. unspecified[b]	% missing and unspecified
Disease	0	0	0
Disease agent	103	704	10.8
Age	12	0	0.2
Gender	5	0	0.1
Mode of transmission	376	3940	57.8
Hospitalizations	4563	48	61.7
Deaths	3951	25	53.2
Risk Setting	299	3089	45.4

[a] "missing" means no entry made

Results

Data Quality Evaluation

A total of 8,932 cases of enteric disease were recorded in RDIS for the year 2002. Four duplicate cases were detected, and 1,458 (16.3%) were identified as travel-associated. Those cases and were removed from the analysis. The final sample consisted of 7,470 cases.

Descriptive Analysis

Campylobacter species were the most frequently reported enteric pathogen (Figure 1). The number of reported cases by pathogen and species/serotypes for the ten selected diseases is shown in Table 2. The remaining part of the report does not include a discussion on Typhoid, Paratyphoid, and Botulinum due to the small number of cases reported in Ontario for 2002.

Figure 1. Number of reported cases of enteric illness for selected reportable diseases for Ontario, 2002 (N = 7,470).

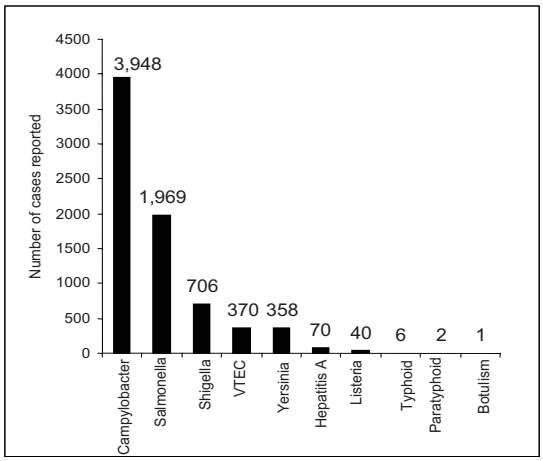


Table 2: Enteric pathogens by number of cases and serotype for selected diseases, Ontario, 2002 (N = 7,470).

Species/serotype	Number	(%)	Percent Serotyped
Campylobacter			
C. jejuni	3576	90.6	97.2
C. coli	88	2.2	2.4
C. fetus	7	0.2	0.2
C. laridis	8	0.2	0.2
Missing/unspecified	269	6.8	0.0
Total	**3,948**	**100.0**	**3,679**
Salmonella			
(top 10 serotypes)			
Typhimurium	361	18.3	25.0
Heidelberg	341	17.3	23.6
Enteritidis	218	11.1	15.1
Thompson	102	5.2	7.1
Newport	90	4.6	6.2
Hadar	85	4.3	5.9
Oranienburg	41	2.1	2.8
Berta	35	1.8	2.4
Infantis	31	1.6	2.1
Braenderup	27	1.4	1.9
Other serotypes	114	5.8	7.9
Missing/unspecified	524	26.6	0.0
Total	**1,969**	**100.0**	**1,445**
Shigella			
S. sonnei	663	94.0	95.3
S. flexneri	30	4.2	4.3
S. dysenteriae	3	0.4	0.4
Missing/unspecified	10	1.4	0.0
Total	**706**	**100.0**	**696**
VTEC			
Total	**370**	**100.0**	
Yersinia			
Total	**358**	**100.0**	
Hepatitis A			
Total	**70**	**100.0**	
Listeria			
Total	**40**	**100.0**	
Typhoid			
Total	**6**	**100.0**	
Paratyphoid			
Total	**2**	**100.0**	
Clostridum botulinum			
Total	**1**	**100.0**	
Grand Total	**7470**	**100.0**	

Overall, males accounted for 51.4% of the cases (Figure 2). Incidence rates varied by age group, with children 4 years of age and younger having the highest incidence rate for most enteric diseases (Figure 3).

34.6% of the cases occurred in the three months from June to August. Disease incidence for pathogens showed seasonal variation. The dates of onset of symptoms for 45.7% of VTEC, 37.2% of Campylobacter, 35.6% of Yersinia, and 34.7% of Salmonella occurred between June and August (Figure 4).

Figure 2: Incidence rates of enteric illness by gender, Ontario, 2002 (N = 7,456).

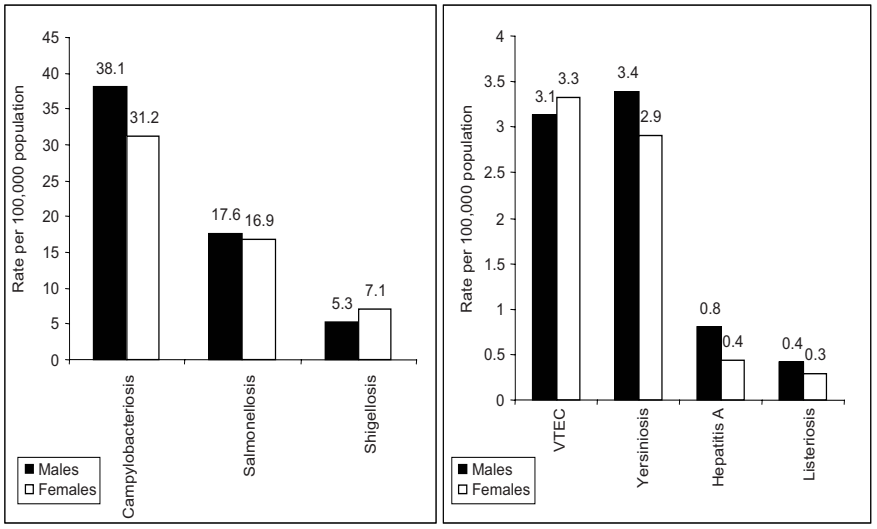


Figure 3: Incidence of enteric illnesses by age group, Ontario, 2002 (N = 7,449).

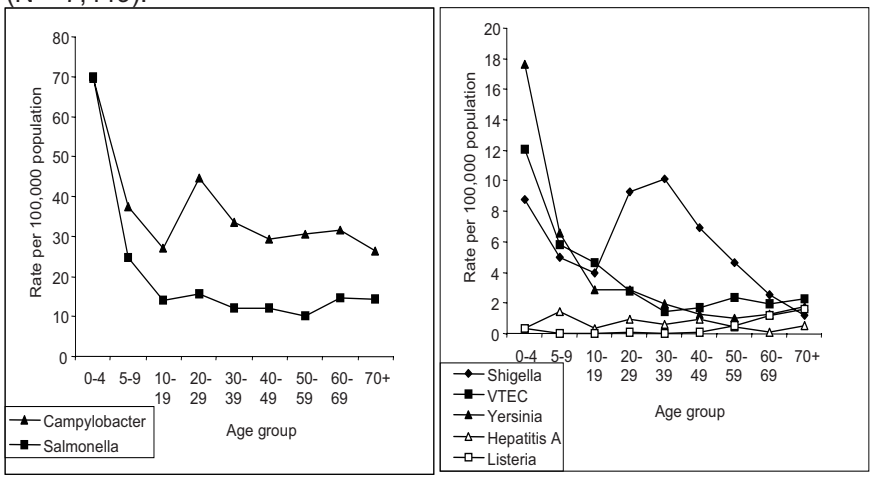
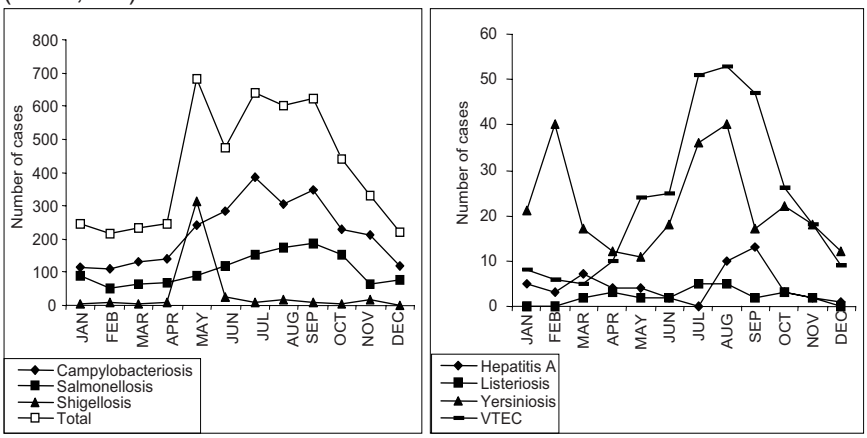


Figure 4: Number of cases of enteric disease by month, Ontario, 2002 (N = 4,941).



Twenty-six deaths were reported in 2002, with an overall case-fatality rate of 0.35%. The overall in-patient case-hospitalization rate was 4.7% (Table 3).

As shown in Table 4, overall, the most frequently reported mode of transmission was foodborne (75.9%), followed by 'other' (12.8%) person-to-person transmission (7.7%), water, (3.5%) and sexual contact (0.1%).

Overall, the most frequently reported risk setting was home (64.3%), followed by restaurant/food vendor (15.0%), workplace (5.9%), 'other' (5.4%), local travel (4.9%), and institutions (4.6%) (Table 5).

Discussion

It is recognized that passive surveillance processes capture only a fraction of enteric disease episodes occurring in the community.[2] The number of cases reported in Ontario in 2002 likely under-represent the true number of enteric disease episodes in the Province. The true incidence of enteric disease is difficult to calculate, as valid estimates of under-reporting are unavailable.[3] The potential for bias should be considered when interpreting the results presented in this report because a number of variables in the database had a large percentage of missing or unspecified data.

This is the first report that focuses on the burden of selected reportable enteric diseases attributed to being acquired within Ontario. The 8,928 cases of enteric illness reported in 2002 is consistent with the number of cases reported in the previous five years. From 1997 to 2002, the annual number of cases ranged from a high of 10,211 in 1998 to a low of 7,643 in 1999.[4]

About one sixth of the cases of enteric disease were identified as travel-associated cases and removed from the analysis. The percentage of travel-associated cases identified in 2002 was lower than that for the period span-

Table 3: Enteric pathogens by hospitalizations (N = 538) and deaths (N = 26) for Ontario, 2002.

	Campylobacter	*Salmonella*	*Shigella*	VTEC	*Yersinia*	Hepatitis A	*Listeria*	*Botulinum*	*Total*
Hospitalizations									
In patient	189	83	25	41	11	2	2	1	354
Out patient	42	34	46	39	19	4	1	0	184
In patient case hospitalization rate	4.8%	4.2%	3.5%	11.1%	3.1%	2.9%	5.0%	100.0%	4.7%
Deaths									
Underlying cause of death	0	1	0	2	0	0	2	0	5
Contributed to death, but was not underlying cause	0	0	0	0	0	0	1	0	1
Did not contribute to death, and was an incidental finding	0	3	0	0	0	0	2	0	5
Missing/unspecified data on relationship to death	3	6	0	1	0	0	5	0	15
Total	3	10	0	3	0	0	10	0	26
Case-fatality rate (total deaths/total no. cases)	0.08%	0.51%	0	0.81%	0	0	25.00%	0	0.35%

Table 4: Enteric pathogens by mode of transmission for Ontario, 2002 (N = 3,154).

Risk Setting	% *Campylobacter*	% *Salmonella*	% *Shigella*	% VTEC	% *Yersinia*	% Hep A	% *Listeria*	% Total
Food	73.3	77.1	88.4	62.1	81.6	12.0	81.8	75.9
Other	18.3	11.1	0.8	13.0	8.8	8.0	18.2	12.8
Person-to-Person	4.4	8.1	10.4	16.6	6.6	72.0	0.0	7.7
Water	4.1	3.8	0.4	8.3	2.9	0.0	0.0	3.5
Sexual Contact	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.1

Table 5: Enteric pathogens by risk setting for Ontario, 2002 (N = 4,082).

Risk Setting	% *Campylobacter*	% *Salmonella*	% *Shigella*	% VTEC	% *Yersinia*	% Hep A	% *Listeria*	Total
Home	62.5	63.8	71.7	52.3	77.3	55.3	68.4	64.3
Restaurant/Food Vendor	17.2	17.4	9.0	10.2	8.3	5.3	0.0	15.0
Workplace	8.0	3.2	5.5	4.7	1.1	7.9	0.0	5.9
Other	4.0	4.8	10.2	7.7	3.9	7.9	5.3	5.4
Local travel	5.1	3.9	1.7	14.5	5.0	13.2	0.0	4.9
Institutional	3.2	6.8	2.0	10.6	4.4	10.5	26.3	4.6

ning 1997 to 2001 (24.6%).

The three months from June to August accounted for 34.6% of all cases. During the same period, *Campylobacter*, *Salmonella,* and *VTEC* accounted for 85.5% of all cases. This is consistent with other studies where disease incidence showed marked seasonality with a peak during the summer months[5] when warmer temperatures facilitate growth of the organism.[6] One inconsistency in the summer seasonal distribution occurred as a result of a large Shigella outbreak in May. The large number of Shigella cases reported in the outbreak had the effect of increasing the total number of enteric cases in May.

There were 26 deaths reported in Ontario-acquired cases in 2002. This number is slightly more than the annual average of 22.6 deaths reported for the period 1997 to 2001 that included travel-associated cases.[4] The pathogen was identified as an incidental finding for five of the 26 deaths. The in-patient case-hospitalization rate was 4.7% in 2002. This compares with the overall rate of 3.8% for the period 1997 to 2001 that included travel-associated cases.[4]

The most frequently reported mode of transmission in 2002 was foodborne (75.9%). This is consistent with previous findings[4] and consistent with the commonly held belief that most enteric pathogens are foodborne.

The most frequently reported risk setting was private home (64.3%). This was moderately higher than the 50.2% reported for Ontario for the period 1997 to 2001.[4] The removal of travel-associated cases resulted in the higher percentage of private homes as a risk factor. This more correctly identifies the risk setting for Ontario-acquired cases. Other identified risk settings included restaurants (15.0%), workplaces (5.9%), local travel (4.9%), and institutes (4.6%).

Conclusion

The 8,928 enteric illnesses reported in 2002 were consistent with the number of cases reported in the previous five years. The main epidemiological findings in this report are characterized by foodborne transmission in the private home setting occurring more frequently during the summer months. Consumer food-handling observational studies have shown that consumers repeatedly use unsafe food-handling practices in their homes,[7] which increase their risk of foodborne illness. To be most effective in reducing the incidence of enteric illness, it is important that specific behaviours associated with illness be identified and incorporated into educational messages that motivate individuals to make healthy changes in their food-handling behaviours in the home environment.

Acknowledgments

The authors would like to thank the staff at public health units, as well as the staff at laboratories in Ontario for their work in investigating and reporting enteric illnesses.

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Evaluation of the Thunder Bay Eat Smart! Restaurant Program Dining Guide

Background

Eat Smart! is Ontario's Healthy Eating Restaurant Program. The Eat Smart! Restaurant Award program has been running in Ontario since 2000. The Nutrition Resource Centre is the provincial administrator for this program and is implemented through local public health units across the province.

The goal of the program is to reduce chronic disease and food-borne illness in Ontario. It aims to achieve this goal through a variety of strategies, including social marketing, education, skill development, environmental support, and program standards.

Eat Smart! was developed in partnership with the Ministry of Health and Long-Term Care, the Heart and Stroke Foundation of Ontario, the Canadian Cancer Society (Ontario Division), the Ministry of Agriculture, Food and Rural Affairs, local public health units, local heart health programs, the food service industry, and consumers.

Eat Smart! promotes restaurants that meet exceptional standards in nutrition, food safety, and non-smoking seating. Restaurants that meet or exceed these standards are awarded an Eat Smart! Award of Excellence.

A list of Eat Smart! restaurants in Thunder Bay and District is published in a dining guide and has been distributed annually through the local newspaper since 2001. In the fall of 2003, the Thunder Bay Eat Smart! Committee conducted an evaluation to determine if consumers had:

- Heard of the Eat Smart! program,
- Recalled receiving the dining guide,
- Retained the dining guide, and
- Knew where they would most likely look for a list of Eat Smart! restaurants.

The goal of the evaluation was to determine if an annually published and distributed dining guide was the most effective method for promoting Eat Smart!, or if an alternative should be considered.

Methods

Data were collected from November 10 to 23, 2003. Eat Smart! dining guides had been distributed via the local newspaper three weeks prior to the data collection start-date. The survey instrument used for data collection was created in-house and an external firm was hired to conduct the telephone survey. Households were selected by random-digit dialing of exchanges in the City of Thunder Bay. All adult residents were eligible to take the survey.

Results

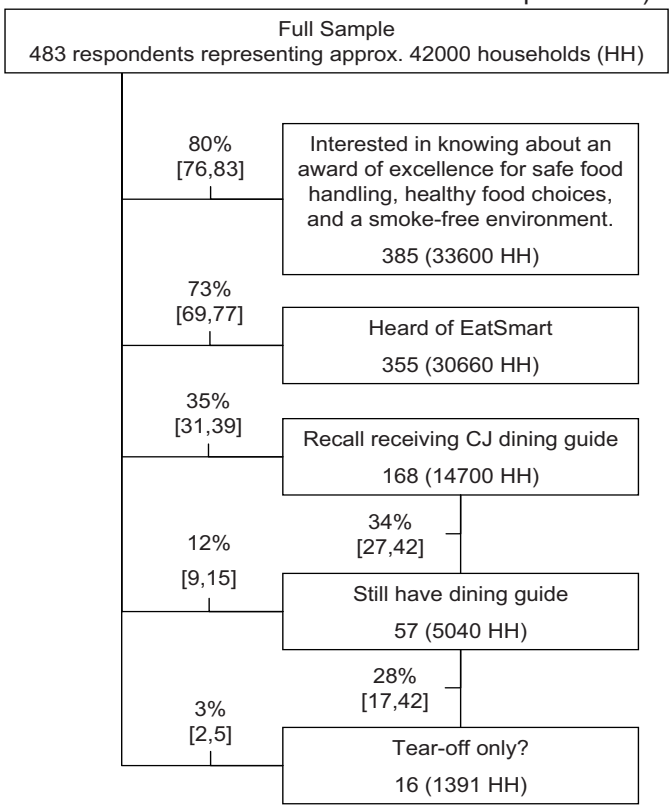
The telephone survey yielded a 53% response rate. The sample consisted of 483 respondents representing approximately 42,000 households, of which 35,390 would have received a newspaper with a dining guide.

Participant ages ranged from 18 to 84, with a mean of 45; 65% of the sample was female. Eighteen percent were people living alone, 33% of respondents lived in a household containing two people, 19% of respondents lived in a household of three, 19% lived in a household of four, and about 11% lived in a household of five or more.

Awareness of Eat Smart!

Interviewers described the criteria required for restaurants to receive an "award of excellence:" a history of safe food handling, as determined by public health inspectors; the availability of healthy food and free substitutions; and, a 100% smoke-free environment. Eighty percent of respondents were interested in knowing which restaurants had received this "award of excellence" and 73% were familiar with the brand name Eat Smart! (Figure1).

Figure 1. Results of Eat Smart! evaluation survey (95% exact binomial confidence intervals are presented).



Retention of Eat Smart! Dining Guide

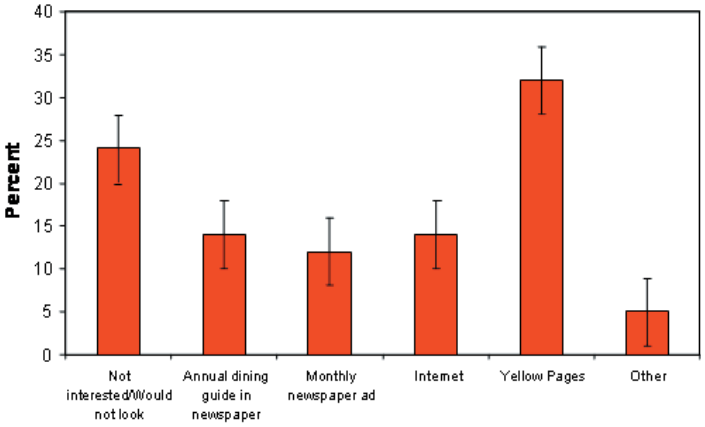
Three weeks prior to the survey, Eat Smart! dining guides were distributed in the local newspaper. In Thunder Bay, the local newspaper reaches approximately 85% of households.

The dining guide contained information about the Eat Smart! program standards and a list of restaurants that had received the Eat Smart! Award of Excellence. The dining guide had a wallet-sized, tear-off card printed with the list of Eat Smart! restaurants. Of the 35% who recalled receiving the dining guide, 34% (12% of the total population) retained the dining guide (Figure 1). Of those who retained the guide, 65% kept the whole dining guide, 28% kept the tear-off list only, and 7% were unsure what they had kept.

Placement of Eat Smart! Advertising

Twenty-four percent of respondents were neither interested nor would look for Eat Smart! restaurants at all. The highest proportion of respondents, 32%, indicated that they would look in the Yellow Pages for Eat Smart! recommendations (Figure 2). Fourteen percent of participants said they would look in the newspaper for an insert similar to the previous dining guide, and another 14% reported they would look on the Internet for the information. Twelve percent of those surveyed said they would look for a monthly or quarterly newspaper advertisement, and 5% of respondents indicated some other way to access the information.

Figure 2. Where would you most likely look for a list of Eat Smart! restaurants?



Discussion

It was found that in Thunder Bay approximately 3/4 of the residents recognized the Eat Smart! brand. This corresponded closely to the percentage of people interested in a program like Eat Smart! Only 7% of those who indicated interest in a restaurant award program had never heard of Eat Smart!

Several other health units have conducted evaluations of the Eat Smart! program. An optional module for Eat Smart! has been developed for the Rapid Risk Factor Surveillance System. It is likely that many health units in Ontario have unpublished data regarding the success of their local Eat Smart! efforts. From personal communications, it seems that recognition of the Eat Smart! brand within the communities assessed is generally under 50%.

To date, our chosen vehicle for disseminating Eat Smart! information has been a high-quality, glossy stand-alone dining guide containing a list of Eat Smart! qualified restaurants, distributed annually via the local newspaper. However, this survey revealed that few of these dining guides are actually retained by members of the public, despite the fact that the survey was conducted only three weeks post-dissemination. Instead, respondents indicated that the Yellow Pages would be a more intuitive and convenient vehicle. Smaller but still significant proportions of respondents indicated a preference for newspaper advertising and the internet.

As a result of the survey, the Thunder Bay Health Unit is implementing a re-design of the dining guide, to be published in the restaurant section of the Yellow Pages – a smaller less expensive newspaper advertisement, and more promotion of health unit's website as a source of Eat Smart! information. These changes have reduced the production and distribution costs by approximately one half, and the funds saved will be used for more extensive promotion of Eat Smart!.

Additional research is needed to determine if and why consumers choose to eat in Eat Smart! certified restaurants, if they know that healthy menu choices are available, and if they indeed take advantage of these alternatives.

Acknowledgements

Simon Hoad, Allyson Veneziano, Anita Lapointe, Eileen Dias, and Janice Piper-Wilson helped to conceive the study and acted as reviewers. Thanks to Anne Ostrom and the Take Heart Thunder Bay – Healthy Lifestyles Coalition for funding the survey.

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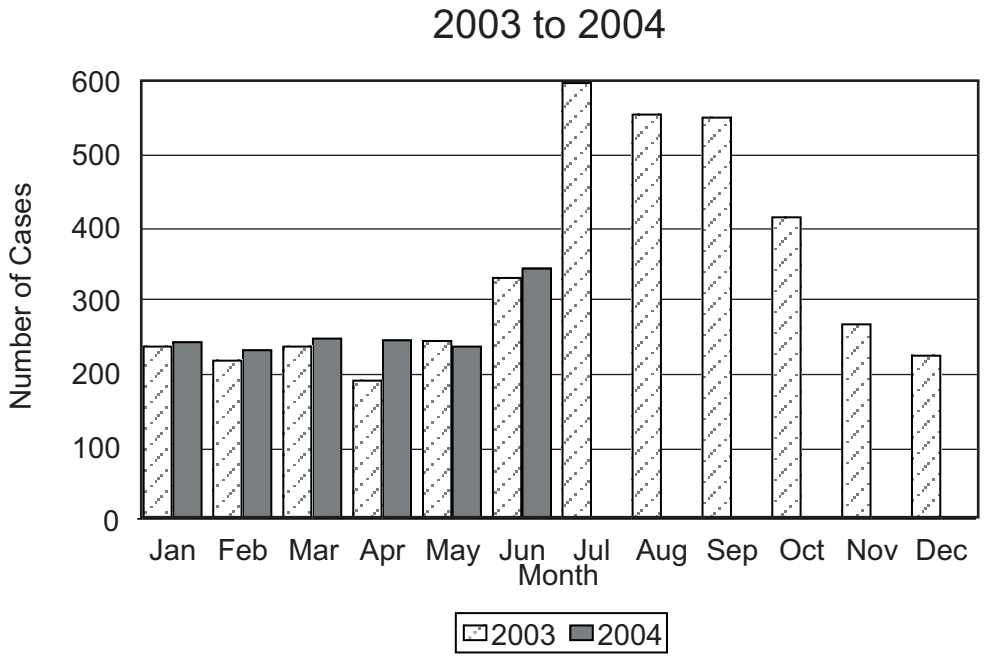
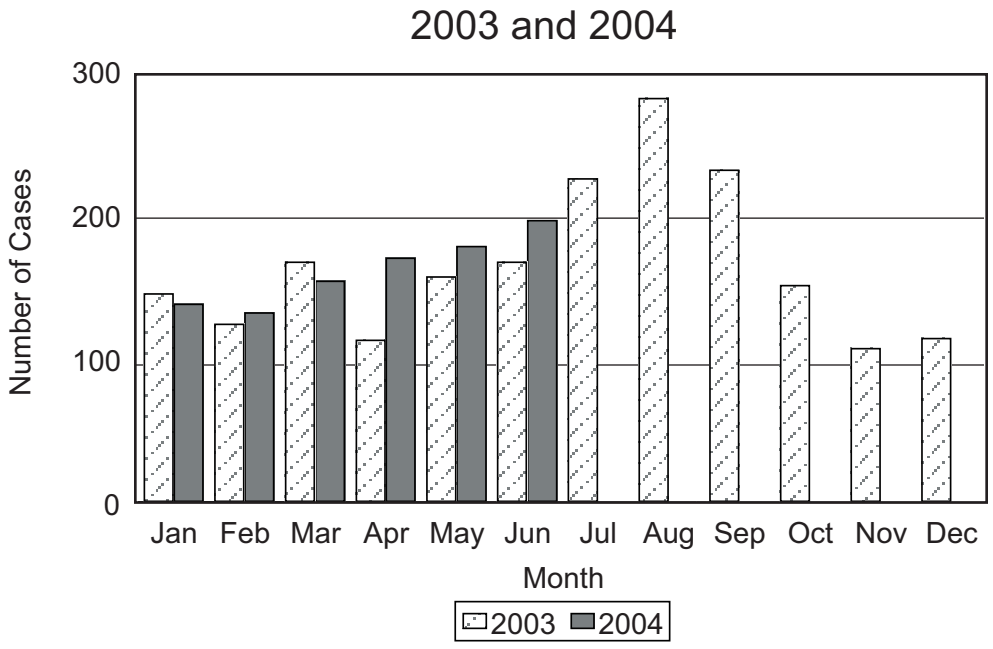
Statistics

Campylobacter Cases in Ontario by Month

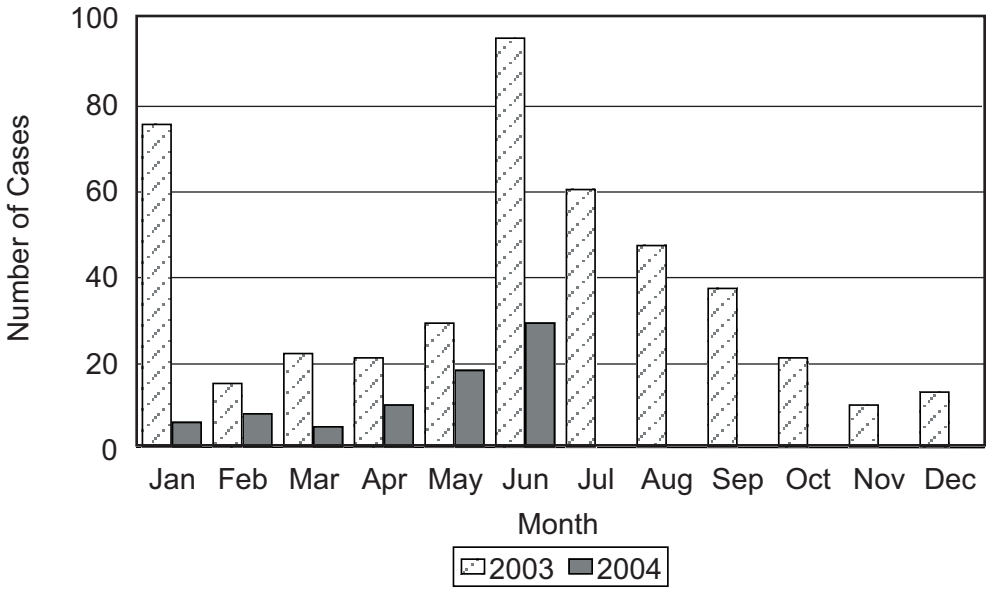


Salmonellosis Cases in Ontario by Month



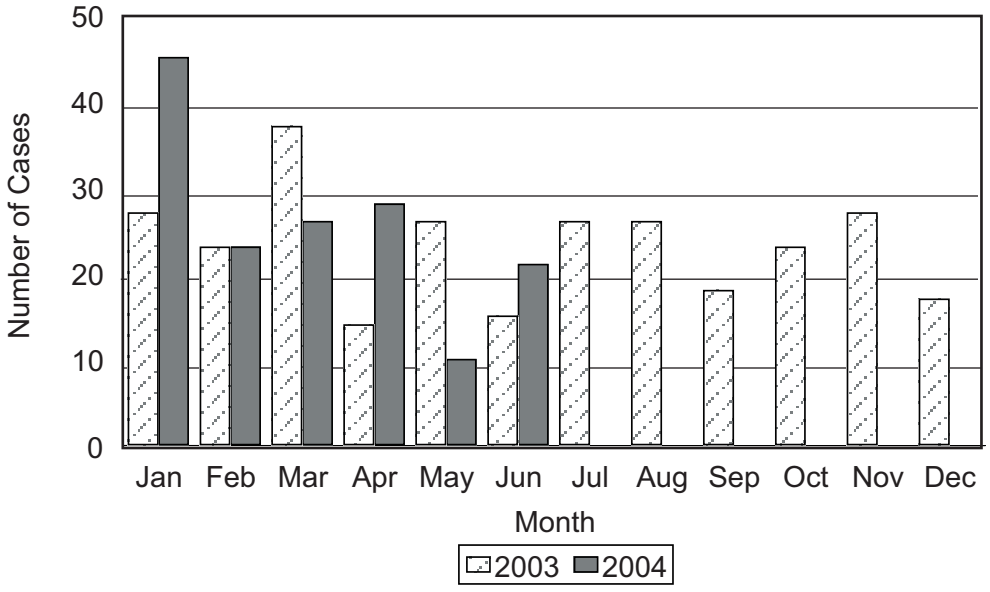
Verotoxin-Producing E. coli Infections

in Ontario by Month, 2003 and 2004

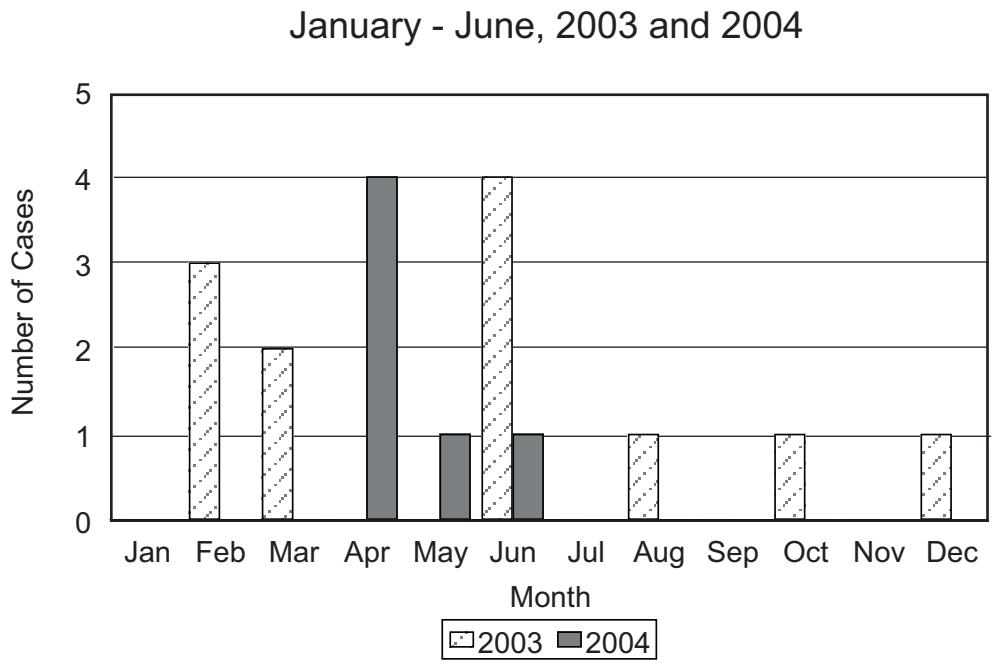


Shigellosis Cases in Ontario by Month

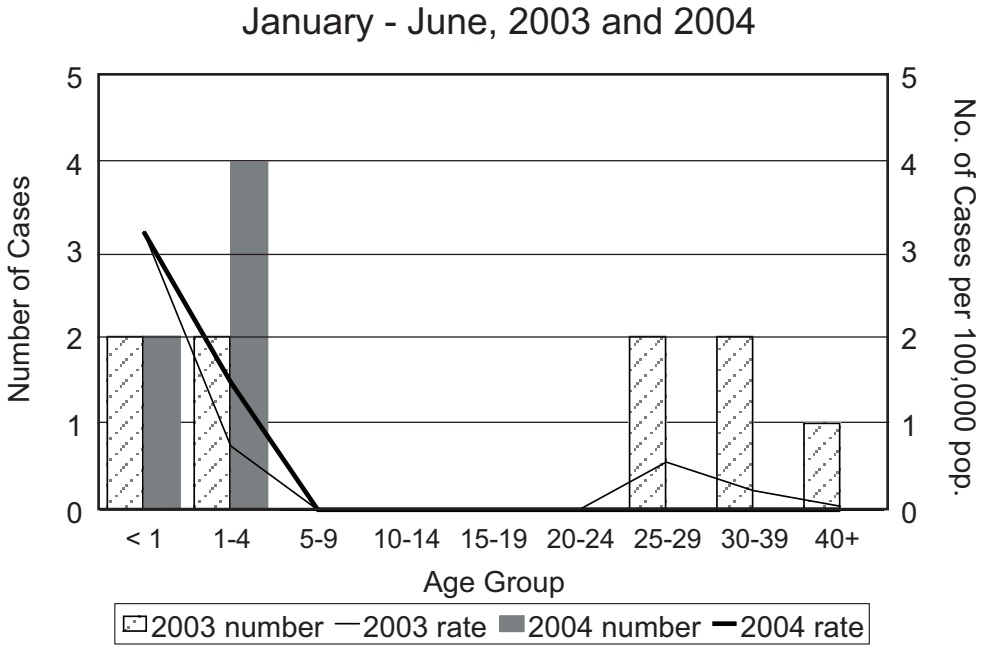
2003 and 2004



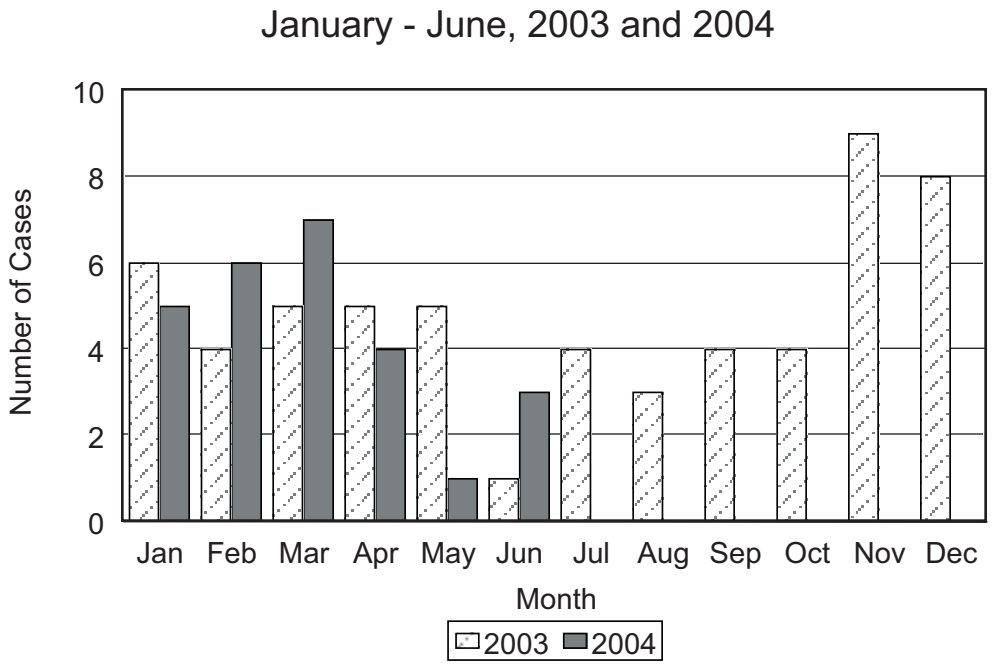
Measles Cases in Ontario by Month



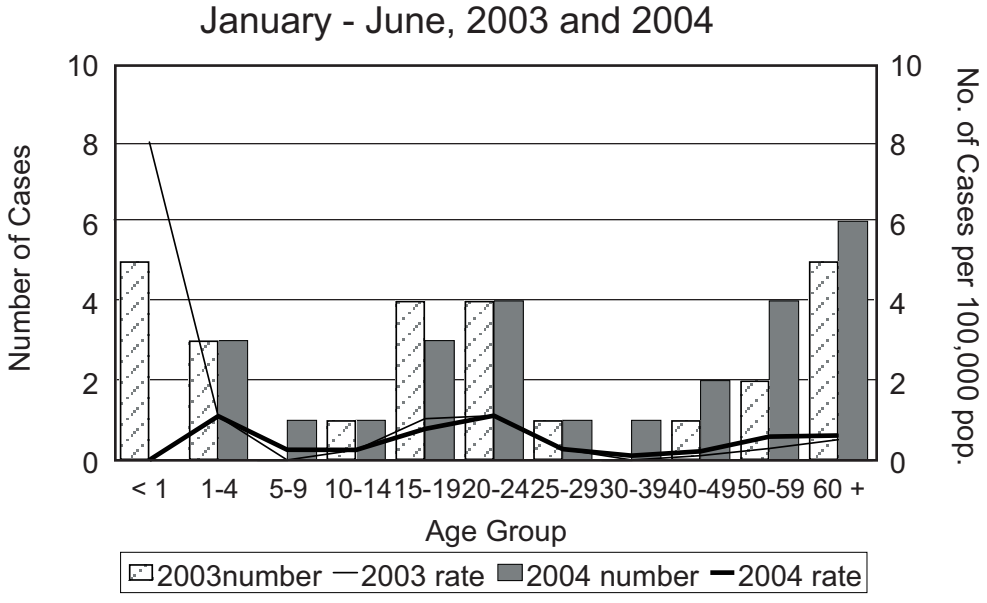
Measles Cases in Ontario by Age-Group



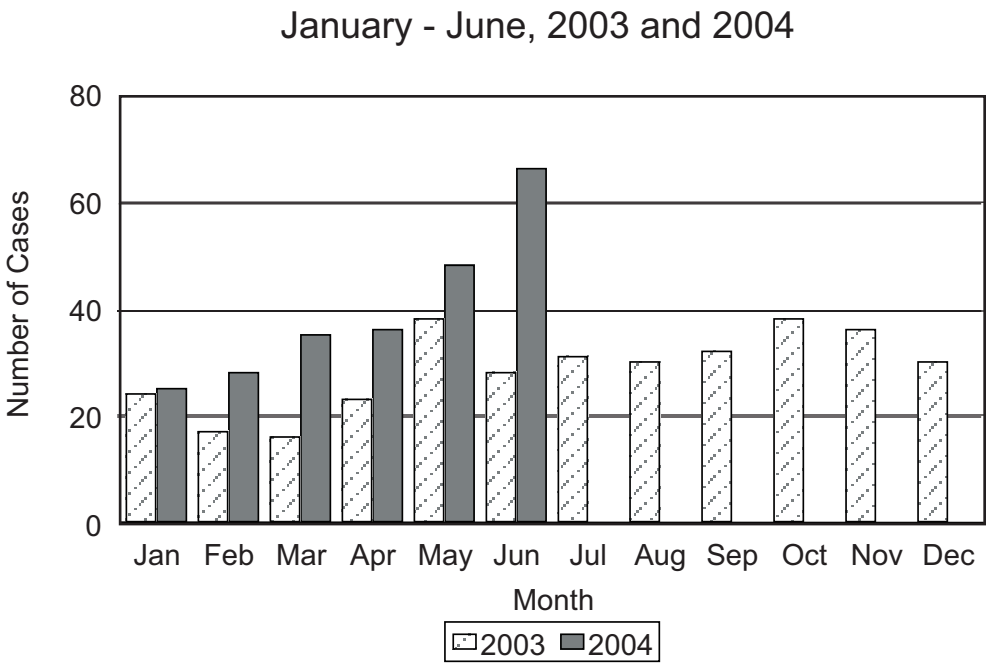
Meningococcal Disease in Ontario by Month



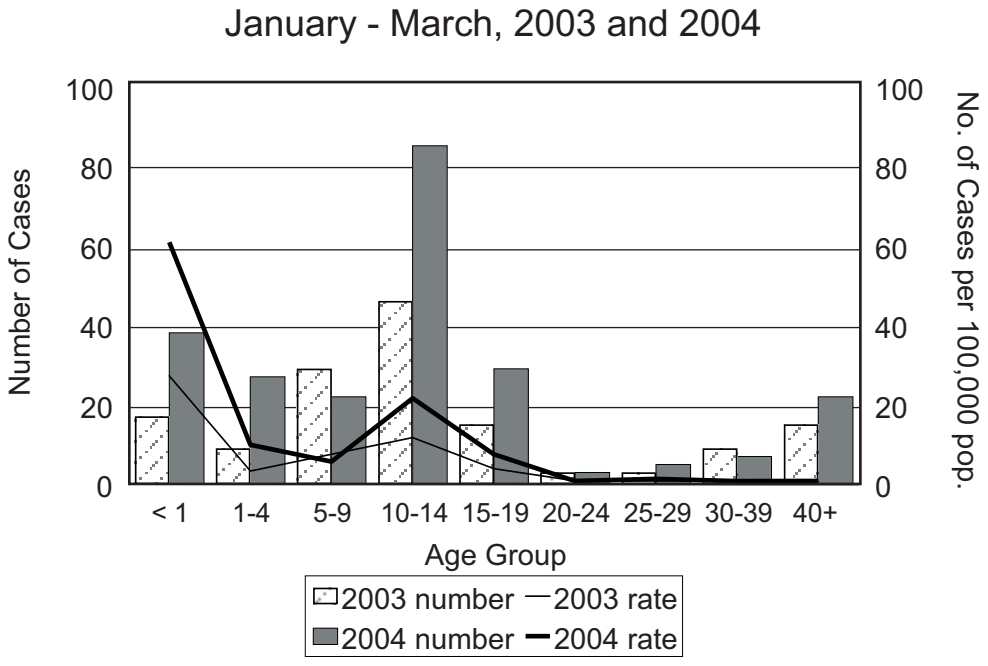
Meningococcal Disease by Age Group



Pertussis Cases in Ontario by Month



Pertussis in Ontario by Age Group



Summary of Reportable Diseases in Ontario - June, 2004

Health Units by Region	Population Projections 2003	AIDS	Campylo.	Chicken-pox	Chlamydia	Enceph./ Meningitis	GAS	Gonorrhea	Hepatitis A	Hepatitis B	Hepatitis C	Hib
Northern Region	**864,731**	**1**	**12**	**163**	**149**		**2**	**7**	**1**		**31**	
Algoma	119,929				23			1			4	
Muskoka-Parry Sound	86,383		2	18	5				1			
North Bay	94,875		2	108	21			4			2	
Northwestern	81,874	1	3	4	22		1				2	
Porcupine	89,876		1		14		1				2	
Sudbury	196,787		4	13	25			1			9	
Thunder Bay	159,592			20	35			1			10	
Timiskaming	35,415				4						2	
Eastern Region	**1,637,692**		**43**	**165**	**199**	**3**	**6**	**19**	**1**		**69**	
Eastern Ontario	197,370		7	2	26			2			6	
Hastings & Prince Ed.	160,658		1	21	16		1				0	
Kingston, Fron. & Len.	188,219		9		31			1			30	
Leeds, Gren. & Lan.	167,762		6		6		1				3	
Ottawa	823,608		19	140	113	3	4	16	1		29	
Renfrew	100,075		1	2	7						1	
Central East Region	**2,114,060**	**1**	**49**	**317**	**153**	**8**	**1**	**15**			**58**	
Durham	547,759	1	13	29	65	2		5			15	
Haliburton-Kawartha	170,627		4		13	1					7	
Peterborough	132,615		1	99	21	1	1				4	
Simcoe	411,024		6	102	31	1		5			15	
York	852,035		25	87	23	3		5			17	
Toronto Region*	**2,611,661**	**6**	**88**	**302**	**516**	**9**	**5**	**147**	**2**	**3**	**121**	
North			*22*	*48*	*107*	*1*	*1*	*26*	*1*		*27*	
South		*4*	*37*	*51*	*181*	*6*	*1*	*74*	*1*	*1*	*41*	
East		*2*	*20*	*144*	*141*		*3*	*28*		*1*	*28*	
West			*9*	*59*	*87*	*2*		*19*		*1*	*25*	
Central West Region	**2,260,237**	**1**	**63**	**615**	**228**	**7**	**1**	**40**	**2**		**58**	
Halton	413,454		13	61	4	2		1	1		12	
Peel	1,122,959	1	27	538	135	5		28	1		31	
Waterloo	470,022		10	0	66		1	10			13	
Wellington-Duff.	253,802		13	16	23			1			2	
Central South Region	**1,188,202**		**40**	**154**	**156**	**2**	**4**	**24**	**1**		**48**	
Brant	131,721		7	23	18	1	1	3				
Haldimand-Norfolk	109,756			18	10		1	1			2	
Hamilton	516,776		15	9	80	1	1	15	1		30	
Niagara	429,949		18	104	48		1	5			16	
Southwest Region	**1,561,717**		**54**	**60**	**177**	**19**	**2**	**26**	**4**	**1**	**53**	
Grey Bruce	160,624		12	7	15	1					8	
Elgin-St. Thomas	86,096		2		13	1		2				
Huron	61,896		5		4			1				
Chatham-Kent	110,124		5	6	15			1			3	
Lambton	132,664				11							
Middlesex-London	428,628		5		46	9	1	10	4	1	22	
Oxford	103,880		4		9	4	1	3			1	
Perth	77,265		7	12	10			1			1	
Windsor-Essex	400,540		14	35	54	4		8			18	
June 2004	**12,238,300**	**9**	**349**	**1,776**	**1,578**	**48**	**21**	**278**	**11**	**4**	**438**	
***** Total YTD 2004**	**-**	**49**	**1,549**	**12,007**	**10,103**	**197**	**170**	**1,731**	**107**	**61**	**2,589**	**3**
***** Total YTD 2003**	**-**	**63**	**1,456**	**10,244**	**9,029**	**174**	**271**	**1,466**	**65**	**64**	**2,729**	**4**

* 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

** Infectious Syphilis cases include 'Primary, Secondary and Early Latent' staging effective January 1, 2003

*** Adjusted for deletions and late reports.

Summary of Reportable Diseases in Ontario - June, 2004 cont'd

Health Units by Region	Influenza	IPD	Measles	Meningo-coccal	Mumps	Pertussis	Rubella	Salmon.	Shigellosis	Syphilis Infectious**	TB	VTEC
Northern Region	**1**	**4**				**6**		**14**			**2**	**3**
Algoma								8				
Muskoka-Parry Sound						5		2				
North Bay								2				
Northwestern		1				1		0			1	
Porcupine	1							1				
Sudbury		2										
Thunder Bay								1			1	3
Timiskaming		1										
Eastern Region		**5**			**1**	**3**		**30**	**2**	**2**	**2**	**4**
Eastern Ontario								1				2
Hastings & Prince Ed.		1						2				1
Kingston, Fron. & Len.		2						4				
Leeds, Gren. & Lan.								2				
Ottawa		2			1	3		20	2	2	2	1
Renfrew								1				
Central East Region	**2**	**8**				**16**		**32**	**3**	**2**	**2**	**5**
Durham	1	2				4		6				1
Haliburton-Kawartha		1				0		1	1			
Peterborough		2				1		1				
Simcoe	1	1				4		6				
York		2				7		18	2	2	2	4
Toronto Region*		**21**	**1**	**2**		**10**	**2**	**50**	**8**	**15**	**19**	**7**
North		*3*				*3*		*12*	*4*	*1*	*5*	*2*
South		*11*		*1*		*4*	*1*	*7*		*12*	*7*	*3*
East		*5*	*1*			*2*	*1*	*23*	*2*	*2*	*7*	
West		*2*		*1*		*1*		*8*	*2*			*2*
Central West Region		**7**			**1**	**17**		**40**	**5**	**1**	**10**	**5**
Halton		1						7	1	1		1
Peel		4			1	2		21	3		9	4
Waterloo		2				8		8	1			
Wellington-Duff.						7		4			1	
Central South Region		**6**		**1**	**1**	**11**		**15**	**1**	**1**	**1**	
Brant						1		1				
Haldimand-Norfolk		1						1		1		
Hamilton		4		1	1	9		6	1			
Niagara		1				1		7			1	
Southwest Region		**3**				**3**		**17**	**2**			**5**
Grey Bruce		1						2				
Elgin-St. Thomas		1						1				
Huron												
Chatham-Kent		1						2				3
Lambton									1			
Middlesex-London								2	1			1
Oxford						1		1				
Perth								1				1
Windsor-Essex						2		8				
June 2004	**3**	**54**	**1**	**3**	**3**	**66**	**2**	**198**	**21**	**21**	**36**	**29**
***** Total YTD 2004**	**869**	**590**	**6**	**26**	**18**	**238**	**4**	**970**	**153**	**210**	**289**	**76**
***** Total YTD 2003**	**458**	**525**	**9**	**26**	**10**	**145**	**5**	**872**	**143**	**192**	**363**	**257**

*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

** Infectious Syphilis cases include 'Primary, Secondary and Early Latent' staging effective January 1, 2003

*** Adjusted for deletions and late reports.

Summary of Reportable Diseases in Ontario - July, 2004

Health Units by Region	Population Projections 2003	AIDS	Campylo.	Chicken-pox	Chlamydia	Enceph./ Meningitis	GAS	Gonorrhea	Hepatitis A	Hepatitis B	Hepatitis C	Hib
Northern Region	**864,731**		**9**	**82**	**136**	**1**	**5**	**2**			**23**	**1**
Algoma	119,929		2	15	16	1					6	
Muskoka-Parry Sound	86,383		2	3	10							
North Bay	94,875		0	38	10			1			4	
Northwestern	81,874		1	1	15		1					
Porcupine	89,876				13		1					
Sudbury	196,787			13	36		2	1			6	1
Thunder Bay	159,592		4	12	33		1				6	
Timiskaming	35,415				3						1	
Eastern Region	**1,637,692**		**51**	**64**	**152**	**8**	**1**	**13**		**1**	**49**	
Eastern Ontario	197,370		6		14			1			4	
Hastings & Prince Ed.	160,658		6	35	10						2	
Kingston, Fron. & Len.	188,219		7	10	24	2		2			18	
Leeds, Gren. & Lan.	167,762		4			1					1	
Ottawa	823,608		27	18	102	5	1	10		1	24	
Renfrew	100,075		1	1	2							
Central East Region	**2,114,060**		**110**	**17**	**114**	**15**		**5**			**41**	
Durham	547,759		18	15	68	3		5			4	
Haliburton-Kawartha	170,627		8		13						11	
Peterborough	132,615		5	2	9	4				2	6	
Simcoe	411,024		16		10	3					11	
York	852,035		63		14	5				1	9	
Toronto Region*	**2,611,661**		**124**	**121**	**519**	**8**	**5**	**153**	**4**	**1**	**103**	
North			*30*	*34*	*110*	*3*	*2*	*29*		*1*	*17*	
South			*37*	*16*	*186*	*2*	*1*	*83*	*2*		*42*	
East			*36*	*45*	*131*	*2*	*2*	*19*	*1*		*23*	
West			*21*	*26*	*92*	*1*		*22*	*1*		*21*	
Central West Region	**2,260,237**		**120**	**227**	**260**	**8**	**6**	**37**	**2**		**52**	
Halton	413,454		20	10		1	1				6	
Peel	1,122,959		56	217	168	6	3	22	2		37	
Waterloo	470,022		31		66	1	1	14			8	
Wellington-Duff.	253,802		13		26		1	1			1	
Central South Region	**1,188,202**	**1**	**76**	**61**	**115**		**5**	**34**	**3**		**42**	
Brant	131,721		4	24	19			8	1			
Haldimand-Norfolk	109,756		8	8	7			2			5	
Hamilton	516,776	1	15	2	44		4	16	2		24	
Niagara	429,949		49	27	45		1	8			13	
Southwest Region	**1,561,717**		**58**	**9**	**181**	**24**	**2**	**29**		**3**	**44**	
Grey Bruce	160,624		12	2	15	1	1			1	6	
Elgin-St. Thomas	86,096		3		4			2			2	
Huron	61,896		5		6	1						
Chatham-Kent	110,124		3		12	1		1			2	
Lambton	132,664				26	0		1		1	3	
Middlesex-London	428,628		1		55	18	1	15			14	
Oxford	103,880		12		7			1			2	
Perth	77,265		7	7	12	1					2	
Windsor-Essex	400,540		15		44	2		9		1	13	
July 2004	**12,238,300**	**1**	**548**	**581**	**1,477**	**64**	**24**	**273**	**9**	**8**	**354**	**1**
***** Total YTD 2004**	**-**	**50**	**2,097**	**12,588**	**11,580**	**261**	**194**	**2,004**	**116**	**69**	**2,943**	**4**
***** Total YTD 2003**	**-**	**71**	**2,046**	**10,876**	**10,574**	**213**	**296**	**1,812**	**81**	**78**	**3,098**	**7**

* 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

** Infectious Syphilis cases include 'Primary, Secondary and Early Latent' staging effective January 1, 2003

*** Adjusted for deletions and late reports.

Summary of Reportable Diseases in Ontario - July, 2004 cont'd

Health Units by Region	Influenza	IPD	Measles	Meningo-coccal	Mumps	Pertussis	Rubella	Salmon.	Shigellosis	Syphilis Infectious**	TB	VTEC
Northern Region		**4**		**1**		**5**		**9**				**9**
Algoma		2		1		1		4				
Muskoka-Parry Sound						4						1
North Bay		1						2				
Northwestern		1										
Porcupine								1				
Sudbury												8
Thunder Bay								2				
Timiskaming												
Eastern Region		**6**		**1**		**12**		**23**	**3**		**2**	**5**
Eastern Ontario		2				3		2				1
Hastings & Prince Ed.								4				1
Kingston, Fron. & Len.		2						1				
Leeds, Gren. & Lan.								2				1
Ottawa		2		1		9		13	3		2	2
Renfrew								1				
Central East Region		**2**				**18**		**48**	**3**		**5**	**14**
Durham		1				2		11			1	2
Haliburton-Kawartha								3				
Peterborough						6		3				
Simcoe						3		8				3
York		1				7		23	3		4	9
Toronto Region*	**1**	**7**				**11**		**62**	**5**	**15**	**18**	**9**
North		*1*				*2*		*13*	*2*	*3*	*5*	*2*
South		*2*				*2*		*7*	*3*	*12*	*5*	
East		*1*				*5*		*21*			*4*	*2*
West	*1*	*3*				*2*		*21*			*4*	*5*
Central West Region		**8**				**33**		**53**	**3**	**2**	**4**	**6**
Halton		2				3		11	1			2
Peel		4				2		25	2	1	4	3
Waterloo		2				18		12		1		1
Wellington-Duff.						10		5				
Central South Region	**1**	**13**		**1**		**12**		**24**	**1**	**1**	**1**	**5**
Brant		3				6		6				
Haldimand-Norfolk								2				
Hamilton	1	7		1		3		9	1	1		4
Niagara		3				3		7			1	1
Southwest Region		**3**		**1**		**1**		**21**		**5**		**3**
Grey Bruce								1				
Elgin-St. Thomas		1						1				
Huron		1						1				
Chatham-Kent		1						2		1		2
Lambton												
Middlesex-London				1				2		3		1
Oxford						1		3				
Perth								5				
Windsor-Essex								6		1		
July 2004	**2**	**43**		**4**		**92**		**240**	**15**	**25**	**30**	**51**
***** Total YTD 2004**	**871**	**633**	**6**	**30**	**18**	**330**	**4**	**1,210**	**168**	**235**	**319**	**127**
***** Total YTD 2003**	**459**	**557**	**9**	**30**	**11**	**176**	**8**	**1,097**	**169**	**228**	**412**	**317**

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** Infectious Syphilis cases include 'Primary, Secondary and Early Latent' staging effective January 1, 2003

*** Adjusted for deletions and late reports.

Reportable Disease Summary for First Nations and Inuit Health Branch: Ontario Region, April 1 - June 30, 2004

Age	Sex	Campylobacter Enteritis	Chickenpox (Varicella)	Chlamydia Infections	Gonorrhoea	GAS, Invasive	Hepatitis C	Herpes, Neonatal	Influenza	Meningococcal Disease	Salmonellosis	Syphilis	Tuberculosis	Viral Meningitis
		Disease												
0-4	M		21					1	1		1			
	F		23											
5-9	M		8											
	F		12											
10-14	M									1				1
	F			3	1									
15-19	M	1		8										
	F			33	6									
20-24	M			11	1		1							
	F			37	3							1		
25-29	M			7	1									
	F			14	3									
30-39	M			8	2									
	F			6	2									
40-49	M			5	1									
	F			1										
50-59	M													
	F			1									1	
Over 60	M									1				
	F					1					1		1	
Unknown	M													
	F													
Σ Male		1	29	39	5		1	1	1	1	1			1
Σ Female			35	95	15	1					1	1	2	
Total		1	64	134	20	1	1	1	1	1	2	1	2	1

On-Reserve Population for First Nations ans Inuit Health Branch - Ontario Region = 69,016