

## Tuberculosis surveillance in immigrants to Manitoba

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Despite a decrease in the incidence of tuberculosis in Canada over the last decade, the proportion of cases in people not born in Canada has increased. To determine the prevalence of active tuberculosis at the first surveillance clinic visit and the incidence of the disease over a 2-year to 6-year follow-up period, we reviewed the records of all 523 immigrants admitted to Manitoba between 1981 and 1985 who were placed under surveillance. Of the 523, 429 (82%) were seen at least once in the clinic. Among the 429, active tuberculosis was diagnosed at the first visit in 12 (3%) and during the follow-up period in 7 (2%). The relative risk of tuberculosis was 4.5 times higher for immigrants under surveillance than for those not under surveillance. Of the 483 immigrants who were to be seen in Winnipeg 232 (48%) were noncompliant: 94 were not seen at any time, and 138 did not attend for the full follow-up period. Active disease was not reported to have developed in any of the noncompliant subjects. Noncompliers were significantly older than compliers ( $p < 0.005$ ), and variations in compliance were noted according to region of origin. Further attempts to improve compliance with surveillance without resorting to punitive measures are indicated.

Si depuis 10 ans la fréquence de survenue de la tuberculose a baissé au Canada, la proportion des cas observés chez des non Canadiens de naissance a augmenté. Afin de connaître la fréquence de la présence de tuberculose évolutive lors d'un premier examen et celle de sa survenue au bout de 2 à 6 ans, nous passons en revue les dossiers de tous les immigrants reçus au Manitoba entre 1981 et 1985 qui ont été mis en surveillance. Il s'agit de 523 sujets; nous avons examiné nous-mêmes 429 (82%) d'entre eux au moins une fois. Parmi ceux-ci on posait un diagnostic de tuberculose évolutive chez 12 sujets (3%) à la première visite et chez 7 autres (2%) lors de visites ultérieures. Le risque de survenue de tuberculose chez les immigrants mis en surveillance est 4,5 fois celui qui existe chez ceux qui ne l'ont pas été. Parmi les 483 immigrants qui étaient censés se faire examiner à Winnipeg 232 (48%) sont réputés indociles: 94 ne se sont pas présentés une seule fois, 138 ne se sont pas prêtés au suivi complet. On n'a signalé aucun cas de maladie évolutive chez ces sujets indociles. Ceux-ci sont significativement plus âgés en moyenne que les dociles ( $p < 0,005$ ); la docilité varie aussi selon la région d'origine. Il y a lieu de chercher à améliorer la docilité des sujets en surveillance sans recourir à des punitions.

**T**he incidence of tuberculosis remains high in both the Canadian native (Indian and Inuit) and immigrant populations, despite a general decline of the disease in Canada over the last decade.<sup>1,2</sup> As more immigrants arrive from countries with high tuberculosis incidence rates, increased

attention has been focused on the control of tuberculosis in this group.<sup>2</sup>

On entry to Canada immigrants with a history of tuberculosis or with chest radiographs suggestive of previous tuberculosis are placed on surveillance by Canadian medical officers of health. We carried

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out a study of immigrants admitted to Manitoba between 1981 and 1985 who were placed on surveillance to determine the prevalence of active tuberculosis at the first clinic visit, to compare the incidence of active tuberculosis in this group over a 2-year to 6-year follow-up period with the rate among immigrants admitted to Manitoba during the same period and not placed on surveillance, and to determine whether factors such as sex, age and country of origin are associated with compliance with surveillance.

## Methods

### *Immigration requirements*

Depending on various factors including health status, immigrants to Canada are admitted as landed immigrants (admission not barred by the health of the immigrant or risk to public health) or visitors/students (time-limited visa, admission not barred by health) or on a minister's permit (admission at the discretion of the minister of immigration, subject to review).

In addition to the physical examination in the country of origin a chest radiograph is required for all prospective immigrants aged 11 years or older. It may be requested by a medical officer for younger people on the basis of the history or clinical findings. The films are reviewed by the medical officer in the country of origin. Sputum, gastric or laryngeal cultures may be requested at the discretion of the medical officer, often in consultation with the Medical Services Branch of the Department of National Health and Welfare in Canada.

For the purposes of immigration inactive pulmonary tuberculosis is defined radiographically as stable abnormalities compatible with tuberculosis on at least two chest radiographs obtained at least 3 months apart, together with three negative sputum cultures, regardless of a past history of tuberculosis or adequate therapy. Both the chest radiography and the sputum cultures must have been performed within 6 months prior to the prospective immigrant's application. Active pulmonary tuberculosis is considered to be present if the chest radiograph is compatible with tuberculosis or sputum is positive on a direct smear for acid-fast bacilli or if a culture is positive for *Mycobacterium tuberculosis*. Except under extraordinary circumstances, in which a minister's permit is needed, people with active tuberculosis are not admitted to Canada until their condition can be upgraded to inactive. This requires evidence of an adequate treatment regimen of at least 6 months' duration, as well as three sputum cultures incubated for at least 7 to 8 weeks that are negative for tubercle bacilli. The 6-month regimen

must have included isoniazid and rifampin throughout the course. Regimens without isoniazid or rifampin must have lasted 12 months or longer. The laboratory report must not be more than 6 months old. If the results of bacteriologic examinations are not available, stable or improving chest x-ray films obtained over a minimum period of 3 months are required; the last film must not be more than 6 months old.<sup>3</sup>

Extrapulmonary tuberculosis is diagnosed on the basis of the history, clinical findings and appropriate microbiologic studies. Because it is noninfectious it normally does not prevent immigration to Canada.

### *Surveillance*

Immigrants with inactive tuberculosis and those with active disease admitted for humanitarian reasons under a minister's permit are required to comply with surveillance in their province of destination. In Manitoba surveillance consists of regular visits for 3 years to the outpatient department at the Respiratory Hospital, Winnipeg. Occasionally in remote rural communities surveillance is done by local physicians in consultation with those in Winnipeg. The surveillance physicians do not routinely receive immigration medical records, which include results of investigations performed in the country of origin.

At the first clinic visit the history and a chest radiograph are obtained and a physical examination is done. If possible, three sputum samples are obtained for culture initially or on subsequent visits. If sputum is unobtainable the physician may obtain a gastric aspirate for culture, depending on the clinical situation and the consent of the patient. Patients whose condition is stable may be discharged from follow-up before the completion of 3 full years of surveillance. Compliance with surveillance is defined as attendance at the clinic for 3 years or until discharged from follow-up by the attending physician. Noncompliance is defined as failure to initially appear at the clinic or to attend follow-up visits. An outreach program has been established in which public health nurses use home visits, telephone calls, and physician and community contacts to encourage compliance.

### *Subjects and follow-up*

Both the Manitoba Central Tuberculosis Registry (CTR) and the Manitoba Provincial Epidemiologist receive notification from the federal Department of Employment and Immigration of all immigrants whose admission to the province is conditional on compliance with surveillance for tuberculosis. Using these two sources we identified a cohort of immi-

grants who arrived in Manitoba between Jan. 1, 1981, and Dec. 31, 1985, and were required to undergo tuberculosis surveillance.

Data on the total number of immigrants admitted to Manitoba from 1981 to 1985 were obtained from the Department of Employment and Immigration.

In Manitoba all cases of active tuberculosis are reported to the CTR, and the patient's age, sex, country of origin, year of immigration, site of infection and method of diagnosis are recorded. The CTR records were used to identify all cases of active tuberculosis in immigrants (under or not under surveillance) who entered Manitoba between 1981 and 1985. To ensure that no cases were overlooked or lost through migration of people in the surveillance cohort to other provinces the Manitoba data were cross-checked with the tuberculosis registers of Ontario and Quebec as well as those of Statistics Canada (to which all the territories and provinces, with the exception of Ontario and Quebec, report their cases). The registers were reviewed up to Dec. 31, 1987, so as to allow a 2-year to 6-year follow-up period for those arriving during the study period. Person-years of follow-up<sup>4</sup> were estimated from date of arrival and last date of follow-up (December 1987) for those under and not under surveillance.

The clinic charts of immigrants under surveillance were reviewed to obtain information on the initial and subsequent investigations performed and the methods of diagnosis and treatment of those with active disease. For the few people whose surveillance was carried out in rural clinics this information was obtained from the local physician.

The Medical Services Branch of the Department

of National Health and Welfare keeps records for all immigrants of medical examinations and investigations performed in the country of origin before immigration. With the permission of the Minister of Employment and Immigration these files were reviewed to obtain information on investigations and treatment for tuberculosis before arrival in Canada.

### Statistical analysis

Testing for significance was done with the chi-squared statistic. We estimated the relative risk with 95% confidence limits from incidence rates.<sup>4</sup>

## Results

Between 1981 and 1985, 21 586 immigrants arrived in Manitoba, of whom 523 (2.4%) were placed on surveillance for tuberculosis. The immigrants placed on surveillance were significantly older than those for whom surveillance was not required ( $p < 0.05$ ). A total of 31% of the former group were between the ages of 40 and 59 years, and 43% were aged 60 or more, compared with 11% and 29% respectively of the general immigrant population. Of the 523 immigrants placed on surveillance 516 had evidence of prior respiratory tuberculosis only, 6 had evidence of tuberculosis involving two or more sites, including the respiratory tract, and 1 had previously had lymphatic tuberculosis.

The rate of placement under surveillance per 1000 immigrants varied by region of origin (Table 1). The rate was highest for immigrants from Asia (42/1000), particularly those from Hong Kong and the Philippines.

Table 1: Rate of required surveillance for tuberculosis among immigrants admitted to Manitoba between 1981 and 1985, per 1000 immigrants

Region	Total no. of immigrants	No. of immigrants under surveillance	Surveillance rate
Asia	10 976	467	42
Philippines	3772	216	57
Vietnam	2505	75	29
Hong Kong	1207	87	72
India	1109	32	28
China	410	13	31
Other	1973	44	22
Europe	6 476	42	6
United States	1 351	1	1
Central America and the Caribbean	1 326	6	4
South America	794	2	2
Africa	531	5	9
Oceania and Australia	128	0	0
Unknown	4	0	0
Total	21 586	523	24

Table 2 shows the results of chest radiography and cultures done in the country of origin and subsequent follow-up in Manitoba. Abnormalities consistent with previous tuberculosis were found in 509 (98%) of the 522 chest radiographs obtained. Cultures were positive for 13 (3%) of the 409 immigrants tested. On arrival in Manitoba 94 (18%) of the 523 immigrants were not seen at all, either because they could not be contacted or because of refusal to attend the clinic; 5 of these subjects had had a positive culture before immigration. The remaining 429 immigrants made at least one clinic visit. Most (65%) were seen within 3 months of their arrival in Canada, 24% attended within 4 to 6 months, and 11% attended 7 months or more after arrival in the country.

Chest radiographs were obtained at the first clinic visit for 427 of the 429 immigrants seen. A total of 389 (91%) showed stable inactive disease, and 5 (1%) showed active pulmonary tuberculosis confirmed on subsequent films; for these 5 subjects chest x-ray films obtained in their country of origin had been interpreted as showing inactive disease. The remaining 33 immigrants (8%) had radiographs demonstrating no evidence of prior tuberculosis; 23 of these subjects had been considered to have inactive disease from x-ray films obtained in their country of origin.

Sputum or gastric aspirate samples were ob-

tained for culture at the first clinic visit from 311 (72%) of the 429 immigrants seen, of whom 10 (3%) had a positive result for tubercle bacilli (Table 3). In the country of origin cultures either had been negative (in nine cases) or had not been done (in one). Three of these 10 immigrants also had radiologic evidence of active pulmonary disease. Active tuberculosis was thus diagnosed on the basis of radiologic or microbiologic evidence or both at the first clinic visit in 12 of the 429 immigrants.

None of the 13 immigrants who had positive results of culture in their country of origin were reported to have active disease during the follow-up period. Only 8 of the 13 were seen at the clinic, and for 3 of the 8 no culture specimen was obtained at the first visit.

The cohort of 523 immigrants was followed for a total of 2184 person-years. Active disease developed during the follow-up period in 7 of the 429 immigrants seen (in all of them while under surveillance). Tuberculosis was not reported to have developed during the follow-up period in any of the 94 immigrants never seen. Thus, the incidence rate of tuberculosis among the 523 immigrants under surveillance during the follow-up period may be expressed as 7 cases per 2184 person-years, or 3.2 cases per 1000 person-years. In contrast, the rate for the 21 063 immigrants admitted without a surveillance requirement during the study period was 67 per

Table 2: Results of investigations done in the country of origin and follow-up in Manitoba for the 523 immigrants placed under surveillance

Investigation; result	No. of immigrants	Follow-up in Manitoba; no. of immigrants	
		Seen (n = 429)	Not seen (n = 94)
Chest radiography			
Inactive tuberculosis	509	418	91
Normal*	13	10	3
Not done	1	1	0
Culture			
Positive	13	8	5
Negative	396	331	65
Not done	114	90	24

\*Defined as no evidence of active or inactive tuberculosis.

Table 3: Results of culture in the country of origin and at the first clinic visit for the 429 immigrants seen

Result in Manitoba	Result in country of origin; no. of immigrants			Total (n = 429)
	Positive (n = 8)	Negative (n = 331)	Not done (n = 90)	
Positive	0	9	1	10
Negative	5	242	54	301
Not done	3	80	35	118

89 076 person-years, or 0.7 per 1000 person-years. The relative risk of tuberculosis during the follow-up period in the surveillance versus the nonsurveillance population was 4.5 (95% confidence limits 2.1 and 8.8).

The data for 40 immigrants were excluded from the analysis of compliance because complete information was unavailable on clinic visits to physicians in rural areas. Of the remaining 483 subjects 232 (48%) were noncompliant, of whom 94 were not seen at any time and 138 did not attend for the full follow-up period.

The sex distribution of those who complied with surveillance and those who did not was similar (Table 4). However, a greater proportion of non-compliers than compliers were aged 60 years or more ( $p < 0.005$ ). Variations were noted in the pattern of noncompliance among immigrants from various countries (Table 5). Noncompliant immigrants from Hong Kong were more likely to totally avoid clinic visits, whereas those from the Philippines were more likely to be seen on one or more occasions and subsequently discontinue follow-up.

Of the 523 immigrants 441 (84%) were landed immigrants, 51 (10%) were admitted under a minister's permit, and 31 (6%) were students or visitors. Three (6%) of the immigrants admitted under a minister's permit had had positive cultures for tuberculosis in their country of origin, compared with 10 of the landed immigrants (2%), a nonsignificant difference. However, active tuberculosis developed

in Manitoba in a significantly greater proportion of the former group (14% v. 3%) ( $p < 0.05$ ). There was no significant difference in compliance between the two groups. Tuberculosis did not develop in any of the students or visitors under surveillance during the study period.

## Discussion

Between 1981 and 1985 the incidence rate of tuberculosis in Manitoba ranged from 13.7 to 19.9 cases per 100 000 population per year, 24% of the cases occurring in people born outside the country (CTR: personal communication, 1986). As in other studies of newly arrived immigrants in the United States and England,<sup>5,6</sup> most cases occurred within 4 years of arrival. In Canada selected recently arrived immigrants are placed under surveillance to speed detection of tuberculosis in subjects at high risk during this 3-year to 4-year period, when tuberculosis is most likely to develop.

Limitations of our study include the possibility of underestimation of tuberculosis cases among those under and not under surveillance owing to a failure to seek medical attention, failure to diagnose disease or failure to report disease. Bias may have been introduced if those who were compliant with surveillance and in whom active disease developed were more likely to have their disease diagnosed and reported.

Active tuberculosis was found in 19 of the 429 immigrants seen, at the first clinic visit in 12 and during subsequent visits in 7. It was not possible to ascertain whether those with active disease when initially seen had had disease before arrival in Canada, which would represent a failure of the screening process, or whether the disease had become active in the short period after arrival. In all cases the chest radiograph in the country of origin had been interpreted as showing stable inactive disease, and all but one subject had had a negative result of culture of sputum or gastric aspirate in the country of origin.

Analysis of the results of investigations done at the initial clinic visit showed variations in the

Table 4: Compliance with surveillance by age and sex

Variable	No. (and %) of immigrants		p*
	Complied (n = 251)	Did not comply (n = 232)	
Sex			NS
Male	150 (60)	127 (55)	
Female	101 (40)	105 (45)	
Age, yr			
≥ 39	80 (32)	46 (20)	
40-59	77 (31)	71 (31)	
≤ 60	94 (37)	115 (49)	< 0.005

\* $\chi^2$  test; NS = not significant.

Table 5: Compliance with surveillance by selected countries of origin

Country	No. (and %) of immigrants		
	Complied	Did not comply	
		Not seen at any time	Seen, then discontinued follow-up
Philippines (n = 212)	118 (56)	19 (9)	75 (35)
Hong Kong (n = 83)	40 (48)	30 (36)	13 (16)
Vietnam (n = 67)	36 (54)	20 (30)	11 (16)

interpretation of radiographs in Canada and in the country of origin. At the first visit sputum samples were not obtained for culture from several subjects who had a positive culture result in their country of origin and who received treatment before immigrating. These subjects denied cough or other symptoms of active disease. The surveillance physician therefore made a clinical decision not to pursue further investigations such as culture of gastric aspirate. In Canada there is no uniform protocol for investigating immigrants under surveillance. Such cultures would likely have been requested if the physician had been aware of the results of the investigations in the country of origin.

Immigrants who are not compliant with surveillance comprise another group of concern to the surveillance physician. Five of the 13 immigrants with positive cultures for *M. tuberculosis* in their country of origin were not seen at any time after immigration. Immigrants who have been found to have active tuberculosis during the immigration process may be more reluctant to comply with subsequent surveillance out of fear or misunderstanding.<sup>7</sup>

For a surveillance system to be justified it must be shown to hasten the detection of infectious cases, thereby decreasing individual morbidity and preventing transmission of disease to others. The early detection of tuberculosis is significant in light of present estimates that 1 contagious person infects, on average, 10 people with tubercle bacilli during 1 year.<sup>8</sup> Our results are consistent with those of Enarson, Ashley and Grzybowski<sup>2</sup> that immigrants admitted under a minister's permit who are placed under surveillance are at particularly high risk for subsequent development of active disease.

None of the 12 immigrants in whom active disease was detected at the first clinic visit were ill enough to voluntarily seek medical care. In the seven subjects who were found to have active disease during subsequent visits, investigations were prompted by symptoms described by the patients on close questioning. It is not known whether these subjects would have sought care in the absence of a surveillance system. Mistrust and fear may lead to a delay in seeking medical advice and are potential causes of poor compliance with surveillance, despite the attempt by outreach nurses and interpreters to allay anxiety and educate immigrants about the disease.<sup>7</sup> The differences in compliance between various age groups and between immigrants from various countries in our study may represent variations in cultural attitudes, knowledge and behaviour.<sup>9,10</sup>

Our findings show that the immigration screening procedure does identify a population at high risk for active tuberculosis after arrival in Canada. How-

ever, the defects in the present system of tuberculosis surveillance are of concern. First, given the prevalence of active disease found at the first clinic visit, the delay of more than 3 months before approximately one-third of the immigrants were first seen is less than satisfactory. Second, a uniform medical approach to surveillance does not exist across Canada. Third, the complete medical histories, including culture reports, are not routinely available to the surveillance physician at the initial visit or at subsequent visits, although they may be requested from the Medical Services Branch. Last, some immigrants placed under surveillance, including five with positive culture results in their country of origin, were not seen at any time. Further attempts to improve compliance with surveillance without resorting to punitive measures are indicated. Programs involving lay outreach health care workers operating in their own ethnic milieu may be helpful in this regard.

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