

Screening immigrants to Canada for tuberculosis: Chest radiography or tuberculin skin testing?

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An online appendix of the recommendations of the Canadian Tuberculosis Committee and its Immigration Subcommittee for screening immigrants is available at www.cmaj.ca/cgi/content/full/169/10/1035/DC1

Residents, and visitors to Canada, who were born in a foreign country with a high incidence of tuberculosis (TB) now account for over two-thirds of all reported cases of TB in this country.^{1,2} Because of the high incidence of TB after immigration, critics have suggested that the current chest radiography screening program, implemented over 50 years ago,³ be replaced with tuberculin skin test screening. What are the relative merits of these 2 approaches of screening for TB, and what are the implications for practising physicians?

Mycobacterium tuberculosis is a very unusual pathogen in that infection can be acquired yet remain dormant or latent for many years before reactivation. While the infection is latent, the person has no symptoms or detectable signs of infection, except for a positive tuberculin skin test reaction. In countries with a high incidence of TB, more than half of all adults have latent TB infection.⁴ If an infected adult moves to another country, the infection may reactivate or active TB may develop there at a later time.⁵ Although the risk of TB is highest in the first 5 years after immigration, it remains substantially higher among immigrants from high-incidence countries than in the general population for at least 20 years after immigration to low-incidence countries.⁶

The US Institute of Medicine has recommended tuberculin skin test screening of all immigrants to the United States from countries with high rates of TB.⁷ At first glance, tuberculin skin testing seems attractive because it is inexpensive and simple to perform and could potentially detect all carriers of latent TB infection, who could then be treated. In theory, all cases of TB could be prevented. However, this strategy has several major limitations.

The first problem is the sensitivity and specificity of the tuberculin skin test. Sensitivity is reduced in immunocompromised people (particularly those with advanced HIV infection), and thus the diagnosis of TB may be missed.⁸ In addition, false-positive reactions are common because infections with nontuberculous mycobacteria (which also cause a positive reaction) are highly prevalent in countries where TB is common.^{9,10} As well, in such countries, newborns and schoolchildren are often routinely given BCG (bacille Calmette-Guérin) vaccination, which results in false-positive tuberculin reactions. BCG vaccination^{4,11-13} and nontuberculous mycobacteria^{4,14} account for one-third to one-half of all positive tuberculin skin test results among immigrants from countries with high and intermediate rates of TB.

A second consideration is the burden on health care ser-

VICES. Although the tuberculin skin test is simple and inexpensive, each person with a positive reaction detected requires further medical evaluation, investigation and, in most cases, treatment with isoniazid for 9 months.^{15,16} Over the past decade most of the 250 000 immigrants who arrived each year in Canada were adults, and more than 80% originated from countries with a high incidence of TB. Given the prevalence of TB infection of almost 50% by the age of 20 years and 80% by the age of 30 among such people,⁴ it can be estimated that over 100 000 tuberculin-positive immigrants arrive in Canada each year. At present, public health resources and infrastructure are insufficient to properly manage the far smaller number of people who are currently referred for follow-up of problems detected by chest radiographic screening.^{17,18} Clearly, implementation of tuberculin screening would require massive investments in the public health infrastructure in Canada.

Such investments would be justified if the strategy of tuberculin screening and treatment of reactors provided substantial benefit to the immigrants' health or were cost-effective. However, for immigrants from countries with lower rates of TB, tuberculin screening would actually result in a small net loss of life, because of the hazards of isoniazid prophylaxis and because many of the positive results would be falsely positive.¹⁹ In addition, most of those with latent TB infection, in whom testing would give a true-positive result, are healthy and at low risk of active TB. Indeed, tuberculin screening of such people is no longer recommended in Canada.¹⁵ On the other hand, tuberculin skin testing is warranted for people with other medical conditions that increase the risk of reactivation of latent infection, including diabetes mellitus, renal failure, immunosuppressive therapy (e.g., corticosteroids) and HIV infection.¹⁵

Several investigators have examined the cost-effectiveness of tuberculin screening for TB.^{19,20} They examined strategies for screening immigrants from countries with various rates of TB and assumed that all immigrants would be tested and that all those with a positive reaction would receive isoniazid therapy. Although in one study, from the United States, tuberculin screening was cost-effective,²⁰ the analysis was based on very low program costs, and thus the results cannot be extrapolated to Canada. Low-cost programs and inadequate public health infrastructure are associated with poor adherence by patients and providers.^{21,22} These are key determinants of effectiveness and cost-effectiveness.^{18,19} When these problems are accounted for,

as well as an adequate infrastructure to handle them, tuberculin screening of all immigrants is far less cost-effective than chest radiographic screening.¹⁹

Chest radiography, which can detect both active TB and latent TB infection, requires complex and expensive equipment and well-trained technicians and has high material costs. Although active pulmonary TB can be detected, the number of cases detected is low, around 5–15 per 10 000 people screened.^{18,23,24} The more important benefit of chest radiography is the detection of people with stable abnormalities compatible with previous TB infection. This inactive TB is detected in 3%–5% of all immigration applicants,^{18,25} is associated with a risk of reactivation of pulmonary TB that is 4–6 times greater than that among people with normal findings on chest radiography^{17,25} and accounts for 14%–33% of all cases of active pulmonary TB over the succeeding 5–10 years.^{17,26,27} Treatment of these people for latent TB infection can provide substantial individual and public health benefits.

Thus, in Canada, the Canadian Tuberculosis Committee and its Immigration Subcommittee have recommended that all immigrants to Canada undergo TB screening by means of chest radiography, which is the best of the currently available methods of screening for TB. Chest radiographic screening will detect a large number of people with inactive TB who are at high risk of subsequently manifesting active TB and spreading the disease. We do not recommend tuberculin skin testing for routine screening. However, there is a role for tuberculin skin testing of immigrants who have medical conditions that increase their risk of reactivation of infection.¹⁵

Practising physicians should be alert to the risks of TB among newly arrived immigrants and visitors to Canada. The risk of TB is proportional to the risk in the country of origin. Although Canada will probably continue to use chest radiography to screen immigrants and to refer those with latent TB infection or active TB to public health officials, some may be referred to primary care physicians. In addition, there are large numbers of foreign-born people in Canada with latent TB infection who experience new medical problems that may place them at risk of reactivation of latent TB infection. Physicians should be alert to the possibility of TB in this population and should consider tuberculin skin testing and the provision of therapy for latent TB infection. *CMAJ* has published a comprehensive set of review papers recommending strategies for the diagnosis and treatment of latent TB infection and active TB.²⁸ The full text of the recommendations of the Canadian Tuberculosis Committee and its Immigration Subcommittee is available as an online appendix (at www.cmaj.ca/cgi/content/full/169/10/1035/DC1).

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