IT IS ESTIMATED BY THE WORLD HEALTH ORGANIZATION (WHO) that one third or about 1.7 billion of the world’s population is infected by *Mycobacterium tuberculosis* (1). Of the annual estimated eight million new active tuberculosis cases, 95% occur in the developing world, and of these only five million receive some form of treatment and fewer than 0.5 million receive supervised curative regimens (2). With this reality and the population dislocations of the past decade, it is no surprise that there is a spillover effect of the global tuberculosis emergency to the developed world (3). Two papers in this issue of the *Journal* examine the magnitude of the problem and the impact on tuberculosis rates in industrialized nations (Memish et al., pages 239-243; Thomas and Gushulak, pages 246-255). But the underlying question remains, What can and should be done to address the problem?

In developed countries – Canada (4), the United States (5), Europe (6), Australia (7,8) and New Zealand (9) – rates of tuberculosis declined towards elimination until the mid 1980s, when the decline plateaued, and in some regions rates rose amid concern that human immunodeficiency virus (HIV) coinfection and program failures had caused the reversal (10). Coincidentally, migration of populations from developing countries to these low prevalence regions brought the heritage of earlier infection resulting from exposure to endemic disease in the country of origin and the risk of future reactivation. Enarson et al. (11) showed that immigrants in the 1960s brought to Canada rates of tuberculosis that paralleled the rates in their country of origin. Recent reports from developed countries indicate that increasing percentages of new active cases are attributable to recently arrived immigrants, refugees or migrant workers. In 1993, 52.7% of cases in Canada (4) and 29.6% of cases in the United States (5) occurred in the foreign-born, up from 36.1% in 1983 and 20% in 1986, respectively. In the United Kingdom, tuberculosis notifications in the Indian ethnic population were 27 times higher, and in the Pakistani-born population 57 times higher, than in the British-born (12). In Switzerland, 51%, the Netherlands, 41%, Denmark, 38% (6) and Australia, 70.7% (7), respectively, of the cases of tuberculosis were found in the foreign-born in the 1990s. Recently arrived (within five years), immigrants to Canada accounted for 42% of tuberculosis cases in 1992 (13). In Australia, 43% of the foreign-born cases had arrived within five years (7), and in the United States 20% occurred within the first year of arrival (5). In spite of an increasing percentage contribution by immigrants to tuberculosis case loads in North America and western Europe, to date there is no evidence that tuberculosis among the foreign-born population significantly affects the indigenous population of a country that is in the elimination phase of tuberculosis (14). Directly examining this question, Menzies’ (15) study of Montreal school children showed no difference between the reactor rates in census tracts with large immigrant populations and those with small immigrant populations.

Immigrant applicants are screened for active infectious pulmonary tuberculosis by physical examination and chest x-ray (required after age 10 in Canada and age 15 in the United States) (16). Both countries demand a negative culture and stable chest x-ray or proof of treatment for those with x-ray abnormalities. Entry requirements vary for European countries (14). Upon arrival in Canada, an annual follow-up for three to five years is recommended (17). The United States does not currently have requirements for follow-up (5). Pre-entry screening eliminates the most infectious cases, and careful follow-up in Canada of those with lung scars gives a case yield of approximately 5% (18).

The risk of immigrant tuberculosis increasing the pool of drug resistant disease is difficult to measure because mycobacterial culture and sensitivity testing are rarely done routinely in developing countries and only occasionally in sample surveys (19). However, evidence from migrant populations suggests that resistance rates are higher in cases from developing countries. Drug resistance has been assessed in western Canada by Long et al (20) and reported to be 7% overall and 11% in immigrants. Drug resistance was 9.9 times higher in immigrants compared with native-born Manitobans (21). In Israel, drug resistance was most common in Russian immigrants (37%) compared with 16% in Ethiopians and 12% in others (22). Drug resistance in the United States in the first quarter of 1991 was 20% in foreign-born and 12% in indigenous cases (23).

Strategies to minimize the problem of migrant tuberculosis are proposed in this issue of the *Journal* by Thomas and echo those of Orr and Hershfield (16) and the European Task Force on Tuberculosis in Immigration (14). All agree on the need for pre-entry screening and mandatory surveillance upon arrival. Orr points out the need for better quality control of the screening physicians and laboratories in the country of
origin and raises concern over the refugee claimants and visitors who are sometimes lost to initial evaluation. The Canadian guidelines for annual three- to five-year follow-up of those placed under surveillance (17) should be stringently followed. Thomas points to the need to increase health care worker awareness of tuberculosis, to identify cases not under surveillance, especially in the 10 major cities in Canada where immigrants settle. Orr recommends that these persons be managed in culturally sensitive ways, with effective communication between immigration personnel and community services. It is particularly important to avoid legislation such as Proposition 187 of California, which proposes to deny nonemergent care to illegal aliens (24), a proposition that would limit foreign-born access to tuberculosis diagnosis and treatment.

The impact of an individual immigrant case of tuberculosis on the health care system is described in this issue by Memish et al: 871 contacts yielded 149 reactors and 11 converters at a program cost of $22,076.26. The authors propose an addition to the immigration screening process, which would require tuberculin skin testing of all applicants and prophylaxis for reactors. The cost of such a proposal, it is suggested, should be borne by the applicant in the country of origin. However, the reliability of execution of such a program would remain questionable in countries where tuberculosis treatment is of uncertain quality and prophylaxis seldom practiced. Alternatively, United States guidelines recommend screening on arrival of those under 35 years of age (25). This process was carried out in the United States in 1979 (26) in Vietnamese refugees because the initial group had a prevalence of active tuberculosis over 1%. Forty-six thousand were given prophylaxis. Screening provided early identification of unsuspected disease and early linkage to the health care system for immunization and other medical care. Estimated screening costs of US$285 included prophylaxis in a study of Denver refugees (27), and costs of US$2,000 to $3,000 included cultures, x-rays and prophylaxis in a Seattle immigrant screening program (28).

The cost of a nonselective program of tuberculin skin testing and prophylaxis of all immigrants to Canada could be estimated by taking the example year quoted by Memish of 1991, when 230,781 immigrants arrived in Canada. Assuming the prevalence of infection in those from endemic areas to be 50% (27), of the 176,128 immigrants from Africa, the Middle East, Asia and Latin America, 88,064 would have had reactive tuberculin skin tests. Assuming no active disease, and without calculating the cost of x-rays and culture, the cost of prophylaxis alone would be US$285 (27) (CDN$396) per person or US$25 million (CDN$35 million) in total.

The WHO (2) has estimated the cost of treating an active case of tuberculosis in the developing world at approximately US$200 (CDN$278) under national tuberculosis program conditions, those designed by the International Union Against Tuberculosis and Lung Disease (IUATLD). The US$1.6 billion (CDN$2.2 billion) necessary to treat the world’s annual case load of eight million seems insurmountable. If, however, instead of contemplating prophylaxis of all immigrants, we could find $35 million annually from Canada and a per capita equivalent from other developed countries facing imported tuberculosis to contribute to tuberculosis control programs in the developing world, we would have a much more significant impact on the global tuberculosis emergency.

In summary, immigrant tuberculosis accounts for an increasing proportion of cases in the industrialized world, but to date shows no significant impact on the rate of tuberculosis in the indigenous population. Pre-immigration screening practices that diagnose and treat infectious cases are effective and must be maintained. Follow-up of inactive cases upon arrival should be mandatory. However, universal tuberculin skin test screening and prophylaxis of all reactors would be a costly program with limited benefit. Instead, a Canadian commitment to renewed involvement in mutual assistance in the developing world for the treatment of tuberculosis under national control programs would have a larger benefit and re-establish Canada as a leader in addressing the global tuberculosis problem.

REFERENCES

15. Menzies R. Tuberculin Sensitivity Among School Children in the United States in 1979 (26) in Vietnam-on arrival of those under 35 years of age (25). This process was carried out in the United States in 1979 (26) in Vietnamese refugees because the initial group had a prevalence of active tuberculosis over 1%. Forty-six thousand were given prophylaxis. Screening provided early identification of unsuspected disease and early linkage to the health care system for immunization and other medical care. Estimated screening costs of US$285 included prophylaxis in a study of Denver refugees (27), and costs of US$2,000 to $3,000 included cultures, x-rays and prophylaxis in a Seattle immigrant screening program (28).

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REFERENCES


16. Orr PH, Hershfield ES. The epidemiology of tuberculosis in the


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