

PHEROPublic Health and
Epidemiology Report OntarioVolume 11, Number 7 http://www.gov.on.ca/health/english/program/pubhealth/phero/phero_mn.html July & August, 2000**IN THIS ISSUE****Summary Report of the 1999/00
Ontario Influenza Season**
Disease Control Service**Immunization Promotion Project
Survey Results**
Disease Control Service**Temporal and Geographical
Distributions of Reported Cases
of *Escherichia coli* O157:H7
Infection in Ontario**
University of Guelph
Health Canada**The First Reported Cluster of
Food-borne Cyclosporiasis in
Canada**
Toronto Public Health
University of Toronto**Statistics**

- April 2000
- 1st Quarter 2000
- Rabies Report, 2nd Quarter 2000

The Public Health and Epidemiology Report Ontario
is published monthly, by the:

Public Health Branch
Ministry of Health
8th Floor, 5700 Yonge Street,
Toronto, Ontario, M2M 4K5
Telephone (416) 327-7090
Facsimile (416) 314-7078

Editorial Board: C. D'Cunha, G. Kettel, K. Kurji,
M. Naus

Editor: Tracy Collura

The contribution of scientific articles by the staff of
local Boards of Health is invited. Address all inquiries
and submissions to the Editor.

Submission of articles to PHERO does not preclude
publication elsewhere. The material in this publication
does not necessarily reflect the policies of the
Ministry of Health. It can be reprinted without
permission, provided the source is credited.

ISSN 1181-960X

BULLETINS and NOTICES**ASSOCIATION OF PUBLIC HEALTH
EPIDEMIOLOGISTS IN ONTARIO'S (APHEO'S)
2000 CONFERENCE****Surveillance In Public Health: From Collection To
Intervention**

Holiday Inn, Oshawa, Ontario

November 16 & 17, 2000

The Conference will focus on the key aspects of surveillance
in public health:

- collection of data
- analysis and interpretation
- dissemination of results to assist with decision-making for
public health programs

Speakers:

Julius Weinberg: Pro Vice Chancellor of Research, City
University, London, England;

Paul Sockett: Chief of Enteric, Foodborne, and Waterborne
Diseases, Bureau of Infectious Diseases, Health Canada;

Ed Adlaf: Primary Investigator, Centre for Addictions and
Mental Health, Toronto;

Davis Balestracci: Statistical Specialist, Blue Cross/Blue
Shield, Minnesota;

Mailing Label Goes Here

William Halperin: Associate Director for Surveillance,
National Institute for Occupational Health & Safety.

For more information contact:

Philippa Holowaty, Epidemiologist, Durham Region
Health Department

Phone: 905-723-8521 ext. 2334 or 1-800-841-2729

e-mail: holowa_p@region.durham.on.ca

SUMMARY REPORT OF THE 1999/00 ONTARIO INFLUENZA SEASON

Summary

Surveillance of the 1999/00 influenza season in Ontario was conducted from October 1999 to April 2000. The influenza season in Ontario started early this year with the first institutional outbreak reported in September 1999. Activity rose steadily through November and December and peaked in the week ending January 8, 2000. This was considerably earlier than the 1998/99 influenza season, which did not see a peak in activity until March 1999. Influenza A remained the predominant serotype in both Ontario and the rest of Canada this year, and laboratory characterization showed that the strain A/Sydney/05/97-like (H3N2) was the most common subtype circulating this season. There were five influenza B cases identified through laboratory surveillance this season, with one case subtyped and identified as B/Beijing/184/93-like; no institutional outbreaks were attributed to influenza B in Ontario this season. Near the end of the season, sporadic cases of A/New Caledonia/20/99-like (H1N1) were identified; this strain has been included as a component in the influenza vaccine for the 2000/01 season.

From November 1999 to April 2000, a total of 2,311 cases of influenza (2,306 influenza A, 5 influenza B) were confirmed by the Ontario laboratories participating in the Division of Disease Surveillance, Laboratory Centre for Disease Control (LCDC) reporting system. During the same period, Ontario health units reported 2,506 laboratory-confirmed cases of influenza for all of Ontario, through the Reportable Disease Information System (RDIS). This represents an increase of 11% over cases reported through RDIS in the 1998/99 season. As influenza is most often diagnosed clinically, without laboratory confirmation, it is likely that this is an underestimate of the actual number of cases in the province. Because of the RDIS Y2K transition, detailed information on non-institutionalized individuals is not yet available.

The 1999/00 season in Ontario was characterized by widespread media attention to influenza for a number of reasons including the licensing of two new anti-viral agents (neuraminidase inhibitors) and media coverage



Check Out the Benefits!

- ☒ Improved Academic Performance
- ☒ Better Health Habits
- ☒ Positive Self Esteem
- ☒ Improved Social Skills
- ☒ Fewer aggressive tendencies
- ☒ Decreased susceptibility to stress

*Does your school provide
physical education on a
daily basis?*

If not, why not?

Canadian Association for Health,
Physical Education and Recreation
606 - 1600 James Naismith Drive
Gloucester, Ontario
K1B 5N4

surrounding a coroner's inquiry into an influenza outbreak in a long-term care facility in Kitchener-Waterloo.

Health units reported 338 institutional outbreaks from 318 long-term and health care institutions. Data from 214 outbreaks in 205 long-term care facilities, indicated that the overall attack rate in residents was 14.7%. There were 318 hospitalizations, 213 radiologically confirmed cases of pneumonia and 233 deaths related to influenza (i.e., a hospitalization rate of 7.2% and case fatality rate of 4.8% among residents of institutions). This occurred despite the fact that the overall resident vaccination rate in long-term care facilities (LTCFs) in Ontario was 92.9% in 1999/00. For the first time, vaccination rates for staff of all LTCFs (n=508) were recorded this year across the province. Rates were generally high, with an overall staff vaccination coverage rate of 79.5%.

Lastly, a sentinel physician influenza surveillance system was introduced this year on a pilot basis and provided population based data on influenza-like illness.

Introduction

Influenza has been a reportable disease in Ontario since 1923 and a province-wide surveillance program has been in place since that time. This has taken various forms and, this year, has seen the addition of a new Sentinel Physician Influenza Surveillance pilot project. The objectives of the 1999/00 Ontario influenza surveillance system were:

- to identify the type of influenza virus circulating in Ontario and to determine its relationship to national and international viral activity
- to monitor antigenic shift in the strain of circulating virus as early as possible
- to identify the incidence and prevalence of influenza in the various geographical regions of Ontario
- to determine the onset, duration and severity of the influenza season in the province
- to evaluate the use and effectiveness of amantadine in the control of influenza A outbreaks in long-term care facilities

In addition, the eligibility criteria for publicly-funded influenza vaccine were expanded during the 1999/00 influenza season, to include all health care and emergency service workers. Two new anti-viral agents,

zanamivir (Relenza®) and oseltamivir (Tamiflu®), were licensed for the treatment of influenza during the 1999/00 season.

Methods

The Public Health Branch of the Ministry of Health and Long-Term Care (MOHLTC) uses several sources of data to monitor influenza activity in Ontario. The six components of influenza surveillance in 1999/00 were:

1. Laboratory surveillance (conducted by the Laboratory Centre for Disease Control, (LCDC), Health Canada)
2. Reportable Disease Information System (RDIS) reporting of laboratory-confirmed influenza cases by health units across Ontario
3. Reporting of Institutional Influenza Outbreaks
4. Influenza Activity level reporting by health units across Ontario
5. School Absenteeism Reporting by health units across Ontario
6. Sentinel Physician Influenza Surveillance (SPIS) Reporting System

1. Laboratory Surveillance

The laboratory surveillance component involves the reporting of positive influenza and other respiratory virus isolates, to the Laboratory Centre for Disease Control (LCDC), by participating laboratories in Ontario. The total number of respiratory specimens tested and the number that test positive are reported, and this information is transmitted back to the Ontario MOHLTC on a weekly basis, throughout the influenza season. During the 1999/00 season the following laboratories participated: the public health laboratories in Toronto, Kingston, Timmins, Orillia, Windsor, Sault Ste. Marie, Thunder Bay, Hamilton and Peterborough. Participating hospital based laboratories included Children's Hospital of Eastern Ontario (Ottawa); Hospital for Sick Children (Toronto); Women's College Hospital (Toronto) and St. Joseph's Hospital (London).

Results

Ontario

Influenza activity peaked early this year with the highest levels of activity occurring the week of January 2-8, 2000. This was in contrast to the 1998/99 influenza season, which peaked from mid-February to early April. A total of 2,311 respiratory isolates positive for influenza

were reported by participating laboratories in Ontario (Figure 1). Of these positive tests, 2,306 (99.8%) were influenza type A, and 5 (0.2%) were influenza type B. This was a decrease of 8% (186 cases) over the total number of positive tests reported in 1998/99. More specifically, there was significantly fewer influenza B isolates (5 in 1999/00 and 623 in 1998/99) when compared to last season (Figure 2). However, when compared to the 1998/99 influenza season, there was a 23% increase in influenza type A (2,306 isolates vs. 1,874 isolates).

Other respiratory viruses circulating in Ontario during the 1999/00 season are shown in Figure 3. Respiratory syncytial virus (RSV) circulated primarily during the latter part of the season, whereas parainfluenza viruses were detected mostly during the early part of the season. Adenovirus was detected sporadically in the province during both the early and latter parts of the influenza season.

Canada

During the 1999/00 influenza season, 6,179 laboratory-confirmed cases of influenza were reported to the LCDC from participating laboratories across Canada. Of these, 99% (6,131 cases) were influenza A and 1% (48 cases) were influenza B. This represents an increase of 15% from the 1998/99 influenza season: specifically, a 27% increase (1693 cases) in influenza A, and a 17-fold decrease in influenza B cases (48 vs. 794 cases). The geographical distribution of cases is shown in Figure 4. When compared to the rest of Canada, Ontario had the highest number of influenza cases in 1999/00. Although there was significantly less influenza B circulating in the province when compared to previous influenza seasons, there was an increase in the overall number of laboratory confirmed cases of influenza. It is likely that this was due, in part, to increased media attention which may have led to increased testing of persons with influenza-like illness (ILI) for influenza and other respiratory viruses.

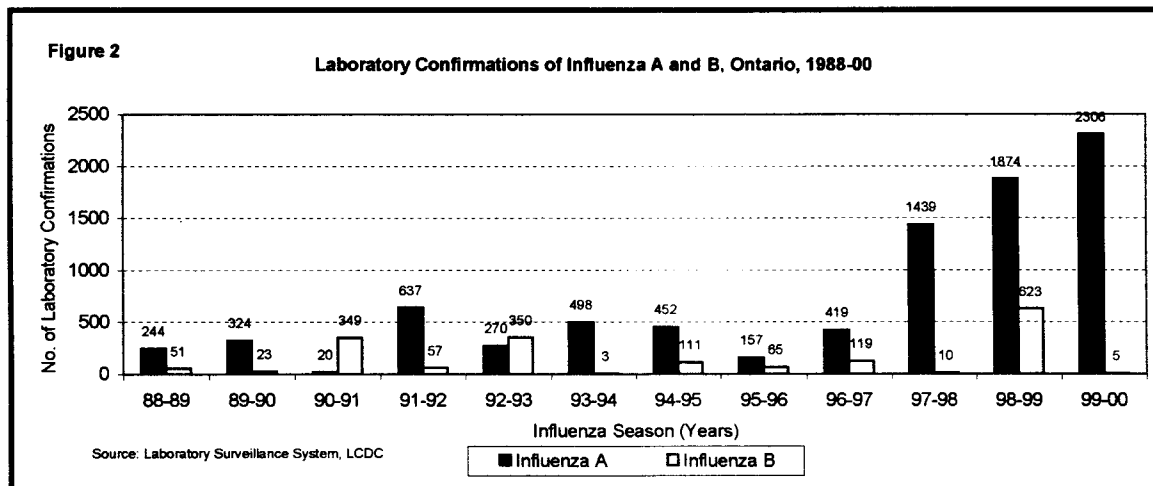
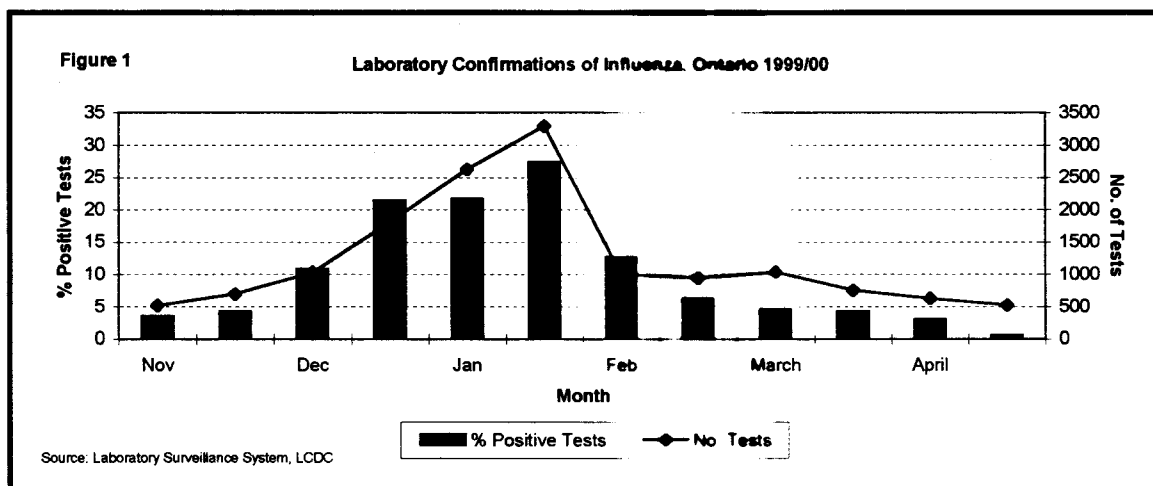
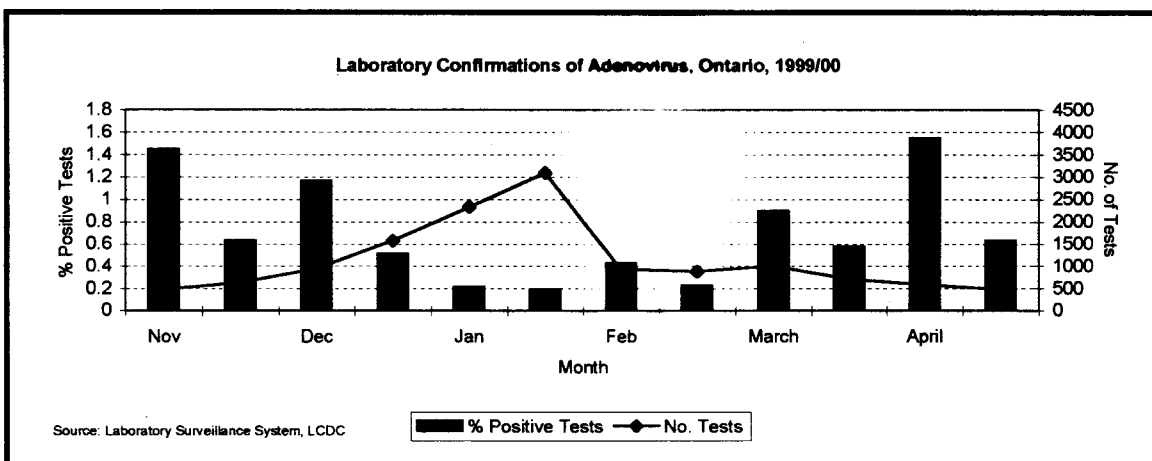
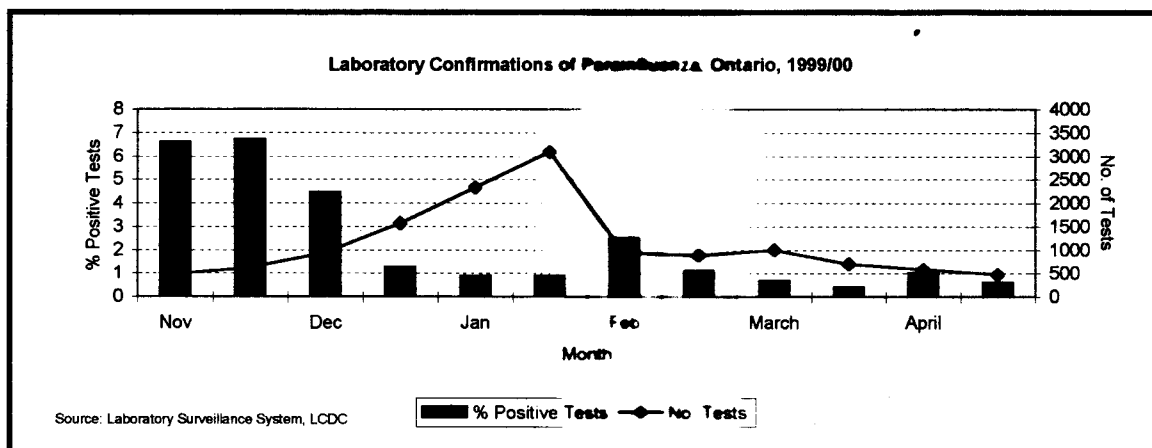
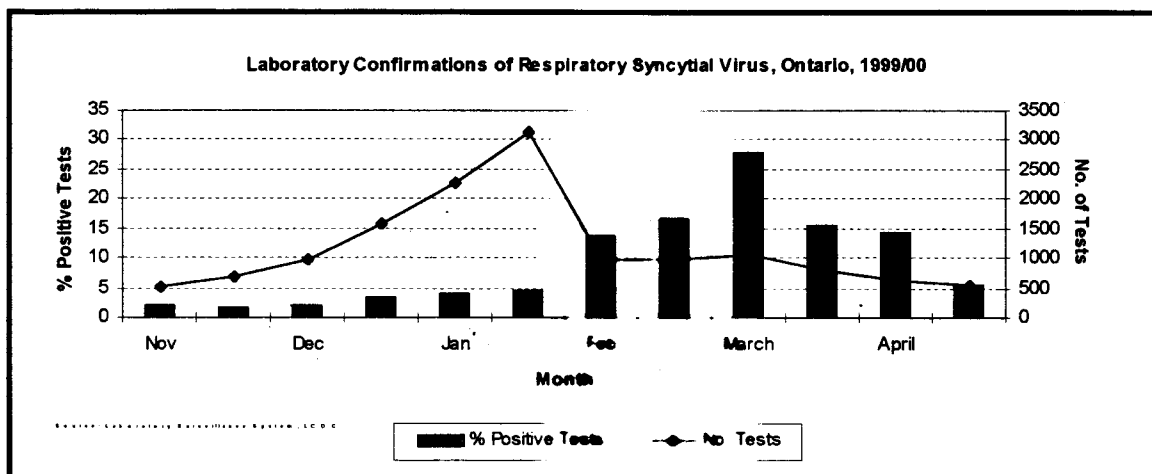


Figure 3



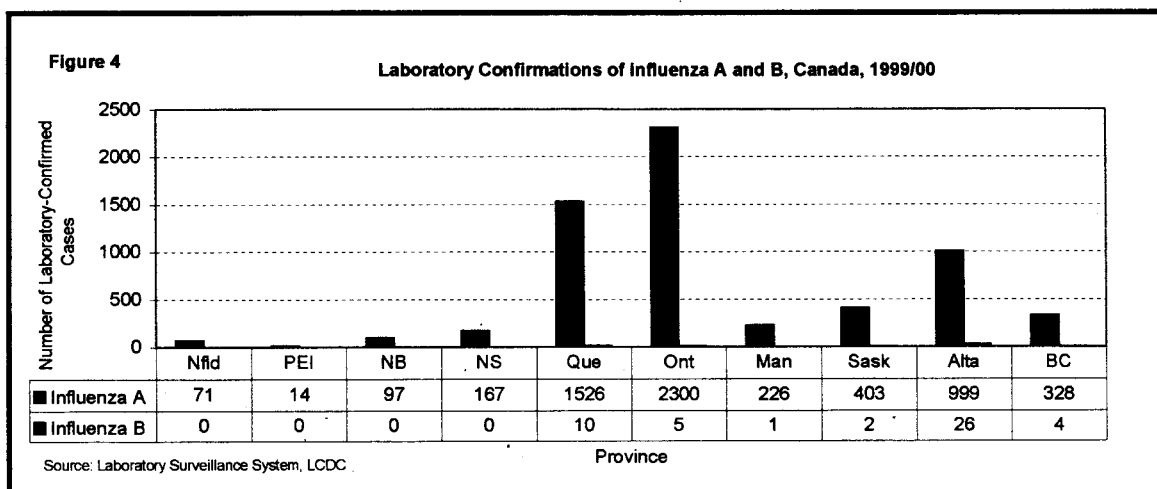


Table 1
Results of Strain Characterizations on 328 Influenza Isolates, Ontario
(October 1/99 – April 22/00)

<u>Influenza Strain</u>	<u>No. Of Isolates (%)</u>	
Influenza A/Sydney/5/97-like (H3N2)	307	(94)
Influenza A/New Caledonia/20/99-like (H1N1)	20	(6)
Influenza B/Beijing/184/93	1	(0.3)

*Source: Central Public Health Laboratory, Toronto, and LCDC, Winnipeg.

Influenza Strains Circulating in Ontario, 1999/00

This season, the Central Public Health Laboratory (CPHL) carried out sub-typing and strain characterization on 157 influenza isolates, and an additional 171 isolates from Ontario were forwarded to the LCDC for strain characterization. For the third consecutive year A/Sydney/05/97 (H3N2) was the predominant strain circulating in Ontario. There were five isolates positive for influenza B, one of which was subtyped and identified as B/Beijing/184/93-like. This strain is antigenically similar to the B/Yamanashi/166/98 strain that was included in this season's influenza vaccine. Towards the end of the influenza season 20 isolates of A/New Caledonia/20/99-like (H1N1) were identified in Ontario. This strain is one of the recommended strains to be included in the vaccine formulation for the 2000/01 influenza season.

2. Reportable Disease Information System (RDIS) Reporting of Confirmed Influenza Cases

Influenza is a reportable disease under Ontario

Regulation 559/91 of the Health Protection and Promotion Act (HPPA). Laboratory-confirmed cases of influenza reported to local public health units are transmitted by the health unit to the Public Health Branch through RDIS. Reporting generally occurs weekly during the influenza season, although this year electronic transmission was interrupted from October 1999 until the end of the influenza season. Because of this, only the number of cases of influenza was reported to the Ministry of Health on a weekly basis using a paper based system and entered into RDIS at the Ministry. The RDIS case definition of influenza is clinically compatible signs and symptoms of influenza with:

- laboratory confirmation by detection or isolation of influenza virus in pharyngeal or nasal secretions; or
- demonstration of a four-fold or greater increase in hemagglutination antibody titers to influenza (seroconversion).

Results

A total of 2,506 influenza cases were reported through RDIS or the paper-based system by Ontario health units between October 1, 1999 and April 30, 2000. There was an overall increase of 10% (256 cases) entered into RDIS when compared to the previous influenza season. The percentage of cases by month of onset is shown in Figure 5. The distribution of reported cases by health unit and region is shown in Table 2 and Figure 6 respectively. The impact of the influenza activity was most felt in the Northern region of the province where the rate of infection was 34/100,000 population followed by the Southwest region with a rate of 32/100,000 population. Although the Central East region reported the largest number of cases, it had the lowest rate of 16/100,000 population.

Because RDIS transmission was interrupted during the influenza season, data collected on non-institutionalized

individuals such as age, number of cases hospitalized and the number of influenza related deaths, are not available at this time.

3. Reports of Institutional Outbreaks

Health units are required to report all laboratory-confirmed influenza outbreaks that occur in LTCFs (nursing homes and homes for the aged) and health care institutions in their jurisdictions. Cases in an institution-based outbreak of influenza are defined as residents/patients or staff in whom influenza is isolated or detected (with a nasopharyngeal swab) or who have seroconverted. Once there has been a laboratory-confirmed case of influenza in an institution, epidemiologically linked clinical cases are also included in the total number of cases for the institutional outbreak. Reports include information on resident/patient and staff immunization rates, attack rates, mortality, morbidity and antiviral use. A preliminary report is

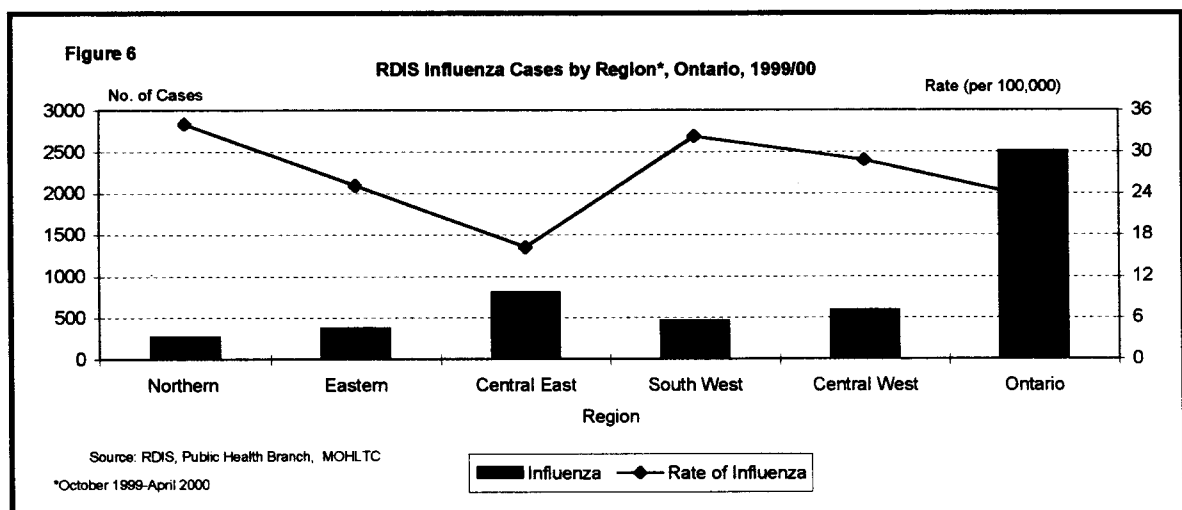
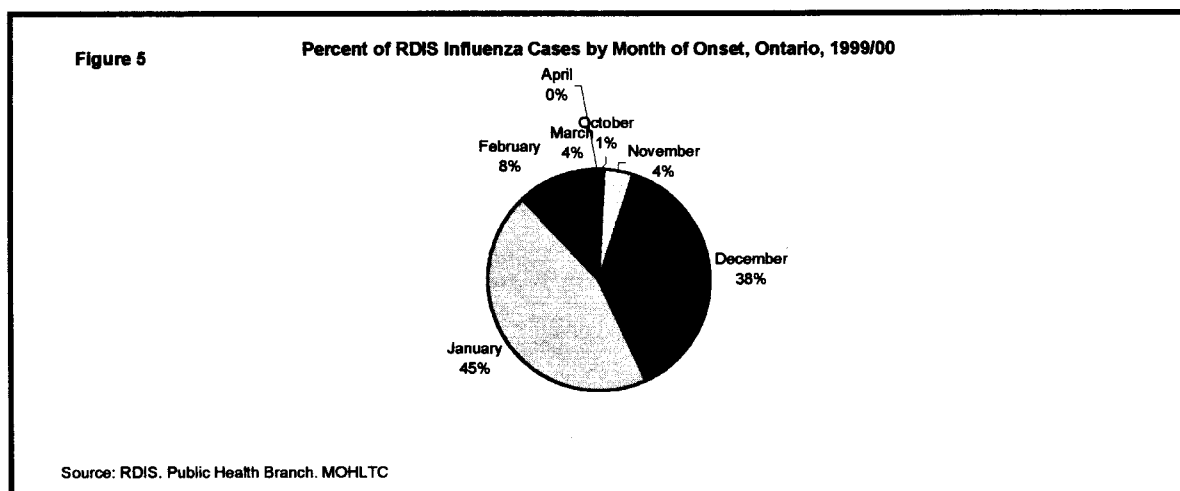


Table 2 Influenza Cases by Health Unit Ontario, 1999/00 Season			
Region	Population	Total No. of	Rate
Health Unit	(1996)	Influenza Cases	(per 100,000)
Northern			
Algoma	123,953	62	50
North Bay	93,841	27	29
Northwestern	80,235	26	32
Porcupine	97,437	85	87
Sudbury	201,154	37	18
Thunder Bay	161,187	26	16
Timiskaming	38,847	8	21
Eastern			
Eastern Ontario	185,314	35	19
Hastings-Prince Edward	143,790	20	14
Kingston-Frontenac	175,568	91	52
Leeds-Grenville	156,129	33	21
Ottawa-Carleton	721,136	193	27
Renfrew	97,634	0	0
Central East			
Durham Region	458,616	47	10
Haliburton-Kawartha	165,039	45	27
Muskoka-Parry Sound	78,675	8	10
Peel Region	852,526	89	10
Peterborough	123,448	27	22
Simcoe County	329,865	83	25
Toronto (amalgamated)			
East York	107,822	16	15
Etobicoke	328,718	33	10
North York	589,653	140	24
Scarborough	558,960	100	18
Toronto City	653,734	94	14
York	146,534	19	13
York Region	592,445	106	18
Southwest			
Bruce, Grey-Owen Sound	153,312	88	57
Elgin-St. Thomas	79,159	24	30
Huron	60,220	49	81
Chatham-Kent	109,650	43	39
Lambton	128,975	7	5
Middlesex-London	389,616	171	44
Oxford	97,142	0	0
Perth	72,106	64	89
Windsor-Essex	350,329	19	5
Central West			
Brant	114,564	66	58
Haldimand-Norfolk Region	102,575	12	12
Halton Region	339,875	44	13
Hamilton-Wentworth	467,799	164	35
Niagara Region	403,504	110	27
Waterloo Region	405,435	178	44
Wellington-Dufferin	217,052	17	8
Total			
Provincial Total			
Source: Public Health Ontario, MOH/PHO			

faxed to the Public Health Branch, MOHLTC, within 24 hours of the start of the outbreak and a final report is faxed shortly after the outbreak is over.

Results

There were 338 confirmed institutional influenza outbreaks reported to the MOHLTC from 318 institutions during the 1999/00 season (Appendix 1). This reflects an increased number of outbreaks over that of the past three seasons (Fig 7). The reasons postulated for this increase include enhanced awareness of influenza in general and awareness of the need to recognize outbreaks early in order to implement control measures and therapy. All of the institutional influenza outbreaks reported during this season were due to influenza A.

While 296 institutions each had one outbreak during the season, 20 institutions (14 long-term care facilities and 6 other institutions) experienced two outbreaks; two long-term care facilities (1 in Perth and 1 in Hamilton

health units) each reported three outbreaks. Institutional outbreaks started early this season and peaked in December (Fig. 8, Appendix 1). Every health unit in Ontario reported at least one institutional outbreak this season and 10 health units reported 10 or more outbreaks. The majority of outbreaks occurred in nursing homes as shown in Table 3.

Data Analysis of Institutional Outbreaks in Long-term Care Facilities, 1999/00

In November 1999, the MOHLTC released the *"Influenza Prevention and Surveillance Protocol for Ontario Long-Term Care Facilities"*. This protocol provides direction to LTCFs for the prevention of influenza infections in residents and persons carrying on activities in the facility. Data from the 214 influenza outbreaks in LTCFs (i.e. nursing homes and homes for the aged) during the 1999/00 influenza season were analyzed to look at the effectiveness of this protocol. The following results were obtained.

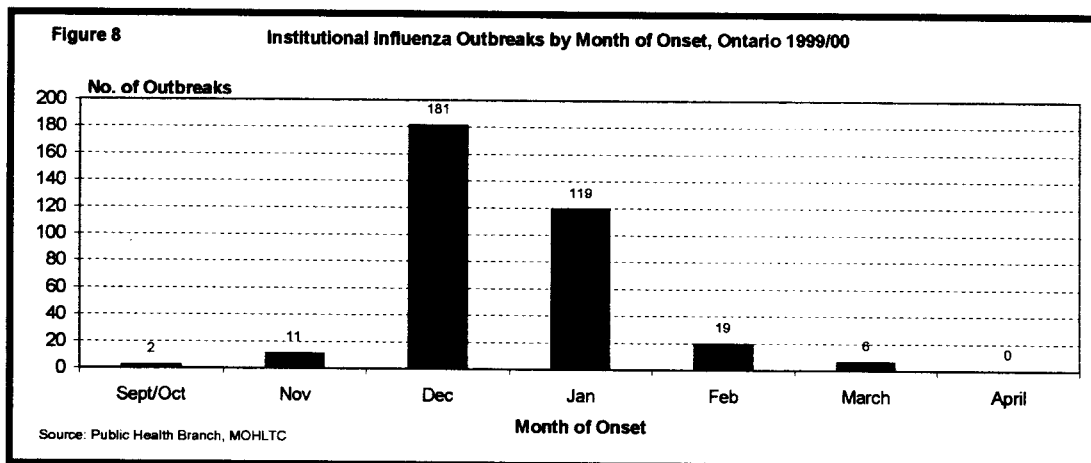
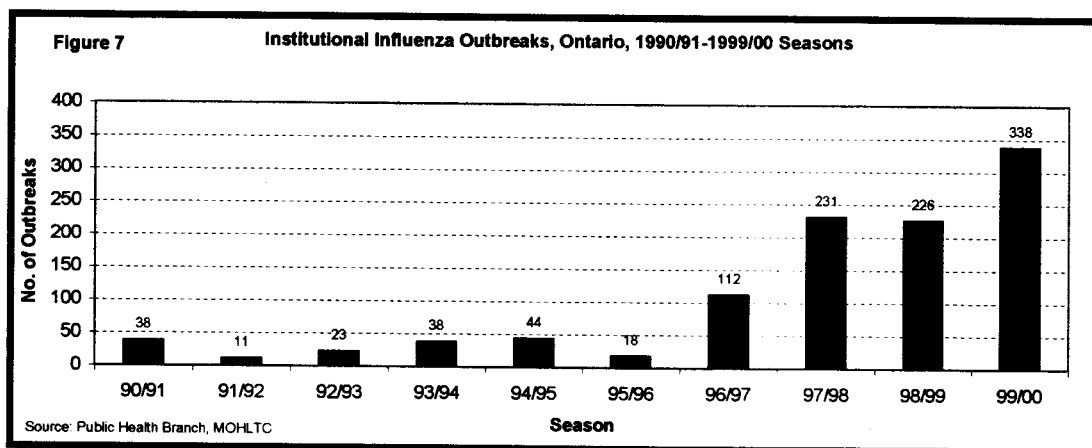


Table 3

Institutional Influenza Outbreaks, by Type of Institution, Ontario 1999/00

Institution Type	Institutions		Outbreaks	
	No.	%	No.	%
Nursing Home (NH)	139	43.7	146	43.2
Homes For Aged (HFA)	66	20.8	68	20.1
Retirement Home	64	20.1	71	21.0
Hospitals (ACH, CCH, PHOSP)	34	10.7	37	10.9
Combined Institutions (e.g. NH/RH, ACH/CCH/NH)	9	2.8	9	2.7
Other	6	1.9	7	2.1
All Institutions	318	100	338	100
Long Term Care Facilities (NH + HFA)	205	64.5	214	63.3

NH = Nursing Home, HFA = Home for Aged, RH = Retirement Home, ACH = Acute Care Hospital, CCH = Chronic Care Hospital, PHOSP = Psychiatric Hospital, Other = other chronic care institutions e.g. developmentally handicapped adult facilities

Duration of Outbreaks

The duration of an outbreak was defined as the number of days from the onset of illness in the first case to the onset of illness in the last case. On average, outbreaks lasted 10.8 days (median 9.5, range 1-41). The average duration was shorter by 0.5 of a day when compared to the average duration for outbreaks during the 1998/99 season. The shorter duration may have been due to increased awareness and early implementation of control measures by the institutions.

Attack Rates and Vaccine Efficacy**Residents:**

During the 214 outbreaks, 4,414 cases were reported among 29,993 residents in 205 LTCFs. The overall attack rate for the season (total number of resident cases for all outbreaks/total number of residents in all the LTCFs during the outbreaks) was 14.7%. This represents a 30.7% reduction in the attack rate from the 1998/99 season when 21.2% of residents were affected. For individual facilities, attack rates ranged from 0.8 to 84.7% with a median of 14.1%. All outbreaks this season were caused by Influenza A compared to 84% of outbreaks in the 1998/99 season. Looking at Influenza A outbreaks only, the attack rate of 14.7% this season was 47.1% lower than the attack rate of 27.8% for influenza A outbreaks reported in 1998/99. The overall attack rate for nursing homes was slightly higher at 16.8% than for all LTCFs during 1999/00. The lower rates observed this season may be due to higher vaccination rates among residents and staff achieved this season when compared to the 98/99 season. Also, the timely institution of control measures in affected facilities could have contributed to the lower attack rate.

Resident attack rates, vaccination rates, and vaccine efficacy are shown in Table 4. The vaccine efficacy for LTCFs (14.9% for LTCFs and 15.2% for NHs) this season was lower than that for the 1998-99 season when the overall vaccine efficacy was 33.9%. Vaccine efficacy was 40.9% for influenza A outbreaks in 1998/99. During both seasons, A/Sydney/5/97 (H3N2)-like was the predominant circulating strain in the province and was a component of the trivalent vaccine used during the season.

Complications and Mortality

Overall, there were 233 deaths, 213 radiologically confirmed cases of pneumonia and 318 hospitalizations among 4,414 cases of influenza in LTCF residents. This corresponds to an overall case fatality rate (CFR) of 5.3%. The vaccine efficacy ($[\text{CFR}_{\text{unvaccinated}} - \text{CFR}_{\text{vaccinated}}] / \text{CFR}_{\text{unvaccinated}}$ %) with respect to the CFR for resident cases in LTCFs was 31.5% and in nursing homes 42.8%. The case fatality rates and complications that were observed among resident cases in LTCF outbreaks in the 1999/00 season are shown in Table 5.

Staff

A total of 29,215 staff worked in LTCFs that experienced outbreaks with an average staff complement of 138 (median 106, range 8-845). Part-time and casual staff were employed in 138 (65.1%) of the outbreak facilities. A total of 1,797 staff cases were reported in 212 outbreaks for which reports were available, giving an overall attack rate of 6.2%. This represents a reduction of 18.4% in the staff overall attack rate compared to the 1998/99 season. During 1998/99 the staff attack rate was 7.6%. No staff cases were reported in 25 (11.8%) of 212 outbreaks.

Table 4**Attack Rates and Vaccine Efficacy: Residents in LTCF Institutional Outbreaks, Ontario 1999/00**

Institution Type	Overall Attack Rate (%)	Overall Vaccination Rate for all Outbreaks (%)	Vaccinated Attack Rate (%)	Unvaccinated Attack Rate (%)	Vaccine Efficacy (%)
Long Term Care Facilities	14.7	92.5	14.8	17.4	14.9
Nursing Homes (NHs)	16.8	92.4	16.8	19.8	15.2

Overall vaccination rate = (total no. vaccinated residents/total number residents for all outbreaks per institution type)%; Vaccinated attack rate = (total no. of vaccinated cases/total no. of vaccinated residents during outbreaks)%; Unvaccinated attack rate = (total number of unvaccinated cases/total number of unvaccinated residents during the outbreaks)%; Vaccine efficacy = [(attack rate in unvaccinated – attack rate in vaccinated)/attack rate in unvaccinated]%; Long Term Care Facility = Nursing Homes and Homes for the Aged

Table 5**Complications, Case Fatality Rates and Vaccine Efficacy in LTCF and Nursing Home Institutional Outbreaks, Ontario 1999/00**

Institution Type	CXR Pneumonia		Hospitalization Rate (%)		Overall Case Fatality Rate		Vaccinated CFR		Unvaccinated CFR		Vaccine Efficacy (CFR) %
(Total cases)	%	(No)	%	(No)	%	(No)	%	(No)	%	(No)	
Long Term Care Facilities (n=4,414)	4.8	(213)	7.2	(318)	5.3	(233)	5.0	(205/4070)	7.3	(26/355)	31.5
Nursing Homes (n=3,042)	5.2	(158)	7.6	(231)	5.2	(160)	4.9	(138/2816)	8.5	(21/246)	42.8

CXR Pneumonia= (Radiologically confirmed cases of pneumonia/total cases); Overall CFR =(No. of deaths/total no. of cases); Vaccinated CFR = (No. of deaths in vaccinated persons /vaccinated cases); Unvaccinated CFR = (No. of deaths in unvaccinated persons/unvaccinated cases).

Institutional policies on staff vaccination were in place before 175 (82.5%) outbreaks. These policies had a antiviral medication from working during an influenza outbreak. Influenza vaccine was offered to staff onsite by 171 (83.4%) outbreak LTCFs out of 205 facilities that reported this information. In 173 (81.6%) of 212 outbreaks, staff were offered influenza vaccine during the outbreak. Staff were excluded from work in 154/212 (84.4%) outbreaks. This exclusion was in accordance with institution policy in 130 (61.3%) of the outbreaks; was ordered by the medical officer of health under s. 22 of the HPPA in 10 (4.7%); and both processes were used in 14 (6.6%) outbreaks.

Anti-viral Use

Amantadine has been the mainstay of anti-viral prophylaxis and treatment of influenza A infections since 1988 and has been used extensively in Ontario for the control of institutional influenza A outbreaks. It is recommended that amantadine be started within 48

hours of the onset of influenza symptoms and, when used for treatment, the duration of therapy be from 3-5 days. Amantadine was given to residents in 200/214 (93.5%) LTCF outbreaks and to staff in 126 (58.9%) outbreaks this season. Amantadine was prescribed for residents for prophylaxis in 198 (99.0%) of the 200 outbreaks and within 48 hours of onset of symptoms in 137 (63.5%) outbreaks. However, in 44 (22.0%) outbreaks, amantadine was prescribed for residents more than 48 hours after the onset of symptoms in the first case. The majority of outbreak facilities calculated an individualized dose of amantadine for residents (189, 94.5%) although a standard 100 mg dose was prescribed in 13 (6.5%) outbreak facilities and a standard dose of 200 mg was used in one facility. On average, amantadine was given to residents for prophylaxis for 13 days (range 2-35 days). During the season, amantadine was used for treatment of residents in 121 (60.5%) outbreaks. However, treatment was given for the recommended duration in only 41 of the 121 (33.9%)

outbreaks. The range of duration of treatment was 1-28 days. Amantadine was reported to have been effective in controlling the outbreak 58.5% of the time (117/200 outbreaks). In most cases, staff were referred to their personal physician for amantadine prescriptions.

The Neuraminidase Inhibitors

This year a new class of anti-virals, the neuraminidase inhibitors, was licensed for treatment of both influenza A and B infection. Two medications were available, zanamivir (Relenza®) an inhaled medication and oseltamivir (Tamiflu®) an oral preparation. Although not yet licensed for prophylaxis there are some preliminary data indicating effectiveness in this role. For the 1999/00 season both medications were available free of charge, on a limited basis, through a study protocol and were used in several of the outbreaks in the province. Nine health units reported use of neuraminidase inhibitors during outbreaks in 28 institutions. Both Relenza® and Tamiflu® were used for treatment and/or prophylaxis for both residents and staff in these institutions.

Vaccination Rates in LTCFs

Under the "Influenza Prevention and Surveillance Protocol for Ontario Long-Term Care Facilities" on-site immunization, or documentation of immunization should be completed annually by November 15. Facilities are required to report immunization status of residents and persons carrying on activities in the facility to their local medical officer of health by December 1 each year. These rates are then reported to the province by the health unit.

Immunization Rates

Data collected from 508 long-term care facilities indicated that overall influenza vaccination coverage achieved for residents this season was 92.9% (range: 57.1%-100%). This is 2% below the provincial target stated in the Mandatory Programs and Services Guidelines, issued under the HPPA, 1983. Long-term care facility staff overall coverage this season was considerably higher than in previous years, at 79.5%, although 99 (19.5%) facilities had coverage rates of less than 70%, the target immunization rate recommended in the Mandatory Programs. More detailed information on staff vaccination will appear in an upcoming PHERO.

Resident Immunization Coverage in Outbreak Institutions

Resident immunization coverage was reported for all 139 nursing homes and 205 long-term care facilities that reported outbreaks during the 1999/00 season. The overall resident influenza vaccination rates for the 1999/00 season are shown in Table 6. For facilities that reported more than one outbreak, the coverage reported on the first outbreak report was used for calculating the institutional vaccination rate. Generally, resident immunization coverage in all facilities was high. There were 26,737 vaccinated residents out of 28,791 residents in 205 facilities that experienced an outbreak.

The overall institutional resident vaccination rate in both nursing homes and long-term care facilities was 92.9%. This is 2.1% below the influenza vaccine coverage target of 95% recommended in the Mandatory

Table 6
Long-Term Care Resident and Staff Vaccination Rates: Outbreak and Non-Outbreak Institutions, Ontario 1999/00

Institution Type	Resident Overall Vaccination Rate (%)		Staff Overall Vaccination Rate (%)	
	Outbreak Facilities* (n=205)	Non-Outbreak Facilities** (n=327)	Outbreak Facilities* (n=205)	Non-Outbreak Facilities** (n=327)
Long Term Care Facilities	92.9	93.1	82.9	78.6
Nursing Homes	92.9	93.8	80.9	80.7

*Vaccination data reflects the total number immunized during the fall preceding the outbreak

** Vaccination data should reflect the total number immunized by December 1st, 1999 (however, it may reflect immunization rates until as late as mid-February, 2000)

Institutional Vaccination Rate = (total no. vaccinated residents or staff/total number residents or staff per institution type)%; Long Term Care Facility = Nursing Homes and Homes for the Aged

Programs and Services Guidelines. The overall resident vaccination rate in 139 nursing homes that reported outbreaks was also 92.9%. This vaccination data reflects the total number of residents immunized during the fall *preceding* the outbreak.

Resident Immunization Coverage in Non-Outbreak Institutions

In 327 long-term care facilities that did not report any outbreaks this season, 93% (31,617/33,962) of residents were immunized against influenza before December 1, 1999. The overall resident vaccination rate for the 220 nursing homes that did not report any outbreaks was 93.8% (18,651/19,890). It should be noted that due to some late reporting this data may actually reflect immunization rates up until mid-February, 2000.

Staff Immunization Coverage in Outbreak Institutions

Staff immunization coverage among LTCFs was generally high. Of 200 (97.60%) outbreak LTCFs that reported on staff immunization coverage, 23,028/27,771 staff members, or 82.9% were immunized against influenza during the fall preceding the outbreaks (Table 6). In outbreak nursing homes the staff coverage was 80.9%. This vaccination data reflects the total number of staff immunized during the fall *preceding* the outbreak.

Twenty-eight (14.0%) LTCFs achieved 100% staff immunization coverage, however, 32 (16.0%) outbreak facilities were unable to achieve the recommended target of 70% staff immunization.

Staff Immunization Coverage in Non-Outbreak Institutions

In 327 long-term care facilities that did not report any outbreaks this season, 78.6% (28,383/36,095) of staff were immunized against influenza prior to December 1, 1999; while in 220 nursing homes that did not report any

outbreaks, the staff immunization coverage was 80.7% (16,931/20,970). It should be noted that due to some late reporting this data may actually reflect immunization rates up until mid-February, 2000.

Staff Immunization Coverage and Outbreak Characteristics in Outbreak Long-Term Care Facilities

As can be seen in Table 7, outbreak duration consistently decreased with increasing staff immunization coverage. There was a decrease of 21.9% in the mean outbreak duration in long-term care facilities at a staff vaccination rate of greater than 90% when compared to the vaccination rate of less than 70%. In nursing homes there was a decrease of 34.5% in the mean outbreak duration in facilities with staff coverage rates of greater than 90% as compared to those with a coverage rate of 70% or less.

4. Influenza Activity Level Reporting

Influenza activity in each health unit of Ontario was assessed weekly by the medical officer of health. This was reported weekly as one of the following three categories:

- 0—"no activity"
- 1—"sporadic activity" (sporadically occurring influenza like-illness (ILI) or laboratory confirmed influenza with no outbreaks detected)
- 2—"localized outbreaks" (outbreaks affecting a single geographic area within the health unit, e.g., an outbreak in one nursing home)
- 3—"widespread outbreaks" (outbreaks affecting multiple and non-adjacent areas within the health unit)

Results

A weekly average of 24 (64.9%) out of 37 health units in Ontario reported influenza activity levels this season. This

Table 7

Staff Immunization Coverage* and Outbreak Characteristics: Outbreak Long-Term Care Facilities, Ontario, 1999/00

Institutional Staff Vaccination Rate	<70% (n=30)		70<90% (n=77)		>90% (n=94)	
Type of Institution	NHs	LTCFs	NHs	LTCFs	NHs	LTCFs
RAR (%)	21.2	17.6	14.6	13.1	17.1	16.1
Mean OB Duration (Days)	13.9	12.8	10.7	11.4	9.1	10.0

*Vaccination data reflects the total number of staff immunized during the fall preceding the outbreak

RAR= resident attack rate

information was presented in the form of a map in the weekly Influenza Bulletin such as the one shown in Figure 9, representing activity levels for the week ending January 8.

Activity levels increased rapidly in November and December and remained high until mid-February. Peak activity was reported during the first week of January with 31/37 (83.8%) health units reporting "widespread outbreaks".

5. School Absenteeism Reporting

This component was recommended but not a requirement of the surveillance system. Selected schools within the health unit were asked to provide weekly reports of pupil absenteeism and these levels were forwarded to the Ministry. Elementary schools were asked to report absenteeism due to ILI exceeding 10% and secondary schools when absenteeism exceeded 15%.

Results

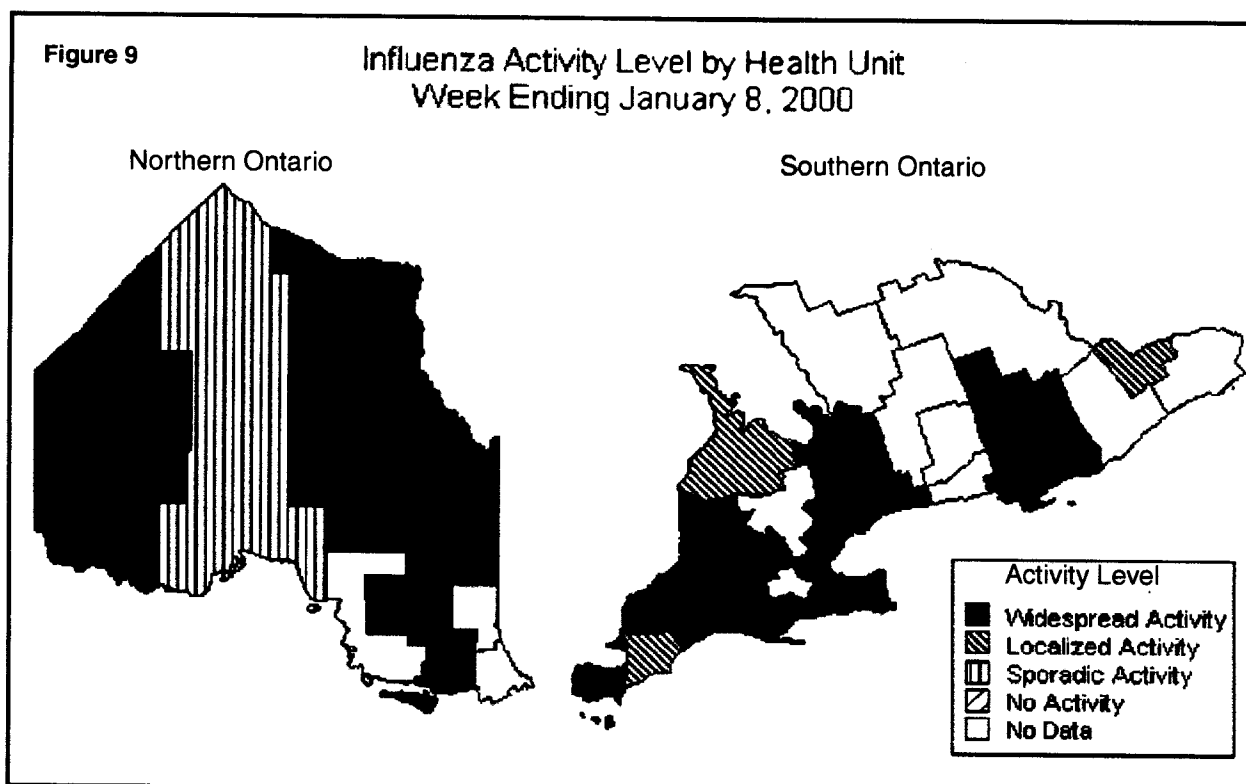
During the 1999/00 season a weekly average of 14 (37.8%) of 37 health units reported on school absenteeism. Absenteeism exceeding 10% was first reported during the second week of December by 6 health units. Peak school absenteeism was reported during early January when 19/37 (51.4%) health units reported absenteeism exceeding thresholds in both elementary and secondary schools in their area. School absenteeism reporting will

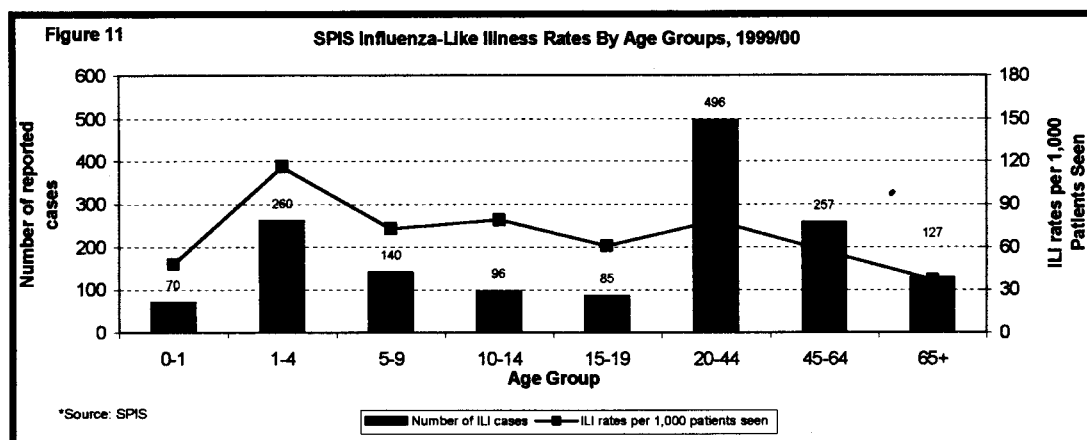
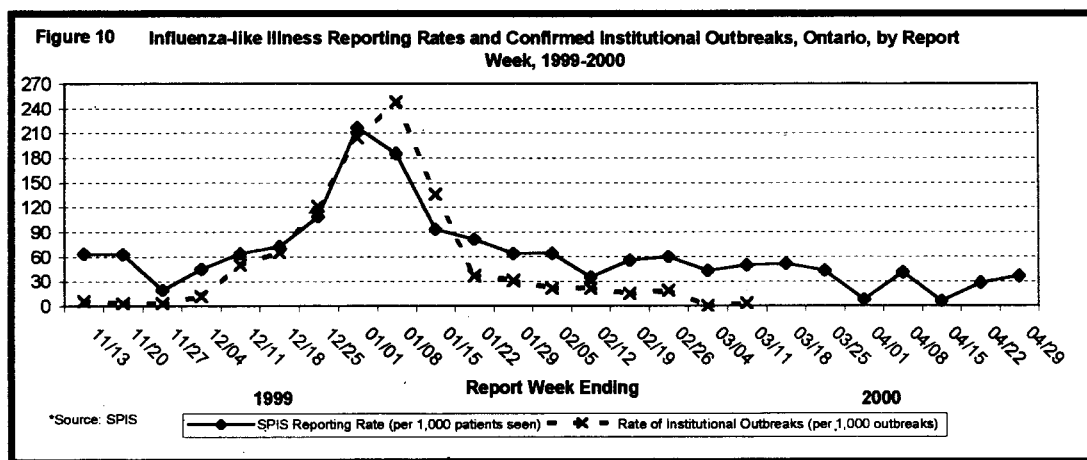
not be continued at the provincial level next influenza season. However, health units will be encouraged to use school absenteeism as one indicator to determine influenza activity levels in their areas.

6. Sentinel Physician Influenza Surveillance System (SPIS)

The SPIS system was added to the Ontario influenza surveillance system for the 1999/00 season in an attempt to obtain improved information on community rates of influenza illness, particularly the burden in the adult population. This population has been traditionally underrepresented in influenza surveillance. Fifty physicians were recruited and 57.6% reported on average each week. The rise in influenza-like illness reported by sentinel physicians preceded the peak in institutional outbreaks by 1 week (Figure 10).

SPIS physicians collected 438 nasopharyngeal swabs through the season and these were subtyped by the CPHL. The dominant strain was A/Sydney/5/97-like (H3N2); however, four isolates of A/Caledonia/20/99-like (H1N1) and one isolate of B/Beijing/184/93 were identified near the end of the season. The positive predictive value (PPV) of the SPIS system was 28% overall but rose to 40% at the peak of the influenza season (week ending January 1/00). A representative population was seen by the SPIS physicians in terms of





age, with a preponderance of ILI cases reported in the 1-4 and 20-44 age groups. (Figure 11).

Composition of 2000/01 Influenza Vaccine

The antigenic characteristics of current circulating and emerging influenza vaccine strains provide the basis for selecting the strains included in each year's influenza vaccine. The National Advisory Committee on Immunization (NACI) has recommended that the trivalent vaccine for the 2000/01 season contain an A/Moscow/10/99 (H3N2)-like virus, an A/New Caledonia/20/99 (H1N1)-like virus, and a B/Beijing/184/93-like virus. It should be noted that A/Panama/2007/99 is an A/Moscow/10/99 (H3N2)-like virus, and the most widely used B/Beijing/184/93-like vaccine strain virus is B/Yamanashi/166/98.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the assistance of Angie Fazzone and John Bicknell, of the Corporate Liaison & Resource Service, Peter Zabchuck and Theresa Tam, of the LCDC, Health Canada, Ilene Guglielmi and Laura Burton, of the Central Public Health Laboratory, and all public health units that participated in the influenza

surveillance program.

SOURCE

Gina Pohani, MHSc, BSc
Project Epidemiologist
Vaccine Preventable Diseases and Tuberculosis Control
Disease Control Service
Public Health Branch

Dr. Bonnie Henry MD MPH
Field Epidemiologist
Disease Control Service
Public Health Branch

Dr. Joyce Nsubuga
Vaccine Preventable Diseases and Tuberculosis Control
Disease Control Service
Public Health Branch

CONTACT

Barbara Kawa, MD, DPH
Senior Medical Consultant
Vaccine Preventable Diseases and Tuberculosis Control
Disease Control Service
Public Health Branch
Tel: (416) 327-7419
Fax: (416) 327-7439

Appendix 1.

Summary of influenza outbreaks in institutions by health unit and month, Ontario, 1999/2000

Influenza Outbreak Summary, Ontario 1999/2000

Month of Onset	Health Unit	Institution Type	Flu Type	Total No. Residents	Vaccination Rate % Residents	AR% Residents	No. CXR Confirmed Residents	Fatal Cases	Duration
September	TORONTO	NH	A	240	100.00	9.58	2	0	12.00
October	BRANT	NH	A	90	100.00	32.22	0	1	6.00
November	TORONTO	HFA	A	456	93.42	6.80	4	3	14.00
	PEEL	NH	A	195	93.85	9.74	2	0	16.00
	TORONTO	OTHER	A	86	.00	2.33	0	0	2.00
	TORONTO	ACH/CCH	A	532	84.59	3.20	1	2	19.00
	BRUCE-GREY	RH	A	51	92.16	21.57	2	1	9.00
	TORONTO	ACH	A	21	.00	28.57	0	0	4.00
	ALGOMA	HFA	A	182	97.80	25.27	0	2	26.00
	TORONTO	CCH	A	510	65.10	18.63	10	10	70.00
	PEEL	NH	A	54	98.15	24.07	0	0	5.00
	TORONTO	OTHER	A	73	1.16	3.33	0	0	1.00
December	PEEL	NH	A	235	89.79	35.74	0	5	40.00
	OTTAWA	RH	A	82	90.24	10.98	1	0	21.00
	TORONTO	NH	A	166	80.12	24.70	2	0	8.00
	CHATHAM	NH	A	96	90.63	6.25	0	0	11.00
	YORK REGION	RH	A	49	67.35	36.73	0	0	10.00
	YORK REGION	NH	A	36	91.67	33.33	3	4	8.00
	CHATHAM	HFA	A	88	94.32	29.55	0	1	12.00
	DURHAM	PHOSP	A	167	85.63	1.80	0	0	5.00
	OTTAWA	RH	A	148	90.54	9.45	2	0	6.00
	PETERBOROUGH	RH	A	90	83.33	22.22	3	0	16.00
	WINDSOR	NH	A	58	100.00	15.52	0	0	8.00
	HALDIMAND	NH	A	199	88.94	2.01	0	0	1.00
	HAMILTON	NH	A	368	90.49	3.53	1	1	5.00
	NORTH BAY	PHOSP	A	265	81.51	32.08	10	6	41.00
	PERTH	RH	A	102	96.08	5.88	0	0	1.00
	ALGOMA	NH	A	119	90.76	12.61	2	0	7.00
	TORONTO	NH	A	98	95.92	9.18	2	0	12.00
	TORONTO	NH	A	237	88.19	10.97	1	1	41.00
	CHATHAM	RH	A	69	85.51	13.04	0	0	9.00
	TORONTO	ACH	A	18	-	11.11	0	0	1.00
	BRUCE-GREY	NH	A	117	93.16	32.48	2	1	7.00
	LONDON	NH	A	167	95.21	2.40	0	0	1.00
	LONDON	CCH	A	443	89.84	3.61	1	0	7.00
	THUNDER BAY	HFA	A	150	92.00	8.67	0	0	6.00
	ALGOMA	NH	A	60	95.00	13.33	0	0	9.00
	TORONTO	NH	A	120	97.50	25.00	1	0	38.00
	TORONTO	NH	A	99	61.62	5.05	1	0	4.00
	TORONTO	NH	A	289	96.19	10.03	0	2	20.00
	BRUCE-GREY	OTHER	A	20	100.00	75.00	0	0	9.00
	OXFORD	ACH	A	18	5.56	11.11	0	0	4.00
	SIMCOE	RH	A	76	96.05	6.58	0	0	10.00
	THUNDER BAY	ACH/CCH	A	17	29.41	47.06	2	0	2.00
	OTTAWA	RH	A	148	90.54	7.78	2	0	4.00
	OXFORD	NH	A	78	93.59	26.92	0	0	2.00
	CHATHAM	NH/HFA	A	220	88.18	9.09	0	2	6.00
	HAMILTON	NH	A	245	91.02	11.02	0	1	30.00
	HURON	RH	A	69	98.55	26.09	0	2	26.00
	LAMBTON	NH	A	96	93.75	22.92	0	3	9.00
	LONDON	RH	A	62	91.94	9.68	0	0	8.00
	WATERLOO	NH	A	84	98.81	14.29	0	0	9.00
	PERTH	NH/RH	A	92	88.04	7.61	0	0	7.00
	TORONTO	HFA	A	127	86.61	14.96	0	1	11.00
	WINDSOR	NH	A	119	86.55	48.74	2	2	10.00
	WINDSOR	HFA	A	213	79.81	7.98	0	0	13.00
	SIMCOE	NH	A	60	100.00	15.00	0	2	7.00
	SIMCOE	HFA	A	122	92.62	9.84	0	1	5.00
	WINDSOR	NH	A	237	95.36	.84	0	0	7.00
	OTTAWA	NH	A	30	90.00	36.67	2	0	7.00
	TORONTO	HFA	A	136	94.12	2.94	0	0	5.00
	TORONTO	ACH/CCH	A	30	46.67	13.33	0	0	3.00
	YORK REGION	RH	A	173	93.64	7.51	1	0	28.00
	YORK REGION	HFA	A	103	93.20	2.91	2	0	3.00
	CHATHAM	NH	A	196	93.88	2.55	0	0	14.00

Month of Onset	Health Unit	Institution Type	Flu Type	Total No. Residents	Vaccination Rate % Residents	AR% Residents	No. CXR Confirmed Residents	Fatal Cases	Duration
	ELGIN	NH	A	59	98.31	47.46	2	6	17.00
	LONDON	NH	A	167	94.01	11.98	2	1	12.00
	TORONTO	NH	A	166	91.57	2.41	0	0	3.00
	BRUCE-GREY	RH	A	40	100.00	5.00	0	0	2.00
	HAMILTON	HFA	A	126	98.41	24.60	2	1	20.00
	TORONTO	NH	A	62	96.77	35.48	0	2	6.00
	TORONTO	HFA	A	365	95.62	1.92	0	1	8.00
	TORONTO	CCH	A	120	90.83	18.33	1	3	12.00
	HALDIMAND	NH	A	59	94.92	23.73	0	0	7.00
	KINGSTON	HFA	A	160	95.63	24.38	3	4	24.00
	TORONTO	NH	A	80	47.50	10.00	5	1	30.00
	TORONTO	HFA	A	456	94.96	9.21	2	3	18.00
	TORONTO	HFA	A	575	94.78	8.17	0	3	25.00
	WELLINGTON	PHOSP	A	111	-	24.32	-	0	9.00
	YORK REGION	NH	A	50	66.00	58.00	0	1	8.00
	YORK REGION	HFA	A	72	27.78	18.06	0	1	10.00
	HALTON	OTHER	A	163	92.64	11.66	0	0	19.00
	HASTINGS	NH	A	70	95.71	47.14	2	5	11.00
	NORTHWESTERN	ACH/CCH	A	28	64.29	57.14	0	0	4.00
	TORONTO	HFA	A	278	92.81	19.42	3	2	33.00
	TORONTO	PHOSP	A	36	11.11	33.33	0	0	11.00
	YORK REGION	NH	A	147	91.16	29.93	6	4	23.00
	YORK REGION	HFA	A	109	89.91	15.60	3	0	16.00
	KINGSTON	ACH	A	-	-	-	1	1	14.00
	TORONTO	NH	A	205	97.56	12.68	0	0	10.00
	TORONTO	RH	A	117	88.03	26.50	0	2	4.00
	WATERLOO	HFA	A	263	95.06	12.55	3	3	14.00
	WINDSOR	NH	A	256	90.63	5.86	0	1	24.00
	DURHAM	NH	A	169	91.12	24.85	3	2	16.00
	HURON	NH	A	63	88.89	55.56	1	1	13.00
	LONDON	NH	A	127	87.40	37.80	3	7	11.00
	NORTH BAY	HFA	A	73	97.26	16.44	0	1	10.00
	SIMCOE	NH	A	49	95.92	63.27	0	0	16.00
	SUDBURY	NH	A	288	92.01	4.17	0	0	7.00
	TORONTO	HFA	A	103	99.03	25.24	1	0	25.00
	WATERLOO	RH	A	32	100.00	28.13	0	1	9.00
	BRUCE-GREY	RH	A	91	90.11	30.77	0	1	15.00
	CHATHAM	RH	A	84	83.33	20.24	0	0	15.00
	DURHAM	NH	A	70	94.29	31.43	0	0	7.00
	HAMILTON	HFA	A	258	94.57	24.03	8	5	27.00
	PEEL	NH	A	119	92.44	19.33	1	1	13.00
	BRANT	NH	A	68	100.00	16.18	0	1	8.00
	LAMBTON	NH	A	153	82.35	55.56	2	11	29.00
	LEEDS	RH	A	30	83.33	16.67	2	0	8.00
	PETERBOROUGH	NH	A	156	92.95	6.41	3	0	13.00
	SIMCOE	RH	A	37	81.08	16.22	0	0	11.00
	SIMCOE	NH	A	95	93.68	27.37	1	1	12.00
	TORONTO	NH	A	155	100.00	6.45	0	1	11.00
	TORONTO	NH	A	128	97.66	33.59	2	0	17.00
	TORONTO	RH	A	241	93.78	4.56	0	0	7.00
	WINDSOR	NH	A	141	85.82	14.18	0	0	8.00
	EASTERN	NH	A	118	88.14	45.76	2	0	17.00
	HALDIMAND	RH	A	43	88.37	32.56	0	0	13.00
	PETERBOROUGH	HFA	A	40	92.50	40.00	0	0	18.00
	TORONTO	HFA	A	319	94.98	6.90	0	3	11.00
	TORONTO	HFA	A	249	91.97	9.64	0	0	14.00
	YORK REGION	RH	A	96	81.25	20.81	1	0	11.00
	ALGOMA	RH	A	111	74.77	26.13	5	0	6.00
	HALTON	HFA	A	295	85.08	4.41	0	0	11.00
	LONDON	CCH	A	443	89.84	10.16	2	4	15.00
	OXFORD	NH	A	96	100.00	8.33	0	1	9.00
	PEEL	RH	A	140	75.00	10.71	0	0	10.00
	PERTH	NH/RH	A	60	98.33	30.00	1	2	18.00
	TORONTO	RH	A	120	85.00	22.50	2	2	16.00
	TORONTO	NH	A	160	98.13	1.88	0	0	3.00
	WELLINGTON	RH	A	98	100.00	39.80	0	0	6.00
	WINDSOR	NH	A	117	84.62	13.68	0	2	17.00
	BRANT	RH	A	74	87.84	10.81	1	0	3.00
	HASTINGS	HFA	A	246	97.97	9.76	0	4	16.00
	KINGSTON	RH	A	12	100.00	66.67	0	0	5.00
	NIAGARA	HFA	A	212	91.04	10.85	3	0	22.00
	NIAGARA	NH	A	65	98.46	33.85	0	4	4.00
	NIAGARA	HFA	A	132	97.73	28.79	1	1	15.00
	NIAGARA	HFA	A	218	82.57	19.72	0	2	15.00
	TORONTO	NH/ACH	A	543	82.87	1.10	1	0	7.00
	TORONTO	RH	A	74	93.24	10.81	0	1	6.00

Month of Onset	Health Unit	Institution Type	Flu Type	Total No. Residents	Vaccination Rate % Residents	AR% Residents	No. CXR Confirmed Residents	Fatal Cases	Duration
January	WELLINGTON	NH	A	214	94.86	39.25	1	2	21.00
	WINDSOR	NH	A	57	89.47	43.86	0	0	11.00
	YORK REGION	RH	A	96	85.42	19.79	1	0	9.00
	BRANT	RH	A	40	100.00	10.00	0	1	1.00
	BRANT	RH	A	68	95.59	13.24	0	1	2.00
	CHATHAM	RH	A	48	97.92	25.00	0	0	9.00
	HALDIMAND	NH	A	80	92.50	40.00	3	3	14.00
	HALIBURTON	RH	A	94	91.49	2.13	1	0	1.00
	HAMILTON	HFA	A	378	90.48	9.26	3	1	15.00
	HURON	HFA	A	120	95.00	12.50	1	0	12.00
	SIMCOE	RH	A	30	100.00	6.67	2	0	7.00
	TORONTO	RH	A	130	93.85	10.77	0	0	33.00
	WELLINGTON	NH	A	106	98.11	38.68	1	2	11.00
	WELLINGTON	NH	A	85	98.82	84.71	1	0	11.00
	WINDSOR	NH	A	65	84.62	44.62	0	2	21.00
	BRANT	HFA	A	77	98.70	6.49	0	1	7.00
	DURHAM	NH	A	100	92.00	24.00	0	0	16.00
	HALTON	RH	A	102	91.18	12.75	0	0	6.00
	HAMILTON	NH	A	112	95.54	23.21	6	0	17.00
	HASTINGS	HFA	A	102	89.22	38.24	2	2	15.00
	HURON	RH	A	33	90.91	15.15	0	0	5.00
	LONDON	NH	A	80	97.50	18.75	0	0	13.00
	NIAGARA	NH	A	151	94.04	4.64	1	0	3.00
	PEEL	NH	A	156	100.00	17.31	0	1	3.00
	PERTH	NH	A	87	97.70	16.09	0	0	13.00
	SIMCOE	NH	A	18	100.00	16.67	0	0	7.00
	WATERLOO	NH	A	96	95.83	7.29	1	0	7.00
	YORK REGION	NH	A	100	96.00	38.00	0	1	18.00
	CHATHAM	RH	A	47	65.96	48.94	0	0	8.00
	NIAGARA	NH	A	132	88.64	16.67	1	2	11.00
	NIAGARA	HFA	A	99	86.87	4.04	0	0	2.00
	NIAGARA	NH	A	116	95.69	25.00	0	0	13.00
	NORTHWESTERN	ACH/CCH/NH	A	57	63.16	33.33	2	1	4.00
	OTTAWA	CCH	A	417	91.85	2.64	0	0	19.00
	SIMCOE	NH	A	94	95.74	15.96	1	2	8.00
	SUDBURY	NH	A	229	94.32	17.90	1	0	20.00
	TORONTO	HFA	A	268	99.63	15.67	0	1	11.00
	TORONTO	NH	A	250	100.00	11.60	11	1	19.00
	TORONTO	NH	A	304	95.07	3.62	0	0	13.00
	TORONTO	NH	A	204	87.75	13.24	1	3	6.00
	TORONTO	RH	A	108	98.15	25.93	0	3	17.00
	WATERLOO	NH	A	84	95.24	16.67	1	2	2.00
	WINDSOR	RH	A	66	83.33	46.97	3	0	7.00
	WINDSOR	NH	A	132	89.39	8.33	0	2	5.00
	DURHAM	HFA	A	147	100.00	4.76	0	1	16.00
	HALTON	NH	A	65	87.69	9.23	0	0	4.00
	HAMILTON	ACH	A	245	-	4.49	1	0	11.00
	HASTINGS	RH	A	35	94.29	28.57	0	0	6.00
	HURON	RH	A	19	84.21	73.68	1	0	7.00
	TORONTO	RH	A	120	85.00	15.43	0	0	9.00
	LEEDS	NH	A	60	86.67	36.67	1	0	6.00
	PERTH	ACH/CCH	A	25	96.00	32.00	0	0	12.00
	TORONTO	NH	A	344	98.84	3.49	6	3	12.00
	ELGIN	PHOSP	A	194	36.60	4.64	0	0	5.00
	HALIBURTON	NH	A	58	98.28	48.28	0	3	3.00
	HALIBURTON	RH	A	79	91.14	13.92	1	0	7.00
	HALTON	ACH	A	29	100.00	24.14	0	1	3.00
	KINGSTON	NH	A	60	86.67	58.33	1	1	6.00
	NIAGARA	NH	A	75	88.00	4.00	0	0	4.00
	PEEL	NH	A	86	94.19	8.14	0	1	5.00
	SIMCOE	HFA	A	148	87.16	8.78	0	0	6.00
	SUDBURY	NH	A	335	92.54	25.07	1	5	16.00
	TORONTO	HFA	A	96	93.75	38.54	0	0	3.00
	CHATHAM	NH/HFA	A	104	92.31	8.65	0	0	5.00
	LEEDS	NH	A	110	95.45	1.82	0	0	1.00
	LONDON	RH	A	114	100.00	6.14	1	0	5.00
	PEEL	NH	A	237	95.36	24.89	3	5	21.00
	OTTAWA	RH	A	172	94.19	17.44	0	0	5.00
	SIMCOE	OTHER	A	408	99.26	5.88	0	0	29.00
	TORONTO	CCH	A	24	95.83	20.83	0	0	3.00
	TORONTO	HFA	A	249	97.19	10.44	3	2	10.00
	TORONTO	NH	A	231	88.74	12.55	1	0	9.00
	TORONTO	ACH	A	18	.00	22.22	4	0	11.00
	WATERLOO	NH	A	48	95.83	18.75	0	0	8.00
	BRUCE-GREY	NH	A	67	100.00	22.39	0	0	11.00
	ELGIN	RH	A	39	94.87	15.38	1	0	8.00

Month of Onset	Health Unit	Institution Type	Flu Type	Total No. Residents	Vaccination Rate % Residents	AR% Residents	No. CXR Confirmed Residents	Fatal Cases	Duration
	HALTON	NH	A	93	100.00	19.35	0	0	6.00
	OTTAWA	NH	A	192	93.75	7.81	0	0	6.00
	PEEL	RH	A	48	91.67	27.08	2	1	6.00
	PORCUPINE	NH	A	61	86.89	31.15	4	3	8.00
	SIMCOE	HFA	A	60	93.33	43.33	3	2	25.00
	SUDBURY	NH	A	36	77.78	36.11	3	1	4.00
	WELLINGTON	HFA	A	87	91.95	11.49	0	1	10.00
	BRUCE-GREY	HFA	A	138	84.78	21.01	0	5	14.00
	CHATHAM	NH	A	96	92.71	2.08	0	0	1.00
	HAMILTON	NH	A	106	95.28	15.09	2	1	10.00
	HAMILTON	ACH	A	21	47.62	33.33	1	0	3.00
	LONDON	NH	A	165	95.15	4.85	0	0	8.00
	OTTAWA	NH	A	319	94.98	1.57	0	0	8.00
	OTTAWA	RH	A	172	93.60	18.54	0	0	17.00
	OTTAWA	HFA	A	203	94.09	10.34	2	0	17.00
	OXFORD	NH	A	78	97.44	7.69	0	1	4.00
	SUDBURY	RH	A	90	84.44	26.67	4	3	3.00
	WATERLOO	RH	A	135	98.52	25.93	0	0	6.00
	HURON	ACH	A	58	48.28	3.45	0	1	2.00
	LEEDS	NH	A	73	91.78	8.22	0	1	6.00
	LONDON	NH/HFA	A	173	95.95	1.16	0	0	1.00
	TIMISKAMING	HFA	A	99	90.00	14.14	3	1	18.00
	NIAGARA	RH	A	101	94.06	5.94	0	0	2.00
	PERTH	NH/RH	A	80	90.00	40.00	0	1	15.00
	SIMCOE	RH	A	36	94.44	13.89	0	1	4.00
	SUDBURY	ACH	A	92	-	11.96	0	0	6.00
	TORONTO	NH	A	126	98.41	4.76	0	0	1.00
	TORONTO	NH	A	154	98.05	7.79	2	1	11.00
	YORK REGION	HFA	A	158	98.73	3.16	0	0	6.00
	BRANT	HFA	A	360	95.83	3.61	0	4	7.00
	HALTON	NH	A	60	98.33	8.33	0	0	6.00
	HAMILTON	NH	A	40	92.50	60.00	6	4	10.00
	LONDON	NH	A	365	88.22	5.48	1	0	10.00
	OTTAWA	HFA	A	195	92.31	2.25	0	0	8.00
	NIAGARA	RH	A	151	13.91	3.97	0	0	4.00
	WINDSOR	HFA	A	29	100.00	10.34	0	0	1.00
	EASTERN	ACH/CCH	A	70	31.43	8.57	0	0	5.00
	EASTERN	RH	A	39	100.00	33.33	0	0	3.00
	HAMILTON	ACH	A	58	37.93	13.79	-	1	10.00
	LAMBTON	CCH	A	70	91.43	5.71	-	1	2.00
	OXFORD	HFA	A	219	99.09	4.11	0	0	4.00
	SUDBURY	NH	A	59	98.31	13.56	0	1	5.00
	LEEDS	PHOSP	A	516	99.42	3.10	1	0	20.00
	LONDON	RH	A	82	100.00	23.17	0	1	4.00
	NIAGARA	HFA	A	120	89.17	4.17	0	0	5.00
	THUNDER BAY	HFA	A	73	94.52	54.79	1	2	4.00
	WATERLOO	NH	A&RSV	88	92.04	12.50	3	1	8.00
	LAMBTON	RH	A	36	83.33	25.00	1	0	8.00
	LONDON	NH	A	97	96.91	18.56	1	0	4.00
	LONDON	NH	A	141	97.87	10.64	1	1	14.00
	OTTAWA	NH	A	192	96.88	17.71	6	6	14.00
	WELLINGTON	HFA	A	112	92.86	10.71	1	1	7.00
	BRANT	CCH	A	32	59.38	28.13	1	2	3.00
	HALDIMAND	HFA	A	141	98.58	11.35	0	1	20.00
	TORONTO	NH	A	60	90.00	55.00	5	0	11.00
	WINDSOR	NH	A	70	91.43	40.00	1	0	9.00
	OXFORD	NH	A	43	95.35	9.30	0	0	5.00
	TORONTO	NH/ACH	A	532	-	.75	0	0	2.00
	CHATHAM	OTHER	A	328	99.39	2.44	1	1	9.00
	HAMILTON	PHOSP	A	151	33.77	1.99	2	0	1.00
	NIAGARA	NH	A	200	93.00	4.50	2	1	7.00
	HASTINGS	NH	A	90	97.78	25.56	0	0	16.00
	OTTAWA	NH	A	60	95.00	48.33	4	2	16.00
	CHATHAM	NH	A	99	91.92	15.15	0	0	5.00
	OTTAWA	HFA	A	195	92.31	2.05	0	0	7.00
	BRUCE-GREY	NH	A	29	100.00	13.79	0	0	3.00
	LEEDS	RH	A	22	77.27	22.73	0	0	9.00
	LONDON	NH	A	62	90.32	4.84	0	1	3.00
	LONDON	PHOSP	A	254	41.34	9.06	0	0	3.00
	HALTON	OTHER	A	163	92.64	11.66	2	0	6.00
	LONDON	NH	A	58	96.55	22.41	0	0	4.00
	LONDON	CCH	A	443	89.84	2.03	1	0	11.00
	OTTAWA	RH	A	134	91.79	16.42	7	2	9.00
	OTTAWA	RH	A	94	94.68	3.19	0	0	3.00
	PORCUPINE	HFA	A	70	92.86	28.57	0	1	16.00
	THUNDER BAY	PHOSP	A	103	35.92	22.33	1	1	5.00

Month of Onset	Health Unit	Institution Type	Flu Type	Total No. Residents	Vaccination Rate % Residents	AR% Residents	No. CXR Confirmed Residents	Fatal Cases	Duration
February	HAMILTON	NH	A	126	96.83	30.95	7	3	12.00
	KINGSTON	NH	A	149	95.30	14.77	0	1	1.00
	OTTAWA	RH	A	49	95.92	38.78	3	0	7.00
	TORONTO	HFA	A	85	98.82	5.88	0	0	5.00
	HALIBURTON	HFA	A	157	87.90	14.01	0	1	5.00
	OTTAWA	RH	A	30	70.00	30.54	0	0	10.00
	RENFREW	HFA	A	177	89.27	2.26	0	1	10.00
	KINGSTON	HFA	A	30	100.00	33.33	0	1	13.00
	TORONTO	HFA	A	391	95.40	11.51	0	1	11.00
	LAMBTON	NH	A	62	88.71	27.42	0	0	10.00
	NORTHWESTERN	NH	A	95	89.47	16.84	1	0	11.00
	LONDON	NH	A	171	94.15	2.92	0	1	5.00
	EASTERN	HFA	A	148	77.03	10.81	0	0	7.00
	HAMILTON	HFA	A	378	90.48	.79	0	0	3.00
	BRANT	RH	A	68	95.59	2.94	0	0	3.00
	OTTAWA	NH	A	240	93.33	2.50	0	1	3.00
	TORONTO	CCH	A	185	-	3.78	0	0	6.00
	PERTH	HFA	A	86	89.53	22.09	0	0	12.00
	HALIBURTON	NH	A	80	90.00	3.75	1	0	5.00
	YORK REGION	NH	A	119	96.64	15.36	0	1	5.00
	ELGIN	HFA	A	134	91.79	8.96	0	1	14.00
	OTTAWA	RH	A	65	90.77	26.15	0	0	10.00
	YORK REGION	HFA	A	63	98.41	12.70	1	0	5.00
	HASTINGS	NH	A	77	98.70	37.66	0	0	5.00
	NIAGARA	HFA	A	54	85.19	16.67	0	0	8.00
	OTTAWA	RH	A	108	90.74	10.19	0	0	4.00
	ALGOMA	NH	A	117	87.18	23.93	3	3	7.00
	BRUCE-GREY	NH	A	42	88.10	30.95	0	2	17.00
	HALIBURTON	NH	A	60	98.33	11.67	0	0	4.00
	HAMILTON	NH	A	181	72.38	12.15	0	0	8.00
	OTTAWA	NH	A	71	91.55	14.08	1	0	11.00
	PERTH	NH	A	90	97.78	13.33	2	1	2.00
	OTTAWA	RH	A	30	100.00	26.67	0	0	4.00
	YORK REGION	NH	A	119	96.64	19.33	0	1	24.00
	HASTINGS	NH	A	70	95.71	15.71	0	1	8.00
	CHATHAM	NH	A	99	93.94	14.14	1	0	5.00
	MUSKOKA	NH	A	80	100.00	15.00	0	0	6.00
	RENFREW	HFA	A	48	89.58	4.17	0	0	7.00
	BRANT	HFA	A	55	100.00	1.68	0	0	4.00
March	NIAGARA	RH	A	110	93.64	9.09	0	0	5.00
	OTTAWA	RH	A	40	92.50	47.50	0	0	8.00
	PERTH	NH	A	90	96.67	12.22	0	0	3.00
	OTTAWA	RH	A	65	90.77	26.15	0	0	6.0
	THUNDER BAY	ACH/CCH	A	18	72.22	22.22	0	0	1.00
	OTTAWA	RH	A	40	92.50	45.00	0	0	7.00

A/R = Attack Rate, CXR = Chest X-ray, NH = Nursing Home, HFA = Home for Aged, RH= Retirement Home, ACH = Acute Care Hospital, CCH = Chronic Care Hospital, PHOSP= Psychiatric Hospital, Other = other chronic care institutions e.g. handicapped adult facilities.

IMMUNIZATION PROMOTION PROJECT SURVEY RESULTS

Introduction

Value of Immunization

Immunizations save lives and prevent serious illness. Before the development of the polio vaccine, there were as many as 20,000 cases of polio in one year in Canada. In the past years, polio has been eradicated from the Americas. Pre-vaccine, there were up to 300,000 cases of measles each year in Canada. The incidence of measles has dropped to 12 cases in 1998. Vaccines have produced a significant decline in the incidence of infectious diseases across Canada as illustrated in Table 1.

Although vaccines are recognized as one of the most effective public health interventions, their continued and ongoing use is not without opposition.

The Opposition to Immunization

Throughout the history of immunization there have been individuals who have strongly opposed vaccine use in healthy people. A letter to the Ottawa Citizen in 1919 states that "there is no reliable evidence that immunization prevents smallpox, or ever saved a single life."²

A recent article about immunization³ discussed the importance of identifying ways to communicate with

the public so they are accurately informed about the risks and benefits of immunization. This article stimulated numerous pages of strongly worded anti-immunization letters.⁴

The anti-immunization influence is real and the impact of those opposed to immunization has been felt around the world. Gangarosa and colleagues⁵ reviewed the impact of anti-vaccine movements on pertussis control. They compared pertussis incidence in countries where a high coverage of diphtheria, tetanus, pertussis (DTP) was maintained (Hungary, former East Germany, Poland and the US) with countries where immunization was disrupted by anti-vaccine movements (Sweden, Japan, UK, The Russian Federation, Ireland, Italy, the former West Germany and Australia). Coverage rates between the two groups varied greatly, as did the incidence of pertussis in these countries. For example, Hungary had a high coverage of DTP vaccine and the incidence of pertussis fell to less than 1 per 100,000.⁶

In 1989, East Germany achieved 95% coverage of DTP vaccine by requiring vaccination. This country had one to two cases per 100,000 during 1980-1990. West Germany adopted a non-compulsory immunization policy and had low coverage of approximately 11% with an incidence of pertussis reported at 180 per 100,000, well over 100 times higher than in East Germany.⁷

In 1974, infant pertussis coverage in Japan was nearly 80%. There were few cases and no deaths. Two infants died within 24 hrs of the DTP immunization and in response to alarmists, the Ministry of Health and Welfare eliminated the pertussis immunization program using the whole cell pertussis vaccine. Coverage rates in 1976 dropped to 10%. In 1979 there were more than 13,000 cases and 41 deaths from pertussis.⁸

Table 1

Overall Success of Vaccines¹

Comparison of Maximum and Current Reported Morbidity of Vaccine Preventable Diseases in Canada

Vaccine-preventable Disease	Pre-vaccine	1997	1998
Poliomyelitis (polio)	20,000	0	0
Diphtheria	9,000	1	0
Pertussis	25,000	4,439	7,519
Tetanus (death)	40-50	0	0
Haemophilus influenza b (Hib)	2,000	60	50
Measles	300,000	572	12
Mumps	52,000	254	110
Rubella	69,000	4,007	69
TOTAL	477,050	9,333	7,760

In Ontario, vaccine coverage rates are generally high. However public health staff and community physicians report growing opposition to immunization. One factor is the increasing number of individuals using the Internet to access information, especially health information. Easily accessible sites make claims that are both sensational and frightening. Some parents call health unit staff to ask about these claims, but others make decisions based solely on the information available on the Internet.

Table 2 displays some of the statements individuals can readily access on the Internet. These statements are presented as fact and rarely have references or citations to official medical sources.

This paper describes results of a survey conducted with health unit managers working in vaccine preventable disease units across Ontario. It is a first step in planning a comprehensive immunization promotion strategy as part of the Immunization Promotion Project. The goal of the Immunization Promotion Project is to develop, test and implement a comprehensive health promotion strategy. This strategy is being designed to raise awareness of the positive effects of immunization in the Ontario population and correct the misinformation currently being circulated by anti-immunization groups.

Methods

In December 1999, a survey was developed to assess the issues and needs facing the vaccine preventable diseases (VPD) staff in the health units across Ontario. The survey consisted of twenty-seven questions with a mix

of structured and open-ended questions. Some prompts were included with the open-ended questions. The survey form was focus tested with a group of three VPD managers and subsequently revised.

The survey included questions about local non-compliance with immunization recommendations and the perceived reasons for non-compliance; the ways immunization was being promoted, frequently asked questions, and resources. Additional questions asked if there were individuals or groups in their region who were advocating against vaccination and if present what was their current and projected impact.

All VPD managers were informed about and received a copy of the survey instrument. Each was contacted to arrange a time for the telephone interview. Interviews were conducted with VPD managers or their designates from all thirty-seven health units. Telephone interviews lasted approximately 30 minutes and were done by one of the Immunization Promotion Project staff.

This report summarizes the findings from the interviews.

Results

The VPD Manager or staff designate was asked if there were concerns in their region about non-compliance with immunization recommendations for infants, children, adolescents and adults. If concerns were identified, they were asked to describe these concerns.

Respondents expressed concerns about non-compliance with the immunization recommendations in their local jurisdiction. See Figure 1.

Table 2

Quotes from Anti- Immunization Web Sites

"Children diagnosed with asthma were five times more likely than not to have received pertussis vaccine."

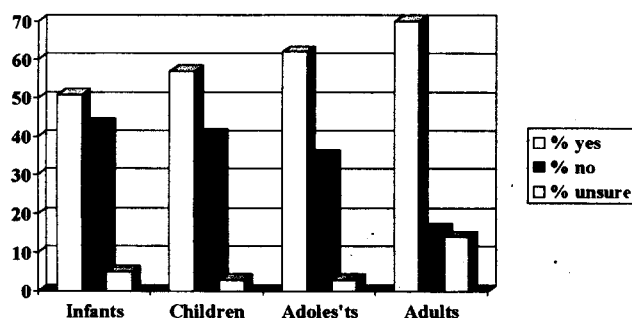
"Another study found babies die at a rate of eight times greater than normal within 3 days after getting a DPT shot."

"A recent study in Lancet (April 29, 1995) found a significant link between the measles vaccine and bowel disease. Those who received the vaccine were 3 times more likely to develop Crohn's disease and more than twice as likely to develop ulcerative colitis."

"This scholarly text, written by a health visionary and world-renowned medical researcher, documents correlations between childhood shots and autism, hyperactivity, learning disabilities, and auto immune diseases...."

Figure 1

Concerns about non-compliance with immunization recommendations for:



- 51% related to infant immunization
- 57% related to childhood immunization
- 62% related to adolescent immunization
- 70% related to adult immunization

Those with concerns about non-compliance with immunization recommendations identified the following issues:

For infants: Staff reported that some parents were concerned about the risks associated with vaccines, specifically the pertussis vaccine; and that anti-immunization groups “spreading inaccurate information” were influencing some parents. In some communities, infant immunizations were not up-to-date due to problems with access to primary care physicians.

For children: Staff reported that parents were more frequently requesting exemptions from the immunization requirements of the Immunization of School Pupils Act. This may be due to parents’ concerns about adverse reactions and the influence of anti-immunization proponents including certain chiropractors, naturopaths, and health food stores. As with infants, the lack of access to primary care physicians was also a factor. Another factor was that some parents could not recall the recommended immunization schedule. See Table 3.

For adolescents: Immunization may be incomplete due to several factors with the most common reported being that parents withdraw permission, possibly due to the influence of anti-immunization proponents. However, teens on their own may choose not to be vaccinated and tend to go to physicians infrequently. Also, staff reported that coverage declined when in-school immunization programs stopped.

For adults: Adults may be unaware of the need for ongoing immunization or forget about booster doses. Also, one of the common myths is that “the flu vaccine causes the flu”. This belief may be influencing immunization decisions for themselves and their children.

Frequently asked questions

Parents frequently asked about the side effects and reactions to vaccines and for information about the immunization schedule, i.e., what shot their child needed and when it was due. Other questions included those about safety, long term side effects (e.g., whether

Table 3

Reasons children's immunizations were not up to date

- Parents' lack of awareness of the immunization schedule
- Parents' lack of knowledge about vaccines and their importance
- A shortage of physicians in the community/region
- Misinformation about long-term side effects and safety concerns with vaccines
- Tracking problems with highly mobile families or parents who do not know they are responsible for providing immunization information
- Increased numbers of parents objecting for reasons of religion or conscience
- Physicians who may not actively encourage immunization or may miss opportunities to vaccinate

MMR causes autism) and whether immunizations are necessary. See Table 4.

Frequently asked questions from health professionals tended to be operational, about immunization schedules, vaccine storage, or dosage. A number of health units identified that health professionals were requesting information about what to do when parents refuse immunization. See Table 5.

Staff from schools, childcare centres, hospital pharmacies, various occupational work groups or other adults also called the health units for information. The most frequently asked questions were about the influenza and travel vaccines. Less frequently, VPD managers reported questions about side effects, vaccine safety, the need for immunization, about the Immunization of

School Pupils Act, and about schedules, which immunization is needed, who has access to publicly funded vaccines, where to get the vaccine and the cost.

Local successes in immunization promotion

VPD managers and staff identified numerous successes in promoting immunization. Twelve health units identified successful interactions between parents and staff on a "call in" or "help line". Staff responded to questions both on the phone and by talking to people in their communities. Many felt they were effective at promoting immunization in this interactive, personal way.

Ten health units identified successes with media campaigns, usually involving a local newspaper.

Table 4

Most frequent questions asked by parents

Frequently asked questions	% of health units
• What are the side effects and reactions to the vaccine?	(81%)
• Schedule - when and what?	(57%)
• Are vaccines safe?	(49%)
• Do vaccines cause other illnesses e.g., autism, SIDS, MS, immune problems, ADHD, polio. . . ?	(43%)
• Are immunizations necessary?	(27%)

Table 5

Most frequently asked questions from health professionals*

Frequently asked questions
• What vaccines to use when gaps exist in immunization
• Concern about giving two shots at once
• What to give to children from other countries - interpreting foreign immunization schedules
• Cold chain storage issues
• Which vaccine to give at certain ages
• Dosage, needle, preparation etc.
• Contraindications to vaccines (immuno-suppressed, pregnant women, etc.)
• What to do when parents refuse to vaccinate their children
• Questions about varicella or any new vaccine
• Travel vaccines

* in descending order of frequency of response

Nine health units had successfully promoted immunization by building partnerships with the local school boards. Six health units reported building a cooperative working relationship with community physicians. This relationship was built, in part, by ongoing communication including a regular newsletter to physicians.

Some health units reported successful promotion of immunization through reminders to parents. Five health units had experienced success using “friendly reminders” about missing immunization records mailed to parents before taking the next step of issuing the official suspension letters. Two health units reported that issuing the suspension letters (notifying parents that children may be suspended from school if proof of immunization or a medical/philosophical exemption form is not provided) led to improvement of immunization and/or reporting. Four health units identified successes when doctors’ offices used tear off reminder cards instructing parents to call a public health response line to update their child’s immunization information.

- Other promotional strategies included:
- Targeted promotion of flu vaccine in long term care facilities and with the media;
- Having a flu shot blitz in workplaces and through seniors clubs;
- Vaccine information in presentations to parents or in school newsletters;
- Providing and discussing immunization information during a cold chain inspection visit to physicians’ offices;
- Developing a web-site;
- Creating a video for a cable TV station with local students;
- Using a Health Bus to reach high risk populations;
- Preparing and distributing a quick reference guide to physicians about vaccines.

Things that have not worked well to promote immunization

About half of the respondents stated that their immunization promotion interventions had achieved at least partial success. For others, activities that were less effective included:

- The computer-generated letter from the Immunization Record Information System (IRIS), informing parents their child’s immunization record was incomplete, was reported by four VPD managers/staff as sounding “harsh” and being poorly received by parents. However, two others said that the suspension letters had increased immunization reporting.
- Educational sessions for physicians were poorly attended by the physicians. However, the office staff including nurses in the doctors’ offices had found the sessions worthwhile.
- Clinics held in malls, or drop in clinics were swamped at certain times creating long waits for participants and having a negative impact on public relations.

Resources used to respond to questions

There was considerable variation in the number of useful resources being recalled by VPD staff from different health units. Most health units reported using the following resources to respond to questions:

- The Canadian Immunization Guide, Health Canada, 1998;
- Your Child’s Best Shot: The Canadian Pediatric Society, 1997;
- The Ministry of Health and Long Term Care (MOHLTC) fact sheets and resources, including the report of the Chief Medical Officer of Health on Immunization (1995) and ‘Vacs Facts’, a monthly fact sheet.
- Fewer than 20% of the health units reported use of the following resources:
- Web sites including the Laboratory Centre for Disease Control (LCDC) or the U.S. Centers for Disease Control (CDC);
- The Ontario Immunization Schedule, distributed to all physicians and health units in 1996;
- Specific books e.g. *Vaccines*, Plotkin & Mortimer (1994);
- Binders or brochures developed by health unit staff;
- Vaccine package inserts and the manufacturers’ vaccine information lines;
- CDC travel information;
- Canadian Communicable Disease Report (CCDR) updates.

Resources recommended to parents

Twenty-six health units (70%) stated they recommended Canadian Pediatric Society's (CPS) book, *Your Child's Best Shot* and had it available in public libraries and/or photocopied sections for parents. MOHLTC fact sheets and pamphlets, including those from the CPS, were each recommended by thirteen health units (35%). Seven health units (19%) recommended web sites including the MOHLTC site, their own web-site, LCDC and CDC sites. Some health units distribute their own pamphlets or brochures.

Missing from the recommendations of parent resources was the Canadian Immunization Awareness Program Web site, which has information for health professional and parent audiences.

Resources recommended to health professionals

The Canadian Immunization Guide was the resource recommended to health professionals most frequently by health unit staff. Other resources recommended frequently included *Your Child's Best Shot*, MOHLTC materials, materials from the vaccine manufacturers or Internet sites.

Resources not recommended

Twenty-one (57%) respondents identified materials they would not recommend as helpful. Twelve expressed concerns about the Internet or more specifically the anti-immunization sites on the Internet. Some found the vaccine manufacturers' materials either too high a literacy level, or outdated. One health unit reported difficulties with some CPS materials (since the Ontario Immunization Schedule was different to the one described in the resource).

Twenty health units felt that the Internet was a source of both confusing and misleading information for parents. Some reported cautioning parents to check that web sites are reliable, valid and reputable.

Three health unit staff expressed concerns about the information provided by some mainstream publications such as *Homemakers* and *Macleans*. Six health units raised concerns about materials distributed by chiropractors and naturopaths whereas five others were cautious about materials distributed by health food stores.

Anti-immunization proponents

Thirty health units (81%) reported the presence of individuals or groups in their region who were advocating against immunization. The key message was that immunizations weren't necessary. In some communities, these individuals or groups were actively promoting misinformation about serious adverse effects attributed to the immunizations.

Anti-immunization messages were usually given 'person to person' or in newspaper articles or in information distributed at chiropractors' offices or in health food stores.

Myths commonly reported

The most common myths surfacing in communities were that vaccines cause harmful side effects that may not be detected for many years; that vaccines hurt the immune system and that 'vaccines aren't necessary since the diseases they protect against are gone or very rare.

Some anti-immunization groups warn parents to not allow "toxic or poisonous" substances to be given to children. They accuse governments and health units of being biased and providing only pro-immunization materials and of covering up the risks. Some, especially those selling holistic services and products frequently offer 'natural' medicines purported to provide protection instead of vaccines. It is stated that "there are greater risks from the vaccines than from having the illnesses".

Other **myths** were also reported and are listed in descending order of frequency:

- "Flu vaccine causes the flu";
- "Polio vaccine causes cancer";
- "Pertussis vaccine causes brain damage";
- "Kids with egg allergies cannot have Measles, Mumps, Rubella (MMR) or Hepatitis B vaccines";
- "Hepatitis B causes chronic fatigue or multiple sclerosis";
- "Influenza vaccine causes Alzheimer's Disease";
- "Childhood vaccines cause sudden infant death (SIDS), diabetes, autism, hyperactivity, brain dysfunction; mental and muscular disabilities";
- "Hepatitis B vaccine is made from blood products".

Although most VPD managers reported the presence of an anti-immunization group or individual in their local area, only eight health units (22%) reported that the anti-immunization effects were starting to be seen.

Perceived future impact

When asked about the future impact of the anti-immunization proponents, nineteen VPD managers (51%) thought that the impact of anti-immunization groups would be greater in the future than at the present time. Nine (24%) felt the impact would be about the same as it is today, whereas 16% stated they were not sure. None felt the impact would be less than it is now.

Identified needs

VPD managers identified supports that might help them better inform parents about the safety and effectiveness of immunizations. These included:

- A planned, coordinated provincial media campaign including components that could be adapted to the local situation and local media. The campaign could inform about the seriousness of illnesses caused by the vaccine preventable diseases. One VPD manager urged that immunization promotion follow the example of the milk marketing board and its successful milk mustache campaign. This campaign needs to provide a firm argument for immunizations to deal with the 'anti' messages.
- A comprehensive package for parents, summarizing issues related to vaccines, with reminders about the schedule and accessible resources to provide more information if they want it.
- A way to get rapid information to counter the *myth of the day*. Suggestions included clarification about what was being said, rebuttal of myths with statistics from current research, questions and answers responding to the issues, pamphlets for doctors and doctors' offices, and ongoing surveillance of anti-immunization sites. It was felt that form letters to respond to anti-immunization media articles were needed.
- A positive web site, kept up to date and well linked to other reliable sites would help with immunization promotion.
- A video for parents – for use pre and postnatally to give a positive message **before** parents hear the anti-immunization messages. This video could also be

used in parenting classes given by a public health nurse or other health professional and available in physicians' offices.

Summary and Discussion

1. Current Promotion

Most health unit staff interviewed report that they have good immunization records and report that they are working at full capacity to promote immunization. Use of a direct "help line" provides an effective way to work with parents and provides an immediate and personalized response to their questions and concerns. A well-researched information binder (currently in preparation at the Public Health Branch) will strengthen this approach.

Media campaigns were used effectively by some health units. These health units frequently found this approach costly and suggested that the impact would be greater if they could link with a coordinated provincial media campaign.

Another strategy for immunization promotion was to work in conjunction with other professional groups, specifically school personnel and community physicians. The combined voice within the community strengthens a consistent message about immunization.

Although the number of health units with their own web sites is increasing, health unit staff tend to be hesitant to recommend the Internet to parents. The Canadian Immunization Awareness Program has a low profile in Ontario.

2. Current Resources

The list of resources to support awareness raising and education about immunization are limited and staff tend to rely on three standard resources. The materials produced by the MOHLTC are part of this resource package and are used widely. The book, *Your Child's Best Shot*, published by the CPS, is described as the "best book" available at this time. However, it is becoming dated as new vaccines (i.e. acellular pertussis) are introduced. Also, it is written for an educated public with a high reading level.

What may be helpful is a resource for parents that is more than a pamphlet but less comprehensive than *Your Child's Best Shot*. Material for wider literacy levels and in different languages would be useful.

A noticeable gap is the lack of Web-based resources used by VPD staff or recommended to others. This gap is noteworthy since there has been a rapid increase in anti-immunization sites available on the Web. Most staff reported that they would not recommend the use of the Internet to parents and expressed concern about some of the sites parents were visiting. However, many parents are receiving their vaccine information on the Internet. This raises an urgent need to identify and promote well researched, responsible Internet sites for VPD staff and parents. Appendix 1 contains the listing of some credible sites.

In proposing new resources, consideration is needed for new materials that can be:

- Quickly updated to respond to changes in the vaccine products and schedules;
- Easily disseminated - perhaps downloaded directly in a reproducible format;
- Produced for publics with different learning styles and abilities, using a variety of formats;
- Disseminated through a source that is seen by parents and health professionals as credible, accurate, current and unbiased.

3. Issues for development

The results from the telephone survey identified several learning needs for parents. These may include:

- Reminders about what shots are needed for their children and at what age;
- Concise, accurate information about risks and adverse effects and what to do about adverse effects;
- Information about vaccine preventable diseases and;
- Accurate information about anti-immunization messages.

Physicians may also benefit from information about vaccine efficacy and vaccine safety. The data suggested that some physicians, especially those who have not seen the vaccine preventable diseases, might benefit from more information about the mortality and morbidity due to vaccine preventable diseases and the benefits of vaccines.

The Cold Chain program, under which public health staff inspect the storage of vaccine in physicians' offices, provides an additional opportunity for public health to interact with physicians and their staff. The Cold Chain

visit could include more education about issues such as vaccine safety, vaccine schedules and how to deal with parents who have only heard the anti-immunization message.

The most common questions from the non-health professional group were about influenza and travel vaccines which are more commonly associated with an adult population. Promotion of adult immunizations may require a specific response. □

SOURCE

Donna Mitchell Ph.D., Health Promotion Consultant,
Immunization Promotion Project,
Vaccine Preventable Diseases and Tuberculosis Control Unit
Disease Control Service

CONTACT

Barbara H. Kawa MD, DPH •
Senior Medical Consultant
Vaccine Preventable Diseases and Tuberculosis Control Unit
Disease Control Service
Tel: (416) 327-7419
Fax: (416) 327-7439

REFERENCES

1. Pless R. Presentation: Getting Our Point Across, Burlington, Ontario, December 1999.
2. Macbean SL. Ottawa Citizen, letter to the editor, 1919.
3. Bedford H, Elliman D. Concerns About Immunisation. British Medical Journal 2000; 320,240-243.
4. <http://bmj.com/cgi/eletters/320/7229/240>.
5. Gangarosa EJ, Galazka AM, Wolfe CR, Phillips LM, Gangarosa RE, Miller E and Chen RT. Impact of Anti-Vaccine Movements on Pertussis Control: The Untold Story. Lancet, 1998; 351(9099): 356-361.
6. Ibid, p.357.
7. Ibid, p. 357.
8. Ibid, p. 358.

Appendix 1

Immunization web sites

Canadian Sites

www.ciap.cpha.ca

Canadian Immunization Awareness Program. Includes Q and A Section

www.hc-sc.gc.ca/hppb/hpo

Health Canada- health promotion online: Under the 10 Hottest Resources on HPO – check out The Canadian Guide to Clinical Preventive Health Care, Section 3, Immunization of Children and Adults.

www.canadian-health-network.ca

The Canadian Health Network - Click on the letter 'I' then search under 'immunization'. Over 40 articles, reports and papers are listed.

www.cps.ca

Canadian Pediatric Society material includes information about vaccines and Q and A from the book, Your Child's Best Shot.

www.fightflu.com

The National Influenza Immunization Campaign site includes a Q/A and information about influenza and the flu vaccine.

U.S. Sites

www.cdc.gov/nip/vacsafe/

The Centers for Disease Control, (U.S.) has vaccine safety fact sheets and information about vaccine safety, hot topics, questions and concerns about vaccine side effects.

www.vaccinesafety.edu

Institute for Vaccine Safety is U. S. site, presents current issues about vaccines.

www.quackwatch.com/index.html

Quackwatch describes itself as a guide to health fraud, quackery and intelligent decisions.

www.idsociety.org

Infectious Diseases Society of America and home to the National (US) Network for Immunization Information produces Immunization News Briefs. To subscribe, visit this site.

www.immunize.org

The Immunization Action Coalition publishes Needletips and Vaccinate Adults and has a search capability.

www.immunize.org/stories/

Stories of people who have suffered or died from vaccine- preventable diseases.

www.vaccines.com

The Vaccine Page is a new site and provides timely vaccine news. The editors do not screen articles.

The World

www.who.int/home/map_ht.html

The World Health Organization. To learn about vaccine preventable diseases, start at Health Topics, scroll to Diseases: Vaccine preventable diseases.

* (note: There are some differences between Canadian & US schedules and vaccines)

TEMPORAL AND GEOGRAPHICAL DISTRIBUTIONS OF REPORTED CASES OF *ESCHERICHIA COLI* O157:H7 INFECTION IN ONTARIO

Reprinted from *Epidemiology and Infection*, Vol. 122, No. 2 (April 1999), with permission from the publisher, Cambridge University Press. All rights reserved.

Summary

The distribution of 3001 cases of verocytotoxigenic *Escherichia coli* (VTEC) reported in the Province of Ontario, Canada were examined to describe the magnitude of this condition geographically and to evaluate the spatial relationship between livestock density and human VTEC incidence using a Geographical Information System. Incidence of VTEC cases had a marked seasonal pattern with peaks in July. Areas with a relatively a high incidence of VTEC cases were situated predominantly in areas of mixed agriculture. Spatial models indicated that cattle density had a positive and significant association with VTEC incidence of reported cases ($P = 0.000$). An elevated risk of VTEC infection in rural population could be associated with living in areas with high cattle density. Results of this study suggested that the importance of contact with cattle and the consumption of contaminated well water or locally produced food products may have been previously underestimated as risk factors for this condition.

Introduction

Between 1990 and 1995, 7482 cases of verocytotoxigenic *E. coli* (VTEC) were reported in Canada, from which more than 40 percent were recorded in the Province of Ontario.¹ The infection in humans is associated with a spectrum of illnesses including severe diarrhea, and hemolytic-uremic syndrome (HUS).² There have been few attempts to study the temporal and geographical distributions of verocytotoxigenic *E. coli* (VTEC) in a defined population.^{3,4} Identification of high risk groups based on the geographic distribution of cases can be of value in targeting resources as part of control strategies for diseases caused by VTEC. Similarly, the relationship between the spatial distribution of disease incidence and exposure variables can be studied in order to identify risk factors. Currently, one area of interest related to VTEC disease is the

relative importance of this condition in rural as opposed to urban areas, and the role that exposure to cattle might play in the epidemiology of this infection in humans.

The present study combined geographic, demographic, agricultural and disease data to describe the spatial distributions of cases of human VTEC in Ontario between 1990 and 1995 and to evaluate the spatial association between livestock density and the incidence of VTEC in human populations using a Geographical Information System (GIS) and spatial regression models.

Materials and Methods

Data sources

Data on the 3001 VTEC sporadic cases reported in Ontario from January 1990 to the end of December 1995 were extracted from the Reportable Disease Information System (RDIS) database from the Ontario Ministry of Health. For the purpose of surveillance data entry in this information system, cases of VTEC infection are defined as: "A persons with compatible clinical signs for which verocytotoxin was detected from stool specimens; persons with compatible clinical signs and for which verocytotoxigenic *Escherichia coli* was isolated from stool or blood; or any symptomatic person with an epidemiologic link to two or more laboratory-confirmed VTEC cases." Information on the Ontario population distribution was derived from the 1991 census of Canada which provided a profile of census divisions and census subdivisions based on data collected from all households.⁵ Farm animal distribution and land use data were obtained from the 1991 Census of Agriculture for Ontario (Statistics Canada).

Rate calculations

Rates over five years of VTEC cases per 10,000 inhabitants in Ontario counties were standardized using the age structure of the 1991 Canadian population.⁶ Calculations for age adjustment were performed using a personally-programmed spreadsheet software (Lotus 123; Lotus development corporation, Georgia, USA).

Time-series and trend analyses

The original time-series consisted of the monthly number of VTEC cases reported in Ontario for the 72 months of the study period. Monthly incidences of VTEC cases were calculated using the total number of new VTEC cases recorded in a region for a given month as the numerator, and the respective total

population reported in the 1991 Ontario census as the denominator. Simple regression analysis was used to define the straight-line trend in the VTEC series over the study period.

Spatial manipulation and mapping

All cartographic outputs were produced by a Geographical Information System (GIS) (ArcView 2.1, ESRI, Redlands, California). In addition to relational linkage between databases and the production of maps, the GIS environment was used to perform several spatial manipulations including the calculation of the county's centroid coordinates (latitude and longitude), the Euclidian distances between each pair of counties, and the production of contiguity and inverse distance matrices used for spatial autocorrelation and regression.

Spatial distribution

The method of nested mean rates was used to delimit counties with extreme or unusual risks of VTEC cases.⁷ For mapping purposes, the measures of animal densities were categorized into four classes according to the natural breaks in their cumulative frequencies. Two indices of spatial autocorrelation, the Moran's I statistic⁸ and the G statistic^{9, 10}, were calculated to explore the spatial distribution of VTEC cases across the 49 counties of Ontario. An observation-specific measure of spatial autocorrelation derived from the G statistic, the G_i statistic, was also calculated.

Regression models

Counties located in the northern regions of the Province ($n = 11$) were omitted from the spatial regression analysis because of the great differences in their geographic and demographic characteristics as compared to the regions included in the southern counterpart¹¹. Metropolitan areas were created in six of the 39 counties located in the southern section of the Province. These new areas were formed to improve the homogeneity in the measure of exposure (animal density) within each area. Metropolitan areas were constructed by extracting the demographic and geographic information of a census sub-division (a geographic sub-element of the county) or merging and then extracting this information from contiguous census sub-divisions. The metropolitan areas thus defined were required to comply with all of the following criteria:

1. population greater than or equal to 100,000;
 2. population density greater than or equal to 1,500 pop/km;
 3. livestock enumeration information matching exactly the boundary of the new metropolitan area available from the agriculture census profile of 1991;
 4. no livestock numerated in the new metropolitan areas;
 5. frequency of VTEC cases for both the metropolitan and the rest of the county can be calculated based on the patient's forward sortation area (FSA) information recorded in the disease database
- Following these criteria, six counties (cd) which included major metropolitan areas were divided into two sub-areas. Since Toronto County consists of a single metropolitan area, this county was no further sub-divided.

Variables used in the modelling process included proportion of the total land which is cultivated (total cultivated area / total area); cattle density (total cattle / total cultivated area); dairy cattle density (total dairy cattle / total cultivated area); density of "livestock other than cattle" (total pig + total sheep + total horse + total poultry / total cultivated area) and livestock density (animal units / total cultivated area). The "animal unit" variable is an index calculated by Agriculture and Agri Food Canada and includes a standardized measure of the number of cattle, horses, sheep, swine and poultry based on the production of nitrogen in their manure.¹ Other predictors considered in the regression analyses were human population density (total population / total county), latitude and longitude of the county centroids. Variables were selected using a backward stepwise manner.

Regression models were constructed using four methods: ordinary least square (OLS) procedure with adjustment of the variance matrix, OLS with a jackknife variance estimate, maximum likelihood estimation (MLE) including a spatial lag coefficient and MLE including a spatial error coefficient. The first OLS method adjusts the variance matrix (White adjustment)¹ for the possible departure from linear regression assumptions (homoscedastic and uncorrelated error terms) due to the spatial structure of the data. An alternative method used to estimate a robust covariance

matrix for the OLS estimates in the presence of heteroscedasticity was based on the jackknife resampling method.¹⁴ Inference on the coefficients of these models was based on the most conservative of the jackknife or adjusted variance estimates.

Two classes of spatial models were evaluated, namely a model with spatial error dependence and a model with a spatially lagged dependent variable. These two classes of spatial models, respectively, take into account the geographical inter-dependence among the errors (spatial error model), and among the observed values (spatial lag model) in a specific model. For more technical details relating to the spatial error and the spatial lag models, we refer the reader to Ord¹⁵, Anselin¹⁶, Anselin¹⁷ and Anselin and Hudak.¹⁸

The inverse of the Euclidian distances between the county=s centroids (inverse distance matrix) was used for all regression calculations which required the specification of a spatial weight matrix. The Akaike Information Criteria (AIC, measure of fit)¹⁹, the parsimony and interpretability of the model, as well as the results from the residual diagnostic tests were considered in the selection and evaluation of the competing spatial regression models. Spatial regression analysis was conducted using the software SpaceStat (SpaceStat ver 1.8; Regional Research Institute, West Virginia University, VI, USA).

Results

The temporal distribution of VTEC cases showed a marked seasonal pattern with peaks centred on the month of July (Figure 1). During the summers of 1990, 1991 and 1995, over 100 cases per month were reported at the highest peak of reporting. Approximately 75 cases per month were reported at a similar time for 1992, 1993 and 1994. Except for two increases in case numbers in the spring of 1992 and 1995, the overall pattern of VTEC was very regular over the study period. For Ontario and all

regional sub-series (northern, southern, eastern, central, western), a non-significant slope coefficient indicated no evidence of a systematic long term increase or decrease in the average monthly number of reported cases.

The geographic distribution of standardized rates of VTEC cases is presented in Figure 2. According to the nested means categorization technique, 8 counties were classified as having a very low (0 - 1.76), 11 low (1.77 - 2.44), 13 average (2.45 - 3.34), 8 high (3.35 - 4.00) and 9 very high (4.01 and higher) incidence of VTEC cases (rate are per 10,000 population). Counties with a very high incidence of VTEC cases as compared to the Ontario average were situated in the western and central part of the western region, the north-west section of the central region, and the far western part of the eastern region, all of which are areas of predominantly mixed agriculture. Areas belonging to the northern region generally had a low incidence of VTEC cases. Counties which represent or include large urban areas were associated with either average or low levels of VTEC rates.

The Moran's I index indicated an overall significant spatial auto-correlation of VTEC incidence in Ontario regardless of the underlying null distribution or the weight matrix chosen for the calculation ($p < 0.005$). An overall spatial inter-dependence of the VTEC incidence across Ontario was also found by calculating the G statistic ($p = 0.002$).

Fig. 1. Linear trend and moving average for VTEC timeseries, Ontario (1990-1995)

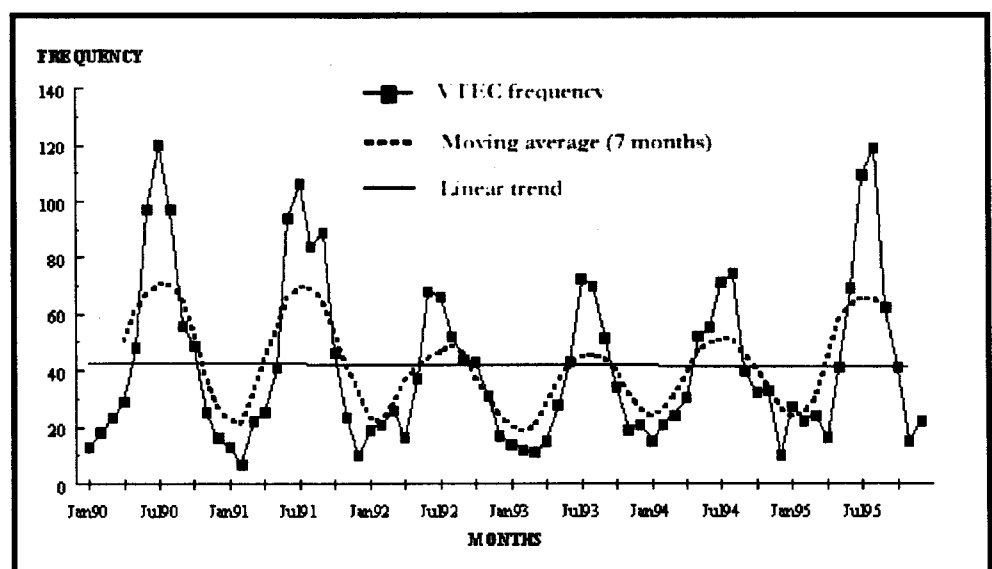
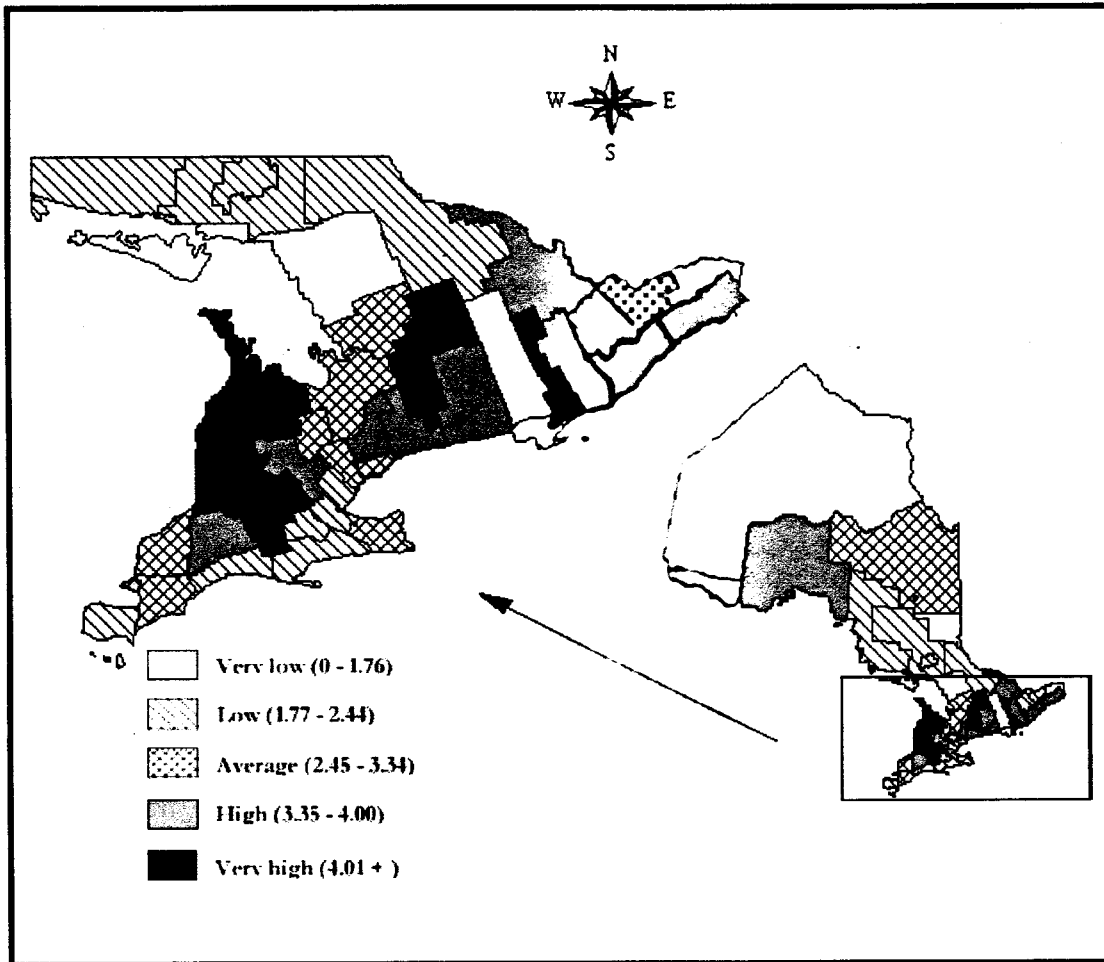


Fig. 2. Incidence of cases of VTEC infection in Ontario, (1990-1995) (cases per 10,000 population)



For most regions, the geographic distribution of cattle density by county presented a similar geographic pattern as the one described for human VTEC cases. Counties with very high cattle density were distributed in three areas of Ontario (Figure 3).

The results of two competing models (A and B) which included 44 geographical units of southern Ontario are presented in Table 1. The first model (A) indicated a positive and significant spatial association between cattle density and human VTEC incidence ($p < 0.001$). Model B also indicated a positive and significant spatial association between a measure of livestock density (animal unit) and human VTEC incidence ($p = 0.002$). For both models, the estimation of a "robust" covariance matrix for the ordinary least square estimates when the assumptions of homoscedastic and uncorrelated error terms were not verified were based on the jackknife method.

Discussion

Although the surveillance definition for VTEC infection in Ontario is inclusive of all serotypes, the majority (>95%) of the VTEC cases recorded in the database were typed as *E. coli* O157 VT+¹¹ and epidemiological interpretation based on the following results should be made accordingly. The monthly distribution of VTEC cases in this study concurs with previous reports of the seasonal distribution of this disease. In a two year study performed in Alberta, 77.4 percent of the VTEC cases occurred between June and September with a marked peak in July.²⁰ In a ten year summary of *E. coli* O157:H surveillance in Scotland, Coia et al. also reported that over 60 percent of the reported cases occurred between May and September.²¹ The cause of the increase in incidence of disease during the summer months is unknown, although it is presumably related in some manner to increased ambient temperature. It is possible

Fig. 3. Cattle density in southern Ontario, 1991. Total number of cattle per cultivated area (hectare)

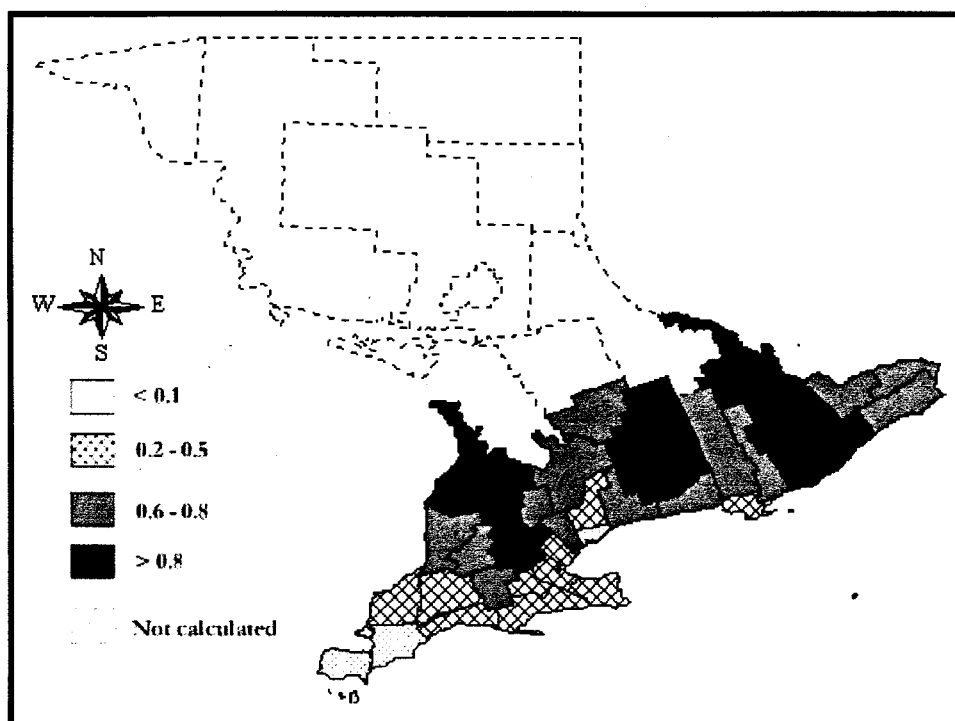


Table 1. Competing models for spatial regression of VTEC incidence in Ontario

Models	Variables	Coefficients	S.E*	p values	A.I.C [†]
A	Constant	2.42	0.16	< 0.001	111.25
	Cattle density	1.47	0.33	< 0.001	
B	Constant	2.59	0.2	< 0.001	114.85
	Livestock density	0.61	0.2	0.002	

* Based on the jackknife resampling method [14]

[†] AIC : Akaike Information Criteria [19]

for example, that elevated environmental temperature favors multiplication of VTEC in the farm environment and on food products during processing, distribution and preparation for consumption.

Clustering in the geographical distribution of VTEC incidence in Ontario was supported by significant indices of spatial autocorrelation regardless of the statistical method used. Detailed analysis of the autocorrelation

pattern also revealed local non-stationarities particularly in the northern regions of the Province. In these regions, the VTEC incidence in a given county was not strongly correlated with the corresponding magnitude in proximate counties suggesting local non-stationarity in the spatial process. This finding underlines the numerous analytical problems associated with the evaluation of geo-political areas with low

population densities and characterized by less precise exposure and outcome measures.²²

Adjustment of the regression model to accommodate the spatial nature of the data, and more specifically the estimation of a "robust" covariance matrix can be accomplished in various ways. Two approaches for such estimation were evaluated during the regression analysis: the first based on the adjusted White variance and the second based on a jackknife method. This latter method gave slightly more conservative estimates than the alternative robust approach based on the adjusted White variance and was adopted. Similarly, other possible spatial adjustments were explored during the first stage of the analysis. In an attempt to adjust the regression models for spatial effects, a spatial lag coefficient and a spatial error term were offered to the regression models. However these spatial terms were not statistically significant.

Important observations made in this study were the relatively high incidence of the condition in rural regions as opposed to urban areas, and the consistent spatial association between VTEC incidence in human populations and measures of cattle or livestock density in the southern section of the Province. The presence of livestock density in a competing model, and the constant failure to include the variable representing "livestock other than cattle" alone or conditional on the presence of cattle density, suggest that the explanatory power of livestock density was possibly due to the strong contribution of cattle in the calculation of that index. Although the present results consistently revealed the spatial association between measures of cattle density and human VTEC incidence, it is not clear how this association should be interpreted. First, the observed effect could suffer from a bias due to the presence of significant metropolitan centres in some counties also having a high cattle population density. Assuming a true association between cattle density and VTEC disease in humans, and considering that a relatively high proportion of the county population will be located in urban centres, the presence of cities with a large population could dilute or reverse the observed cattle-VTEC association when measured at the county level. One way of minimizing such bias is to make the groups, within each geographic units, as homogeneous as possible in regard to the exposure measure.²³ Therefore

in the present study, seven of the largest metropolitan areas of southern Ontario, representing approximately 44% of the total population, were extracted from their counties of origin. This spatial manipulation created seven urban geographical units with a measure of cattle density equal to zero. However, the use of a similar "extraction" procedure for smaller metropolitan areas was limited by the joint precision of the disease, census and geographical databases. The magnitude and direction of this bias on the cattle-VTEC association was not evaluated in the context of the present study. Secondly, it is also possible that the observed association is not causal. Regardless, the potential importance of this association substantiates the need for further research on the topic.

The overall spatial association of cattle density and human VTEC incidence suggests that living in an agricultural region where cattle are raised could be an important risk factor for the acquisition of VTEC disease. In the past, VTEC organisms have been isolated from the feces of healthy cattle and other farm animals, thereby identifying them as reservoirs for human infection.^{24, 25, 26, 27} People living or working on dairy farms have an increased exposure to VTEC strains than urban controls²⁸ and are known to be at higher risk of carrying VTEC organisms.²⁹ This increased carriage rate might be explained by a closer contact of farm families with cattle and cattle manure and by the consumption of unpasteurized milk by some individuals.³⁰ Whether or not this evidence of increased exposure to VTEC organisms actually translates into higher reported cases as compared to the rest of the population is unknown. However, in regions with higher cattle density, other transmission patterns involving the contamination of various elements of the environment are likely to exist. Since cattle manure is used as fertilizer for crops and pastures, contamination of vegetables, shallow water wells and recreational water is possible. An example of the contamination of water wells in intense agricultural areas was illustrated in a 1992 Ontario survey of ground water quality in which 32 percent of wells exceeded the maximum acceptable concentration for coliform bacteria and 24 percent had fecal coliform bacteria isolated.³¹ Possible contamination of drinking water and exposure to animals were also underlined as influential factors for VTEC cases following the preliminary findings of a Scottish

surveillance study which documented that 20 percent of cases lived on or had visited a farm, 17 percent had been in contact with animal manure, 12 percent had a private water supply and 2 percent had recent water failures in their homes.²¹ The impact of living in an agricultural area on the risk of VTEC cases was further suggested by a recent study comparing VTEC isolation rates of diarrheic patients living in urban and rural regions of Mexico. In this study, Parra and co-workers reported a higher VTEC isolation rate in patients who lived in rural regions compared to those in urban areas.⁴ Unfortunately, no information on the definition of rural regions, no denominators and no details concerning the density of farm animals in these regions were given by the authors, making the study results difficult to compare with those of the present investigation. It is also possible that geographic variations in human VTEC incidence could reflect regional differences in meat production, handling and distribution practices, although investigation of these factors was beyond the scope of the present investigation.

The results of the present study suggest that human VTEC incidence is high in rural regions as compared to urban areas and that farm animal density, more particularly cattle density, is a significant predictor of this incidence in many regions of Ontario. These findings support the possible influence of direct and indirect contact with reservoir animals as an important mode of transmission of VTEC organisms. In areas with higher cattle density, factors that could be responsible for VTEC transmission include the contamination of surface water and shallow wells by cattle manure used as fertilizer; working with, or being in close contact with cattle; and consumption of food produced and processed locally. It is understood that, under the limitations of the present study design, the observed association between human VTEC incidence and cattle density may not be causal. However, the importance of such information for the public health and agricultural sectors is such that further studies including specific evaluations of the comparative risk of disease acquisition between rural and urban human populations, as well as investigations of environmental risk factors associated with human exposure to cattle are warranted. Finally, this study also illustrates the value of existing population-based surveillance data to describe

the geographical distribution of reportable enteric diseases as a mean of orienting resources and efforts to areas of higher risk and guiding policy-making.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge Dr M. Shoukri of the Department of Population Medicine of the Ontario Veterinary College, University of Guelph; Dr C. Leber and Dr J. Carlson of the Ontario Ministry of Health; the Medical Officers of Health of the regional health units of Ontario; Dr B. MacDonald of Agriculture and Agri-Food Canada, Guelph; the Laboratory Centre for Disease Control (LCDC), Health Canada; and the Agroecosystem research group of the University of Guelph for their participation in this study. We thank also Dr M. Karmali for his helpful comments in the preparation of this manuscript. □

SOURCE

Authors: P. Michel¹, J.B. Wilson^{1,3}, S. W. Martin¹, R. C. Clarke², S. A. McEwen¹, C. L. Gyles⁴

¹ Department of Population Medicine, Ontario Veterinary College (OVC), University of Guelph, Guelph; ² Guelph Laboratory, Health Canada, Guelph, Ontario; ³ Laboratory Centre for Disease Control (LCDC), Health Canada, Ottawa; ⁴ Department of Pathobiology, Ontario Veterinary College (OVC), University of Guelph, Guelph.

Corresponding and requests for reprint should be sent to Dr Pascal Michel, Guelph Laboratory, Health Canada, 110 Stone Road West, Guelph, Ontario, Canada, N1G-3W4. Tel (519) 822-3300; fax (519) 822-2280; email: pascal_michel@hc-sc.gc.ca

CONTACT

Dean Middleton, BSc, DVM, MSc
Veterinary Consultant
Disease Control Service
Public Health Branch

REFERENCES

1. Notifiable Diseases Annual Summary, 1995. Canada Communicable Disease Report. 1997; 23S9:92-93
2. Griffin, P. M. and Tauxe, R. V. The epidemiology of infection caused by *E. coli* O157:H7, other enterohemorrhagic *E. coli*, and the associated hemolytic uremic syndrome. *Epidemiol. Rev.* 1991; 13:60-97.
3. Waters, JR; Sharp, JCM, and Dev, VJ. Infection caused by *Escherichia coli* O157:H7 in Alberta, Canada, and in Scotland: A five-year Review, 1987-1991. *Clin Infect Dis.* 1994; 19:34-43.
4. Parra MR, Torres LJ, Camorlinga PM, Giono CS, Gonzalez AS, Munoz HO. Frequency of identification of cytotoxigenic strains of *Escherichia coli* in cases of diarrhea from rural and urban communities. *Arch Invest Med (Mex)* 1991; 22:217-22.
5. Statistics Canada. Profile of census divisions and census subdivisions - Part A. Ottawa: Supply and Services Canada,

1992. 1991 Census of Canada. Service number 846-031.
6. Pickle LW, White AA. Effects of the choice of age-adjustment method on maps of death rates. *Stat Med* 1995;14:615-27.
7. Brown P, Hirschfield A, Marsden J. Analysing spatial patterns of disease: some issues in the mapping of incidence data for relatively rare conditions. In: MJC de Lepper, HJ Scholten, RM Stern, editors. The added Value of Geographical Information Systems in public and environmental health. The Netherlands. Kluwer Academic Publishers; 1995:145-63.
8. Moran P. The interpretation on statistical maps. *J Royal Stat Soc* 1948; B 10:243-51.
9. Getis A, Ord JK. The analysis of spatial association by use of distance statistics. *Geogr Anal* 1992; 24:189-206.
10. Ord JK, Getis A. Local spatial autocorrelation statistics: Distributional issues and an application. *Geogr Anal* 1995; 27:286-306.
11. Michel P. An Epidemiologic Study of Human cases of Verocytotoxigenic *Escherichia coli* Infection Reported in Ontario [dissertation] Ontario, Canada; University of Guelph; 1997.
12. Ministry of Agriculture and Food, Ministry of the Environment, Ministry of Housing of Ontario. Agricultural code of practice. 1996; 14-5.
13. White H. A heteroskedastic-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 1980; 48:817-38.
14. Efron B. The Jackknife, the Bootstrap and Other Resampling Plans. Philadelphia: *SIAM J Appl Math* 1982.
15. Ord K. Estimation methods for models of spatial interaction. *J Am Stat Assoc* 1975; 70:120-26.
16. Anselin L. Estimation methods for spatial autoregressive structures. Regional Science Dissertation and Monograph Series. New York (NY); 1980.
17. Anselin L. Spatial econometrics, Methods and Models. Dordrecht. Kluwer Academic; 1988.
18. Anselin L, Hudak S. Spatial econometrics in practice: a review of software options. *Regional Science and Urban Economics* 1992; 22:509-36.
19. Akaike H. Likelihood of a model and information criteria. *Journal of Econometrics* 1981; 16:3-14.
20. Pai CH, Ahmed N, Lior H, Johnson WM, Sims HV, Woods DE. Epidemiology of sporadic diarrhea due to verocytotoxin-producing *Escherichia coli*: a two-year prospective study. *J Infect Dis* 1988; 157:1054-7.
21. Coia JE, Sharp JCM, Curnow J, Reilly WJ. Ten years experience of *Escherichia coli* O157 in Scotland (1984 - 1993). In: MA Karmali and AG Goglio, editors. Recent advances in Verocytotoxin-producing *Escherichia coli* infections; 2nd international conference on VTEC, Bergamo, Italy. Elsevier Science B. V; 1994:41.
22. Smans M, Estève J. Practical approaches to disease mapping. In: Elliot P, Cuzick J, English D, Stern R, editors. Geographical and Environmental Epidemiology; Methods for Small-Area Studies. Oxford Medical Publication; 1996.
23. Morgenstern H. Uses of ecologic analysis in epidemiologic research. *Am J Pub Health* 1982; 72:1336-44.
24. Chapman PA, Wright DJ, Norman P, Fox J, Crick E. Cattle as a Possible Source of Verocytotoxin-Producing *Escherichia coli*-O157 Infections in Man. *Epidemiol Infect* 1993; 111:439-47.
25. Clarke RC, McEwen SA, Harnett N, Lior H, Gyles CL. The prevalence of verotoxin-producing *Escherichia coli* (VTEC) in bovines at slaughter. *Abstr Annu Meet Am Soc Microbio* 1988.
26. Wray C, Randall LP, McLaren IM, Woodward MJ. Verocytotoxic *Escherichia coli* from animals, their incidence and detection. In: MA Karmali and AG Goglio, editors. Recent advances in Verocytotoxin-producing *Escherichia coli* infections; 2nd international conference on VTEC Bergamo, Italy. Elsevier Science B. V; 1994:69.
27. Conedera G, Zuin A, Marangon S. Seroprevalence of neutralizing antibodies to *Escherichia coli* verocytotoxins in domestic and wild animals in Italy. In: MA Karmali and AG Goglio, editors. Recent advances in Verocytotoxin-producing *Escherichia coli* infections; 2nd international conference on VTEC, Bergamo, Italy. Elsevier Science B. V; 1994:81.
28. Raymond D, Johnson RP, Karmali MA, Petric M, Winkler M, Johnson S, Rahn K, Renwick S, Wilson J, Clarke RC and Spika J. Neutralizing Antibodies to *Escherichia coli* Verocytotoxin 1 and antibodies to O157 Lipopolysaccharide in Healthy Farm Family Members and Urban Residents. *J Clin Microbiol* 1996; 34:2053-2057.
29. Wilson JB, Clarke RC, Renwick R, Rahn K, Johnson RP, Alves D *et al.* Verocytotoxigenic *Escherichia coli* infection on dairy farms in southern Ontario. In: MA Karmali and AG Goglio, editors. Recent advances in Verocytotoxin-producing *Escherichia coli* infections; 2nd international conference on VTEC, Bergamo, Italy. Elsevier Science B. V; 1994:61.
30. West AM, Martin SW, McEwen SA, Clarke RC, Tamblyn SE. Factors associated with the presence of *Salmonella sp.* in dairy farm families in southwestern Ontario. *Can J Pul Health* 1988; 79:119-23.
31. Agriculture and AgriFood Canada. The Ontario farm groundwater quality survey; Winter 1991/1992.

THE FIRST REPORTED CLUSTER OF FOOD-BORNE CYCLOSPORIASIS IN CANADA

Reprinted from the Canadian Journal of Public Health, 1999; 90(6): 399-402, with permission. All rights reserved.

Abstract

Introduction

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

Methods

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

Results

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

Discussion

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

Resume

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

Méthode. Les cas ont été confirmés à une institution où une exposition commune a eu lieu pour six cas de

cyclosporiasis. On a sondé les invités à un déjeuner à propos de leur exposition à la nourriture. On a examiné la cuisine et les sources d'eau; on a fait des tests environnementaux.

Résultats. Avoir mangé un flan à la fraise, qui contenait des fraises, des framboises et des bleuets, a été associé à l'attaque de la maladie (risque relatif = 2.13, $p=0.02$). Il n'y avait pas d'évidence que l'eau de l'institution était associée à la maladie.

Discussion. Pendant le cours de l'enquête il s'est avéré que cette manifestation représentait le groupe indicateur canadien d'une manifestation nord-américaine répandue, associée aux framboises importées du Guatemala. L'enquête locale souligne le rôle des bureaux de santé publique dans les infections par moyen de nourriture qui naissent à travers les juridictions.

Introduction

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

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

In late May 1996, a local physician notified the North York Public Health Department of a possible outbreak of cyclosporiasis amongst 49 guests attending a private

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

Methods

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

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

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

institution, we checked the school absentee records to determine whether absenteeism had increased surrounding the luncheon.

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

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

Environmental investigation

Staff from both the communicable disease and the environmental divisions of the NYPHD performed an onsite inspection of the institution. One litre water samples were taken on day 12-13 from water faucets and water traps in the kitchen, bathrooms, and from the mikvah and its rainwater collection system. Samples were tested for pathogenic organisms, including *Cyclospora*, at the provincial Public Health Laboratory Etobicoke. The municipal street main and building connection were examined for a possible containment breach. The municipal plumbing inspector investigated the institution plumbing system for sites of cross-contamination from the unpotable mikvah water or other sources of environment contamination. The mikvah was closed until inspections and repairs of the plumbing system were completed. The caterer's kitchen was in a neighbouring municipality and was investigated in a similar manner by the responsible Public Health Unit.

Food Trace-back

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

Table I
Clinical Symptoms of Cases (n=35)

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

Results

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

Environmental investigation

A cross-contamination site was found between the mikvah water filtration system and the institution's potable hot water line. Environmental testing of this mikvah and all other environmental sources did not reveal *Cyclospora* or other pathogenic species.

Risk associated with food ingestion and other exposures

The strawberry flan was the only exposure found to be a risk factor for developing illness, (relative risk 2.16; $p=0.02$) (Table II). The caterer prepared all food items

except for the strawberry flan which was bought from a local bakery. The strawberry flan consisted of a pastry cup filled with custard and topped with glazed sliced fresh strawberries. The caterer served the flan on individual plates surrounded by each of two or three fresh raspberries and blueberries on custard that was prepared and added on site. All berries were washed in a colander with fresh running water. Exposure to other water sources at the luncheon site (water fountain, bathroom use, and kitchen) was not associated with illness.

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

Food Traceback

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

Figure 1
Date of Onset of Symptoms for Guests of the Luncheon
35 cases (median incubation time 8 days)

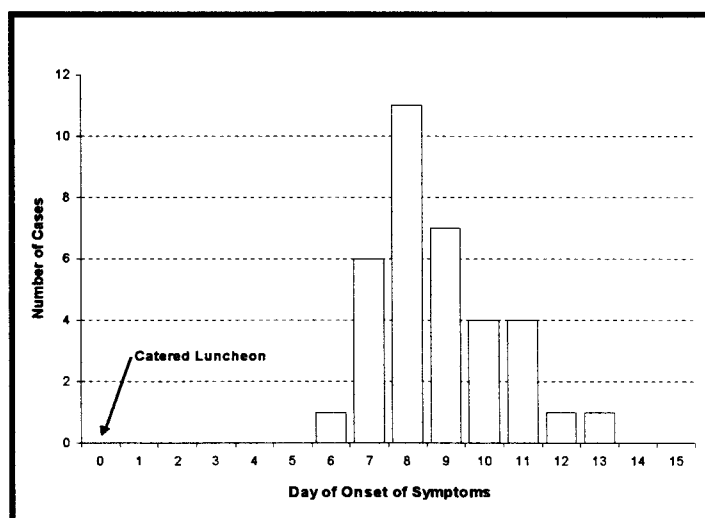


Table II**Food Exposure and Risk of Developing Illness for Guests of the Luncheon**

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

⁺ = Food items shown include all fresh produce and the cooked items with highest risk and statistical significance.

[#] = Exposure is people who recalled eating the food item. The food items are ranked by frequency of exposure in cases.

* = Fisher exact P-value

Discussion

The North York luncheon in May 1996 is the first reported cluster of cyclosporiasis in Canada. Subsequent investigations indicate that this was the index Canadian cluster of a widespread outbreak associated with Guatemalan raspberries.⁷ In our investigation, eating strawberry flan, decorated with strawberries, raspberries and blueberries, was the only exposure statistically associated with developing illness. Since almost identically produced pastry cups were not associated with illness, the likely source of cyclosporiasis was the raspberries, blueberries or custard used to decorate the desert plate at the event. Unlike previously reported outbreaks associated with contaminated water, this outbreak was food-borne. This was despite finding a potential contamination site of the institution's drinking water.

During investigation of the May cluster there was several events that suggested it was part of a larger, widespread Cyclospora outbreak. First, the NYPHD investigated a second unrelated enteric outbreak of a catered event in May. In this second outbreak, at least 17 of 50 people became ill, 6 people were laboratory-confirmed Cyclospora positive. Fresh berries were served at this event. Second, a private outpatient laboratory contacted the NYPHD to report an increase in stool specimens positive for Cyclospora. These cases were separate from the first two outbreaks

identified and were not associated with foreign travel. This laboratory was unaware of the outbreak investigations that were underway. Finally, we became aware of a simultaneous berry-associated Cyclospora outbreak in Houston, Texas.

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

Although results of the food exposure analysis from the luncheon strongly suggest an association of cyclosporiasis with consumption of strawberry flan, there are several limitations of the study. Recall history

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

These investigations described above along with many similar investigations at the local level are cornerstones of food safety. The era of increasing international food trade further challenges us to maintain systems of detecting and investigating food-borne illness that may be widespread throughout Canada (and the world). Outbreaks of food-borne illness will be reported to, and investigated by, local health departments, whether they are from well-known or emerging pathogens. The ability of provincial and national public health departments to detect and investigate multi-jurisdiction outbreaks depends on the capacity of local health departments and vice versa. The chain of defense against existing and new food-borne health threats is only as strong as the weakest link in the health care system.

ACKNOWLEDGEMENTS

Syed Neamatullah, Field Epidemiology Training Program, Laboratory Centre for Disease Control, Ottawa; Chuck Leber, Public Health Branch, Ontario Ministry of Health, North York; Denise Werker, Field Epidemiology Training Program, Laboratory Centre for Disease Control, Ottawa; Jay Keystone and Dideia Raymond, Topical Disease Unit, The Toronto Hospital, Toronto; Barbara Herwaldt, Michael Arrowood and Susanne Wahlquist, National Center for Infectious Diseases, Center for Disease Control and Prevention, Atlanta; Doug Morrison, Food Protection Branch, Health Canada, Toronto; Ted Scholten, Provincial Public Health Laboratory, Etobicoke.



SOURCE

D.G. Manuel^{1,2}, R. Shahin¹, W. Lee¹, M. Grmusa¹

¹ Toronto Public Health, Toronto, ON

² Community Medicine Residency Program, University of Toronto, ON

Correspondence

Dr. R. Shahin, Toronto Public Health, North York District Office, 5100 Yonge Street, Toronto, ON, M2N 5V7

CONTACT

Dean Middleton, BSc, DVM, MSc.

Veterinary Consultant

Disease Control Service

Public Health Branch

REFERENCES

1. Purvich DB, Perry IL, Bulawka D, Kowalewska-Grochowska KI, Oldale BL. A case of Cyclospora infection in an Albertan traveller. *CCDR* 1995;21(10):88-91.
2. Huang P, Weber JT, Sosin DM, et al. The first reported outbreak of diarrheal illness associated with Cyclospora in the United States. *Ann Int Med* 1995;123(6):409-14.
3. Koopmans E, Katz D, Malecki J, et al. Novel parasite and mode of transmission: Cyclospora infection - Florida. 45th Annual Epidemic Intelligence Service (EIS) Conference. Hyattsville, MD, 1996:259.
4. Carter R, Guido F, Jacquette G, Rapoport M. Outbreak of cyclosporiasis associated with drinking water. Conference on Antimicrobial Agents and Chemotherapy. New Orleans, 1996.
5. Sitientes-Osornio J, Porras-Cortes G, Bendall RP, Morales-Villarreal F, Reyes-Teran G, Ruiz-Palacios GM. Cyclospora cayentensis infection in patients with and without AIDS: biliary disease as another clinical manifestation. *Clin Infect Dis* 1995;21(5):1092-7.
6. Hoge CW, Shlim DR, Ghimire M, et al. Placebo-controlled trial of co-trimoxazole for Cyclospora infections among travellers and foreign residents in Nepal. *Lancet* 1995;345(8951):691-3.
7. Herwaldt B, Ackers M-L, The Cyclospora Working Group. An outbreak in 1996 of cyclosporiasis associated with imported raspberries. *N Engl J Med* 1997;336:1548-56.
8. Neamatullah S, Manuel D, Werker D, et al. Investigation of Cyclospora outbreak associated with consumption of fresh berries. In: 64th Conjoint Meeting on Infectious Diseases, Hamilton, Ont., November 10-14, 1996. Edmonton, Alta.: Canadian Association for Clinical Microbiology and Infectious Diseases, 1996:M-6.

Summary of Reportable Diseases in April, 2000

Health Units by Region	1996 Population	AIDS	Campylo.	Chicken- pox	Chlamydia	Enceph/ Meningitis	GAS	Gonorrhea
Algoma	123,953				4			
North Bay	93,841				9			
Northwestern	80,235				20			2
Porcupine	97,437		2		16			
Sudbury	201,154				23		1	
Thunder Bay	161,187		3		34		1	
Timiskaming	38,847		1		2			
Total - Northern	796,654		6		108		2	2
Eastern Ontario	185,314		1		7	1		1
* Hastings-Prince Edward	143,790							
Kingston-Frontenac	175,568		6		31	1		1
Leeds-Grenville	156,129		3		3	1	1	
Ottawa-Carleton	721,136		16		88	1	1	6
Renfrew	97,634		1		6			
Total - Eastern	1,479,571		27		135	4	2	8
Durham Region	458,616		3		23			7
East York	107,822		1		4	1	1	5
Etobicoke	328,718		5		24		2	6
Haliburton-Kawartha	165,039		5		4		2	1
Muskoka-Parry Sound	78,675							
North York	589,653		17		26	2		14
Peel Region	852,526		25		45	1	1	6
Peterborough	123,448		2		13		6	1
Scarborough	558,960		17		96	1		22
Simcoe County	329,865		2		24	1		1
Toronto City	653,734		16		60	1		29
York City	146,534		5		10		4	5
York Region	592,445		24		36			4
Total - Central East	4,986,035		122		365	7	19	101
Bruce, Grey-Owen Sound	153,312		2		7			
Egin-St. Thomas	79,159				4		2	
Huron	60,220		2				1	
Chatham-Kent	109,650		3		8			
Lambton	128,975							
Middlesex-London	389,616		5		37	3	6	3
Oxford	97,142					1		
Perth	72,106				3			
Windsor-Essex	350,329		13		39		1	1
Total - Southwest	1,440,509		25		98	4	10	4
Brant	114,564		1		10		1	
Haldimand-Norfolk Region	102,575		1		2			1
Halton Region	339,875		1					
Hamilton-Wentworth	467,799		3		70	1	2	10
Niagara Region	403,504		6		21		2	3
Waterloo Region	405,435		10		32	1	3	8
Wellington-Dufferin	217,052		4		6	2	2	
Total - Central West	2,050,804		26		141	4	10	22
April 2000	10,753,573		206	N/A	847	19	43	137
Total YTD 2000	-	11	857	N/A	4,153	104	181	796
** Total YTD 1999	-	43	1,075	N/A	4,479	119	119	644

* Data incomplete for the month of April from Hastings-Prince Edward health unit due to technical difficulties.

** Adjusted for deletions and late reports.

Summary of Reportable Diseases in April, 2000

Health Units by Region	1996 Population	Mumps	Pertussis	Rubella	Salmon.	Shigellosis	Syphilis (Prim/Sec)	VTEC
Algoma	123,953							1
North Bay	93,841				1			
Northwestern	80,235				1			
Porcupine	97,437				3			
Sudbury	201,154				1			1
Thunder Bay	161,187				2			
Timiskaming	38,847							
Total - Northern	796,654				8			2
Eastern Ontario	185,314							1
* Hastings-Prince Edward	143,790							
Kingston-Frontenac	175,568		4					
Leeds-Grenville	156,129		1		2			
Ottawa-Carleton	721,136		1		9	2		
Renfrew	97,634				1			
Total - Eastern	1,479,571		6		12	2		1
Durham Region	458,616				3			
East York	107,822				2			
Eggoicoke	328,718		1		8	1		
Haliburton-Kawartha	165,039				1			
Muskoka-Parry Sound	78,675							
North York	589,653				11	3		
Peel Region	852,526				15	2		1
Peterborough	123,448				1			
Scarborough	558,960		6	1	8			1
Simcoe County	329,865				3			
Toronto City	653,734	1			8	3		1
York City	146,534				3			
York Region	592,445		3	1	7	2		1
Total - Central East	4,986,035	1	10	2	70	11		4
Bruce, Grey-Owen Sound	153,312							
Egin-St. Thomas	79,159		1		2			
Huron	60,220		6					1
Chatham-Kent	109,650				1			
Lambton	128,975				2			
Middlesex-London	389,616		4	1	3	1		
Oxford	97,142							
Perth	72,106				2			
Windsor-Essex	350,329				6			1
Total - Southwest	1,440,509		11	1	16	1		2
Brant	114,564							
Haldimand-Norfolk Region	102,575				1			
Halton Region	339,875				2			
Hamilton-Wentworth	467,799		1		4	2		
Niagara Region	403,504				4			1
Waterloo Region	405,435		5		4	1		1
Wellington-Dufferin	217,052				5	1		
Total - Central West	2,050,804		6		20	4		2
April 2000	10,753,573	1	33	3	126	18		11
Total YTD 2000	-	18	162	34	614	97	2	53
** Total YTD 1999	-	13	437	2	657	118	7	44

* Data incomplete for the month of April from Hastings-Prince Edward health unit due to technical difficulties.

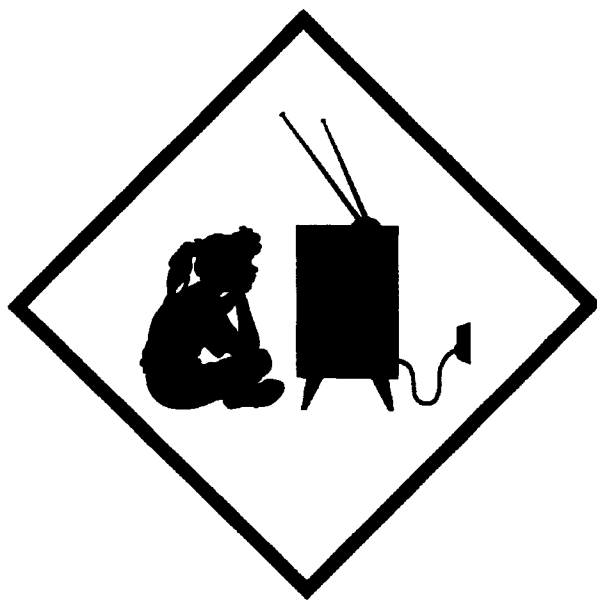
** Adjusted for deletions and late reports.

Summary of Reportable Diseases in April, 2000

Health Units by Region	1996 Population	Mumps	Pertussis	Rubella	Salmon.	Shigellosis	Syphilis (Prim/Sec)	VTEC
Algoma	123,953							1
North Bay	93,841				1			
Northwestern	80,235				1			
Porcupine	97,437				3			
Sudbury	201,154				1			1
Thunder Bay	161,187				2			
Timiskaming	38,847							
Total - Northern	796,654				8			2
Eastern Ontario	185,314							1
* Hastings-Prince Edward	143,790							
Kingston-Frontenac	175,568		4					
Leeds-Grenville	156,129		1		2			
Ottawa-Carleton	721,136		1		9	2		
Renfrew	97,634				1			
Total - Eastern	1,479,571		6		12	2		1
Durham Region	458,616				3			
East York	107,822				2			
Etobicoke	328,718		1		8	1		
Haliburton-Kawartha	165,039				1			
Muskoka-Parry Sound	78,675							
North York	589,653				11	3		
Peel Region	852,526				15	2		1
Peterborough	123,448				1			
Scarborough	558,960		6	1	8			1
Simcoe County	329,865				3			
Toronto City	653,734	1			8	3		1
York City	146,534				3			
York Region	592,445		3	1	7	2		1
Total - Central East	4,986,035	1	10	2	70	11		4
Bruce, Grey-Owen Sound	153,312							
Elgin-St. Thomas	79,159		1		2			
Huron	60,220		6					1
Chatham-Kent	109,650				1			
Lambton	128,975				2			
Middlesex-London	389,616		4	1	3	1		
Oxford	97,142							
Perth	72,106				2			
Windsor-Essex	350,329				6			1
Total - Southwest	1,440,509		11	1	16	1		2
Brant	114,564							
Haldimand-Norfolk Region	102,575				1			
Halton Region	339,875				2			
Hamilton-Wentworth	467,799		1		4	2		
Niagara Region	403,504				4			1
Waterloo Region	405,435		5		4	1		1
Wellington-Dufferin	217,052				5	1		
Total - Central West	2,050,804		6		20	4		2
April 2000	10,753,573	1	33	3	126	18		11
Total YTD 2000	-	18	162	34	614	97	2	53
** Total YTD 1999	-	13	437	2	657	118	7	44

* Data incomplete for the month of April from Hastings-Prince Edward health unit due to technical difficulties.

** Adjusted for deletions and late reports.



CAUTION: CHILDREN NOT AT PLAY.

Once, children spent their time running and playing. Today they're more likely to be found in front of the TV. Encourage children to be more active. Fighting heart disease may be as simple as child's play. To learn more, contact your nearest Heart and Stroke Foundation.

*You can help prevent heart disease
and stroke. We can tell you how.*



*improving
your odds
against
Canada's
#1 killer.*

Summary of Reportable Diseases

Quarterly Report

1st Quarter, 2000

Ministry of Health



Ontario

Summary of Reportable Diseases in Ontario -1st Quarter 2000

Health Units by Region	1996 Population	AIDS	Campylo.	Chicken- pox	Chlamydia	Enceph/ Meningitis	GAS	Gonorrhea
Algoma	123,953		5		34		1	2
North Bay	93,841		5		40			
Northwestern	80,235				51		2	10
Porcupine	97,437		3		36	1		
Sudbury	201,154		2		68	2	2	
Thunder Bay	161,187		8		96	2	1	7
Timiskaming	38,847		1		3			
Total - Northern	796,654		24		328	5	6	19
Eastern Ontario	185,314	1	6		19		1	1
Hastings-Prince Edward	143,790		3		10	1	1	
Kingston-Frontenac	175,568	1	6		59	2	4	4
Leeds-Grenville	156,129		4		8	2	3	1
Ottawa-Carleton	721,136	2	41		282	5	9	38
Renfrew	97,634		2		20		2	
Total - Eastern	1,479,571	4	62		398	10	20	44
Durham Region	458,616		15		139	6	3	31
East York	107,822		10		39		1	8
Etobicoke	328,718		29		131		1	25
Haliburton-Kawartha	165,039		3		7		1	
Muskoka-Parry Sound	78,675		2		6			
North York	589,653	1	47		139	4	3	46
Peel Region	852,526		65		242	12	4	68
Peterborough	123,448		5		38		12	5
Scarborough	558,960	1	25		350	6	5	91
Simcoe County	329,865		15		75	3	5	3
Toronto City	653,734	1	80		357	4	3	148
York City	146,534		11		73	1	3	31
York Region	592,445		64		146	5	6	17
Total - Central East	4,986,035	3	371		1,742	41	47	473
Bruce, Grey-Owen Sound	153,312		9		19	1	2	1
Egin-St. Thomas	79,159		1		10		2	2
Huron	60,220		17		8	1		1
Chatham-Kent	109,650		3		12			
Lambton	128,975		9		1		4	
Middlesex-London	389,616	1	21		171	10	5	27
Oxford	97,142					2	1	
Perth	72,106		8		3	2	4	
Windsor-Essex	350,329		24		112		4	13
Total - Southwest	1,440,509	1	92		336	16	22	44
Brant	114,564		6		53		2	5
Haldimand-Norfolk Region	102,575		7		8		6	1
Halton Region	339,875		19		34	4	4	2
Hamilton-Wentworth	467,799	2	16		170	1	3	28
Niagara Region	403,504		18		88	1	16	11
Waterloo Region	405,435	1	21		112	7	9	29
Wellington-Dufferin	217,052		15		37		3	3
Total - Central West	2,050,804	3	102		502	13	43	79
1st Quarter 2000	10,753,573	11	651	N/A	3,306	85	138	659
Total YTD 2000	-	11	651	N/A	3,306	85	138	659
** Total YTD 1999	-	28	766	N/A	3,415	82	84	457

** Adjusted for deletions and late reports.

Summary of Reportable Diseases in Ontario -1st Quarter 2000

Health Units by Region	1996 Population	PPNG	Hepatitis A	Hepatitis B	Hepatitis C	Hib	Influenza	Measles	Meningo- coccal
Algoma	123,953				32		18		
North Bay	93,841				10		28		
Northwestern	80,235		1	2	6		18		
Porcupine	97,437				13		75		
Sudbury	201,154				39		47		
Thunder Bay	161,187			1	30		14		
Timiskaming	38,847			1	5		5		
Total - Northern	796,654		1	4	135		205		
Eastern Ontario	185,314		1	2	6		34		
Hastings-Prince Edward	143,790				3		9		
Kingston-Frontenac	175,568	1		2	141	1	73		
Leeds-Grenville	156,129				35		32		
Ottawa-Carleton	721,136	8	6	5	125		143		
Renfrew	97,634		1	1	6		16		
Total - Eastern	1,479,571	9	8	10	316	1	307		
Durham Region	458,616	2	2				31		
East York	107,822	2		1	37		8		1
Etobicoke	328,718		1	2	52		17		
Haliburton-Kawartha	165,039		1	3	18		31		
Muskoka-Parry Sound	78,675		10				4		
North York	589,653	5	4		113		61		3
Peel Region	852,526	1	2		129		50		4
Peterborough	123,448		1		22		8		
Scarborough	558,960		4		89		40	2	3
Simcoe County	329,865		1		63		17		
Toronto City	653,734	20	4	5	72		49		2
York City	146,534	1			20		11		
York Region	592,445	3	2	4	55		42		3
Total - Central East	4,986,035	34	22	15	670		369	2	16
Bruce, Grey-Owen Sound	153,312			4	14		33		
Elgin-St. Thomas	79,159			2	8		15		
Huron	60,220				5		21		
Chatham-Kent	109,650				18		17		
Lambton	128,975						5		
Middlesex-London	389,616	4	2	1	97		94		3
Oxford	97,142				3				
Perth	72,106				4		41		1
Windsor-Essex	350,329			3	55		9		
Total - Southwest	1,440,509	4	2	10	204		235		4
Brant	114,564	2	1	1			65		1
Haldimand-Norfolk Region	102,575	1			8		9		
Halton Region	339,875		1		19		26		3
Hamilton-Wentworth	467,799	8	1	5	88		112		1
Niagara Region	403,504			2	99		68		2
Waterloo Region	405,435	2	1	10	51		71		1
Wellington-Dufferin	217,052			2	12		18		1
Total - Central West	2,050,804	13	4	20	277		369		9
1st Quarter 2000	10,753,573	60	37	59	1,597	1	1,485	2	29
Total YTD 2000	-	60	37	59	1,597	1	1,485	2	29
** Total YTD 1999	-	26	61	49	1,922	2	2,142		27

** Adjusted for deletions and late reports.

Summary of Reportable Diseases in Ontario -1st Quarter 2000

Health Units by Region	1996 Population	Mumps	Pertussis	Rubella	Salmon.	Shigellosis	Syphilis (Prim/Sec)	VTEC
Algoma	123,953	1	4		4			
North Bay	93,841				4			
Northwestern	80,235				1			
Porcupine	97,437				3			
Sudbury	201,154		1		3			
Thunder Bay	161,187				8			
Timiskaming	38,847							
Total - Northern	796,654	1	5		23			
Eastern Ontario	185,314		2	1	2	1		
Hastings-Prince Edward	143,790		4		2			
Kingston-Frontenac	175,568		2	1	9			
Leeds-Grenville	156,129	1	2	1	4			
Ottawa-Carleton	721,136	1	14	1	18	10		1
Renfrew	97,634				6			
Total - Eastern	1,479,571	2	24	4	41	11		1
Durham Region	458,616		6	1	10	1		
East York	107,822				2	1	1	2
Etobicoke	328,718		1		14	5		1
Haliburton-Kawartha	165,039	1	4	1	5	1		
Muskoka-Parry Sound	78,675		1					
North York	589,653	3	5	1	37	8		2
Peel Region	852,526	3	3	1	60	10		1
Peterborough	123,448		7	1	5	2		4
Scarborough	558,960		4	1	31	3		1
Simcoe County	329,865	1	4	1	10	3		2
Toronto City	653,734		5	1	29	9	1	
York City	146,534				7	2		
York Region	592,445	2	13	3	53	6		4
Total - Central East	4,986,035	10	53	11	263	51	2	17
Bruce, Grey-Owen Sound	153,312		5	1	27	1		
Egin-St. Thomas	79,159		1		2			
Huron	60,220		8	8	5			3
Chatham-Kent	109,650		1		2	1		
Lambton	128,975		1	1	1			
Middlesex-London	389,616	3	7	2	18	4		2
Oxford	97,142	1						
Perth	72,106				5			1
Windsor-Essex	350,329		1		14	1		1
Total - Southwest	1,440,509	4	24	12	74	7		7
Brant	114,564				2			
Haldimand-Norfolk Region	102,575				4			
Halton Region	339,875		3		12	2		2
Hamilton-Wentworth	467,799		2	1	15			3
Niagara Region	403,504		3	1	13	2		10
Waterloo Region	405,435		13	3	23	5		2
Wellington-Dufferin	217,052		2	1	18	1		
Total - Central West	2,050,804		23	6	87	10		17
1st Quarter 2000	10,753,573	17	129	33	488	79	2	42
Total YTD 2000	-	17	129	33	488	79	2	42
** Total YTD 1999	-	8	355	2	496	85	4	30

** Adjusted for deletions and late reports.

Summary of Rabies Quarterly Report 2nd Quarter, 2000

Ministry of Health



Ontario

Animal Rabies Report: April to June 2000

Animal Type County or Region	Fox		Raccoon		Skunk		Other Wildlife		Bat		Dog		Cat		Livestock		Totals	
	#	Cumulative	#	Cumulative	#	Cumulative	#	Cumulative	#	Cumulative	#	Cumulative	#	Cumulative	#	Cumulative	#	Cumulative
		00 99		00 99		00 99		00 99		00 99		00 99		00 99		00 99		00 99
Stormont																	0	0
Dundas																	0	0
Glengarry																	0	0
Prescott																	0	0
Russell																	0	0
Ottawa-Carleton									3	3	1						3	3
Renfrew																	0	0
Lanark																	0	0
Greenville			6	18													6	18
Leeds			7	7													7	7
Frontenac				4					1	2							1	6
Lennox & Addington																	0	0
Hastings																	0	0
Prince Edward																	0	0
Northumberland																	0	0
Victoria																	0	0
Haliburton																	0	0
Peterborough				1													0	0
Durham																	0	0
York Region																	0	0
Toronto																	0	0
Simcoe																	0	0

Animal Rabies Report: April to June 2000

Animal Type County or Region	Fox		Raccoon		Skunk		Other Wildlife		Bat		Dog		Cat		Livestock		Totals	
	#	Cumulative	#	Cumulative	#	Cumulative	#	Cumulative	#	Cumulative	#	Cumulative	#	Cumulative	#	Cumulative	#	Cumulative
Peel																	0	0
Halton					1	1											1	1
Dufferin					3	4	1								1	3	3	5
Wellington	1	1				1	3				1				1		0	3
Waterloo		1					2										0	0
Perth					1	1	1										1	1
Grey					2	11	7								1	1	4	3
Bruce					2	5	1								1	2	1	3
Huron					2	3											2	3
Wentworth																	0	0
Haldimand-Norfolk										1							0	0
Brant									1	1							1	1
Niagara																	0	0
Elgin																	0	0
Oxford																	0	0
Middlesex																	0	0
Lambton																	0	0
Kent																	0	0
Essex																	0	0

Animal Rabies Report: April to June 2000

Animal Type County or Region	Fox		Raccoon		Skunk		Other Wildlife		Bat		Dog		Cat		Livestock		Totals	
	Cumulative		Cumulative		Cumulative		Cumulative		Cumulative		Cumulative		Cumulative		Cumulative		Cumulative	
	#	00 99	#	00 99	#	00 99	#	00 99	#	00 99	#	00 99	#	00 99	#	00 99	#	00 99
Muskoka																	0	0
Parry Sound																	0	0
Nipissing																	0	0
Sudbury																	0	0
Cochrane	3	4															3	4
Timiskaming																	0	0
Algoma																	0	0
Thunder Bay																	0	0
Rainy River																	0	0
Kenora	2	2															2	2
Eastern			13	29					4	5	1						17	34
Central				1		1				1							0	3
Western	1	2			10	25	15		1	1		1			2	5	13	26
Southern									1	1	1						1	1
Northern	5	6															5	6
TOTALS	5	7	2	13	29	1	10	25	16	0	0	0	1	0	0	2	5	73

Notes for this quarter: Livestock were 1 horse and 1 cow.

Bats were all big brown bats.

The raccoon in Central region in 1999 was infected with arctic fox strain rabies.