

Epidemiology of tuberculosis in Montreal

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Abstract

Objective: To identify the epidemiologic characteristics of tuberculosis (TB) in Montreal and the patterns of resistance to antituberculous drugs in order to improve TB control in the region.

Design: Descriptive analysis of surveillance data for TB cases reported in Montreal by physicians and laboratories between 1992 and 1995.

Setting: Region of Montreal, population 1 775 899.

Participants: All cases of active TB among Montreal residents reported to the Department of Public Health between Jan. 1, 1992, and Dec. 31, 1995.

Outcome measures: Epidemiologic characteristics, proportion of cases resistant to antituberculous drugs and types of resistance.

Results: A total of 798 cases of TB (mean annual incidence 11.2 per 100 000) were reported in Montreal during the study period. Of these patients, 617 (77.3%) were born outside Canada. The annual incidence of TB in the foreign-born population (37.5 per 100 000) was 10 times the rate in the Canadian-born population, and the highest rate among foreign-born residents (62.8 per 100 000) occurred in those 15–29 years of age. In general, annual incidence in Montreal's foreign-born population reflected the reported incidence of TB in their regions of birth. In 8.7% of all cases, the disease was resistant to isoniazid, and the proportion of cases resistant to this drug was greater than 4% in almost all age groups, among both foreign-born and Canadian-born patients.

Conclusions: TB remains a major problem in Montreal, as in other large cities. Surveillance data give opportunities to public health agencies to adapt their prevention and control strategies to local situations and can also help clinicians in their clinical decision-making.

Résumé

Objectif : Identifier les caractéristiques épidémiologiques des cas de tuberculose de la région de Montréal et les profils de résistance aux médicaments antituberculeux afin d'améliorer le contrôle de la tuberculose dans la région.

Conception : Analyse descriptive des données de surveillance des cas de tuberculose à Montréal déclarés par les médecins cliniciens et les laboratoires de 1992 à 1995.

Contexte : Région de Montréal, population 1 775 899.

Participants : Tous les cas de tuberculose active parmi les résidents de Montréal, déclarés à la Direction de la santé publique entre le 1^{er} janvier 1992 et le 31 décembre 1995.

Mesure de résultats : Caractéristiques épidémiologiques, proportion des cas résistants aux médicaments antituberculeux et profils de résistance.

Résultats : À Montréal, 798 cas de tuberculose (incidence annuelle moyenne : 11,2 cas par 100 000 habitants) ont été déclarés durant la période à l'étude. De ces patients, 617 (77,3 %) étaient nés hors du Canada. L'incidence de la tuberculose chez les personnes nées à l'extérieur du Canada (37,5 par 100 000) était 10 fois celle chez les Canadiens de naissance et le taux d'incidence maximal chez les personnes nées à l'extérieur du Canada se retrouvait chez les 15 à 29 ans (62,8 cas par 100 000). En général, les taux d'incidence chez les personnes nées à l'extérieur du Canada reflétaient les taux d'incidence dans la région d'origine. La proportion des cas résistants à l'isoniazide atteignait 8,7 % et dé-



Evidence

Études

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‡ See related articles page 599 and 611

passait presque toujours 4 % peu importe le groupe d'âge ou le fait d'être né au Canada ou à l'extérieur du Canada.

Conclusions : La tuberculose reste un problème important à Montréal comme dans d'autres grandes villes. Des données de surveillance permettent aux intervenants de santé publique d'adapter leur programme de prévention et de contrôle à la situation locale et peuvent aider les médecins traitants dans leur prise de décision clinique.

Since the 1950s, there has been a steady decline in the incidence of tuberculosis (TB) in Canada. However, since the late 1980s, this decline has proceeded at a much slower rate, and from 1991 to 1994, the incidence stabilized at approximately 7 cases per 100 000 population.¹ There have also been major changes in the proportion of cases in each risk group: from 1980 to 1994, the proportion of cases among nonaboriginal Canadian-born people decreased from 49% to 21%, the proportion of cases among foreign-born residents increased from 35% to 57%, and the proportion of cases among aboriginal people increased from 14% to 19%.¹

Similarly, the incidence of TB in the province of Quebec has decreased steadily over the last 15 years, reaching its lowest rate, 5 cases per 100 000, in 1993 and 1994.² Foreign-born persons accounted for 48.7% of the 380 cases reported in 1995 and aboriginal people for only 5.5%. In contrast, in Montreal the annual number of cases plateaued at approximately 200 in the early 1980s (11 cases per 100 000) and has remained at that level through the mid-1990s (Fig. 1). In 1985 the number of cases in Montreal represented 36.7% of all cases reported for the province, and since then this proportion has increased steadily, to over 60%.^{2,3}

TB continues to occur in many large North American and European cities, where the flow of immigrants from countries where the disease is endemic and the presence of HIV in the population help to maintain higher levels of

incidence. Poverty, drug use and cultural barriers can be major impediments to even a well-planned treatment regimen and can allow persistent transmission of the bacilli and introduction of multidrug-resistant strains.⁴

Methods

Throughout Canada, active TB is a reportable disease. In Montreal notifications of active TB cases are sent to the Department of Public Health (DPH). Each case is investigated by a public health nurse, who obtains clinical and epidemiologic information and ensures that the appropriate treatment is initiated, that the patient adheres to the treatment and that those in close contact with the patient are tested and referred for further assessment when necessary.

A case is classified as culture confirmed if *Mycobacterium tuberculosis* is demonstrated on culture of sputum, body fluids or tissues. Without bacteriological proof, a case is classified as clinically confirmed if the symptoms and signs are clinically compatible with tuberculosis, if there is radiological or pathological evidence of active disease and if treatment has been prescribed by the physician.

Each case is classified according to one principal site of diagnosis. If more than one site is involved, the most contagious form is considered the principal site. For extrapulmonary disease, the site other than peripheral lymph nodes is considered the principal site.

All culture-confirmed isolates of *M. tuberculosis* are tested for susceptibility to isoniazid at 0.1 mg/L concentration, rifampin at 2 mg/L, streptomycin at 2 mg/L, ethambutol at 2.5 mg/L and pyrazinamide at 100 mg/L. These tests are done by the Quebec Public Health Laboratory (QPHL) according to the BACTEC 460 radiometric method (Becton Dickinson, Sparks, Md.). Resistance to any one of these drugs and to any secondary drugs is confirmed by the proportions method using Middlebrook 7H10 medium.⁵ For our analysis, strains showing resistance to isoniazid and rifampin with or without resistance to other drugs were considered multidrug resistant.^{6,7} The Montreal DPH receives the results of drug susceptibility testing from the QPHL.

The DPH maintains a nominal database of all reported patients with active TB who reside in the region at the time of diagnosis. This database contains epidemiologic data, as well as the results of drug susceptibility testing. In

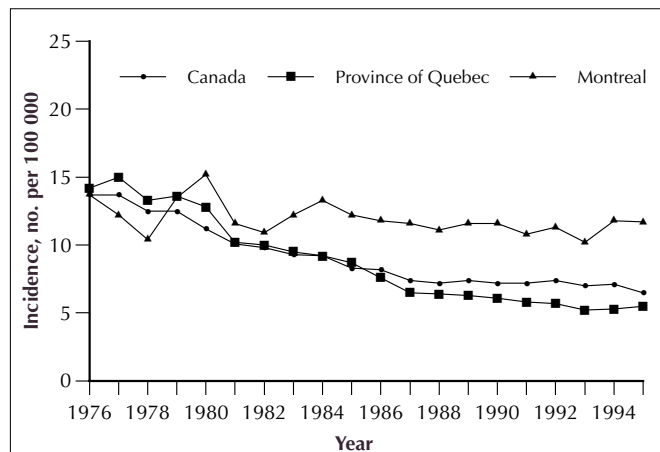


Fig. 1: Incidence of tuberculosis (TB) in Montreal, the province of Quebec and Canada, 1976–1995.



this review we included all clinically or bacteriologically confirmed cases of TB in people with a permanent address on the island of Montreal (population 1 775 899) that were reported to the DPH between Jan. 1, 1992, and Dec. 31, 1995. The denominators used to calculate rates were based on the 1991 census.⁸

Results

Incidence

From 1992 to 1995, 798 cases of active TB were reported to the Montreal DPH (mean annual incidence of 11.2 cases per 100 000 population), which represents 54.3% of all cases reported in Quebec.

Country of birth

People born outside Canada accounted for 617 (77.3%) of the TB cases in Montreal, although only 23.5% of the total population is foreign-born.⁹ The mean annual incidence for foreign-born residents (37.5 cases per 100 000) was 10 times that of Canadian-born residents (3.3 cases per 100 000). The highest age-specific rate for foreign-born residents (62.8 per 100 000) occurred among those aged 15–29 years. For Canadian-born residents, the highest age-specific rate (10.0 per 100 000) occurred among those aged 65 and over. However, in every age group the incidence was markedly higher among foreign-born than among Canadian-born patients (Fig. 2).

Among the 617 patients born outside Canada, 148 (24.0%) were from Haiti (mean annual rate of 133.5 per 100 000) and 88 (14.3%) from Vietnam (mean annual rate 137.0 per 100 000). For immigrant groups from Asia, the Indian subcontinent, Central and South America, and the Caribbean region, the mean annual incidence in Montreal

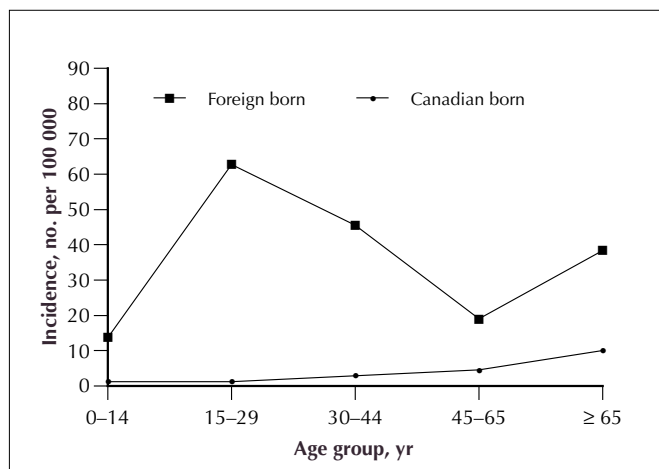


Fig. 2: Incidence of TB in Montreal by age and place of birth, 1992–1995.

reflected the reported incidence in their regions of birth (Table 1).

Among the 592 foreign-born patients whose year of arrival was known, 197 (33.2%) cases of TB occurred within 2 years of arrival in Canada and 333 (56.3%) within 5 years. Cases occurring within 2 years of arrival were more likely to be respiratory (157 [79.7%] of 197) than were cases occurring more than 2 years after arrival (261 [66.1%] of 395) (Fig. 3).

Clinical details and resistance to antituberculous medications

Of the 798 patients with TB, 529 (66.3%) had pulmonary disease, and 121 (15.2%) had regional adenitis. Regional adenitis accounted for 117 (19.0%) of the 617

Table 1: Incidence of tuberculosis (TB) among ethnic groups in Montreal for 612 of 617 cases among foreign-born residents, 1992–1995

Region of birth	No. (and %) of cases	Incidence, no. per 100 000	
		In Montreal	In region of birth*
Southeast Asia	145 (23.7)	116.1	127.3
Indian subcontinent	60 (9.8)	111.4	135.3
Eastern Asia	34 (5.6)	57.5	51.5
Caribbean and West Indies	153 (25.0)	87.7	74.4
Central and South America	39 (6.4)	33.9	42.4
North Africa and the Middle East	43 (7.0)	16.5	41.5
Sub-Saharan Africa	59 (9.6)	200.3	50.7
Western Europe	41 (6.7)	6.6	18.4
Eastern Europe	38 (6.2)	23.8	41.3
All regions	612 (100)	37.5	73.4

*Data adapted from the World Health Organization.¹⁰

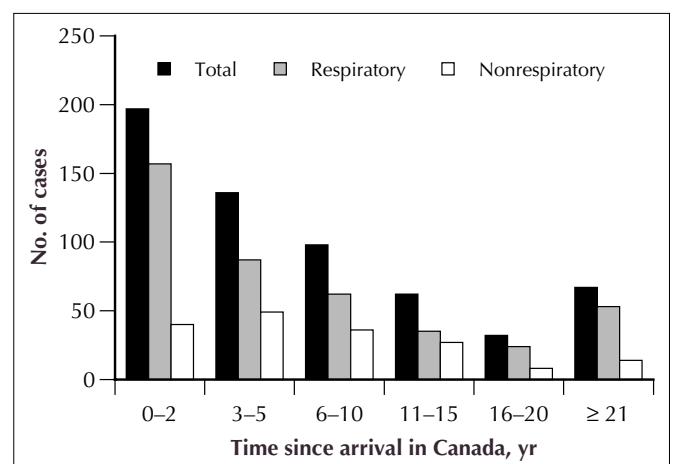


Fig. 3: Interval between entry into Canada and diagnosis of TB, for cases diagnosed in Montreal, 1992–1995. Data in this table exclude 24 patients for whom year of arrival was unknown and 1 patient whose country of origin was the US.

cases among foreign-born residents but only 4 (2.2%) among Canadian-born residents (Table 2). Excluding 19 cases of miliary or disseminated TB, there were 54 cases in which more than one organ was involved. Lung involvement was present in 38 of those 54 cases.

The vast majority of reported cases (728 [91.2%]) were bacteriologically confirmed. Of these, 118 (16.2%) were resistant to at least one antimicrobial agent (Table 3). The patterns of resistance did not differ markedly between Canadian-born and foreign-born patients.

Resistance to isoniazid, with or without resistance to other drugs, was present in 63 of the 728 strains (8.7%). From 1992 to 1994, this percentage increased from 4.5% to 12.8%, but it decreased again in 1995, to 8.7% (χ^2 linear trend = 3.36, $p = 0.07$). The percentage of strains resistant to isoniazid was only slightly higher among foreign-born patients (9.1% [52/571]) than among Canadian-born residents (7.0% [11/157]). Resistance to isoniazid was greater than 4% in all age groups except among Canadian-born patients over 65 years of age (data not shown).

Discussion

Our review of routinely collected surveillance data demonstrates that in Montreal, as in many other large urban centres, TB occurs largely among high-risk groups. The 2 major risk groups in Montreal are people of all ages from regions of the world where TB is endemic and elderly Canadian-born people. Although the data presented here do not include other risk factors, case investigations indicate that most of these patients also face important psychosocial problems — poverty, homelessness and alcohol or drug use — which can pose significant barriers to completing a course of treatment.

The question of completeness of case reporting is fun-

damental for a surveillance system. Underreporting is a lesser concern for TB than for many other reportable diseases. In Quebec there are no private hospitals, culture for mycobacteria is done exclusively in hospital laboratories, and mycobacteria isolates are systematically sent to the QPHL for species identification and susceptibility testing. The QPHL automatically reports all cultures of *M. tuberculosis* to the relevant public health department and later verifies that each case appears in the provincial surveillance database. The only cases that might not be reported, then, are clinical cases in which no bacteriological confirmation is obtained. We have no way of systematically identifying these cases.

The presence of HIV infection, an important risk factor for active TB, is not included in the Quebec TB surveillance database. However, in a review of public health and hospital charts for 339 cases of TB in patients aged 15 to 49 years that were reported between 1992 and 1994, Culman and associates¹¹ found that 192 (56.6%) patients had undergone HIV testing and 52 (27.1%) of these were HIV positive (15.3% of all cases in that age group).

For the same 3 years, 47 (3.6%) of the 1288 patients with AIDS reported to the Montreal AIDS Surveillance Program also had pulmonary or extrapulmonary TB. By linking the TB and AIDS surveillance databases and using a capture-recapture method, Turmel and colleagues¹² estimated the total number of patients with both AIDS and TB at 64 for the 1992-1994 period.

These analyses indicate that in Montreal approximately 20 cases of active TB occur each year in HIV-positive people and that no more than 10% of TB cases can be attributed to HIV infection. Given the potential impact of HIV on TB, it is essential that national bodies examine possible methods of capturing the extent of co-infection while maintaining data security and patient confidentiality.

Drug resistance is another important concern for TB

Table 2: Mode of presentation of TB

	Origin; no. (and %) of cases		Total
	Foreign born	Canadian born	
Respiratory			
Pulmonary	382 (61.9)	147 (81.2)	529 (66.3)
Pleurisy	24 (3.9)	9 (5.0)	33 (4.1)
Miliary	14 (2.3)	5 (2.8)	19 (2.4)
Others	8 (1.3)	4 (2.2)	12 (1.5)
Subtotal	428 (69.4)	165 (91.2)	593 (74.3)
Nonrespiratory			
Adenitis	117 (19.0)	4 (2.2)	121 (15.2)
Genitourinary	17 (2.8)	3 (1.7)	20 (2.5)
Bones or joints	21 (3.4)	3 (1.7)	24 (3.0)
Abdominal	21 (3.4)	3 (1.7)	24 (3.0)
Others	13 (2.1)	3 (1.7)	16 (2.0)
Subtotal	189 (30.6)	16 (8.8)	205 (25.7)
Total	617 (100)	181 (100)	798 (100)

Table 3: Susceptibility and resistance to antituberculous drugs* and types of resistance

Type of TB	Origin; no. (and %) of resistant strains		
	Foreign born	Canadian born	Total
Susceptible	478 (83.7)	132 (84.1)	610 (83.8)
Resistant			
SM only	33 (5.8)	7 (4.5)	40 (5.5)
INH only	17 (3.0)	4 (2.5)	21 (2.9)
INH and SM	12 (2.1)	0 (0)	12 (1.6)
MDR TB	7 (1.2)	3 (1.9)	10 (1.4)
Others†	24 (4.2)	11 (7.0)	35 (4.8)
Subtotal	93 (16.3)	25 (15.9)	118 (16.2)
Total	571 (100)	157 (100)	728 (100)

*SM = streptomycin; INH = isoniazid; MDR TB = multidrug-resistant (resistant to INH and rifampin with or without resistance to other drugs).

†Includes a total of 20 strains that were resistant to INH and another antituberculous agent (not including rifampin).



control programs. For the period of our review, Montreal was fortunate to have had very few cases of multidrug-resistant TB (< 2%); however, the percentage of strains resistant to isoniazid was greater than 4% in almost every age group among both foreign-born and Canadian-born patients. Several US and Canadian organizations have recently recommended that in communities where resistance to isoniazid is greater than 4%, initial treatment should include a 4-drug regimen (consisting of isoniazid, rifampin, pyrazinamide, and ethambutol or streptomycin), with adjustment of that regimen on the basis of the results of susceptibility testing.^{13,14}

These data demonstrate the epidemiologic trends of TB in Montreal and the usefulness of the surveillance data in guiding public health intervention programs and clinical care. It is evident that we must develop intervention strategies for high-risk groups and that we must address the problems of drug resistance and HIV-TB co-infection before they increase.

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