

A B S T R A C T

This study describes the epidemiology of cocaine and heroin abuse in urban Canada as part of an initial report on a national substance abuse surveillance system, the Canadian Community Epidemiology Network on Drug Use. Data pertaining to prevalence of use, law enforcement, treatment, morbidity and mortality of cocaine and heroin were obtained from the appropriate health and law enforcement institutions in six sentinel cities: Vancouver, Calgary, Winnipeg, Toronto, Montreal and Halifax. Cocaine and heroin appear to be more available in Vancouver than in the remaining cities. In all CCENDU cities, large proportions of persons in treatment programs for substance abuse identified cocaine as their major addiction; however, there is considerable variation in treatment utilization regarding heroin. Vancouver ranks first in terms of the per capita number of cocaine- and heroin-related hospital separations and mortality rate. Cocaine abuse appears to be an emerging problem in Calgary, Winnipeg and Halifax, and opiate abuse appears to be an emerging problem in Calgary.

A B R É G É

Cette étude épidémiologique décrit la consommation de cocaïne et d'opiacés dans six centres urbains canadiens. L'étude fait partie d'un système national de surveillance, soit le Réseau communautaire canadien de l'épidémiologie des toxicomanies (RCCET). On a recueilli des données sur la prévalence de la consommation, l'activité policière, le traitement, la morbidité et la mortalité, au niveau local à Vancouver, Calgary, Winnipeg, Toronto, Montréal et Halifax. Les principales observations qui se dégagent de cet exercice sont que la cocaïne et l'héroïne sont plus accessibles à Vancouver que dans les autres centres urbains. Dans chacune des six villes du Réseau, une part importante des services de traitement est consacrée à la dépendance cocaïnique. Par contraste, l'abus d'héroïne varie considérablement parmi les villes témoins. Le nombre de congés hospitaliers pour un diagnostic relié à la cocaïne et à l'héroïne est le plus élevée à Vancouver. La cocaïne paraît être un problème naissant à Calgary, Winnipeg et Halifax. À Calgary, les indicateurs de morbidité et de mortalité révèlent que les opiacés sont aujourd'hui un problème.

The Epidemiology of Cocaine and Opiate Abuse in Urban Canada

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The economic costs associated with illicit drug abuse in Canada accounted for about \$1.37 million in 1992, representing 7% of the total economic costs of substance abuse in Canada that year.¹ Although public concern often focusses on illicit drug abuse, its covert nature makes it difficult to obtain reliable epidemiological information about that behaviour, particularly concerning cocaine and heroin. Recognizing the fragmented and sparse nature of information on illicit drugs, in 1994 a group of professionals in the field of addictions and associated with governmental and non-governmental institutions formed a network spanning Canada. The primary goal of the Canadian Community Epidemiology Network on Drug Use (CCENDU) is to coordinate and facilitate the collection, organization and dissemination of surveillance information on substance abuse. CCENDU is a surveillance system involving six sentinel cities: Vancouver, Calgary, Winnipeg, Toronto, Montreal-Centre and Halifax.

The purpose of the present article is to describe the epidemiology of cocaine and opiate abuse in urban Canada, using population-based data aggregated at the level of the six sentinel cities.

Sources and quality of information

Population-based data pertaining to cocaine and heroin were obtained from the appropriate health and law enforcement institutions with jurisdiction in each city or province. Presented here are data pertaining to prevalence of use, law enforcement, treatment, morbidity and mortality. As much as possible, data were obtained for the calendar year 1995. Ratios are based on denominators referring to the census² population in the city or province, as appropriate. The variable quality of data within and across the sentinel cities was recognized at the outset of CCENDU. Detailed information about sources and quality of data is available in CCENDU's *Inaugural National Report*³ and the local reports.⁴⁻⁹ Here, we present a brief description of the limitations of the measures.

Prevalence indicators

Information on prevalence was obtained from the most recent national, provincial and local surveys.¹⁰⁻²¹

Law enforcement indicators

The law enforcement indicators are drug-related offenses or charges, and seizures of drugs, as compiled by the law enforcement agencies with jurisdiction in the CCENDU cities. Observed differences among sites may reflect enforcement intensity, priorities and reporting as well as differences in drug abuse among the population.

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Drug abuse treatment

The proportions of clients who identified cocaine or heroin as drugs that contributed to their being in treatment for substance abuse were compiled by the treatment programs in the CCENDU cities. Treatment programs for substance abuse vary greatly across Canada in terms of type (outpatient/inpatient, long/short stay, nominal/anonymous, individual/group therapy), criteria for admission and availability.

Morbidity indicators

Information about cocaine- and opiate-related disease was based on hospital separations for patients treated in the hospitals of the CCENDU cities, as compiled by the Canadian Institute for Health Information. Included were the seven ICD-9 codes explicitly attributing a disease to cocaine (304.2, 305.6, 968.5) or opiates (304.0, 304.7, 305.5, 965.0), found either as the most responsible diagnosis, or, in any of 16 diagnostic fields. The morbidity data refer to numbers of separations rather than of patients. Hospital separations may reflect not only underlying rates of disease in an area but also factors related to the health care system.

Mortality indicators

Information about deaths involving or caused by cocaine or heroin was obtained from the medical examiners' offices with jurisdiction in each CCENDU city. There is great variability in medical examiners' mandates, investigative methods and evidence required to classify a death.

RESULTS

Cocaine and heroin use are uncommon among the general population. Based on national telephone surveys in 1989 and in 1994, cocaine/crack use in the 12 months prior to the survey was reported by less than 1.5% of Canadians 15 years of age or older.^{10,11} A very small proportion (0.5%) of Canadians have used heroin in their lifetime.¹⁰ Based on provincial surveys, the prevalence of use of cocaine/crack cocaine and heroin among adolescent students in junior and high school ranges from about 2% to 4% (Table I).¹²⁻¹⁷

TABLE I
Most Recent Estimates of the Prevalence of Cocaine and Heroin Use Among Adolescents, in the 12 Months Prior to the Survey, as Percentages

	Vancouver (1993)	Calgary* (1993)	Winnipeg	Toronto (1995)	Montreal (1994)	Halifax (1996)
Among students						
Cocaine	4	3†	n/a	2	6.1 ‡	4†
Crack	4	n/a	n/a	2	1.7 ‡	n/a
Heroin	2	2¶	n/a	2	n/a	2
Among street youth						
Cocaine	85‡	n/a	n/a	31	32 §	33
Crack	n/a	n/a	n/a	31	18 §	20
Heroin	n/a	n/a	n/a	4	32 ‡	n/a

* overall estimate for the province

† cocaine and/or crack

‡ percentage reporting having ever used that substance

¶ narcotics, not exclusively heroin

§ use in the month prior to the survey

TABLE II
Cocaine-, Heroin- and Other Opiate-related Charges and Seizures in 1995

	Vancouver	Calgary	Winnipeg	Toronto*	Montreal†	Halifax
# charges per 100,000 population						
Cocaine-related	141 ‡	n/a	25	n/a	62 ‡	11
Heroin-related	46 ‡	n/a	0	n/a	7 ‡	2
# seizures						
Cocaine	n/a	194	n/a	272	n/a	122¶
Crack	n/a	n/a	n/a	1537	n/a	n/a
Heroin	n/a	1	0	194	169	0
# grams seized						
Cocaine	806,700	9340	1162	6714	17,565	25,549¶
Crack	n/a	n/a	19	14,203	262	n/a
Heroin	178,900	460	0	1521	4956	0
Other opiates	4320	174	40	n/a	n/a	2200

* Toronto data include first three quarters of 1995 only

† SPCUM only

‡ Offenses rather than charges

¶ Cocaine and crack cocaine combined

Cocaine and heroin abuse appear to be confined to special subgroups of the population. Street youth in particular are at risk of cocaine and crack cocaine abuse (Table I). In Vancouver, 85% of street youth reported having ever used cocaine; more than half of street youth reported frequent use, and 48% of male and 32% of female street youth reported injection drug use.¹⁸ About one third of street youth in Toronto and Halifax report having used cocaine over the course of a year, or in the previous month in the case of street youth in Montreal.¹⁹⁻²¹ Street youth in several cities are at risk of heroin abuse. Heroin use was reported by 4% of street youth in Toronto; in Montreal, 5% of street youth reported using heroin every day.^{19,20}

Table II shows law enforcement data pertaining to cocaine and opiates. Both cocaine and heroin appear to be markedly more available in Vancouver than in the

remaining CCENDU cities. In particular, the amounts of cocaine and heroin seized in Vancouver are greater by several orders of magnitude than the amounts seized in the other CCENDU cities. Crack cocaine appears to be most problematic in Toronto where the numbers of crack cocaine seizures have increased steadily since the early 1990s, whereas the numbers of cocaine powder seizures have decreased. Table II also shows that heroin charges and seizures are much less common in Calgary, Winnipeg and Halifax. Seizures in Winnipeg and Halifax tend to be of morphine and prescription opiates rather than heroin.

In 1995 in all of the CCENDU cities, large proportions of persons in treatment programs for substance abuse identified cocaine dependence or abuse as a major addiction.⁴⁻⁹ Cocaine was the drug of choice for 11% of clients in treatment in

of prescription opiates was reported by 11% of adult males and 14% of adult females in treatment.

Table III shows morbidity data from hospital separations with cocaine- and opiate-related diagnoses. Such diagnoses are rare, accounting for less than one tenth of one percent of all separations in each CCENDU city. However, there is considerable variation among the CCENDU cities. Based on most responsible diagnosis, Calgary and Halifax appear to have less cocaine-related morbidity than do Vancouver, Toronto and Winnipeg. Regarding opiates, based on most responsible diagnosis, Vancouver and Toronto rank first and second respectively with ratios two to three times higher than those observed in Calgary, Winnipeg and Halifax. Based on diagnoses in any of 16 diagnostic fields, Vancouver ranks first for both cocaine- and opiate-related morbidity, with per capita ratios 5 or more times greater than ratios observed in the remaining CCENDU cities.

Table IV shows mortality data pertaining to cocaine and opiates. The mortality rate due to cocaine appears to be highest in British Columbia. There, a marked increase in drug overdose deaths due to cocaine and heroin observed from 1990 to 1993 was attributed in part to the high level of purity of heroin.²² In 1995, 119 deaths (22 per 100,000 population) in Vancouver involved heroin, cocaine and other illicit drugs. In Toronto where the mortality rate related to cocaine was 1.2 deaths per 100,000 population, both heroin and cocaine were detected in 50% of the cocaine deaths. The percentage of Toronto cases where cocaine was lethally involved, as opposed to being present, increased from 10% in 1993 to 54% in 1994. In Winnipeg and Halifax, cocaine and heroin appear not to have been the cause of many deaths. From 1993 to 1995 in Halifax, cocaine was detected in or considered the cause of three deaths (0.3 deaths per 100,000 population per year). Based on mortality data, opiate abuse appears to be an emerging problem in Calgary.

DISCUSSION

The present epidemiological information on cocaine and opiates suggests the

TABLE III
Number of Hospital Separations with Cocaine- and Opiate-related Diagnoses, as the Most Responsible Diagnosis and in any of 16 Diagnostic Fields, per 10,000 Separations and per 100,000 Population, 1995

	Vancouver	Calgary	Winnipeg	Toronto	Montreal*	Halifax†
Cocaine-related						
Most responsible diagnosis						
per 10,000 separations	2	<1	3	3	n/a	<1
per 100,000 population	7	2	8	10	n/a	<1 (2)
In 16 diagnostic fields						
per 10,000 separations	75	10	14	11	15*	5
per 100,000 population	220	28	30	34	32*	11(31)
Opiate-related						
Most responsible diagnosis						
per 10,000 separations	5	1	2	2	n/a	<1
per 100,000 population	14	3	4	8	n/a	2 (4)
In 16 diagnostic fields						
per 10,000 separations	65	14	4	5	12*	4
per 100,000 population	189	39	13	22	20*	9 (23)

* Based on the number of separations with the ICD-9 codes of interest appearing in the first and second diagnostic fields

† Halifax data compiled from four Halifax city hospitals only. The first ratio is based on the CMA Halifax population of 342,771 persons; the second is based on a population of 127,800 for the city of Halifax.

TABLE IV
Deaths in Which Cocaine and Opiates were Detected

	BC * (1995)	Calgary† (1995)	Manitoba* (1994)	Toronto (1994)	Quebec* (1994)	Halifax (1995)
Cocaine‡						
Number of deaths	148	9	7	28	35	0
Mortality rate per 100,000 population	4	1	<1	1	2	0
Opiates‡						
Number of deaths						
heroin	169	15	0	67	29	0
other opiates	4	10	3	n/a	7	1
Mortality rate per 100,000 population	5	3	<1	3	2	<1

* Statistics pertain to the province

† Deaths directly attributed to heroin or morphine

‡ Cocaine and opiate deaths are not mutually exclusive categories

Vancouver and 21% of those in treatment in Winnipeg for drug use other than alcohol. In Calgary, 9% of clients in community-based treatment and 4% in hospital-based treatment identified cocaine as their major problem substance. In Toronto, 26% of clients in treatment reported cocaine as their major problem of use, with cocaine ranking second after alcohol as the most frequently used drug of abuse. In Montreal, 32% of clients 18 to 24 years of age and 25% of those 25 to 34 years of age reported using cocaine. In Halifax, cocaine use was reported by 28% of adult clients in treatment, and cocaine was ranked third and second as the most frequently used drug among male and female clients, respectively.

Regarding the proportions of drug users in treatment for opiate dependence or abuse, there appears to be considerable variability across the CCENDU cities.⁴⁻⁹ In Vancouver and Toronto, about 10% of persons in treatment for substance abuse in 1995 indicated heroin as their drug of choice. In Calgary, 5% of all clients in community-based treatment reported heroin/opiates as the drug used most frequently, while 10% of clients in hospital-based treatment indicated heroin/opiates as their major drug problem. In Winnipeg, 11% of clients in treatment for drug abuse identified opiates/analgesics as their drug of choice. Two percent of persons in treatment in Montreal reported a heroin problem. In Halifax, 2% of clients in treatment indicated heroin use although the use

availability, use and consequences of those drugs vary considerably across urban Canada. All indicators suggest that heroin is not a major problem in Winnipeg and Halifax. Opiates appear to be an emerging problem in Calgary. In contrast, based on all indicators, Vancouver is faced with a serious health and social threat due to heroin, apparently even more so than Montreal and Toronto where that illicit drug also is entrenched. The availability of cheap, pure heroin is considered a major factor in the high rate of overdose deaths in Vancouver.²²

The geographic differences concerning heroin may be founded partly in historical patterns of the availability of that drug. Heroin is a synthetic drug not manufactured in Canada. An estimated 75% of the supply originates from Southeast Asia in the "Golden Triangle" comprising Thailand, Laos and Burma.²³ More than 90% of heroin is imported by air with the principal Canadian destination being Vancouver.²⁴ Based on historical accounts by addictions counsellors, heroin use has always been rare among drug users in Halifax.^{25,26} Winnipeg is thought to be a trans-shipment site with drugs arriving there not destined for use primarily by Manitoba residents, but re-shipped elsewhere in Canada and to the United States.⁶

Regarding cocaine, based on the information gathered by CCENDU, the prevalence and impact of cocaine abuse are most severe in Vancouver, Toronto and Montreal. Injectable cocaine appears to be a major public health issue in Vancouver, Toronto and Montreal, especially in Vancouver where concomitant cocaine and heroin use is becoming the dominant pattern of injection drug use.²⁷ Relative to those cities, cocaine appears to be an emerging problem in Calgary, Winnipeg and Halifax.

During the 1960s, there was a resurgence in cocaine use primarily among the upper-middle class because of its expense and limited supply. The advent of crack around 1985 resulted in a reduction in price and an increase in availability that drastically changed the demographics of cocaine use: socioeconomic status no longer limited cocaine use.^{28,29} The availability of the drug may still be a factor in

determining the prevalence of cocaine use across Canada.

As injectable drugs, both cocaine and heroin are implicated in the increasing proportion of cases of HIV/AIDS in Canada in which injection drug use is an identified risk factor.³⁰ In 1994, the British Columbia Centre for Disease Control recognized HIV infection among injection drug users as a developing epidemic, with the majority of new infections occurring in Vancouver.⁴ Heroin and cocaine are the principal drugs of choice among injection drug users in Vancouver and almost all cocaine use in Vancouver's street population is by injection.⁴ The high injection rate among cocaine users (as often as 20 times per day) markedly increases the potential for HIV/AIDS transmission in which injection drug use is a risk factor, in all the CCENDU cities.

Although variable in quality, the population-based information provides an indication of the scale of the challenges related to cocaine and heroin use and abuse in urban Canada. Clearly improving the quality of data in the six cities is a priority for the Canadian Community Epidemiology Network on Drug Use.

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shown to "explain" all the mortality previously associated with PM (particulate matter) or its surrogate, sulphate. These same authors have previously attributed significant adverse health effects to sulphate.⁷ Their present concern about the four gases is based on an inappropriate comparison of risk reductions derived from two very different models: results from a multi-pollutant model (for 5 Canadian cities) incorporating the four gases but not PM, are compared to results from a single pollutant model (in 6 U.S. cities) for PM_{2.5} and sulphate during a different time period.⁸ This comparison does not appear to be appropriate if PM does not improve the predictive power of the multi-pollutant model for the air pollution mix, on morbidity and mortality.⁹ Similarly, risks due to different pollutants should be compared using comparable units of measure that take into account differences in means and variances.

Given the inconsistent city-to-city patterns for gaseous pollutants observed by Burnett et al., as well as the inconsistency of their results with others, more research appears to be warranted. For example, it would seem that any examples of risk reductions should be based on data for gaseous pollutants, PM and sulphate in the same cities, over the same time frame, and using the same multi-pollutant model. In addition, validation of these findings by other methods and using other populations are critically needed to reconcile the results from ecological time-series studies with the body of evidence supporting current air quality objectives.

If these surprising results are confirmed, the methods of Burnett et al. should be applied to a variety of control strategies in

a comprehensive and planned process in order to contribute to gains in population health. The present study raises an interesting hypothesis which begs questions as to the relative importance to human health of gaseous and particulate matter, and who is affected; it is inappropriate as the basis for a specific risk management decision of the type in their example.

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Authors' response

We would like to thank the *Journal* for giving us the opportunity to further clarify our work and to respond to the letter to the editor submitted by Granville, Gephart and Keefe.

The authors of the letter suggest that detecting an association between urban air pollution and daily mortality rates in Canadian cities is surprising. We suggest that not detecting such an effect would be more surprising since such effects have been observed in similar epidemiological studies throughout the world¹ with little evidence to suggest a population threshold. This implies that there exists an association between relatively low concentrations of air pollution and mortality. We had access to large databases and used sensitive methods of analysis to detect effects.

The authors suggest that the relatively low levels of air pollution in Canada would preclude a mortality effect of the size reported in our paper (8.2% increase in mortality). However, this percentage was based on the effects of four pollutants in combination, not just a single pollutant

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