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Public Health Branch
Ministry of Health and Long-Term Care
8th Floor, 5700 Yonge Street,
Toronto, Ontario, M2M 4K5
Telephone (416) 327-7090
Facsimile (416) 314-7078
Email: Tracy.Collura@moh.gov.on.ca

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.

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WILDLIFE MANAGEMENT AGENCIES SHOULD PARTICIPATE IN RABIES CONTROL

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Rabies in North America is spread by wild terrestrial mammals and bats but has its major visible and financial impacts on public health, human society, and agriculture. As a result, federal, state, provincial, and municipal authorities concerned with human health, the livestock industry, companion animals and wildlife each have partial jurisdiction, but no single agency has full responsibility to control rabies in wildlife. This creates the potential for bureaucratic gridlock to hinder establishing effective control programs. In the process it exposes the fragility of interdepartmental cooperation where substantial budget is involved. More seriously, the subject is sufficiently complex that no one group understands the full extent of both problems and solutions faced by other sectors. The exact division of responsibility for rabies varies from state to state and province to province, but the pattern remains similar. After more than a decade of shrinking budgets, it is too easy for senior officials in each department to declare rabies control someone else's problem, with the result that

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action is delayed. Control of rabies by vaccinating wildlife populations is very expensive in relation to most budgets for wildlife management and the potential savings are felt mostly by the agencies which provide or fund post-exposure treatment of humans and investigate potential human and companion animal exposures to rabies. Whether these represent savings to governments depends on how much state or provincial funding is spent toward exposure investigations and treatment of humans, and who pays for laboratory diagnosis of rabies in animals, as well as investigations of the origin of rabies virus samples. Thus, it is hard for wildlife specialists to assess the extent of the problem while wrestling with the cost of the solution.

Ontario has a particular interest in wildlife rabies because the southern parts of the province (100,000 km^2) annually reported more cases of animal rabies than any comparable area in North America from 1958 to 1991, except 1960 (MacInnes 1987, Tabel et al. 1974). Total cases of laboratory confirmed rabies ran between 25% and 50% of the total in the United States In 1992, number of reported cases in New York exceeded the Ontario total for the first time in over 30 years. The total in New York that year was the greatest number of cases ever reported in one year by a single state in the U.S., but it was below the mean for Ontario from 1970 to 1988, and was exceeded by subsequent yearly totals in New York itself. Although research toward oral vaccination of wildlife has a long history in the U.S. (Winkler 1992), efforts to mount actual control programs only began in 1995 in Texas (Fearneyhough et al. 1998). By contrast, oral vaccination of foxes has much reduced rabies in several countries of western Europe (Müller 1992, 1997; Aubert et al. 1994; Schlüter and Müller 1995, Stöhr and Meslin 1996). In a 30,000-km2 part of Ontario, the arctic fox strain of rabies was eliminated between 1989 and 1996 by application of oral vaccination.

Bats pose a special problem with rabies. In recent years, most human fatalities to rabies in the U.S. have been to virus of bat origin (Rupprecht et al. 1995, 1996). Several bat species carry their own variants of rabies virus (Baer and Smith 1991), yet prevalence of infected bats is very low in the wild. Bats are obviously not susceptible to the sorts of oral vaccination practised on terrestrial carnivores, and as those techniques are the main focus of this paper, rabies in bats will not be discussed in detail. Because bats are subject to important conservation programs and considerations, rabies in bats also cannot be ignored by wildlife agencies.

The administrative problem of starting wildlife rabies control was faced in a cooperative and constructive way in Ontario over 25 years ago. An interdepartmental committee within the provincial government decided to find solutions regardless of whose department held jurisdiction over which part of the problem. Funding was raised by a joint approach to government for new money, rather than by extracting shares from each departmental budget. That occurred during a unique window of opportunity.

Our objective is to show that wildlife agencies have important, but not exclusive, roles to play in control of rabies which is spread by terrestrial wildlife. Those functions will be applied by other departments if the wildlife agency stays on the sidelines, and there are serious questions of philosophy and efficient use of government funds if these wheels must be reinvented. Funding for rabies control should not be taken from current wildlife budgets.

Impacts of Rabies

Impacts on wildlife and wildlife management

Rabies is spread in terrestrial systems by skunks (*Mephitis mephitis and Spilogale spp.*) in much of the central U.S., and in northern California; by raccoons (*Procyon lotor*) in the east, from Florida and Alabama on the south to Maine and Ohio across the northern U.S.; by red foxes (*Vulpes vulpes*) in Ontario and Quebec, and sporadically northern New York, Vermont, New Hampshire and Maine; by arctic (*Alopex lagopus*) and red foxes in northern Canada and Alaska; by gray foxes (*Urocyon cinereoargentatus*) in south-central Texas and in Arizona (Rohde et al. 1997, Rupprecht et al. 1996, Smith and Baer 1988), and by coyotes (*Canis latrans*) in southern Texas (Rohde et al. 1997). Additional virus variants occur in bats but do not become epizootic or enzootic in terrestrial mammals (Baer and Smith 1991).

Rabies is only one of several diseases which can influence dynamics of its vector populations and there is no indication that it has fundamentally more serious effects on population levels than several other conditions. Although the cyclic nature of rabies where it is enzootic suggests that it causes significant changes in numbers of animals, direct evidence is fragmentary

(reviewed by MacInnes 1987). In Europe and Ontario, an increase in fox densities coincided with reduction of rabies by oral vaccination, but was found to result from ecological changes as much or more than from rabies control; increases occurred at the same times in regions which had no rabies (Müller et al. 1995).

Canine distemper may have as large or larger impacts on raccoon populations than rabies, but where measured explicitly, during one outbreak it had only small effects (Schubert et al. 1998). Parvoviruses, infectious canine hepatitis, and other viral diseases have potential to affect severely fox, skunk, and raccoon populations (Addison et al. 1987). Sarcoptic mange (*Sarcoptes scabei*) also can change fox and coyote numbers (Lindström 1992).

Raccoons, foxes, and skunks are included in most furbearer management programs in North America but are usually not the principal fur species. Fur programs generally have less priority, and lesser budgets, than game management, with reductions continuing as anti-fur forces apply more pressure. Public pressure to eliminate traps is important. Fur royalties bring less revenue than hunting licenses. The near collapse of fur markets in the late 1980s further lowered the priority for furbearer programs in most jurisdictions. Rabies control would, simply, not be undertaken for the sake of the wild species which are most affected by it. Certainly the economic value of these species would not justify the costs of rabies control.

Most wildlife agencies have some mandate to protect public safety, but because humans can be protected against rabies by post-exposure vaccination, direct intervention in the wild is not essential. Treating the problem at its roots, by eliminating rabies from the wildlife vector populations, ultimately will save money for governments and for society, especially pet owners. Rabies also can complicate management of nuisance animal complaints and certainly affects policy regarding rehabilitation of wildlife. Rabies has strained relations between wildlife rehabilitators and state wildlife departments throughout the regions affected by raccoon rabies in the eastern U.S. since 1977.

The abrupt spread of raccoon rabies from Florida, Alabama, and Georgia to West Virginia in 1977 may have resulted from private hunting clubs' efforts to restock their properties (Nettles et al. 1979). Since that time, some rapid advances of the raccoon rabies front are suspected to have resulted from translocation of raccoons by nuisance animal personnel, rehabilitators, or private landowners, but that has never been proven. The movement of the raccoon variant of rabies through the mid-Atlantic states appears to have greatly lowered the interest of hunters in taking raccoons. While that may initially have been due to reductions in raccoon numbers as the first wave of disease came through, interest appears to have remained low despite some recovery of raccoon numbers.

Impacts on the human health care system

In Ontario during 1980B89, an average of 2,150 people/year received post-exposure treatment due to exposure to a rabid animal. In 1988, the average cost of 1 post-exposure treatment series was $660CDN and currently that has risen to about $800CDN. Comparable costs in the USA ranged from $586US to $1,137US (Uhaa et al. 1992) although recent figures from New York are from $1,500US to $2,800US. In Ontario, between 15,000 and 25,000 animal bite contacts were investigated annually by public health inspectors to evaluate the need for treatment. The average cost of a single investigation was $100CDN (in 1988), including salary and administrative costs. Additional investigations were carried out by Canadian Food Inspection Agency (CFIA, formerly Agriculture Canada) staff (Table 1). Animal control officers, especially in larger cities, also were involved in potential rabies cases. Costs that rabies added to animal control expenditures have proven impossible to isolate.

Costs to health care in the U.S. have been harder to isolate. Kreindel et al. (1998) estimated that the use of Post-exposure Prophylaxis (PEP) in Massachussets increased from 1.7/100,000 in 1991 to 45/100,000 in 1995, as a direct result of the invasion by raccoon rabies. Total health care charges lay between $2.4 and $6.4 million (US), but that did not include costs of investigations, etc., which in Ontario cost more than PEP itself (Table 1). There is much variation within the U.S. on who pays for what. For example, in New York, post-exposure treatment may be administered by county health departments, which will be reimbursed by the state Department of Health. That has lead to as many as 3,400 state-assisted treatments in one year (1996), at an average cost of $1,800.00 per treatment. Because of state support, the numbers are easily assembled, with

Table 1

SOURCE OF COST	AGENCY	AVERAGE ANNUAL COST ($THOUSANDS, CDN)	POTENTIAL SAVINGS IF RABIES IS ELIMINATED. ($THOUSANDS, CDN)
Human post-exposure treatments	Ontario Ministry of Health	1,350	1,000
Animal bite investigations	County Health Units	2,000	1,000
	Canadian Food Inspecion Agency	400	300
Nuisance animal control	Municipalities	27	27
Communications	Ontario Ministry of Health	200	100
	Canadian Food Inspection Agency	100	50
Collection and diagnosis of suspected rabid animals	Canadian Food Inspection Agency	1,200	400
Livestock compensation	Ontario Ministry of Agriculture and Food, Canadian Food Inspection Agency	271	271
Wildife research and control	Ontario Ministry of Natural resources	2,500	1,500
Pet Vaccination	Private Citizens	50,000	none
TOTAL		58,048	4,648

the caveat that, if an individual's treatment costs are wholly covered by health insurance, the incident will not be reported. In Vermont, the state may require post-exposure treatment, but does not assist financially. Thus, true costs to the state economy are not derived easily and the difference between costs to the overall economy and costs to the state budget may be very large.

Rabies caused an average of 1.9 human deaths/year in the U.S. from 1976 to 1995. Costs of protecting humans was estimated to exceed $230 million (US) annually, although a large proportion of that went to vaccinating dogs and cats (Rupprecht et al. 1995, Uhaa et al. 1992). If no post-exposure treatment were administered to humans, annual human mortality would increase, perhaps to about 100 to 200/year [estimate derived from data in Fishbein (1991)]. Given that there is an effective prevention system, to allow such a system to go unused because of expense would be unacceptable to the public. Our point is that rabiesBhuman interaction has many dimensions, so the decision of whether or not to embark on control of rabies in wildlife requires complex arguments and rigorous reasoning. No single government agency has the full perspective for rabies control, from human and domestic/companion animal health to management of wildlife populations, so cooperation is essential.

Impacts on agriculture

In Canada and some U.S. states, compensation is paid for livestock which died of rabies. Ontario pays 60% of a federal-provincial shared program (Table 1). That

program was deemed more cost-effective than a government-supported scheme to vaccinate all cattle against rabies.

Additional costs to the livestock industry are often discussed but not estimated adequately. In Canada, when a cow dies of rabies, the rest of the herd is quarantined for 60 days. Animals may not be shipped off the farm during quarantine, but milk can be sold. In a beef operation, cash flow is interrupted, additional feed is consumed, and animals held too long may fatten too much and bring lower prices when sold. During 1991, 326 farms with 15,270 animals were subject to quarantine in Ontario, yet that year had a lesser total of rabies cases than any of the 20 previous years.

Costs for public protection

In Ontario, the federal and provincial governments spend substantial amounts annually to educate the public about rabies (Table 1). The major thrust of this is to encourage vaccination of dogs and cats and to warn people to avoid foxes, skunks, and bats, which are the principal wild vectors of rabies. Free vaccination clinics for dogs and cats were provided formerly by Agriculture Canada, but since 1985 these have been replaced by low-cost clinics organized by local veterinarians or local (county) Health Units.

The Canadian Food Inspection Agency (CFIA, formerly Agriculture and AgriFood Canada) is responsible for diagnosis of rabies in animals throughout Canada. There is a major diagnostic laboratory at Nepean, Ontario, that services most of Ontario and all the other eastern provinces of Canada. A second laboratory, in Lethbridge, Alberta, services northwestern Ontario and all the western provinces. In addition, CFIA maintains a network of district offices, one of whose responsibilities is investigation of potential animal exposures to rabies and collection and shipping of specimens to be submitted for diagnosis (Table 1).

Costs to the public

The largest single cost of rabies is what private citizens pay for regular vaccination of their dogs and cats. Precise data are not available, but we estimate that there are 800,000 dogs (1/10 humans), and probably somewhat more cats in southern Ontario. This gives an estimate of up to $50,000,000CDN spent annually to vaccinate pets, if an average vaccination costs $40.00CDN. A comparable figure was derived by Uhaa et al. (1992) for New Jersey. However, vaccination of pets will continue to be recommended, even if rabies is eliminated from terrestrial wildlife. Migratory bats carry rabies throughout North America (Baer and Smith 1992) and companion animals are the principal rabies contacts for humans (Honig 1985), so continued vaccination of pets will be necessary. Therefore, lowering the costs of pet vaccination should not be claimed as a benefit of control of rabies among terrestrial vectors.

Social impacts

The Ontario program to control wildlife rabies has received a great deal of public support because of the fear of rabies and the abundant publicity generated by rabies. In the perspective of modern wildlife agencies, this is an area supported by urban and rural residents.

Rabies causes social stress. The disease is almost always fatal to humans once clinical signs develop and some modes of transmission appear mysterious; both facts cause great fear of the disease. Roughly half of recent human deaths from rabies in the U.S. involved no known exposure to a rabid animal (Rupprecht et al. 1995). Older vaccines for humans involved 14 to 21 intradermal injections and often provoked very painful reactions. Many people still fear the treatment despite the fact that the modern treatment (since 1981) is much more benign. A major source of fear is uncertainty; before vaccination was available for humans, even a bite from a known rabid animal did not guarantee that infection and death would follow, yet persons who were not bitten sometimes developed rabies (Kaplan et al. 1986). A person who was bitten might not develop the disease for several months. The horrific symptoms of rabies, involving mind as well as body and the feeling of being defenceless against wild animals in the vicious attack mode stimulated by rabies contributed to the hysteria surrounding the disease. All these factors combined to make average North Americans very fearful of rabies.

When a county in Ontario was suffering a rabies outbreak, there was a lot of media coverage of the disease, including reminders from local health and agricultural authorities about pet vaccination. It also generated official requests from township councils that the Ontario Ministry of Natural Resources (OMNR) do something to eliminate foxes. Local governments also requested that OMNR allow restoration of fox and

coyote bounties paid locally, to alleviate the rabies problem, despite the lack of evidence that bounties changed rabies levels (MacInnes 1988). Public perceptions about wildlife are often short on facts and based on oversimplification (e.g. Phillips et al. 1998, Woolf and Roseberry 1998).

During the past 3 decades in Ontario there have been several major rabies incidents, each requiring treatment of 50 or more humans. Examples include:

1) in 1982, school children found a litter of kittens in an unused barn next to the school playground. These were taken into the school, and subsequently adopted by families. After 2 kittens died of rabies, over 150 people received post-exposure treatment;
2) in 1983, at a children's summer camp, one horse died of unknown causes during the last week of July. When a second horse died during the first week of August, rabies was diagnosed. Re-examination of the first animal also indicated rabies. There was a major turnover of campers at the end of July, so authorities had to trace children who were on holiday in Europe, etc. Over 60 campers were treated;
3) more than 200 residents of 2 nursing homes received post-exposure treatment, in 2 unrelated incidents in 1992. In both cases, puppies which had been adopted from local animal shelters and used in pet therapy programs became rabid after visiting a nursing home;
4) in 1993, a horse died of rabies 3 days after it was sold at a public auction. Over 300 people might have touched it. In each of these cases, authorities had to enlist the media to get possibly affected persons to come forward. Similar examples of mass exposure have occurred in New York (2 in 1996) and New Hampshire (1995) in recent years.

Although each of these cases involved a rabid domestic or companion animal, the ultimate source of rabies was red fox (in Ontario), or raccoon (New York and New Hampshire). Rabies is a matter of great public concern and the subject of much contact with politicians at all levels.

One measure of the impact of the publicity is that in 1985, when there was a rabies outbreak on the northern outskirts of Toronto, one of the major city newspapers telephoned to ask if they should advise the public to stay away from Provincial Parks and Conservation Areas during the Labor Day holiday, because of the risk of rabies. The reply was that the risk of being involved in a car accident while travelling to and from the park was greater than that of meeting a rabid animal, despite the outbreak. In fact, in that year, the number of post-exposure treatments was roughly twice the number of people killed in highway accidents.

Wildlife rabies control

History in Ontario

The arctic fox strain of rabies invaded Ontario in 1954B56 (Johnston and Beauregard 1969, Tabel et al. 1974). A decade later, when case loads were still increasing, it became clear that rabies was likely to persist in the agricultural parts of southern Ontario. In most other areas subject to the original invasion, it was dying out naturally (Tabel et al. 1974, MacInnes 1987, Lagacé 1998). In 1966, an Interdepartmental Committee on Rabies was formed, with representatives from the Departments of Health, Agriculture, and Lands and Forests (which in 1972 became OMNR). Its mandate was to seek solutions to the rabies problem and to coordinate the efforts of the 3 departments. Coincident with formation of this group, a World Health Organization (WHO) expert committee recommended that vaccination, preferably oral vaccination by means of baits, was the most promising way to reduce rabies in the wild (WHO unpublished report, 1966, cited by Winkler 1992). The need for Ontario to be proactive was intensified in 1967 by the death of a 5-year-old girl from rabies, after being attacked by her pet kitten.

The Interdepartmental Committee was succeeded by the Rabies Advisory Committee, which had broader membership. In addition to adding the federal agency most concerned with rabies, the Committee mandate required members from outside government, who came from academia and industry. Whether it was this broad membership, or if the personalities involved were the key, this Committee gave effective leadership and direction, balancing between a narrow target, the elimination of rabies, and the breadth of research needed to design an effective program, while ensuring that all the elements were acceptably safe for the public.

Wildlife Science in the Rabies Control Program

In most states and provinces the expertise to develop baits and test them in the field and to investigate relevant aspects of behavior and population dynamics of the vector species resides within the wildlife agency or among university staff whose orientation is toward wildlife. Further, such people usually have contact with experts in related subjects. Most of the leaders of wildlife vaccination programs in Europe have been veterinarians or at least were employed by the equivalent of the domestic animal health or human public health groups found in most state and provincial governments. The Rabies Research Unit of the OMNR has played the lead role in many aspects of research leading to a successful vaccine-bait program and we believe the program benefited from this association with wildlife specialists, compared to European programs.

The Ontario program developed 2 distinct branches in 1984, when it became evident that the oral vaccine for foxes was not effective in skunks. Skunks were the most important species spreading rabies in Ontario cities (Rosatte et al. 1992a). That led to development of an urban rabies program based on TrapBVaccinateBRelease for skunks and raccoons. In addition to the rabies control aspects, that effort yielded extensive data on urban wildlife (Rosatte et al. 1992b), and raised the profile of OMNR among urban residents.

The rabies program covered many disciplines of science and technology. The design of an attractive bait was constrained by requirements for vaccine presentation, need for large-scale mass production, and proposed methods for delivery. The Ontario program benefited greatly from close association with other members of the OMNR wildlife research group, but several contracts with industry and universities also were necessary, on subjects ranging from virology, serology, and vaccine development, through design of production and distribution machinery to make experimental baits practical, to computer-based mapping designed to provide disciplined, uniform, and recordable distribution of baits over large areas (MacInnes et al. 1992). Close contact with European efforts to combat fox rabies during the 1980s suggested that greater hands-on knowledge of fox biology, plus an experimental approach following recommendations by Romesburg (1981) and Macnab (1983) would enable the Ontario team to design a cheaper yet effective vaccination program. This was truly a multi-team effort, including teams in vaccine development and serology, manufacturing, wildlife biology, the staff of the provincial air service, a university GIS laboratory, and industrial consultants in packaging machinery and robotics (MacInnes et al. 1992). Individuals often served on 2 teams.

Workshops held at major conferences on rabies, centered on developing better understanding of the behaviour of rabies in the wild, have asked repeatedly for more and better data on the basic population dynamics of the principal rabies vector species. Although this should be available from wildlife specialists, much of the desired information has never been collected over long periods, and on a landscape scale, for foxes, raccoons and skunks. There is especially lack of appreciation of the importance to rabies and rabies control of natural fluctuations of animal density and of rates of increase and decrease. If rabies control is approached seriously, there will be opportunity for active research on the dynamics of affected species.

Computer simulation and wildlife biology

Computer simulation has been used in Europe and North America to examine the feasibility of rabies control by vaccination (reviewed by Barlow 1996). Coyne et al. (1988) described a simple deterministic model whose results indicated that very elevated levels of vaccination might be required to control raccoon rabies in the eastern U.S.. However, the biology underlying that model was very weak and the conclusions were therefore suspect. The derivation of a single rate of increase for raccoons was far removed from the real world of field biology and the lack of consideration of fluctuations in non-rabies sources of mortality was especially problematic.

A model prepared specifically for the Ontario fox rabies situation was spatial and stochastic, and required extensive field data on fox biology and movements (Voigt et al. 1985). That model predicted that if 60% of a fox population were vaccinated annually, the probability of eliminating rabies was 0.70/attempt. Because the Coyne model was deterministic, it could only predict that control would succeed or fail. Only in a stochastic environment was it possible to predict success in some, but not all, trials with the same input parameters. Assessment of which model was more

valid required extensive knowledge of wildlife population biology. We believe the Ontario model, applied to raccoons, would indicate that rabies could be eliminated from raccoon populations at substantially lesser population vaccination rates than those predicted by the Coyne model. Examining the simple models from an ecological perspective revealed that control by vaccination may be practical and achievable under the right circumstances (Barlow 1996). On the other hand, Tischendorf et al. (1998), using a spatial and stochastic model, showed that it was possible to model the persistence of rabies at low levels in the face of high levels of vaccination, a circumstance which seems to be occurring in parts of Germany.

The alternative to vaccination of wildlife vectors is to reduce vector populations to a low enough level that rabies transmission will cease. That has never worked for long terms (MacInnes 1988, Müller 1997) and is even more expensive than vaccination. If it could be attempted in North America in the 1990s, in the face of the animal welfare and animal rights movements, is another question. Methods to make such reductions, without damage to other species, also are suspect and controversial. The Coyne model indicated that culling at modest levels might appreciably enhance success of oral vaccination, but we believe that is an artifact of the equation which drives that particular model.

Cost of controlling rabies

An experiment to control rabies on 30,000 km^2 in eastern Ontario extended from 1989 to 1995. By the end of 1993, rabies was almost absent from the area. No baits were dropped from 1996 through 1999, except in 1997, when the only baits deployed were to prevent possible reinvasion from east of the original study area. A single rabid skunk was encountered in November 1996, but no further cases were observed after that. Elimination of rabies was accomplished by dropping baits at a target rate of 20/km^2, with flight lines spaced one to 2 km apart, over the whole area, in early October each year (MacInnes 1988). The cost has been $23.00B$28.00CDN/km^2 to buy and distribute baits. There are additional costs for monitoring success, bringing the estimated annual expenditure to $900,000CDN. We are now well into a program to eliminate the Arctic fox variant of rabies from all of southern Ontario by 2003. Baiting will end sooner if rabies disappears earlier than predicted. In France, 2 B 10 bait campaigns (done spring and fall, and sometimes in summer as well) were sufficient to eliminate fox rabies (Aubert et al. 1994). As indicated in Table 1, elimination of rabies will significantly reduce the overall costs of rabies to the Ontario and federal governments. Assessment of the true cost/benefit picture requires a long-term view. Rabies control is cheaper, annually, than dealing with an ongoing enzootic situation. Note that all the costs estimated in table 1 cover fox and bat rabies only. Although raccoon rabies entered the province in 1999, and we are already taking countermeasures, as well as conducting research, all costs associated with raccoon rabies were omitted from this analysis. The investment in research to get us to real control has exceeded $25 million (CDN) for fox rabies, spread over 1967B1988. It will take several years after the elimination of that strain to write off that investment. However, agencies now considering getting into rabies control can benefit from Canadian, U.S., and European research, so their costs will be much lower for future programs.

Costs of controlling raccoon rabies in the eastern U.S. cannot be estimated yet but are likely to be 6 to 10 times greater per unit area than the cost to eliminate fox rabies from Ontario. The best density of baits necessary to immunize enough raccoons to stop the spread of rabies has not yet been determined experimentally. Costs recommended for New Jersey included a "safe" level of baiting to ensure success (Uhaa et al. 1992). Our experience in Ontario suggests that actual bait numbers may be substantially less, but that will require more experimental verification. Raccoons occur at about 10 times the density of foxes in southern Ontario and this disparity is probably greater further south. Even the most optimistic estimates are that 50 B 75 vaccine-baits/km2 will be required and the vaccine-baits for raccoons cost about twice as much as Ontario fox baits, due to greater cost of vaccine.

Attitudes of Wildlife Agencies

North American wildlife agencies, with the notable exceptions of Ontario and New Jersey (Roscoe et al. 1998), have distanced themselves from oral vaccination and other means to control rabies in wildlife. The principal reason is financial, as agency budgets have undergone at least a decade of shrinkage, and oral vaccination is very expensive by wildlife standards. Another reason is either that the public health agency

did not invite participation or asked for resources that were not immediately available.

Throughout the eastern U.S., raccoons are viewed principally as a nuisance species, especially since the severe decline in the market for their fur since about 1985. Their possible involvement in declines of migrant bird populations is controversial, but causes additional concern (Keyser et al. 1998, Terborgh 1992). Private conversations with senior officials of several state wildlife agencies indicated that rabies could possibly be viewed as a positive force, as it was believed to reduce raccoon numbers. This was cited by at least 5 agencies as a major consideration in deciding whether to support rabies control. We believe that is a short-sighted and too-passive view of the problem. It also is a weak use of questionable facts to conceal lack of resources for proactive approaches. Unfortunately, putting the most positive spin on a wildlife situation is often the only response available.

If raccoon numbers are really restricted to lower peaks between rabies outbreaks, after rabies has become enzootic, has never been established. However, numbers are certainly reduced during a rabies event, especially the first incursion of the raccoon variant of rabies into a naive raccoon population. If disease is a way of reducing nuisance problems, it is surely preferable to encourage diseases less dangerous to humans than rabies?

The literature from Europe suggested that fox populations rose coincident to control of rabies, but more recent observations indicated that fox numbers rose concurrently in Britain and Scandinavia, both rabies-free areas. Unfortunately, these estimates are from verbal presentations, and no published data are available. In Ontario, fox numbers rose just before our rabies control program began, but again these are anecdotal reports from trappers, without numerical data. Although many trappers and OMNR staff noted that mange became a major problem as rabies case numbers declined, similar and concurrent outbreaks of mange were reported in Ohio and Michigan as well as in parts of Ontario where there never was rabies. Thus, rabies control may be used as an excuse for inadequate knowledge of the true situation in wildlife populations.

Rabies control in Ontario has produced very large samples of biological statistics about raccoons (see, for example, Rosatte et al. 1992b). This has been useful to the rabies control community, as data on density and on the extent of raccoon dispersal are very important to planning vaccination barriers to contain further spread of rabies.

A more fundamental subject, discussed below, is the whole question of agency intervention, on a large scale, into the dynamics of natural communities. One may question if urban and suburban raccoon populations represent undisturbed natural communities and even if most raccoons, thriving in agricultural countryside, are deriving large benefits from their close association with human activities.

Discussion

Control of rabies in wildlife populations, ultimately to benefit people (public health) and agricultural business has raised controversy. Before any wildlife agency gets involved seriously in such a venture several questions must be answered. Will the control work? Under what circumstances? Will it be worth the cost? Will it raise other issues, or conflict with other wildlife management? In Ontario, complete elimination of fox rabies has been accomplished on an experimental area and progress toward elimination from the whole enzootic zone is very encouraging.

What are the other issues? Regan (1996:1) asked: "Whom do public sector wildlife biologists serve? Wildlife resources? The public? Both? If so, which receives precedence in decision making?" He also indicated that the public is really a set of many customer groups and individuals. Rabies control certainly involves a non-traditional public for wildlife agencies, because it concerns public health much more than the wildlife-using public. While the public health agency is free to hire its own wildlife expert(s), we believe that the overall public good will be better served if existing wildlife professionals apply their expertise to the project. However, because any such enterprise involves individual personalities, not every project will fulfill that prediction.

Bruggemann (1992) produced a very negative opinion concerning vaccination of raccoons in the eastern U.S.. That was based on 3 principal ideas:

1) current methods to prevent rabies in humans are working adequately,

2) a computer simulation study indicated that oral vaccination of raccoons was unlikely to work (Coyne et al. 1989) and, therefore,
3) vaccination on a large scale constitutes unnecessary intervention in a wildlife population.

An additional complication is that the current vaccine of choice for raccoons is a recombinant virus (Rupprecht et al. 1987) and there are still reservations about the release of man-made synthetic organisms into the environment.

We have shown in Ontario that complete elimination of fox rabies is feasible, and the long-term costs are significantly less than those for continuing human treatments indefinitely. More experiments are needed before the same can be said for raccoon rabies.

Bruggeman's (1992) choice of the Coyne model to illustrate a point is particularly ironic. Starting from a biological perspective [National Audubon Society (Bruggeman 1992)], is it not questionable to use a model whose underlying biology is so weak? That would be particularly serious for a wildlife agency, as one of the simulations indicates that culling will raise the success rate of oral vaccination. Given the negative attitudes of senior state wildlife personnel, it might be attractive to cite this paper, despite its weaknesses.

Bruggeman's (1992) third point is worthy of serious consideration. Is intervention in a natural system, for the benefit of human health, a good idea? There will be many opinions on this subject and points of view will change with circumstances. For example, there is concern in Ontario that, if rabies is controlled, fox populations will explode, to the detriment of more valued species such as ruffed grouse (Bonasa umbellus). However, there were substantial grouse numbers before invasion of rabies in 1956 and many factors in addition to rabies influence the dynamics of fox numbers. Rabies reached record levels in Ontario during the 1980s, yet by the end of that decade foxes were anecdotally more abundant than in the 1970s as they were also in Europe (Müller et al. 1995, Müller 1997). In the 1990s foxes were much more conspicuous than in previous decades, but by 1997, sarcoptic mange was reported widely by trappers, and trappers stated that catch per trap night dropped sharply. There are, unfortunately, no data to allow quantitative examination of the fluctuations in fox numbers. The 1980s and 1990s had milder winters, with much less snow, than the 1970s. Collapse of the fur market during the late 1980s also might have contributed to increased fox numbers, but it also destroyed the most available data to quantify fox numbers. The whole question of the influence of disease, among other factors, on wildlife numbers is complex and far from fully elucidated.

Solutions to these issues will vary with the proponent's point of view. Knowledge of fox rabies, or raccoon rabies, and their interactions related to population dynamics is inadequate to address the questions without hard data.

If wildlife managers do not participate in the elimination of rabies from wildlife populations, are they satisfied to do nothing while teams drawn from agriculture and public health, but lacking direct experience with wildlife, intervene in wildlife ecosystems? Is it not more productive and constructive to participate in such an enterprise, as opposed to watching from the sidelines with a book of regulations in hand? If the alternative to vaccination is population reduction, the wildlife agency will become involved whether it wishes to or not. If the only means to avoid the above scenarios is to provide no intervention strategy at all, what will be the human and animal health costs and implications? Will the lack of program be acceptable to the public?

In Pennsylvania, one county passed a bylaw to make it illegal for citizens to erect bat boxes, because of the risk of rabies. Does such a resolution represent a failure of communications among agencies concerned with different facets of bat conservation, public relations, and rabies?

There is an additional challenge for successful elimination of raccoon rabies. Single states within the larger enzootic zones cannot proceed with elimination programs in isolation. Re-invasion from neighbouring states will always be a risk, unless all programs are coordinated carefully. In Germany, elimination of fox rabies has progressed slowly, at least partly because the individual states did not act in concert (Stöhr and Meslin 1996). In France, which had a national program, elimination occurred within 5 years (Aubert et al. 1994). Rabies has been eliminated twice from Switzerland, but has re-entered from neighbouring France or Germany. The challenge in North America is to achieve cooperation and coordination between two or more levels of government in two countries. We are making progress especially through the involvement of US Department of Agriculture.

Rabies control has wide public and political support in Ontario, Texas, and recently treated areas in New York. There are few wildlife programs where the results are so readily perceived by the public, within 2-3 years. The wildlife agency will benefit from being seen to participate in a program that benefits humans and target wildlife. However, the wildlife agency must not be required to extract the cost of such a program from regular budgets, because that cost is too great in relation to current expenditures on wildlife and the major benefits will be to other sectors of federal, state or provincial, and municipal governments.

Eliminating rabies from selected wildlife populations may be chiefly for the benefit of the public health and agricultural sectors, but the wildlife sector should participate as a partner. Wildlife science has a huge role to play in elucidating the ecosystem-wide implications of such interventions.

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SOURCES

Charles MacInnes
Rabies Research Coordinator
Wildlife and Natural Heritage
Ministry of Natural Resources

Charles Le Ber
Senior Veterinary Consultant
Disease Control Service
Public Health Branch

CONTACT

Charles Le Ber
Senior Veterinary Consultant
Disease Control Service
Public Health Branch

DESCRIPTIVE ANALYSIS OF ENDEMIC CRYPTOSPORIDIOSIS CASES REPORTED IN ONTARIO, 1996-1997

Introduction

Cryptosporidiosis is a significant enteric disease in North America characterized by profuse, watery diarrhea, nausea and abdominal pain.[1,2,3] Outbreaks [4,5] and surveys of patients with gastroenteritis [6,7,8] show that the disease is present in the Canadian population. Cryptosporidiosis is currently notifiable in British Columbia, Alberta, Saskatchewan, New Brunswick, and Ontario where the disease was made notifiable in 1996.

Investigation of cryptosporidiosis has focussed principally on outbreaks and specific high-risk populations, particularly immunocompromised individuals. Although outbreaks are well documented, the behaviour of cryptosporidiosis in non-outbreak settings is relatively unknown. The objectives of this study were to describe the demographic, temporal and spatial distributions, as well as the reported risk factors and symptoms, of endemic cryptosporidiosis in Ontario during the years 1996-1997 inclusive using notifiable disease data. Since such data have potential limitations[9], analyses included an initial assessment of the internal validity of the data.

Materials And Methods

Data Sources

Data used for this study consisted of all cases of cryptosporidiosis reported to the Ontario Ministry of Health between January 1996 and December 1997 through the Reportable Disease Information System (RDIS). At the time of the study, only these two years of data were available. In RDIS, a case of cryptosporidiosis is defined as an individual with clinically compatible signs and symptoms with either (a) demonstration of oocysts in stool or life-cycle stages of the parasite in intestinal biopsy sections, or (b) an epidemiological link to one or more laboratory confirmed cases. For each case in the database, 15 fields were examined (Table I).

Two geographic variables corresponding to a census division and to an urban/rural area designation were linked to each case via the reported residential postal code using a commercial database (Enhanced Postal Code File, Desktop Mapping Technologies, Inc.,

Table I
Number and Percent of Missing or Unspecified Values by Field* for all Cases of Cryptosporidiosis Reported in Ontario, 1996-1997 (n=487)

RDIS Field	Number Missing	Number Unspecified	Percent Missing or Unspecified
Responsible Health Unit	0	0	0
Episode Date	0	0	0
Disease	0	0	0
Date of Birth	2	0	0.4
Gender	2	0	0.4
Organism/Agent	2	0	0.4
Postal Code	35	3	7.8
Outbreak Associated	29	25	11.1
Risk Setting	30	156	38.2
Symptoms	196	45	49.5
Probable Source	34	262	60.8
Hospitalization	327	4	68.0
Other Risk	370	40	84.2
Specify Source	364	52	85.4
Risk Factor	352	85	89.7

* Fields in bold are mandatory for submission to the Ontario Ministry of Health and Long-Term Care

Markham, Ontario). Census divisions are geographic areas representing counties, regional districts, regional municipalities and other types of areas, and they are the intermediate area between the municipality and the province. Urban areas are defined within the commercial database as areas with a minimum population of 1000 and a population density of at least 400/km^2. All other areas are considered rural.

The 1991 Canadian census population was used as the reference population for the standardization of rates, and the Ontario population from the 1996 Canadian census was used to calculate factor-specific rates and expected population proportions.

Data Quality Evaluation

Fields allowing string entries were manually examined for implausible values and such values were relabeled "unspecified". For fields allowing categorical entries, the terms "unknown", "unspecified" and "other" were replaced with the term "unspecified". The percentage of missing or unspecified values was calculated for each field. The database was checked for duplicate cases using the date of birth, episode date, sex and postal code. Dates within records were checked to ensure that the chronological sequence of events reported was plausible.

Descriptive Analysis

Cases positively identified in RDIS as outbreak-associated were removed from the database before further analyses. Provincial age- and sex-adjusted rates were calculated for each year of the study period. Annual age- and sex-adjusted rates were calculated for each of Ontario's 49 census divisions. Rates were calculated per 100,000 population using the direct standardization method.[10] Rate calculations and descriptive analyses were performed using ArcView GIS 3.1 (Environmental Systems Research Institute, Incorporated) and Microsoft®l Excel 97 (Microsoft Corporation). Differences between observed and expected proportions were tested using the binomial test with exact p-values, and differences between medians were tested using the Mann-Whitney test.[11]

Results

Data Quality Evaluation

A total of 487 cases of cryptosporidiosis were identified in RDIS for the two year study period. The reporting of case information by the Regional Health Units to the Ontario Ministry of Health was mandatory for 9 of the 15 database fields examined. The percentage of missing or unspecified values is shown in Table I. No duplicate cases were detected. No inconsistencies were detected in the chronological sequence of events within records.

Descriptive Analysis

Of the 487 cases reported, 36 (7%) were identified as being part of an outbreak and were removed from further analyses. Based on the remaining 451 cases, the Ontario provincial annual age- and sex-adjusted rates were 2.16 and 2.10 cases per 100,000 for the years 1996 and 1997, respectively.

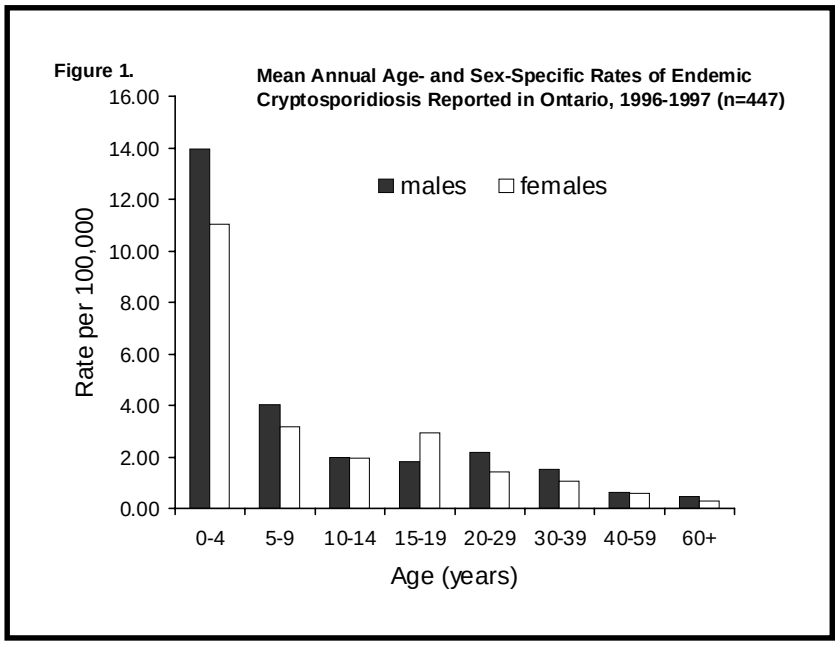
Overall, the proportion of males observed (55%) was significantly higher than expected (49%) based on the Ontario population ($p<0.01$). Males had a higher mean annual incidence than females for all age groups except those 15-19 years of age (Figure 1). The highest mean annual incidence was observed in children less than 5 years of age for both males and females (13.94 cases and 11.05 cases per 100,000, respectively).

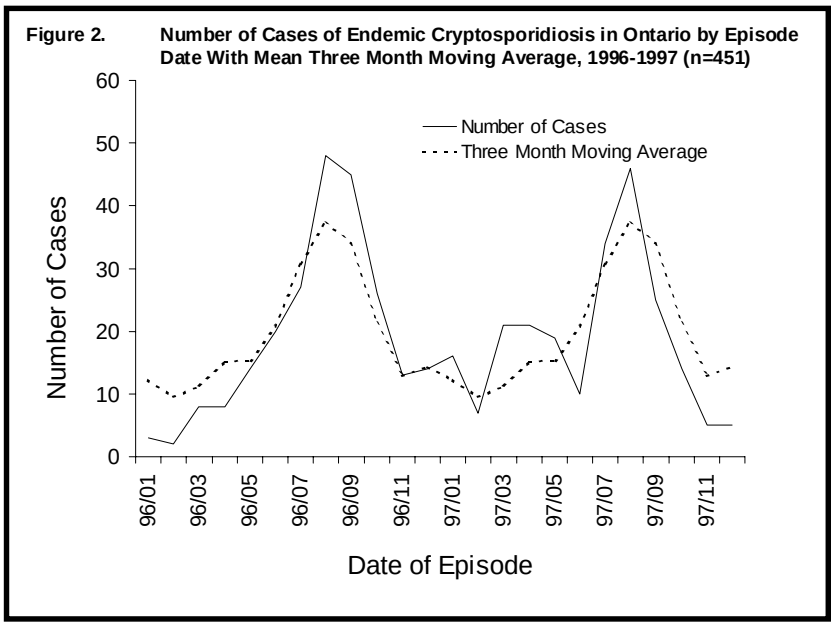
The median age for males was not significantly different than the median age for females (7 and 8 years old respectively, $p=0.82$). Individuals under 5 and over 59 years of age represented 41% and 3% of cases, respectively. Only 2 cases (0.4%) occurred in individuals under 6 months of age, 27 cases (6%) occurred in individuals under 12 months of age, and 87 cases (19%) occurred in individuals under 24 months of age.

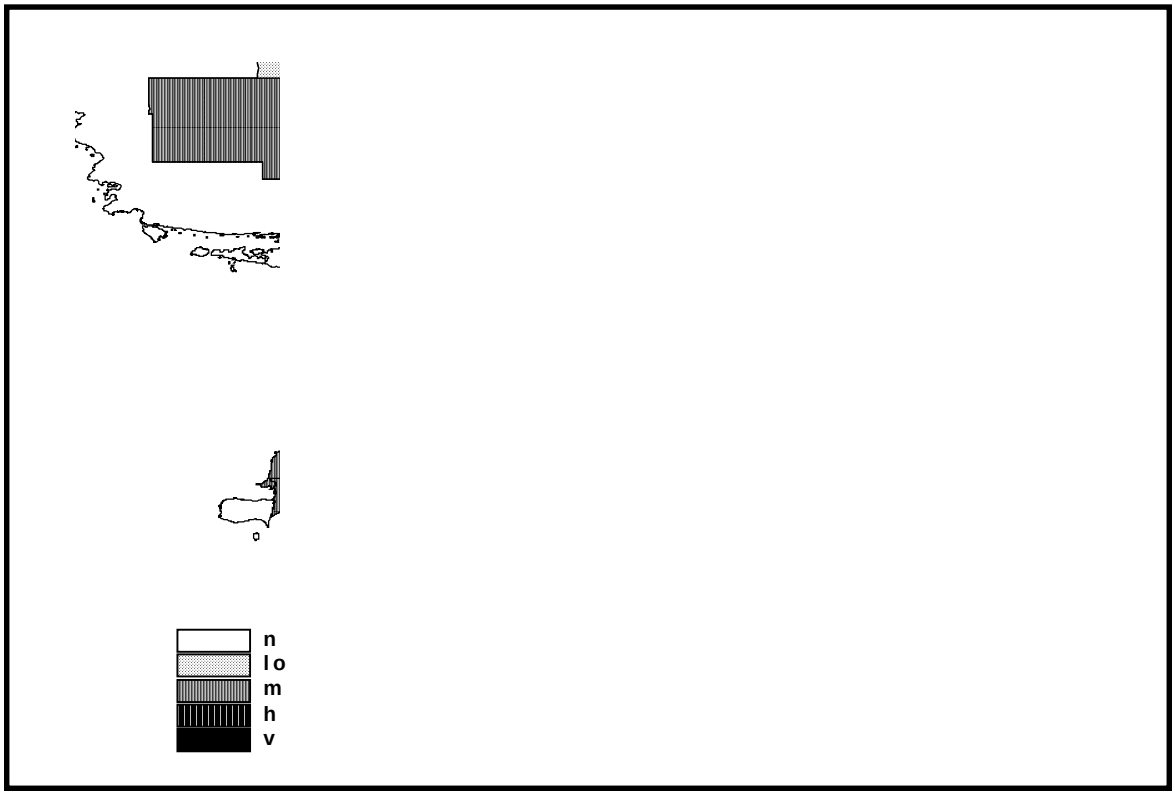
Cases where HIV or AIDS was reported as a risk factor (n=21) represented 5% of all endemic cases. Of these, 100% were male, with a median age of 46 years (range 26 to 65 years). When these 21 cases were removed from the analysis, the proportion of males in the database (53%) remained higher than expected (49%), but the difference failed to reach statistical significance ($p=0.09$).

Overall, the number of cases occurring between July and November inclusive (63%) was significantly higher than expected (42%) assuming no seasonal variation ($p<0.01$). The number of cases was highest in August, with 48 cases in August 1996 and 46 cases in August 1997. The number of cases per month of the study period is shown in Figure 2.

Mean annual age- and sex-adjusted rates for Ontario's 49 census divisions are shown in Figure 3. Overall, 121 cases (29%) were classified as rural. This proportion was significantly higher than expected (17%) based on the Ontario population ($p<0.01$). The median age of







rural cases was not significantly different than the median age of urban cases for both males (5 and 8 years respectively, p=0.08) and females (8 and 10 years respectively, p=0.38). There was an equal proportion of male cases in the rural (56%) and urban (57%) groups.

Home was the most frequently reported risk setting (54%), followed by travel or prior residence in an endemic area (22%). The frequency of risk settings is shown in Table II. The most commonly reported probable sources of infection (Table III) were surface water (26%), livestock (21%), and person-to-person transmission (15%). Diarrhea was the most common symptom reported, occurring in 50% of cases, followed by nausea or vomiting (14%) and cramps or abdominal pain (12%) (Table IV). Twenty-three cases (5%) were hospitalized as in-patients.

Discussion

Due to under-reporting, incidence rates observed in this study are probably significant under-estimates of the true incidence of endemic cryptosporidiosis in Ontario. The reason for under-reporting is probably multifaceted since case detection and reporting may depend on a series of consecutive events. Perz et al.[12] estimate conditional probabilities for each stage in the reporting of cases of cryptosporidiosis, from initial infection to entry into the notifiable disease database. Overall reporting estimates are 3 cases per 10,000 infections for non-AIDS adults (>12 years), 3 cases per 1,000 infections for non-AIDS children (≤12 years), and approximately 65 cases per 100 infections for adults and children with AIDS.[12] Along with age and immune status, under-reporting rates may also depend on geographic location.

Controversy exists over whether being male is a risk factor for cryptosporidiosis since many studies have conflicting results.[3,13,14,15] The significance of higher rates of disease in males in seven of the eight age groups in this study is unclear, and it is possible that sex is a surrogate measure for host- or environment-related factors.

The observed age distribution (Figure 1) is similar to distributions reported in other studies, where peak incidence is between zero and five years of age and there is no elevated incidence in the elderly.[1,3,16] This is important to note, since a Connecticut-based survey reported that physicians may erroneously identify the elderly as being at risk for infection.[17] Although an increased incidence in children was observed, this may reflect increased case detection and reporting. Relative incidence rates should be interpreted carefully, especially since inflating the number of cases observed in this study by the under-reporting estimates presented

Table II
Frequency Distribution of Reported Risk Settings for Endemic Cases of Cryptosporidiosis Reported in Ontario, 1996-1997 (n=265)

Risk Setting	Number	Percent
Home	142	53.6
Travel or Prior Residence in an Endemic Area	57	21.5
Lake/River/Stream/Pond	21	7.9
Day Care	8	3.0
Local Camping	6	2.3
Local Vacation Property	6	2.3
Workplace	6	2.3
Rendezvous Outside of Usual Domicile	6	2.3
Pool/Spa	4	1.5
School	3	1.1
Hospital	2	0.8
Correctional Facility	1	0.4
Residential Facility	1	0.4
Facility for the Developmentally Disabled	1	0.4
Restaurant/Food Vendor	1	0.4

Table III
Frequency Distribution of Reported Probable Sources of Infection for Endemic Cases of Cryptosporidiosis Reported in Ontario, 1996-1997 (n=157)

Probable Source	Number	Percent
Water - Lake/Stream/River/Pond	41	26.1
Livestock	33	21.0
Person-to-Person	23	14.7
Water - Private Well	15	9.6
Food	13	8.3
Pets	13	8.3
Water - Municipal Unfiltered	8	5.1
Water - Pool/Spa	6	3.8
Water - Municipal Filtered	4	2.5
Water - Bottled	1	0.6

Table IV
Frequency Distribution of Reported Symptoms Associated with Endemic Cases of Cryptosporidiosis Reported in Ontario, 1996-1997 (n=489)*

Symptom	Number	Percent
Watery Diarrhea	115	26.6
Loose Stools	99	22.9
Nausea and/or Vomiting	61	14.1
Cramps	51	11.8
Abdominal Pain	36	8.8
Fever	22	5.1
Malaise	10	2.3
Weight Loss	8	1.9
Anorexia	7	1.6
Bloody Diarrhea	7	1.6
Weakness	5	1.2
Chills	4	0.9
Fatigue	2	0.5
Headache	2	0.5
Dehydration	2	0.5
Dizziness	1	0.2
Myalgia	1	0.2

* Up to three symptoms were allowed per case

above resulted in an incidence of disease in adults (>14 years) that was approximately 1.7 times the incidence in children (≤14 years).

Cryptosporidiosis appeared seasonal in Ontario, peaking in the summer and early autumn (Figure 2). Although two years' data cannot fully establish a temporal pattern of disease, the pattern observed corresponds to those published, where disease peaks in the summer and autumn months.[6,8,13,16] Lifestyle factors including outdoor recreation, agricultural practices, and environmental changes may have contributed to the observed seasonal distribution, although data to support these hypotheses is needed.

Differences in disease incidence among Ontario's 49 census divisions may be due to environmental or demographic factors (Figure 3). The high proportion of rural cases observed may be due to exposure to livestock, either through direct contact with feces, contaminated water, or more complex mechanisms of exposure. Zoonotic transmission from farm animals is known to occur [3,18] and shedding of *Cryptosporidium* oocysts has been demonstrated in cattle, sheep, pigs and horses throughout Canada[19], making livestock a potential source of infection in rural Ontario. However, it is impossible to determine if the proportion of probable sources reported as "livestock" (21%) was an accurate indication of livestock as a source of infection in the population studied.

Water represented 48% of all probable sources reported, with water from natural sources identified more often than water from municipal sources (Table III). Person-to-person transmission represented 15% of probable sources reported, and this route of transmission may be especially important in children due to increased fecal contact. The probable sources identified in this study reflect known sources of *Cryptosporidium* spp. in North America.[1,3,4,20] However, the high percentage of missing or unspecified values makes it impossible to determine if the relative frequencies observed accurately reflect the distribution of sources for cryptosporidiosis infections in the Ontario population.

Travel or prior residence in an endemic area was reported for 22% of the cases for whom risk settings were available. Although this estimated the proportion of cases who became infected outside Canada, the proportion of cases due to foreign travel alone, excluding immigration, could not be determined.

The observed frequency of symptoms (Table IV) was consistent with the literature, where diarrhea (rarely bloody), nausea, vomiting, abdominal pain, and fever are most frequently reported.[2,3]

A main limitation of data from communicable disease reporting systems is the inherent bias towards known risks resulting from subjective data collection. Data presented here are likely biased towards known risks for cryptosporidiosis. Potential sources of bias may have included the high proportion of missing or unspecified values[9], differential reporting, and methodological differences in data collection among Regional Health Units.

The results of this study suggest that cryptosporidiosis is a significant enteric disease in Ontario, with an increased incidence observed in males, those under five years of age, and rural residents. The calculated incidence of infection in this study (mean annual rate of 2.13 cases per 100,000) is probably a substantial under-estimate of the true incidence, since substantial under-reporting of cases probably occurs. One means of enhancing case detection and reporting may be to encourage physicians to test for Cryptosporidium when symptomatic patients are examined. A lack of familiarity with cryptosporidiosis among physicians, including its symptoms and at-risk groups, has been identified in a Connecticut study as a barrier to the ordering of appropriate diagnostic tests.[17] Another important means of enhancing data quality is to encourage investigation of cases in an objective and standardized manner. This should enable more accurate hypothesis generation for further studies, which is one important function of passive surveillance systems.

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CORRESPONDING AUTHOR/REQUEST FOR RE-PRINTS:

Dr. Jeff Wilson
Department of Population Medicine, University of Guelph
Guelph, ON N1G 2W1
Phone: (519) 824-4120 x 4728
Fax: (519) 763-3117
Email: jwilson@uoguelph.ca

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SOURCE

Shannon E. Majowicz, MSc[1], Pascal Michel, DVM, PhD[1,2], Jeffery J. Aramini, DVM, MSc[1], Scott A. McEwen, DVM, DVSc[1], Jeff B. Wilson, DVM, PhD[1,3]

[1] Department of Population Medicine, Ontario Veterinary College, University of Guelph, Guelph, Ontario.
[2] Health Protection Branch, Health Canada, Guelph, Ontario
[3] Division of Enteric, Foodborne and Waterborne Diseases, Laboratory Centre for Disease Control (LCDC), Health Canada, Guelph

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DISEASE CONTROL SERVICE COMMENT

In view of the March 2001 waterborne outbreak of Cryptosporidium in North Battleford, Saskatchewan, the publication of this article is timely. Two Cryptosporidium outbreaks associated with municipal water distribution systems have occurred in Ontario. One outbreak occurred in the water distribution system in Kitchener-Waterloo in 1993 and the other occurred in Collingwood in 1996. The latter outbreak occurred during the study time-period and the outbreak-associated cases were removed from the analysis.

CONTACT

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

IS THERE EVIDENCE TO RECOMMEND MANDATORY CERTIFICATION OF FOOD HANDLERS?

Introduction

Boards of health in Ontario are required to offer a food safety-training program for food handlers working in high and medium risk food premises under requirement 4 of the Mandatory Food Safety Program, Mandatory Health Programs and Services Guidelines, Ministry of Health and Long-Term Care. Programs should provide the food handler with the knowledge to identify risk factors associated with food-borne illnesses and food allergy incidents and to take appropriate preventive action. In addition, other benefits of an effective food handler training course should include:

- reduction of food-borne illness and food allergy incidents (prevention)
- more efficient deployment of resources
- prevention of hazards at the production/preparation stage
- earlier detection of potential hazards
- reduction of consumer complaints, and
- possibility of retention of trained food handlers within the industry.[1]

To complete the program and become certified, the participant must successfully pass a test. Currently, certification is not registered, nor time-limited.

To date, little has been done to measure the long-term effects of food handler certification. It is hypothesized that premises with a higher proportion of certified food handlers would have a lower incidence of Hazard Analysis Critical Control Point (HACCP) infractions and thus a reduced incidence of food-borne illness. Further, mandatory certification may decrease public health inspector time.

The objective of this project was to examine any evidence of long-term effects of food handler education and certification within the context of potential recommendation of mandatory certification of food handlers.

Monica Campbell et al. undertook a systematic review of the effectiveness of documented food safety interventions in 1997. This review identified food

safety interventions applicable to public health practice in Ontario, and assessed their effectiveness. Interventions of interest focussed on premises where food is prepared, stored, served or sold, and included restaurants, institutions, homes and other community-based settings. The review concluded there was evidence to support the effectiveness of food handler training and certification [2], but did not identify specific strategies.

Methods

The research question for this current review was built upon those used in the previous review and was specific to the training of any food service industry employee.

How effective is food handler certification as an intervention to affect food handler knowledge and/or behaviours? Is there evidence of specific strategies to ensure good food handling? Should all food handlers be certified, or is one handler per shift sufficient?

The updated literature review was adapted, based on Campbell's methods. Computer searches of published studies and hand searches of the Public Health and Epidemiology Report Ontario and Environmental Health Review were done for 1996 to 1999.

Unpublished studies and internally published reports were also sought by contacting Directors of Environmental Health at each Ontario health unit and provincial epidemiologists to request evaluation studies of food handler education/certification that had been conducted in the last 5 years, reports to the respective Boards of Health about food handler education/certification and the results of any recommendations and other key references, documents or informants. Information was requested from Philadelphia and Los Angeles County Health Departments about their innovative food handler education programs identified in the literature.

The existing registry of certified food handlers at the Hamilton Public Health Department was reviewed to investigate potential linkages with results of routine inspections.

Results

Five published articles were retrieved. Four articles were evaluative, and one was descriptive. All four of the evaluative articles found that food handler training or certification had a positive impact on either knowledge or behaviour but seldom both. Surveys, inspection records, visual inspections and inspection ratings were used. Deficiencies in either the training/certification program descriptions or measures used were noted. Recommendations for further research into the design of the training program or further training were made.

The descriptive article described changes to the food safety ordinance at the Los Angeles County Department of Health Services (DHS).[3] Mandatory training was recommended after an investigative report aired on a local television station. The report used hidden cameras to record food handling practices at several restaurants. The observations were compared to official inspection reports, revealing that very poor practices in several restaurants received acceptable inspection scores. It is now required that at least one individual who has successfully completed the four hour training program is on duty while the establishment is open.[3]

Unpublished evaluation studies were received from Leeds, Grenville and Lanark [4], Waterloo [5], and Chatham-Kent.[6] Both of the former used pre- and post-certification tests and found that there was a significant increase in short-term knowledge. Chatham-Kent Health Unit conducted an opinion survey of local premise owners/managers/supervisors about food handler certification. Sixty four per cent felt that food handler certification would be useful for themselves, 47 per cent felt it would be useful for management and 48 per cent thought it would be useful for other staff.

Middlesex-London Board of Health[7] endorsed recommendations that mandatory certification be endorsed for all commercial and institutional food handlers and that this be incorporated into Ontario Regulation 562 (Food Premises). No supporting information was received nor follow-up identified.

Other provinces did not supply formal evaluations. Food handler certification has been mandatory in the City of Winnipeg since March 1996. Public health inspectors have noted that inspections are "smoother", there has been a decrease in violations and an increase in food safety knowledge amongst premise operators. Mandatory training is a long-range goal in Manitoba (P. Parys, personal communication).

Food handler training is mandatory in Alberta, Saskatchewan, British Columbia and the Northwest Territories. In Alberta, food handler certification became mandatory with a goal to decrease the incidence of food-borne illness, but reporting

uncertainty has prevented demonstration of effectiveness (L. Stefaniw, personal communication).

Philadelphia and Los Angeles County departments have not conducted evaluations of their programs. Los Angeles County noted anecdotally that food establishment operators have, in general, accepted the requirement and have associated the training with their ability to achieve improved inspection scores (J. Fielding, personal communication).

Discussion

The literature published since the Campbell review reached similar conclusions. The four evaluative studies reviewed [8,9,10,11] concluded that there was a positive correlation between food handler training/certification and either knowledge or behaviour. Food handler certification had some significant effects on knowledge and behaviour in three of the studies. Kirby and Gardiner did not find a significant difference between the first and second inspection for the study group in their study.[9] On the first visit, the study group had significantly higher scores than the control group, which may be a volunteer effect.

The measures of effectiveness used varied: in two of the studies [8,10] surveys were used to assess changes in knowledge following training. The other two studies [9,11] assessed changes in behaviour following training by examining inspection results. Powell and Attwell compared the level of knowledge and inspection score as a measure for change in behaviour but found none. [8]

Powell and Attwell [8] suggest that food handler training has other benefits. The authors hypothesize that since untrained staff work alongside trained staff they might acquire an elementary knowledge of hygiene. Kirby and Gardiner concluded that the most effective way to train food handlers is a cascade approach, training managers first, followed by workers.[9]

Informal evaluations by three health units in Ontario indicated that food handler training increased knowledge but they did not measure behaviour. Similarly, anecdotal evidence from the City of Winnipeg and the Los Angeles County health department indicate that premise operators have accepted mandatory training in those areas. It is important to be cautious when there is a lack of systematic evaluation to confirm these anecdotal impressions. This has helped to decrease critical violations, such as temperature abuse and the provision of hand washing supplies, and enhance the relationship between the premise operator and public health inspector.

Although the literature indicates that there is a positive correlation between food handler training and increased knowledge or behaviour, several questions remain:

- How long is knowledge retained? Thus far there have not been any studies that have measured the long-term impact of food handler training. The effect of certification has been measured immediately following certification and up to two years post certification.
- Are food handlers motivated to apply knowledge in their establishments? There do not appear to be any reliable measures for changes in knowledge and behaviour together. This should be considered in future effectiveness reviews.
- Does passing a certification course lead to a decrease in food-borne illness?
- Who are the higher risk food handlers? Factors such as level of wage, job type and experience in industry, should be considered to identify who should become certified.
- Are there higher risk premises? Do food handlers with similar knowledge behave differently in different environments?
- What are the patterns of food handler employment? Are handlers transient, temporary workers who would be difficult to track? Do handlers stay in the field long enough that re-certification is an issue?

The following list identifies issues for consideration in mandating food handler certification:

1. Create a registry/database: a system that would track certified food handlers would have to be developed. All health units within an area, e.g., Central-West, Ontario, could share this system.
2. Certification expiration and re-certification: since there is not any evidence of long-term impacts of food handler training it is recommended that food handlers become re-certified after a set period of time, e.g., two years, to reinforce existing food handler knowledge and educate with new evidence and information. A registry would help track these individuals so that they could be notified to re-certify.

3. Who will be certified: the two approaches commonly used are either the manager or one employee per shift.
4. Standardize the objectives and assessment components of the course but allow for local context specific format: currently each health unit has their own course design. Standardization of course material and content or courses that meet minimum ministry requirements would allow food handlers to move without having to become re-certified.
5. Enforcement: it is important to consider how mandatory certification would be enforced. In areas with existing mandatory certification programs the public health inspector checks for compliance during regular food premise inspections. Similarly it should be determined how non-compliance would be handled.
6. Exemption for internal training programs: in Saskatchewan smaller premises apply for certification of their own internal training programs, often due to financial concerns. The local health department approves the content of these programs. These programs are designed for the individual premise, thus certification is not transferable. However if the course met minimum ministry standards, it would be transferable.
7. Grace period to become certified: new operators should be given a period of time to have staff certified without penalization.

The next steps recommended by the authors are to seek external funding to run a pilot project in Hamilton to assess the feasibility of mandating certification and then conduct a province-wide effectiveness study using a randomised controlled design to compare mandatory certification with voluntary certification.

Mandatory food handler certification sounds like a good idea but more evidence is needed before it is implemented in Ontario.

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SOURCES

A. Eby
McMaster Institute of Environment and Health
McMaster University
Hamilton, ON

F. Scott
McMaster Institute of Environment and Health
McMaster University
Hamilton, ON

J. Eyles
McMaster Institute of Environment and Health
McMaster University
Hamilton, ON

S. Harding-Cruz
Hamilton Social and Public Health Services
Environmental Health Branch/PHRED Program
Hamilton, ON

R. Hall
Hamilton Social and Public Health Services
Environmental Health Branch/PHRED Program
Hamilton, ON

B. Hunter
Hamilton Social and Public Health Services
Environmental Health Branch/PHRED Program
Hamilton, ON

CONTACT

Dr. Charles Le Ber
Senior Veterinary Consultant
Disease Control Service
Public Health Branch

REFERENCES

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AN OUTBREAK OF HUMAN BLASTOMYCOSIS: THE EPIDEMIOLOGY OF BLASTOMYCOSIS IN THE KENORA CATCHMENT REGION OF ONTARIO, CANADA

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Introduction

Blastomycosis is a systemic fungal infection caused by the organism Blastomyces dermatitidis. It has a highly variable clinical spectrum and can cause acute pneumonia-like illness or chronic pulmonary disease; in a disseminated form it can have cutaneous manifestations, less commonly involve the genitourinary tract, bone or even the central nervous system, and in rare instances lead to death.[1,2]

The incidence of blastomycosis has not been reliably reported because it is not nationally reportable in Canada or the United States, although it is reportable in Wisconsin.[1,3] The ecological niche of blastomycosis has become better defined, but is not yet fully understood because of the great difficulty in isolating the organism from the environment. Outbreak studies have implicated the building of a hunting lodge, proximity to a construction site, raccoon hunting, exposure to a beaver lodge, and activities by riverbanks as sources of exposure.[4-7] So far, favourable characteristics are thought to be warm moist soil, slightly acidic pH, animal excrement, organic debris and adjacency to waterways such as lakes or rivers.[3,5,8] However, because of the difficulty in isolating the organism from the soil, the clustering of cases should be used to build upon the growing body of information.

Blastomycosis is referred to as one of the more important endemic mycoses in North America, but its epidemiology is poorly understood.[9] Central Canada has long since been identified as part of the endemic areas, but there have been few studies originating from this region. From 1970 to 1981, the Central Public Health Laboratory in Toronto, Ontario, confirmed 38 cases of blastomycosis.[4] Since then, 16 cases were reported in Ontario from 1982 until 1989, when blastomycosis was removed from the list of diseases reportable under Ontario regulations.[10] Recently, there has been a resurgence of interest in blastomycosis in Ontario. In the Kenora, Keewatin, Jaffray Mellick tri-municipal area, and the surrounding reserves in the northwestern region of Ontario, there has been an apparent increase in blastomycosis incidence. This study attempts to describe the epidemiology of blastomycosis in this area, to estimate and compare the incidence with that of other endemic areas, and to contribute to the growing body of information on blastomycosis.

Methods

Design

The study consisted of two parts. In one, a retrospective review was carried out of all incident cases of blastomycosis from 1 January 1997, to 30 April 1999. The second involved a retrospective test for trend of all cases hospitalized with a diagnosis of blastomycosis from 1 January 1990 to 31 December 1998.

Setting

The study involved the Lake of the Woods District Hospital (LWDH) in Kenora, Ontario. The study area consisted of the catchment area of the LWDH: Kenora, Keewatin, Jaffray Mellick tri-municipal area, and the surrounding reserves.

Cases

Incident cases of blastomycosis from 1 January 1997 to 30 April 1999 were identified from the inpatient and outpatient records at LWDH coded with the ICD-9 code 116.0 for blastomycosis, from hospital laboratory records that had a positive microscopic identification of blastomycosis, and from records of individuals with positive results for blastomycosis by culture and microscopy obtained from Thunder Bay Regional Laboratory.

The case definition for a definite case was a positive culture or microscopic visualization of characteristic thick-walled, single budding yeast cells with broad isthmus from a clinical sample, and onset of symptoms characteristic of blastomycosis within the study period. Probable cases were defined as those with onset of symptoms during the study period who had a positive diagnosis by serology or had clinical symptoms typical of blastomycosis that were non-responsive to antibiotics and resolved upon antifungal treatment.

All hospital records at LWDH with the ICD-9 code 116.0 for blastomycosis in any diagnostic field, from 1 January 1990 to 31 December 1998, were analyzed

by temporal test for trend. Individuals who were not residents of the study area were excluded.

Questionnaire

One investigator telephoned all individuals classified as incident cases of blastomycosis and administered a standard questionnaire on risk factors.

Analysis

SPSS version 8 was used to analyze incident case data. Population data for the calculations were taken from the 1996 census and, for some reserve communities, from the 1991 census or from Indian and Northern Affairs Canada. In all cases, the more recent population data were used. Chi-square and Fisher's exact test were used for comparison of categorical variables, and t tests for continuous variables. Findings were considered significant if the two-sided p value was < 0.05. Overlapping of 95% confidence intervals (CIs) indicated a non-significant finding. Exposure variables were considered individually and were then grouped into recreational waterway exposure, soil exposure, and wood exposure groups.

The yearly incidence rates of hospitalized cases of blastomycosis from 1990 to 1998 were calculated using the 1996 census population. The hospitalization data were entered into Epi-Info 6.0 and analyzed using the chi-square test for trend. The yearly rates were compared with reference to the 1990 incidence rate of hospitalized cases, and any 95% CI that did not overlap was considered to be significantly different. The overall p value for trend was used to estimate whether there was a significant departure from the horizontal.

Main results

Incident cases

There were 61 individuals with onset of symptoms of blastomycosis during the period from 1 January 1997 to 30 April 1999. Of these, 55 were definite cases identified through culture, microscopic examination, or microscopic visualization; six were probable cases.

Sociodemographic features:

The mean age of the 61 individuals was 41.9 years (range: 3 to 80). There were 29 (47.5%) females and 32 (52.5%) males. Sex-specific and age-specific incidence rates are presented in Table 1. The sex-specific incidence

Table 1
Annual incidence rate of blastomycosis per 100,000

Category	Rate	95% CI
Crude incidence rate for Kenora catchment	117.2	90.3 - 152.4
Crude incidence rate for tri-municipal area*	104.9	74.9 - 142.6
Crude incidence rate for reserve communities*	404.9	221.1 - 680.2
Crude incidence rate for Sioux Narrows	99.8	2.5 - 555.9
Crude incidence rate for Kenora unorganized	46.2	9.5 - 134.9
Male specific rate for Kenora catchment**	124.3	83.9 - 177.7
Female specific rate for Kenora catchment**	111.7	75.4 - 159.7
Age-specific rates for Kenora catchment (both sexes)		
0-14 years	50.5	18.5 - 110.1
15-24 years	83.5	30.6 - 182.0
25-44 years	123.9	75.7 - 190.9
45-64 years	235.4	150.8 - 350.7
65-74 years	55.6	6.7 - 200.5
>= 75 years	109.2	22.5 - 318.8

* 95% CI for the tri-municipal area and the reserve communities do not overlap, and is therefore significantly different at p = 0.05 level.

** 95% CI for the males and females do overlap and therefore are not significantly different

rates among males and females were not significantly different. Age-specific rates indicated no significant differences in blastomycosis among age groups.

Of the 61 cases identified, 37 (63.8%) were Caucasian and 21 (36.2%) were Aboriginal. Rates specific for ethnicity indicated a significantly higher incidence among Aboriginal individuals. Reliable population data were not available to calculate age-specific rates by ethnic group.

Geographic and temporal distribution: Figure 1 shows the incidence of blastomycosis over the entire study area. The estimated crude incidence rate was 117.2 per 100,000 (95% CI = 90.2 to 152.4). No distinct trends were demonstrated in individual communities; this was likely a result of the wide confidence intervals. The Kenora, Keewatin, Jaffray Mellick tri-municipal area accounted for 40 cases (65.5%), and reserve communities accounted for 14 (22.9%). Comparison of incidence rates showed a significantly higher rate in reserve communities than in the tri-municipal area (Figure 1).

The distribution of cases by month of onset of initial symptoms showed a tendency to a September to January onset of symptoms; of the 58 (95.1%) cases for which this information was available, onset in 35 (60.3%) occurred during these months.

Morbidity

Table 2 presents the clinical spectrum of blastomycosis in the 61 cases. Overall, two (3.2%) had cutaneous lesions and bone involvement, and another 14 (22.9%) had cutaneous lesions; none had involvement of the central nervous system. There were three deaths; of these, two (3.3%) were directly due to blastomycosis infection.

Both individuals had associated chronic illnesses, one with chronic liver failure, and one who had chronic renal failure and was receiving dialysis. Two individuals were immunocompromised, one as a result of lupus and pyelonephritis, and the other because of testicular cancer. No other individuals had an immunosuppressive illness.

There were 26 (43.3%) inpatients compared with 34 (56.7%) outpatients. The mean age of the inpatients was 38.2 years (range: 3 to 80) and was not significantly different from the mean age of the outpatients (mean = 45 years, p = 0.19). The inpatients consisted of 14 (53%) Aboriginal and 12 (46%) non-Aboriginal persons. A significantly higher proportion of Aboriginal than non-Aboriginal cases were of inpatient status (p = 0.015). Aboriginal inpatients had a significantly lower mean age than non-Aboriginal inpatients (34.3 years [range: 3 to 62] compared to 46.4 years [range: 14 to 80], p = 0.2).

Figure 1: Incidence of blastomycosis in the Kenora catchment area

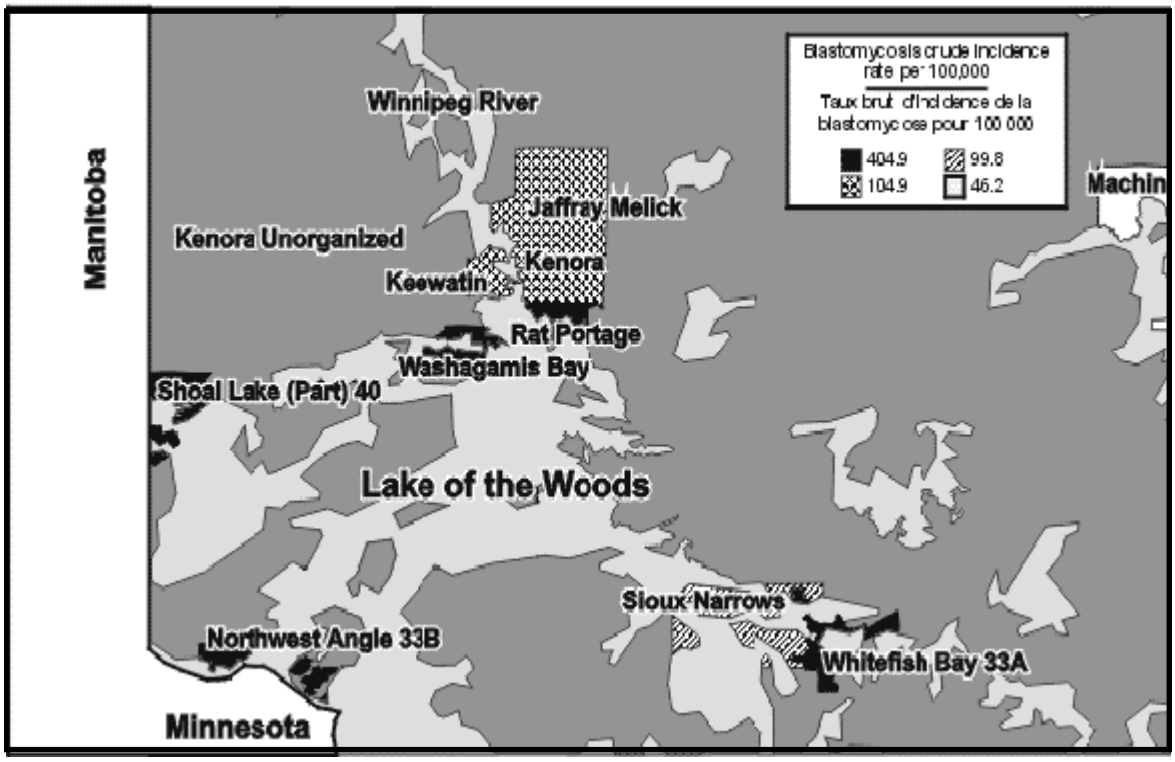

Table 2
Clinical spectrum of cases

Symptom	n (%)
Cough	53 (93.0)
Fatigue	46 (82.1)
Shortness of breath	43 (76.8)
Fever	41 (73.2)
Weight loss	38 (67.9)
Night sweats	38 (67.9)
Chest pain	33 (57.9)
Skin lesions	16 (28.0)

Of the 61 individuals, four (6.6%) had had a previous diagnosis of blastomycosis. In one patient, this was 12 months before the study period. In two patients, the diagnosis was made >1 year before; and in another patient, it was made 8 years before the study.

Risk factors

Of the 61 individuals initially identified, 52 (85.2%) were interviewed; 36 (69.2%) were non-Aboriginal and 16 (30.8%) were Aboriginal. This represented a significantly higher response rate among non-Aboriginal than Aboriginal persons (p = 0.01). There was no significant association between gender or inpatient and outpatient status and having been interviewed (p = 0.56, 0.52, respectively).

Of the 52 people interviewed, 32 (61.5%) were employed, of whom 15 (46.9%) had likely exposures in their employment. There were 35 (67.3%) who were exposed to shorelines of streams, rivers, or lakes, which constituted the largest positive response; among these, 26 (74%) had daily or almost daily exposure. The second most common exposures were fishing and swimming, involving 28 (53.8%) individuals, of whom 19 (36.5%) had daily or almost daily exposure. Gardening was also a common activity (22 [42.3%] of cases). The exposure routes were grouped by categories of recreational waterway exposure, wood exposure, and soil exposure (Table 3). Among these exposure groups, 38 (73.1%) individuals participated in activities included in the recreational waterway group, and 34 (65.4%) and 27 (51.9%) participated in activities associated with soil exposure and wood exposure, respectively.

There was no significant association between ethnicity and the grouped exposure variables for recreational waterway exposure, soil exposure, or wood exposure (p = 0.738, 0.529, and 0.768, respectively). Individual exposure variables such as shoreline exposure, fishing or swimming, and gardening showed a similar lack of association with ethnicity (p = 0.75, 0.23, and 0.37, respectively).

Hospitalized cases

The study identified 52 hospitalized cases from 1 January 1990 to 31 December 1998. All were confirmed by laboratory testing, had symptoms characteristic of blastomycosis, and were residents within the study area. The 19 hospitalizations in 1998 were significantly different from the numbers in previous years (relative risk = 4.75, 95% CI = 1.62 to 13.96), which ranged from two to eight. The Chi-square test for trend indicated a significant increasing trend from 1990 to 1998 (p = 0.0003). In 1997, only two cases were hospitalized for blastomycosis.

Table 3
Risk factors

Exposure Routes	n (%)
Shorelines	35 (67.3)
Fishing/Swimming	28 (53.8)
Gardening with shovel/tools	22 (42.3)
Weed clearing	18 (34.6)
Hollow/Dead trees	16 (30.1)
Woodpile	15 (28.8)
Digging holes	15 (28.8)
Chopping wood	15 (28.8)
Camping	14 (26.9)
Animals infected with blastomycosis	9 (17.3)
Hunting/Trapping	9 (17.3)
Septic beds	8 (15.4)
Cadavers	7 (13.3)
Using brushcutters	7 (13.3)
Beaver dams	7 (13.5)
Cutting trees	7 (13.5)
Animal pelts	6 (11.5)
People infected with blastomycosis	5 (9.6)
Planting trees	5 (9.6)
Working under houses/sheds/cottages	5 (9.6)
Sleeping on the ground	5 (9.6)
Working with tractors/backhoes	3 (5.8)
Climbing into holes	3 (5.8)

Table 4
Grouped exposure variables

Groups*	Exposures/Activities
Recreational waterway/Shoreline	Fishing/Swimming Shorelines Camping/Hunting
Soil	Digging Climbing into holes Planting trees Gardening with shovel/tools Weed clearing Working under houses/sheds
Wood	Hollow/Dead trees Woodpiles Chopping wood

* Individuals can be in more than one group.

Table 5
Trend in incidence rate of hospitalized cases from 1990 to 1998 (Chi-square test for trend)

Year	Hospitalizations	Incidence rate*	Relative risk** (c2)	95% CI
1990	4	17.9	1	-
1991	3	13.5	0.75	0.17 - 3.35
1992	3	13.5	0.75	0.17 - 3.35
1993	4	17.9	1	0.25 - 4.00
1994	4	17.9	1	0.25 - 4.00
1995	5	22.4	1.25	0.34 - 4.65
1996	8	35.9	2	0.60 - 6.64
1997	2	8.9	0.5	0.09 - 2.73
1998	19	85.2	4.75	1.62 - 13.96

* Rates were calculated using 1996 census populations.

** Relative to 1991 hospitalizations.

Discussion

The estimated incidence rate of blastomycosis in the Kenora region stands at 117 per 100,000. In comparison to other endemic areas in North America, the Eagle River area in Vilas County, Wisconsin, has the closest reported incidence rate of 100 per 100,000.[11]

If it can be assumed that the trend seen in hospitalizations reflects the true trend in all cases occurring in the region, the results show that the incidence increased suddenly at a significant level in 1998 ($p = 0.0003$). The reason for this sudden jump could not be clearly ascertained from this study. Local physicians and public-health professionals have suggested that it was likely due to improved awareness and increased testing. The awareness of the physicians and community may have been heightened by the deaths due to blastomycosis,

one of which occurred in June of 1998, preceding the identification of the majority of cases in the same year. On the other hand, this could simply be a result of the higher incidence from September to January.

Specific regions within the study area reported remarkably higher rates of incidence: when the communities were grouped, the reserve communities demonstrated a significantly higher rate of incidence (404.9 per 100,000) than the Kenora, Keewatin, and Jaffray Mellick tri-municipal area (104.9 per 100,000). The differences between the tri-municipal area and the surrounding reserves are mainly that of population density and degree of urbanization. This ties in with the previous literature, which indicates that although blastomycosis can be clustered in urban settings, the ecological niche of the organism is greater in rural environments.[3] The communities identified by case occurrence, whether in the tri-municipal area or on reserve land, all border the shorelines and waterways along the Lake of the Woods. Klein and Vergermont described similar occurrences in Wisconsin, where cases were distributed along the Eagle and Plover Rivers.[5] The suggested reason for such clustering around waterways is the greater probability of conditions that support the ecological niche of Blastomyces. The waterways provide moist soil, increased humidity, and decaying organic debris. Also, the increased moisture levels enhance the aerosolization of spores.

The second hypothesis for the clustering of cases is the diverse recreational activities that draw individuals to these locations.[5] Therefore, the combination of ideal location for Blastomyces growth and the attractiveness of the location for recreational uses seems to cause this clustering.

Although the exposure due to recreational waterway activity is likely important in this region, it was not able to explain the higher rate of blastomycosis among Aboriginal persons. Since this was a case series study and not a case controlled study, although certain experimental exposures appear to be frequent among cases, without data on the prevalence of these activities, in a controlled population, we can not make definite conclusions about specific risk factors. There was no significant association between ethnicity and the major exposure groups of waterway activities, soil exposure and wood exposure. This supports the hypothesis put forth in a recent study by Baumgardner and Brockman[11] that place of residence is of greater influence than specific activities when endemic areas are being considered.

Although cases of blastomycosis occurred throughout the year, there was a tendency for onset to occur from September to January. The incubation period of blastomycosis has been estimated to range from 21 to 106 days [5,9], which would put the period of infection at June to October. This coincides with the time of the year with the most rainfall and least snow cover on the ground, both of which could contribute to infection from blastomycosis.[12]

The study was able to identify only two (3.8%) individuals who were taking systemic steroids and could be immunocompromised - a finding that suggests that blastomycosis is a primary pathogen and is not opportunistic.[2] There was no association in the identified cases between age, gender, or the presence of chronic illness and the need for hospitalization ($p = 0.19$, 0.63, and 0.31, respectively). A significantly higher proportion of Aboriginal than non-Aboriginal individuals were hospitalized, probably because of the lower mean age of Aboriginal inpatients compared with Aboriginal outpatients ($p = 0.04$). Of the Aboriginal cases who were hospitalized, five (36%) were < 13 years old, whereas there were no non-Aboriginal individuals in that age group. The over-representation of Aboriginal persons in the inpatient category could not be linked to any specific high-risk activity. As previously stated, there was no association between ethnicity and participation in any exposure-related activities. The risk of developing blastomycosis seems to be higher in young children in Aboriginal populations than in non-Aboriginal populations.

Previous studies have identified specific factors that are characteristic of endemic areas of blastomycosis.[13] The soil conditions and the forest type (pine and spruce) that prevail in endemic areas are present in the tri-municipal area and surrounding regions. Although precipitation levels are lower in the study area (mean annual level: 56.3 cm) than in another endemic area, Wisconsin (mean annual level: 79 cm), the lower rainfall is probably compensated for by the Lake of the Woods and Winnipeg River waterways, which supply the surrounding areas with the needed moisture for the ecological niche of blastomycosis.

Conclusions

The study identified the Kenora catchment area as having the highest estimated incidence of blastomycosis for a region of this size. The exposure variable of greatest prevalence was waterway recreational activities. In Ontario, blastomycosis was taken off the list of reportable diseases in 1989, which diminishes the ability to track changes in its incidence. The sudden increase in cases in the Kenora catchment region in 1998 is evidence that data gathering should be maintained. A passive reporting system based at the Thunder Bay Laboratory and the LWDH laboratory could be effective in keeping track of blastomycosis in the region. Physicians in the area should be informed of the high rates, particularly in the Aboriginal population, and should be aware of the seasonal and other epidemiologic characteristics of blastomycosis. Further work on the ecological niche of blastomycosis might provide a way of avoiding high-risk locations.

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SOURCE

PJ Dwight, HBSc, MHSc.
Department of Community Health
Faculty of Medicine
University of Toronto

M Naus, MD, MHSc
Provincial Epidemiologist and Physician Manager
Disease Control Service
Ontario Ministry of Health and Long-Term Care
Toronto

P Sarsfield, MD
Medical Officer of Health and CEO
Northwestern Health Unit

B Limerick
Environmental Health Team Leader|
Northwestern Health Unit, Kenora
Ontario

CONTACT

Monika Naus, MD, MHSc, FRCPC, FACPM
Physician Manager and Provincial Epidemiologist
Communicable Diseases
Disease Control Service
Public Health Branch

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REPORTED ENTERIC OUTBREAKS IN ONTARIO, 1999.

Introduction

In Ontario, health units investigate enteric outbreaks as a requirement of the *Mandatory Health Programs and Services Guidelines*.[1] Outbreaks are reported via the outbreak module of the Reportable Disease Information System (RDIS). This paper will provide summary information on enteric outbreaks reported in 1999. A summary article on reported enteric outbreaks in Ontario for the years 1994 to 1998 was published in the August 27th, 1999 edition of PHERO.

Definitions

Enteric diseases are diseases of the gastrointestinal tract, including many food and waterborne diseases. The RDIS variable "Agent/Organism" consists of the specific type of pathogen reported.

These pathogens were placed in the categories 'viral', 'bacterial', 'parasitic', 'other', and 'unknown'. An enteric disease outbreak is defined as the occurrence of two or more cases of enteric illnesses linked in terms of time, exposure to source, and most often location.

The selections in the RDIS variable "Type Of Establishment" were regrouped for the purposes of this analysis as 'health care facilities', 'day care facilities', 'restaurants' (including cafeterias, catered events, resorts, clubs, hotels/motels), 'private residences', and 'other' (including unknown responses, church/religious establishments). The RDIS variable "Outbreak Mode Of Transmission" includes the selections 'person-to-person', 'food as a vehicle', 'water as a vehicle', 'vectorborne', 'other' and 'unknown'. The following definitions are used for the selections in the variable "Type Of Transmission"; a 'common' or 'point source' outbreak involves exposure by several individuals to a common agent, an 'extended common source' outbreak involves prolonged exposure to the source, 'propagated' outbreaks involve person-to-person spread, and a 'mixed' outbreak results from a combination of common source and propagated outbreaks.

Methods

All outbreaks reported in the RDIS outbreak module with an "Episode Date" (i.e., the date of onset or its best estimate) in 1999 were considered for analysis. Outbreak records were included in the analysis if the RDIS variables "Epidemic Curve Total Ill", or the sum of "Staff-Actual Ill" and "Clients-Actual Ill", had more than one case reported. The RDIS data were accessed January 26th, 2001.

Results

There were 344 reported enteric outbreaks in Ontario in 1999. Of these, 27 were not included in the analysis because the outbreaks did not meet the outbreak definition. Analysis was therefore performed on 317 outbreaks. York Region reported the largest number of outbreaks of any health unit with 41 (Figure 1).

A total of 10,063 persons were affected in the outbreaks. The mean, median, mode and range of cases affected by the outbreaks were 32, 18, 4, and 2 to 504, respectively. Fifty-six (18%) outbreaks involved 2 to 5 cases, 43 (13%) involved 6 to 10 cases, 199 (63%) involved 11 to 99 cases, and 19 (6%) outbreaks had 100 or more cases. There were 223 clients and 3 staff hospitalized. Seventy client deaths were reported. The four-month period of December to March accounted for 61% of all reported outbreaks (Figure 2).

Other' was the most frequently identified "Agent/ Organism" reported in 49 (15%) outbreaks (Figure 3). Viruses accounted for 47 (15%) outbreaks and 2,752 cases, representing 59% (2,752/4,662) of the cases that did not have missing data. Of the 47 viral outbreaks, 31 were caused by norwalk virus, 10 rotavirus, 2 enterovirus, 2 calcivirus, and 2 astrovirus. Of the 19 (6%) bacterial outbreaks, 8 were caused by *Salmonella sp.*, 5 *Campylobacter sp.*, 2 *Shigella sp.*, 2 *Clostridium sp.*, 1 verotoxin producing *Escherichia coli*, and 1 *Yersinia sp.* Of the 9 (3%) parasitic outbreaks, 8 were caused by *Giardia* and 1 *Cryptosporidium*. One hundred and eighty-five (58%) outbreaks were reported with missing "Agent/Organism" data.

The most frequently reported "Type Of Establishment" was 'health care facilities' with 214 (68%) outbreaks. These outbreaks accounted for 85% of all individuals affected in outbreaks (Figure 4). The primary "Mode Of Transmission" was 'person-to-person' reported in 183 (58%) outbreaks and in 6,682 (66%) cases. The primary "Type Of Outbreak" was 'propagated' and it was reported in 155 (49%) outbreaks and in 5,962 (59%) cases (Figure 5).

Name	ID	Outbreaks
Algoma	35	1
Brant	1	3
Bruce-Grey	29	0
Chatham-Kent	9	0
City of York	33	2
Durham	2	0
East York	31	5
Eastern Ontario	25	1
Elgin-St Thomas	3	5
Etobicoke	42	14
Haldimand-Norfolk	5	0
Haliburton-Kawartha-PR	28	0
Halton	6	0
Hamilton-Wentworth	7	0
Hastings-Prince Edward	27	11
Huron	8	0
Kingston-Frontenac-L&A	30	0
Lambton	10	8
Leeds Grenville, Lanark	26	22
Middlesex-London	11	1
Muskoka Parry Sound	34	6
Niagara	12	32
North Bay	13	0
North York	32	35
Northwestern	39	0
Ottawa-Carleton	14	0
Oxford	15	0
Peel	16	11
Perth	17	3
Peterborough	18	13
Porcupine	37	10
Renfrew	19	0
Scarborough	40	24
Simcoe	20	2
Sudbury	36	1
Thunder Bay	38	4
Timiskaming	21	5
Toronto	41	23
Waterloo	22	11
Wellington-Dufferin-Guelph	24	6
Windsor-Essex	4	7
York Region	23	41
No Health Unit Indicated		***10***
Total		***317***

Figure 1: Number of Enteric Outbreaks, By Health Unit, 1999.

0 = No Outbreaks Reported

Figure 2. Enteric Outbreaks, by Month Reported to Health Unit, Ontario, 1999.

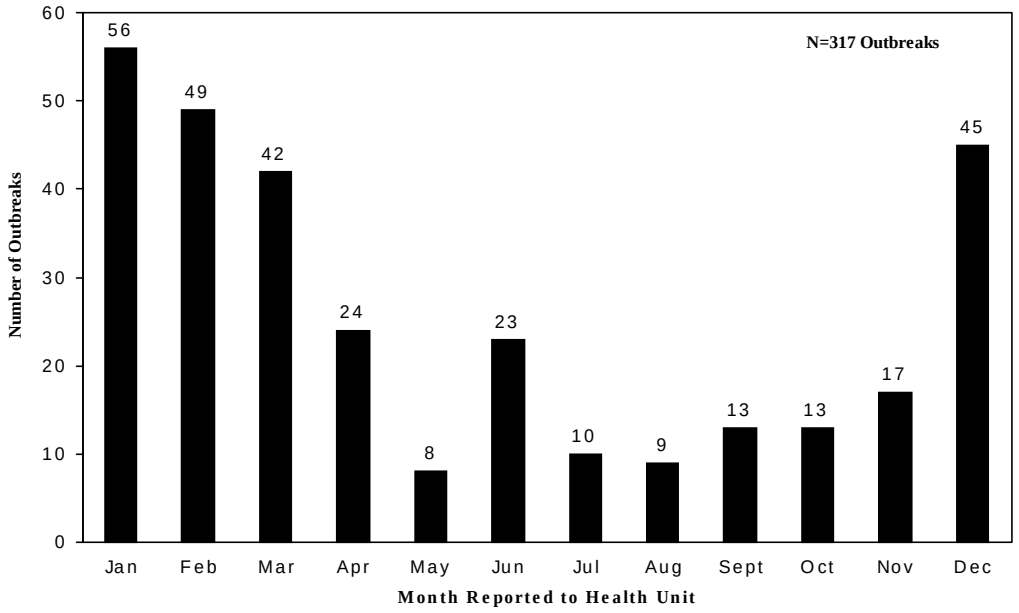


Figure 3. Number of Enteric Outbreaks and Cases, by Agent/Organism, Ontario, 1999.

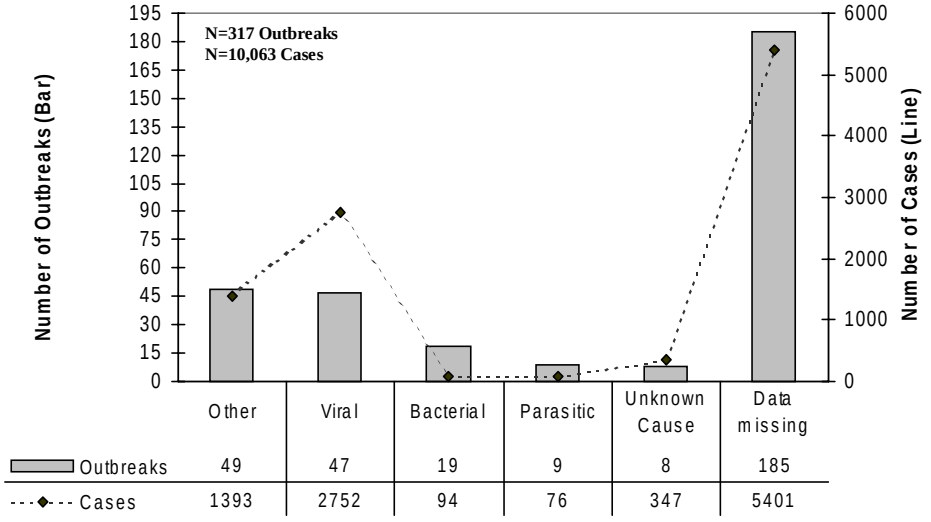
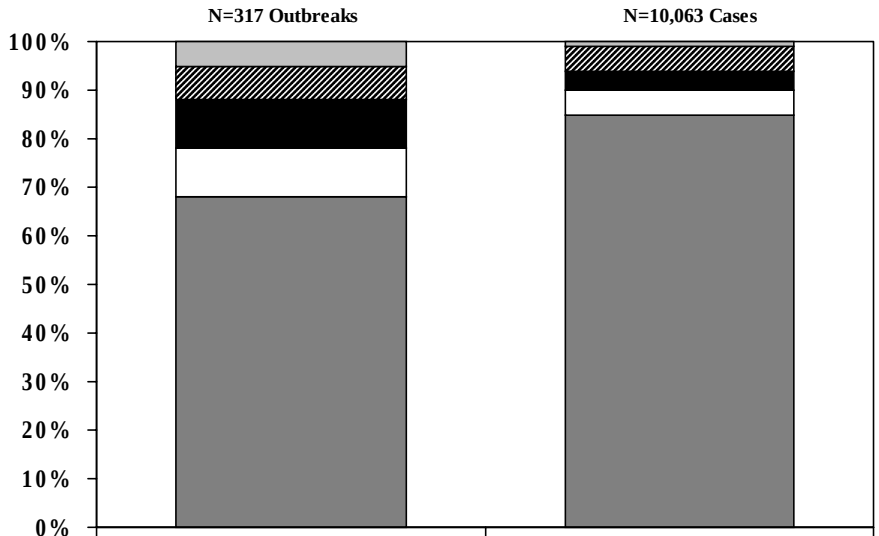


Figure 4. Percent of Outbreaks and Cases, by Type of Establishment, Ontario, 1999.



	Outbreaks (%)	Cases (%)
Private Homes	5	1
Other	7	5
Restaurants, etc.	10	4
Day Care Facilities	10	5
Health Care Facilities	68	85

Figure 5. Number of Outbreaks and Cases, by Type and Mode of Transmission, Ontario, 1999.

	Outbreak Type						
Outbreak Mode of Transmission	*Common Source*	*Extended Common*	*Mixed Pattern*	*Propagated*	*Unknown*	*Missing*	**Total**
Person-to-Person	5 (2)	15 (5)	7 (2)	131 (41)	12 (4)	13 (4)	183 (58)
	24 (0)	394 (4)	181 (2)	5,151 (51)	490 (5)	442 (5)	6,682 (66)
Vehicle-food	25 (8)	2 (1)	0	0	1 (0)	0	28 (9)
	391 (4)	17 (0)	0	0	4 (0)	0	412 (4)
Vehicle-water	4 (1)	0	0	0	0	0	4 (1)
	14 (0)	0	0	0	0	0	14 (0)
Vector-borne	0	0	0	1 (0)	0	0	1 (0)
	0	0	0	8 (0)	0	0	8 (0)
Other	0	0	0	2 (1)	1 (0)	0	3 (1)
	0	0	0	29 (0)	143 (1)	0	172 (2)
Unknown	8 (3)	1 (0)	0	21 (7)	49 (16)	2 (1)	81 (26)
	81 (1)	49 (1)	0	774 (8)	1,361 (14)	50 (1)	2,315 (23)
Missing	1 (0)	0	0	0	7 (2)	9 (3)	17 (5)
	7 (0)	0	0	0	294 (3)	159 (2)	460 (5)
Total	43 (14)	18 (6)	7 (2)	155 (49)	70 (22)	24 (8)	**317 (100)**
	517 (5)	460 (5)	181 (2)	5,962 (59)	2,292 (23)	651 (7)	**10,063 (100)**

Note: Top half of Category = Number of Outbreaks (% of Grand Total Outbreaks)
Lower half of Category = Number of Cases (% of Grand Total Cases)

The mean, median and range of duration of outbreaks based on the date of the index case to the date of the last case was 11, 10 and 1 to 34 days. The mean, median and range from the date of suspected exposure to the date of the index case was 1.2, 0, and 0 to 40 days, respectively. The mean, median and range from the date of the index case to the date the health unit was notified was 5.4, 3.0 and 0 to 60 days, respectively. The mean, median and range from the date the health unit was notified to the date the investigation began was 0.2, 0 and 0 to 16 days, respectively.

Discussion

Of the 344 outbreaks reported in 1999, 27 did not meet the case definition because the reported number of persons affected was less than two or not specified. It is likely that some of these 27 episodes were outbreaks. Fourteen health units did not report any outbreaks in 1999. Some of these health units had populations large enough that one or more outbreaks might have been expected.

The annual number of outbreaks (317), and the mean (32), median (18), and mode (4) of the number of persons affected in the outbreaks were similar to the findings reported from 1994 to 1998.[2] 'Other' was the most frequently reported "Agent/Organism". This category likely consisted of other viruses, bacteria or parasites not available from the "Agent/Organism" selection list. Viral causes were the most frequently reported of the known outbreak "Agents". The 58% of outbreaks that had missing information markedly biased these findings.

Sixty-eight percent of outbreaks occurred in health care institutions. This high percent influenced many of the other outbreak characteristics described below. Outbreaks in these "Establishments" were likely well reported because health care institutions often have staff who are dedicated to investigating the illnesses. Day care facilities and restaurants each accounted for 10% of the outbreaks, and 5% and 4% of the cases, respectively. Outbreaks in these establishments were likely well reported. 'Other', which included unknown and missing, was reported in 7% of outbreaks and 5% of cases. Five percent of outbreaks occurred in private homes and these outbreaks accounted for 1% of the cases. Outbreaks in private homes are likely the most poorly reported "Type Of Establishment".

A separate analysis of the outbreaks involving 10 or more cases showed that these outbreaks occurred almost exclusively in health care facilities. These institutions often have a large number of individuals in close proximity with an increased susceptibility to illnesses. The agent most frequently identified in these outbreaks were viruses. In addition, these outbreaks occurred most frequently in the winter months and accounted for the increase above expected number of outbreaks in the period from December to March.

Two percent (226/10,063) of those affected in the outbreaks were hospitalized. Analysis showed that 91% (205/226) of the persons hospitalized were from outbreaks in health care facilities. Similarly, 67% (47/70) of the mortalities were persons who were involved in outbreaks in health care institutions. The age and sex of these cases could not be determined from the database, however, the high percent of those who were hospitalized and died that were from health care institutions suggests that these individuals may have been more susceptible and adversely affected by the illness.

In their respective categories 'person-to-person' transmission and 'propagated' type of outbreak accounted for the majority of outbreaks. This resulted because of the association of viral outbreaks with these categories and the relative ease with which viruses are transmitted from person to person.

The mean of 1.1 days from the suspected date of exposure to the date of the index case provides some indication about the incubation period. The one data point that resulted in the range of 40 days was likely an erroneous outlier. All other data points were closer to the mean of 1.2 days. The mean of 5.4 days from the date of the index case to the date the health unit was notified of the outbreak was reasonable. A better statistic to indicate the timeliness of reporting outbreaks is the number of days from the date an outbreak was declared to the date the health unit was notified, however, this statistic could not be obtained from the data. The mean of 0.2 days from the date the health unit was notified to the date the health unit began the investigation indicates a rapid response from health units.

Conclusion

The predominant finding of this review of reported enteric outbreaks in Ontario in 1999 is viral illnesses transmitted by person-to-person spread in health care

facilities occurring in the winter months. These findings were consistent with the findings for the years 1994 to 1998.[2] While the amount of under-reporting that occurred was difficult to determine, a differential reporting bias likely affected the findings because outbreaks in health care facilities were likely better reported than outbreaks occurring among persons living in the community.

❑

SOURCE

Paul E. Alexander, MHSc, candidate
University of Toronto
Practicum Student
Disease Control Service
Public Health Branch

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

CONTACT

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

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Communiqué

Public Health Research, Education and Development Program

City of Hamilton &
McMaster University

FAMILY PHYSICIAN PRACTICES MODE OF COMMUNICATION PREFERENCES WITH THE PUBLIC HEALTH UNIT ABOUT VACCINATIONS AND COMMUNICABLE DISEASES

According to the Mandatory Health Program and Services Guidelines, local public health units in Ontario are responsible for monitoring and preventing communicable disease in collaboration with health care providers and other community partners (for example, restaurant owners, schools, nursing homes). Public health units consult web-sites, journals, Ontario Ministry of Health and Long Term Care publications, as well as national and international agencies to obtain information about new developments in communicable disease, methods of identifying and controlling these diseases and reporting trends in disease incidence. In Ontario, family physicians and their practice staff play an important role in monitoring and preventing communicable disease, as they identify new cases of communicable disease and administer vaccinations to people in the community. Thus, heath units must have excellent communication pathways to work effectively with family physician practices.

Little has been written about how the 37 public health units collaborate with family physicians and their practice staff about communicable disease. However, the Ontario Ministry's Public Health Branch does obtain from health units "global reports" indicating health unit "compliance" with Mandatory Health Program and Services Guidelines. In the last 20 years, technological changes including fax and email have increased the

number of ways in which public health units can communicate with family physician practices. The City of Hamilton Social and Public Health Services Communicable Disease Control (CDC) Branch conducted a survey of family physicians to ask them about their preferences regarding communication about vaccinations and communicable disease.

Methods

Two groups of family physician practices were surveyed. CDC Branch records were used to identify 30 of the 200 family physicians who most frequently contacted the Branch within the previous six months (the "frequent contact" group). Using a list of 400 family physicians in the community kept up to date in the McMaster University Department of Family Medicine, an additional 40 family physician practices were randomly selected for the "infrequent contact" comparison group. Names randomly selected that were also on the CDC Branch list were removed and replaced with another randomly selected physician from the Department of Family Medicine list.

A questionnaire was developed specifically for this survey. The questionnaire asked who in the family practice communicated with public health about vaccines and communicable disease; what timely information was needed during and after office hours; the types of communicable disease information requested and received; and, the methods of communication (telephone, e-mail, fax, mail and courier) most preferred when requesting and receiving information. An introductory letter accompanying the questionnaire explained the purpose of the survey and assured respondents that their replies would be kept confidential.

Results

The letters and questionnaires were mailed to the 70 family medicine clinics via Canada Post in February 1998. Two weeks later, 29% (20 of 70) of the questionnaires were returned. A second questionnaire then was sent to non-respondents by fax. One month after the initial mailing, 54% (38 of 70) had been returned. Non-respondents were contacted by phone and asked to return the completed questionnaire. In April, approximately eight weeks after the initial mail out, the survey was concluded with an overall response rate of 80% (65 of 70). Of the family practices surveyed, 77% (23 of 30) of the "frequent contact" group and 83% (33 of 40) of the "infrequent contact" group returned completed questionnaires.

In 43% of the family physician practices, the practice nurse was the person who was the key office person responsible for requesting and receiving vaccination and communicable disease information from the CDC Branch. In 30% of the practices, the physician was the key office person responsible, in 15% the medical secretary and in 12% professionals such as the medical assistant, health care aide and/or lab technician. No differences were identified between the "frequent contact" and "infrequent contact" groups regarding the key office person responsible for requesting and receiving vaccination and communicable disease information.

During office hours, the majority (84%) of family physician practices reported "always" being able to obtain timely information about immunization and communicable disease from the CDC Branch both in the "frequent contact" (78%) and "infrequent contact" (88%) groups (Table 1). Most (77%) practices do not request information after office hours. This proportion was slightly higher in the "frequent contact" (83%) than the "infrequent contact" (73%) groups (Table 1).

Information about vaccines was the most often requested type of information by family physician practices (75%), 67% for the "frequent contact" group and 80% for the "infrequent contact" group. Information on hepatitis - A, B and C (44%), immunization schedules (38%), sexually transmitted disease (35%), tuberculosis (24%), and illness spread by food and water (23%) was less often requested. There were no significant ($P < 0.05$) differences between the "frequent contact" and "infrequent contact" family practice groups (Table 2a).

Family physician practices reported receiving without requesting information on the following topics: vaccine information (87% of practices), immunization schedules (83%), hepatitis - A, B, and C (56%), sexually transmitted diseases (48%), tuberculosis (31%), and illness spread by food and water (27%). No significant differences were reported between "frequent contact" and "infrequent contact" groups (Table 2b).

For the "frequent contact" and "infrequent contact" groups the telephone (46 % and 52% respectively) and fax (32% and 36% respectively) were the most preferred

Table 1
Percent of Family Physician Practices that Reported Being Able to Obtain Timely Information about Immunization and Communicable Diseases for those Practices Having "Frequent Contact" and "Infrequent Contact" with Public Health Communicable Disease Program During Office Hours and After Office Hours, Hamilton-Wentworth, 1998.

Ability to Get Timely Information About Immunization and Communicable and Infectious Diseases	A) During Office Hours			B) After Office Hours		
	Practices having "Frequent Contact" with CDC Program %	Practices having "Infrequent Contact" with CDC Program %	All Practices %	Practices having "Frequent Contact" with CDC Program %	Practices having "Infrequent Contact" with CD Program %	All Practices %
Never/Sometimes	13	9	11	9	17	13
Always	78	88	84	9	10	9
Don't Request	9	3	5	83	73	77
Total	100 (N=23)	100 (N=33)	100 (N=56)	100 (N=23)	100 (N=30)	100 (N=53)

Table 2a
Type of Communicable Disease (CD) Information Requested by Family Physicians Practices in "Frequent Contact" and "Infrequent Contact" with the Communicable Disease Program, Hamilton-Wentworth, 1998.

Type of Information Requested	Practices in "Frequent Contact" with the CD Program %	Practices in "Infrequent Contact" with the CD Program %	All Practices %	P Value*
Vaccine	67 (12/18)	80 (24/30)	75 (36/48)	0.325
Immunization Schedule	36 (7/19)	39 (11/28)	38 (18/47)	0.767
Hepatitis A, B, C	42 (8/19)	45 (13/29)	44 (21/48)	0.556
Tuberculosis	32 (6/19)	20 (6/30)	24 (12/49)	0.501
Illness Spread by Food and Water	26 (5/19)	21 (6/29)	23 (11/48)	0.526
Sexually Transmitted Diseases	25 (5/20)	41 (12/29)	35 (17/49)	0.555
*Chi square test				

method of communication with the CDC Branch when requesting all types of information on immunization and communicable disease. Fax (43% and 50% respectively) and mail (34% and 39% respectively) were the most preferred method of communication with the CDC Branch when receiving without requesting communicable disease information on immunization and communicable disease.

Overall, while all respondents were satisfied with the quality of communication, more than 55% of the respondents reported that they were "very satisfied" with the quality of communication between themselves and the CDC Branch regarding immunization and communicable and infectious disease information.

Discussion

Despite numerous requests for health units and family physician practices to use the Internet in their communication (Friede et al 1995; Hollander & Martin 1999), this survey found family physician practices preferred to use the telephone and/or fax when requesting information on immunization and communicable diseases. Fax and mail were preferred when receiving without requesting communicable disease information from the CDC Branch.

Family physician practices most frequently requested information on vaccines and immunization schedules. Most practices were satisfied with the quality of communication with the CDC Branch.

Table 2b
Percent of Family Physician Practices in "Frequent Contact and "Infrequent Contact" with the Communicable Disease (CD) Program, by Type of Communicable Disease Information Received without Requesting, Hamilton-Wentworth, 1998

Type of Information Received without Requesting %	Practices in "Frequent Contact" with the CD Program %	Practices in "Infrequent Contact" with the CD Program %	All Practices %	P Value*
Vaccine	91 (20/22)	83 (19/23)	87 (39/45)	0.414
Immunization Schedule	76 (16/21)	88 (22/25)	83 (38/46)	1.00
Hepatitis A, B, C	60 (12/20)	52 (12/23)	56 (24/43)	0.364
Sexually Transmitted Diseases	45 (9/20)	50 (11/22)	48 (20/42)	0.366
Tuberculosis	29 (5/17)	32 (7/22)	31 (12/39)	0.740
Illness Spread by Food and Water	12 (2/17)	38 (9/24)	27 (11/41)	0.085

*chi square test

Of all family physician practices surveyed, only 7 (13%) reported that they "never/sometimes" are able to get timely information about immunization and communicable and infectious disease from the CDC Branch after hours. However, 41 (77%) of all practices reported that they do not request this information after hours. Family practices may not require this information after hours as they are closed. Other practices may not be familiar with the many ways to access the CDC Branch including after hour pager on-call service, Internet access, direct phone, and staff dedicated to promptly respond to inquiries from family physician practices.

These survey results are surprising as the Internet was not identified as a preferred method of communication by family physician practices. Tuominen & Crouse, 1996 have implemented successful strategies to familiarize family physicians with the Internet as a source of information. Of the family practices included in this survey, 70% reported other professionals such as the practice nurse, medical secretary, medical assistant, health care aide and lab technician as the key office contact requesting and receiving immunization and communicable disease information. These professionals should be considered in strategies developed to encourage family physician practices to use the Internet. ❑

SOURCE AND CONTACT

Daina Mueller
Program Manager, Youth and Mental Health Branch
City of Hamilton Social and Public Health Services Department

Dr. Larry W. Chambers
Epidemiology Consultant, Public Health Research & Development Program
Community Support & Research Branch
City of Hamilton Social and Public Health Services Department

Dr. Elizabeth Richardson
Medical Officer of Health
City of Hamilton Social and Public Health Services Department

Ornella Tolomeo
Acting Manager, Communicable Disease Control Branch
City of Hamilton Social and Public Health Services Department

Katy Wong
Research Assistant
City of Hamilton Social and Public Health Services Department

Janusz Kaczorowski
Assistant Professor and Research Coordinator
Department of Family Medicine
Faculty of Health Sciences
McMaster University

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Communiqué

Public Health Research, Education and Development Program

Hamilton Social and Public Health Services

1999 HAMILTON-WENTWORTH HEALTH SURVEY: SECOND-HAND SMOKE AND MUNICIPAL TOBACCO BY-LAW DESCRIPTIVE REPORT

Introduction

The 1999 Hamilton-Wentworth Health Survey (HWHS) was initiated to provide data regarding a number of health-related attitudes, behaviours, and beliefs of residents of the Region of Hamilton-Wentworth. The 1999 HWHS is a follow-up to a 1995 survey, covering many of the same topics and incorporating several new ones such as sun safety and health-related quality of life. The survey was conducted approximately six months prior to the implementation of new smoking restrictions in several communities in the former Regional Municipality of Hamilton-Wentworth. The survey results were used for the purposes of media advocacy as well as needs assessment and program planning.

This report will focus on the 1999 survey's findings relating to second-hand smoke and by-laws intended to protect against its harmful effects. Exposure to second-hand smoke is shown to be associated with a large number of health problems including lung cancer (Wigle et al. 1987, Fontham 1991) and heart disease (Glantz & Parmley 1991, Steenalnd 1992). Estimates suggest second-hand smoke is responsible for the deaths of 3,000 to 3,500 non-smoking Canadians each year (Wigle et al. 1987). Second-hand smoke also poses a significant risk to children's health including increased risk of the development of asthma, middle ear infections, and bronchitis (Ryland et al. 1995, Kitchens 1995, Stoddard & Miller 1995).

Methods

The 1999 HWHS is a general population survey conducted for Hamilton Social and Public Health Services by the Institute for Social Research (ISR), York University. Data were collected via telephone survey between October 13 and November 10, 1999.

The HWHS questionnaire measures public support for existing and proposed by-laws regarding smoking in public places, as well as region-wide smoking rates (questionnaire is available by request). The questionnaire also contains questions on health-related quality of life, general health status, sun protection behaviour, social capital and demographics. Where possible, questions of proven validity and reliability were used. The questionnaire was pilot tested by ISR (10 interviews) prior to data collection to test question wording, order, and skip patterns and to assess survey length. The average interview time was 14 minutes.

The survey sample was designed to represent the adult population (aged 18 years and over), residing in private homes in the six municipalities that make up the Regional Municipality of Hamilton-Wentworth. The survey sample included 500 residents from Hamilton and at least 100 residents from each of the surrounding municipalities, for a minimum total sample size of 1,000 residents.

Survey respondents were chosen through a two-stage process. Stage one, the selection of households within each municipality, involved randomly selecting residential telephone numbers, using a random digit dialing technique. Stage two, the random selection of individual respondents, involved selecting the adult household member (aged 18 years and over) who had the most recent birthday. This individual was administered the questionnaire. In order to maximize survey response rates, up to 12 calls were made to each household and refusals were called a second time.

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 9.0 and are presented as percentages of respondents answering each question.

Results

Of 1,637 eligible household, 1,012 adult residents completed the telephone interview. This translates into a total survey response rate of 62%. Given this response rate, an estimating procedure was used to determine the survey's degree of precision. The findings suggest that

the margin of error is generally plus or minus three percent, 19 out of 20 times (95% of the time). Item specific confidence intervals are available by request.

The extent to which the survey sample was the same or different from the Hamilton-Wentworth population was determined by comparing demographic characteristics and a selected health behaviour variable (current smoking status) from the 1999 HWHS to the most recent Census (Statistics Canada 1998) (demographic) and Ontario Health Survey (Ontario Ministry of Health 1999) (smoking status) data. The results of the Census data comparison are shown in Table 1. Compared to 1996 Census data for Hamilton-Wentworth, individuals interviewed for the 1999 HWHS were more likely to be female, married, employed, and report higher household income and education levels. These results are similar to those reported for the 1995 HWHS (Taylor et al. 1996), and for telephone surveys in general (Cannell et al. 1987).

Survey Findings

The 1999 HWHS sought to determine how often respondents are exposed to second-hand smoke. Respondents were also asked a series of questions regarding their attitudes about exposure to second-hand smoke. In addition, the survey included questions on residents' attitudes about second-hand smoke and tobacco by-laws.

Self-reported exposure to second-hand smoke

When asked how often they are exposed to second-hand smoke, 36% of respondents report they are exposed everyday (see Table 2). Another 10% of respondents report they are exposed to second-hand smoke three to six times per week, and 17% report they are exposed once or twice per week. Seventeen percent (17%) of respondents state they are exposed to second-hand smoke less than once a week and 18% report they are never exposed (see Table 2).

Attitudes towards exposure to second-hand smoke

Respondents were asked whether they think exposure to second-hand smoke is likely to cause health problems. More than half of the respondents (53%) think it is very likely that exposure to second-hand smoke causes health problems (see Table 2). Another 29% think it is somewhat likely to cause health problems. Only 6% of respondents think it is very unlikely that exposure to second-hand smoke causes health problems.

Respondents who agreed that second-hand smoke exposure is linked to health problems were then asked whether they were concerned about their own exposure. A majority of these respondents (72%) report being concerned about their exposure (see Table 2). Of the respondents who are concerned about exposure to second-hand smoke, 40% are very concerned, 32% are somewhat concerned, and 26% are either not very concerned or not concerned at all.

Among non-smokers, 86% think it is likely that exposure to second-hand smoke will cause health problems compared to 72% of smokers (see Figure 1). Smokers and non-smokers also differ in terms of their level of concern about personal exposure to second-hand smoke and the likelihood of health problems. Concern is expressed by 83% of non-smokers as compared to 42% of smokers (see Figure 2).

Attitudes about tobacco by-laws

The HWHS polled residents regarding their attitudes toward tobacco by-laws. They were asked about their support for the restrictions that were to be implemented on June 1, 2000 that would restrict smoking to fully enclosed, separately ventilated Designated Smoking Areas (DSAs) in several communities. Support is strong, with 75% of respondents saying they support the by-law* (see Table 2). Opposition to these restrictions is indicated by 21% of respondents.

When asked whether they would support DSAs in bars, 47% report they would support such a measure and 38% report they would oppose it (see Table 2). It is interesting to note that 15% of respondents express no opinion or feel the question is not applicable.

Workplaces in Hamilton, Ancaster, Dundas, and Flamborough are currently required to be non-smoking except for fully enclosed, separately ventilated DSAs. When asked whether they support the current by-law restricting smoking in workplaces to DSAs, across all municipalities 79% of respondents express support for the by-law. Only 14% of those surveyed oppose the current workplace smoking restrictions.

In a separate item, respondents were asked about their support for completely smoke-free workplaces. Overall, 74% of respondents support the smoke-free workplace concept and 21% oppose it (see Table 2).

* Municipality-specific estimates can not be reported here due to small sample size.

Table 1. Demographic Characteristics of 1999 Hamilton-Wentworth Health Survey Respondents Compared to 1996 Census Data for Hamilton-Wentworth

Characteristics	1999 Hamilton-Wentworth Health Survey Respondents (%)	1996 Census* (%)
Gender		
Male	46	49
Female	54	51
Age		
18 – 19 years	4	--
20 – 44 years	50	52
45 – 64 years	32	29
65+ years	14	19
Marital Status		
Ever married	78	71
Single / never married	16	29
Living with partner	6	--
Household Income		
Less than $20,000	13	24
$20,000 - $39,000	26	25
$40,000 - $59,000	21	20
$60,000 - $79,000	15	15
$80,000 - $99,000	10	8
$100,000 and over	15	8
Employment Status[+]		
Employed	62	57
Unemployed	2	6
Not in the labour force[~]	36	37
Education		
Primary school or less	5	12
Some secondary school	13	25
Completed secondary school	30	14
Some community college, technical college, CEGEP or nursing program	8	7
Completed community college, technical college, CEGEP or nursing program	19	19
Some university	5	8
University degree	19	12

*All Census data is based on a population 15 years of age and over. 1999 Hamilton-Wentworth Health Survey data is based on a population 18 years of age and over.

[+]Employment status is based on total population (not specific to population in the labour force).

[~] Refers to individuals who are not actively seeking employment at the time of the survey/Census, students, retired individuals, etc.

Table 2. Respondents' Exposure and Attitudes towards Second-hand Smoke, Attitudes towards Tobacco By-laws and Dining Out Behaviour, Hamilton-Wentworth 1999.

	Percent* (%)
Exposure to and attitudes towards second-hand smoke	
Exposure to second-hand smoke (for at least 5 minutes) within last month	(n=1026)[+]
Every day	36
3-6 times per week	10
1-2 times per week	17
Less than once per week	17
Never	18
Don't know / Refused	2
Exposure to second-hand smoke likely to cause health problems	(n=1026)
Very likely	53
Somewhat likely	29
Somewhat unlikely	6
Very unlikely	6
Undecided	6
Concern about personal exposure to second-hand smoke	(n=899)^
Very concerned	40
Somewhat concerned	32
Not very concerned	14
Not at all concerned	12
Don't know / Refused	2
Attitudes towards tobacco by-laws	
Support for smoke-free restaurants with DSAs° by June 2000	(n=1026)
Strongly support / Somewhat support	75
Somewhat oppose / Strongly oppose	21
Don't go, don't care / No opinion / Don't know	4
Support for smoke-free bars with DSAs°	(n=1026)
Strongly support / Somewhat support	47
Somewhat oppose / Strongly oppose	38
Don't go, don't care / No opinion	15
Support for completely smoke-free workplaces	(n=1026)
Strongly support / Somewhat support	74
Somewhat oppose / Strongly oppose	21
Undecided / Don't know / Refused	5
Dining out behavior	
Where do respondents asked to be seated in a restaurant	(n=1026)
Non-smoking section	65
Smoking section	15
Makes no difference	10
Never go to restaurants that permit smoking / Never go to restaurants	5
Depends whether going with a smoker or not	5
After by-law implemented, eat out more or less	(n=1014)~
Makes no difference	76
More often	11
Less often	10
Don't know / Refused	3

*Percentages may not add up to exactly 100% due to rounding.
[+]Survey data were weighted to better reflect the local household and municipal population distribution. This weighting causes the numerator (the 'n' reported in the above table) to increase slightly from the 1,012 completed interviews to 1,026.
^This question was asked of only those respondents who report that exposure to second-hand smoke is likely to cause health problems.
°Fully enclosed separately ventilated Designated Smoking Areas (DSAs).
~This question was asked of only those respondents who report dining out.

Figure 1. Attitudes about Likelihood of Second-hand Smoke Causing Health Problems by Smoking Status, Hamilton-Wentworth 1999

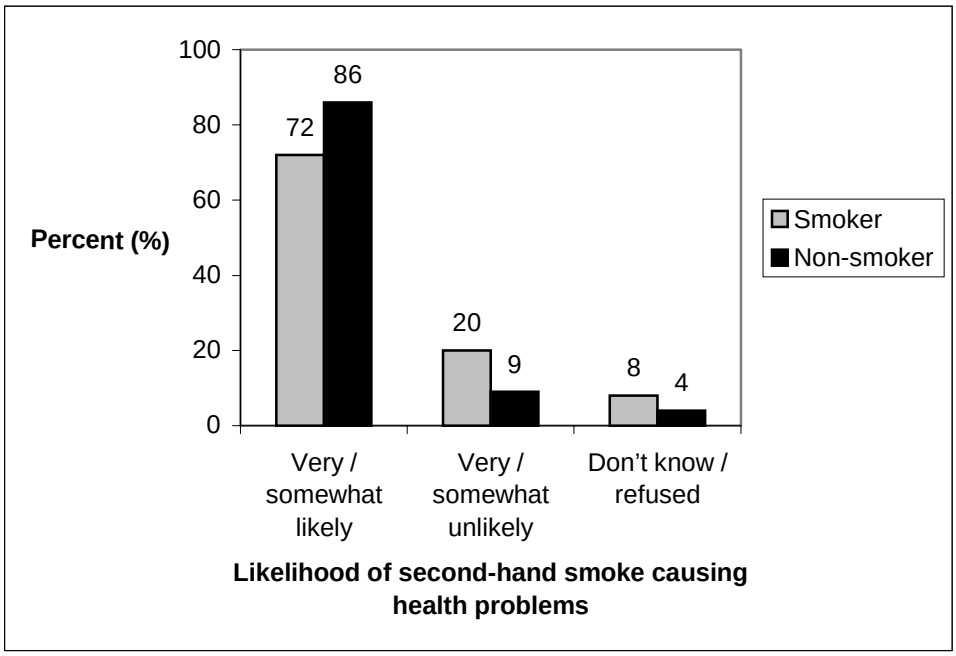
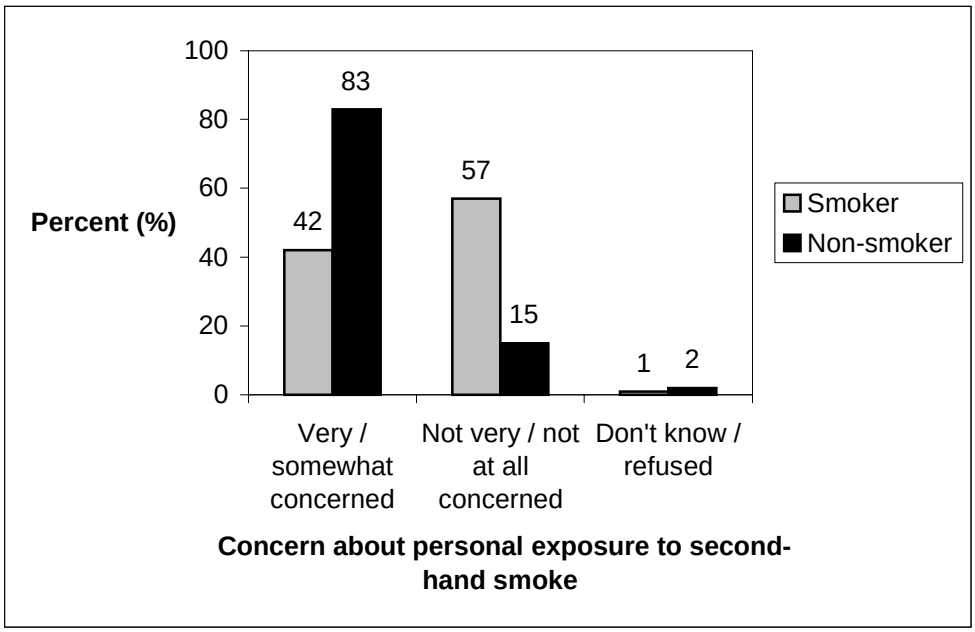


Figure 2. Concern about Personal Exposure to Second-hand Smoke* by Smoking Status, Hamilton-Wentworth 1999



*This question was asked of only those respondents who report that exposure to second-hand smoke is likely to cause health problems (see Figure 1).

Public attitudes towards tobacco by-laws differ between non-smokers and smokers. It is interesting to note that on some questions there is a relatively high level of consensus while on others it is more sharply divided. Support for restricting smoking in restaurants to DSAs is highest among non-smokers (83%) in contrast to smokers (53%) (see Figure 3).

Support for the current by-law restricting smoking in workplaces to DSAs, however, is high among both smokers and non-smokers. Of those who identify themselves as smokers, 66% express support for the by-law restriction while 85% of non-smokers support the restriction. Opposition is expressed by only 28% of smokers and by 9% of non-smokers.

Dining Out

Several questions were included in the HWHS to assess whether people's concern about second-hand smoke affects their choices regarding dining out. When asked where they prefer to be seated in a restaurant, 65% of respondents prefer non-smoking, 15% prefer smoking, 10% report it makes no difference, and 5% say it depends on whether they are dining out with someone who smokes (see Table 2).

Respondents were also asked about whether the implementation of the by-law restricting smoking in restaurants to DSAs would affect how often they eat out in restaurants. A large proportion of respondents (76%) report that the implementation of the by-law restrictions would not change their dining out habits and 11% report they would eat out more often (see Table 2). This suggests that 87% of respondents would eat out as much or more than they currently do once smoking in restaurants is restricted to DSAs. Only 10% claim they would eat out less often.

Respondents were also asked how frequently they dine out in restaurants. A cross-tabulation was calculated to compare how frequently respondents dine out with their stated beliefs about how implementation of the by-law will change their dining behaviour. The cross-tabulation (Table 3) reveals that among those who report dining out frequently or moderately, 78% and 77% respectively say they would dine out as much as before. Furthermore, it showed that 11% of those who report dining out frequently and 13% of those who report dining out moderately state they would eat out in restaurants more often following the implementation of the smoke-free by-law.

Figure 3. Support for Smoke-free Restaurants with Designated Smoking Areas by June 2000 by Smoking Status, Hamilton-Wentworth 1999

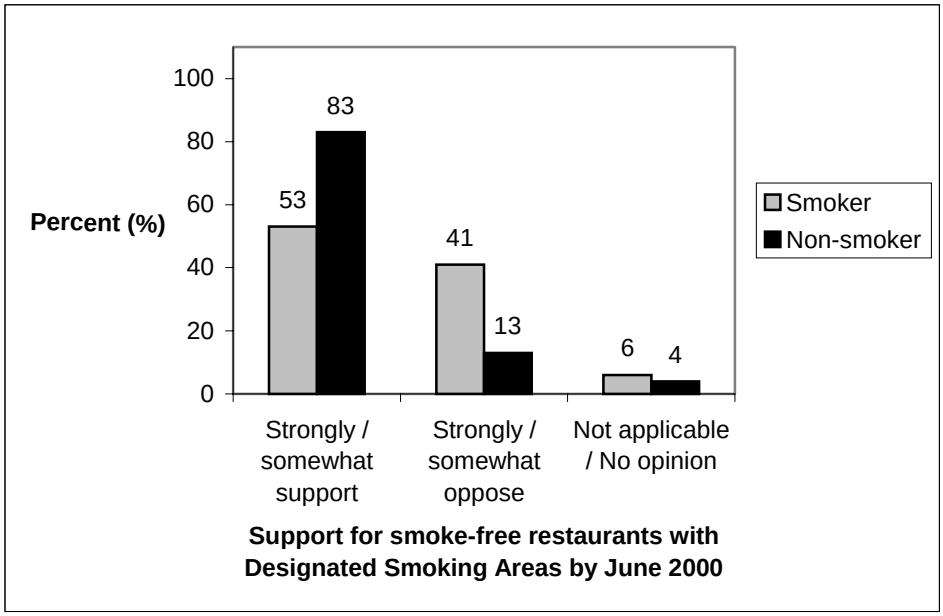


Table 3. Impact of Designated Smoking Area By-Law on Respondents' Dining Out Behaviour by Frequency of Dining Out, Hamilton-Wentworth 1999

	Frequency of dining out*		
Impact on dining out behaviour	Frequent (%)	Moderate (%)	Infrequent / Never (%)
Make no difference	78	77	74
More often	11	13	9
Less often	10	9	13
Don't know / refused	2	1	4

***Frequent = more than once per week**
Moderate = 1-3 times per month to 6-11 times per year
Infrequent / never = 1-5 times per year or never

In general, analysis of responses regarding expected dining out frequency by smoking status, indicates that implementation of the by-law is not likely to alter dining out habits. Among non-smokers, 93% express the intention to dine out as much or more after the by-law is implemented. A similar pattern is seen among smokers with 76% saying they will dine out as much or more after by-law implementation.

Discussion

In preparation for public debates regarding smoking by-laws, many health departments conduct surveys to measure public attitudes about smoking by-laws. The 1999 HWHS is one such survey and a review of its findings offers a view into some of their potential strengths and weaknesses.

The selection of questions is critical and even careful attention to this area can still produce uneven results. Some questions in the 1999 HWHS yielded valuable information about public beliefs and attitudes. For example, the questions regarding beliefs about the likelihood that second-hand smoke causes health problems and concern about exposure to second-hand smoke were very useful in determining the extent to which health messages have been internalized. They also provided information regarding the salience of second-hand smoke as a health concern.

Other questions such as the self-reports of exposure to second-hand smoke were much less telling. One limitation was the unknown reliability and validity of self-reported exposure to second-hand smoke. Another limitation was that the questions did not address the length of exposure or concentration of second-hand smoke.

The 1999 HWHS also contained a number of items that asked respondents' opinions about specific smoking by-laws that were to take effect in the near future. The inclusion of these questions provided a snapshot of public opinion regarding a specific piece of municipal legislation and a valuable advocacy tool. The decision to use these questions was made in response to immediate concerns regarding the legislation that was soon to take effect. This immediate political concern blinded the survey tool's authors to the need to look toward the future and include more general questions relating to support for 100% smoke-free restaurants or specific provisions not included in the soon-to-be enacted legislation.

While the survey sampling was designed to be representative of the six municipalities (with a minimum sampling of 500 respondents for the old City of Hamilton, and 100 for each of the other five municipalities), the total sample of 1012 respondents was too small to enable the production of municipality-specific data on public support and opinions with any confidence. That is, the H-W results do represent the H-W region and the make-up of its six municipalities, however, one cannot use the results for each municipality alone (e.g. Ancaster), with any confidence. To conduct such a survey requires a sample size approximately five times the size used for the 1999 HWHS. In 1999, resource restrictions prevented the conduction of such

a survey. In the future, the relative trade-off between the need for municipality-specific data and the cost to carry out such a survey should be examined further.

In developing surveys for this purpose, there are few absolutes, as the needs and specific application will vary from one community to the next. As with the development of any survey tool, our experience with the 1999 HWHS suggests it is advisable to step back from the immediate context and consider future applications of the data. It is also important to bear in mind that while public opinion surveys are important tools in public policy development, it is wise to be realistic about their potential impact. Ultimately, surveys are simply one tool to be considered alongside other strategies such as coalition building, public awareness campaigns, and the involvement of stakeholders in the policy development process.

❑

SOURCES

Brian C. Kreps, BA, MA
Tobacco Use Prevention Promoter
Healthy Lifestyles and Disease Prevention Branch
Hamilton Social and Public Health Services

Kate Feightner
Epidemiologist
Community Support and Research Branch
Hamilton Social and Public Health Services

Larry Chambers, Ph D.
PHRED Consultant
Community Support and Research Branch
Hamilton Social and Public Health Services

Brenda Suggett
Epidemiologist
Community Support and Research Branch
Hamilton Social and Public Health Services

Helen Hale Tomasik
Director
Healthy Lifestyles and Disease Prevention Branch
Hamilton Social and Public Health Services

Tracey Taylor
Program Manager
Healthy Lifestyles and Disease Prevention Branch
Hamilton Social and Public Health Services

CONTACT

Jerome Conway, Ph.D.
Coordinator, Tobacco Program
Population Health Service
Public Health Branch
Telephone: (416) 327-7379
Facsimile: (416) 327-7438

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Summary of Reportable Diseases in March, 2001

Health Units by Region	1996 Population	AIDS	Campylo.	Chicken-pox	Chlamydia	Enceph./ Meningitis	GAS	Gonorrhea
Algoma	123,953		2	1	20	1	2	
North Bay	93,841		1		5			
Northwestern	80,235		2	4	13		1	
Porcupine	97,437		3	11	3			
Sudbury	201,154		4		29	1	1	
Thunder Bay	161,187							
Timiskaming	38,847							
Total - Northern	**796,654**		**12**	**16**	**70**	**2**	**4**	
Eastern Ontario	185,314		1		3	1		
Hastings-Prince Edward	143,790		2	4	9			1
Kingston-Frontenac	175,568		4		28	2		
Leeds-Grenville	156,129			34	4			
Ottawa-Carleton	721,136		24		103	3		15
Renfrew	97,634		1		8			
Total- Eastern	**1,479,571**		**32**	**38**	**155**	**6**		**16**
Durham Region	458,616		2	166	41	1	2	6
Haliburton-Kawartha	165,039		3		3		1	
Muskoka-Parry Sound	78,675		1	4	1			
Peel Region	852,526		25	228	39	4	4	9
Peterborough	123,448				5			1
Simcoe County	329,865			23	22	1		4
Toronto City - total	2,385,421	2	49	327	498	1	4	121
North	*589,653*		*12*	*71*	*109*			*27*
South	*653,734*	*1*	*15*	*68*	*158*	*1*	*2*	*46*
West	*475,252*	*1*	*15*	*4*	*162*		*1*	*29*
East	*666,782*		*7*	*184*	*69*		*1*	*19*
York Region	592,445		12		6	1	5	
Total - Central East	**4,986,035**	**2**	**92**	**748**	**615**	**8**	**16**	**141**
Bruce, Grey-Owen Sound	153,312		1	2	2	2		
Elgin-St. Thomas	79,159							
Huron	60,220			13	4		1	
Chatham-Kent	109,650		1	14	10			
Lambton	128,975	1	1					
Middlesex-London	389,616		6		34	3	3	4
Oxford	97,142				2		1	
Perth	72,106		3	12	3			
Windsor-Essex	350,329		6		37			2
Total - Southwest	**1,440,509**	**1**	**18**	**41**	**92**	**5**	**5**	**6**
Brant	114,564		1		12	2	1	2
Haldimand-Norfolk Region	102,575		2	3	3			
Halton Region	339,875		5		10			
Hamilton-Wentworth	467,799		5	9	54	1	5	8
Niagara Region	403,504		9	232	26			4
Waterloo Region	405,435		9		38		2	1
Wellington-Dufferin	217,052		9	1	15		1	
Total - Central West	**2,050,804**		**40**	**245**	**158**	**3**	**9**	**15**
March 2001	**10,753,573**	**3**	**194**	**1,088**	**1,090**	**24**	**34**	**178**
*** Total YTD 2001**	**-**	**7**	**640**	**3,049**	**3,521**	**80**	**99**	**649**
*** Total YTD 2000**	**-**	**16**	**641**	**8,328**	**3,643**	**77**	**141**	**728**

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

* Adjusted for deletions and late reports.

Summary of Reportable Diseases in March, 2001

Health Units by Region	1996 Population	PPNG	Hepatitis A	Hepatitis B	Hepatitis C	Hib	Influenza	Measles	Meningo-coccal
Algoma	123,953				10		2		
North Bay	93,841				2		1		
Northwestern	80,235						1		
Porcupine	97,437						15		
Sudbury	201,154				13		6		
Thunder Bay	161,187								
Timiskaming	38,847								
Total - Northern	**796,654**				**25**		**25**		
Eastern Ontario	185,314						5		
Hastings-Prince Edward	143,790				1		6		
Kingston-Frontenac	175,568			1	32		3		
Leeds-Grenville	156,129			1	33		1		
Ottawa-Carleton	721,136				27		38		2
Renfrew	97,634						3		
Total- Eastern	**1,479,571**			**2**	**93**		**56**		**2**
Durham Region	458,616						3		
Haliburton-Kawartha	165,039			2	3		2		
Muskoka-Parry Sound	78,675								
Peel Region	852,526	1			12		7		
Peterborough	123,448		1		4		3		
Simcoe County	329,865						6		
Toronto City - total	2,385,421	5	2	3	71		24		2
North	*589,653*	*1*			*27*		*4*		*1*
South	*653,734*	*4*	*1*	*3*	*12*		*8*		*1*
West	*475,252*				*21*		*8*		
East	*666,782*		*1*		*11*		*4*		
York Region	592,445			1			7		1
Total - Central East	**4,986,035**	**6**	**3**	**6**	**90**		**52**		**3**
Bruce, Grey-Owen Sound	153,312				2		6		
Elgin-St. Thomas	79,159								
Huron	60,220				3		2		
Chatham-Kent	109,650								
Lambton	128,975								
Middlesex-London	389,616	2			8		1		5
Oxford	97,142						1		
Perth	72,106						1		
Windsor-Essex	350,329				7		1		
Total - Southwest	**1,440,509**	**2**			**20**		**12**		**5**
Brant	114,564		1				11		
Haldimand-Norfolk Region	102,575						3		
Halton Region	339,875				3		7		
Hamilton-Wentworth	467,799				23		8	2	4
Niagara Region	403,504		1		23		11		
Waterloo Region	405,435				24		4		
Wellington-Dufferin	217,052				3		2		
Total - Central West	**2,050,804**		**2**		**76**		**46**	**2**	**4**
March 2001	**10,753,573**	**8**	**5**	**8**	**304**		**191**	**2**	**14**
*** Total YTD 2001**	**-**	**35**	**24**	**28**	**1,019**	**3**	**620**	**6**	**38**
*** Total YTD 2000**	**-**	**67**	**33**	**50**	**1,610**	**2**	**1,495**	**2**	**31**

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

* Adjusted for deletions and late reports.

Summary of Reportable Diseases in March, 2001

Health Units by Region	1996 Population	Mumps	Pertussis	Rubella	Salmon.	Shigellosis	Syphilis (Prim/Sec)	VTEC
Algoma	123,953				2			
North Bay	93,841				1			1
Northwestern	80,235		3					
Porcupine	97,437							
Sudbury	201,154		1		4	1		1
Thunder Bay	161,187							
Timiskaming	38,847							
Total - Northern	**796,654**		**4**		**7**	**1**		**2**
Eastern Ontario	185,314				5			1
Hastings-Prince Edward	143,790				7			
Kingston-Frontenac	175,568				1			
Leeds-Grenville	156,129		6		1	1		
Ottawa-Carleton	721,136				13	4		1
Renfrew	97,634				2			
Total- Eastern	**1,479,571**		**6**		**29**	**5**		**2**
Durham Region	458,616				4			
Haliburton-Kawartha	165,039				2			1
Muskoka-Parry Sound	78,675				1			
Peel Region	852,526		3		26	2		1
Peterborough	123,448				3			1
Simcoe County	329,865				1			
Toronto City - total	2,385,421		3		33	2		3
North	*589,653*		*2*		*13*	*1*		*2*
South	*653,734*				*5*			
West	*475,252*				*7*			
East	*666,782*		*1*		*8*	*1*		*1*
York Region	592,445				15			1
Total - Central East	**4,986,035**		**6**		**85**	**4**		**7**
Bruce, Grey-Owen Sound	153,312				1			
Elgin-St. Thomas	79,159							
Huron	60,220				1			
Chatham-Kent	109,650				1			
Lambton	128,975		2					
Middlesex-London	389,616				4	1		
Oxford	97,142							
Perth	72,106							1
Windsor-Essex	350,329		3		9			1
Total - Southwest	**1,440,509**		**5**		**16**	**1**		**2**
Brant	114,564				2			
Haldimand-Norfolk Region	102,575				2			
Halton Region	339,875		1		3	1		
Hamilton-Wentworth	467,799				8			
Niagara Region	403,504				3			
Waterloo Region	405,435				2			
Wellington-Dufferin	217,052				2			
Total - Central West	**2,050,804**		**1**		**22**	**1**		
March 2001	**10,753,573**		**22**		**159**	**12**		**13**
*** Total YTD 2001**	**-**		**101**	**3**	**486**	**56**	**1**	**39**
*** Total YTD 2000**	**-**	**14**	**122**	**2**	**487**	**79**	**4**	**39**

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

* Adjusted for deletions and late reports.