



## Projection of tuberculosis incidence with increasing immigration trends<sup>☆</sup>

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### ABSTRACT

Tuberculosis (TB) incidence rates vary substantially from regions to regions and from countries to countries. In countries such as Canada where TB incidence rate is low, increasing immigration trends may have significant impact on the TB transmission patterns in these countries. In this study we formulate a deterministic epidemiological model of TB transmission in two demographically distinct populations: Canadian born and foreign born populations, in order to investigate the effects of this demographic distinction on the short-term incidence and long-term transmission dynamics, and with special emphasis on the impact of immigration latent TB cases on the overall TB incidence rate in the whole population.

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### 1. Introduction

The primary objective of this study is to forecast future trends in the incidence of infectious tuberculosis (TB) in Canada using a deterministic mathematical model. While the study will predict future TB trends in the Canadian born and foreign born populations individually, it will also take into consideration the spread of TB between these two populations and their effect on national TB incidence rates as a whole.

TB is a bacterial infection that spreads from one person to another by the airborne route. Initial infection with TB occurs when bacteria within aerosolized droplets are inhaled into the lung (Smith and Moss, 1994). Characteristics of the host immune response dictate whether an exposed individual will develop latent infection, in which the bacteria are contained, or active disease, where the host develops clinical symptoms and can transmit manifestations of disease. It is in general felt that about

5% will develop active TB within 2 years of exposure, and another 5% will develop active TB more than 2 years from the time of exposure (i.e., adding up to a 10% lifetime risk) (Adler and Rose, 1996; Comstock, 1982; Karus, 1983; Styblo, 1986; WHO Fact Sheet).

TB infects roughly one-third of the world's population, killing more than three million people every year today and potentially could cause the death of another 40 million people over the next 20 years (Bleed et al., 2001; WHO, 2004). TB is also the number one killer of HIV-positive individuals, accounting for more than 30% of AIDS deaths (WHO, 1996). The figure of worldwide new infection is staggering: someone in the world is newly infected with TB every second and nearly 1% of the world's population is newly infected with TB each year.

While most cases and deaths occur in developing countries, TB still maintains a presence in industrialized parts of the world. With the deterioration of health services in many developing nations and the emergence of multi extensively drug resistant TB, the prospect of a global TB epidemic is a very real threat to nations throughout the world and many industrialized nations recognize that the growing global TB epidemic poses a national threat to their health and economic security. In 1993, driven by these related concerns, the World Health Organization declared TB to be a global emergency—the first disease to carry this status in the organization's history.

In the industrialized world, TB disproportionately affects immigrant and refugee populations. In Canada, for example, two-thirds of the country's TB cases occur in the nation's foreign born population, which comprises less than one-fifth of the

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