



Incidence of tuberculosis infection among healthcare workers: Risk factors and 20-year evolution



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Summary

Objective: To determine the incidence of latent tuberculosis infection (LTBI), and risk factors for tuberculosis skin test (TST) conversion among Healthcare workers (HCWs) during a 20-year follow-up period.

Design: Prospective cohort analysis. Surveillance was conducted from January 1, 1988, to December 31, 2007. SETTING: 600-bed tertiary referral hospital in Barcelona, Spain.

Participants: HCWs in risk for occupational tuberculosis (TB) exposure, with negative baseline TST, direct contact with patients and/or biological samples and at least one follow-up visit with TST.

Methods: TST is performed in HCWs with no previous history of TB or no previous positive TST. When TST is negative this test is performed once a year in high-risk workers, or at least every 2 years according to the hospital's guidelines. In all cases an interview questionnaire to gather information on possible risk factors was performed.

Results: The study included 614 HCWs, 27% worked in areas of risk for TB exposure. Annual incidence rate had decreased from 46.8 per 100 person-years in 1990 to 1.08 per 100 person-years in 2007. Cumulative incidence was higher in HCWs who work in high-risk areas ($p = 0.004$) and in time periods from 1990 to 1995, and from 1996 to 2001 ($p < 0.0001$). Cox regression model showed a hazard ratio of 1.55 (CI 95%; 1.05–2.27) in high-risk workers, adjusted by gender, age and professional status.

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Conclusions: Incidence of LTBI among HCWs is high, although it decreased throughout the follow-up period. It is crucial to maintain surveillance programs in HCWs.

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Introduction

The risk for *Mycobacterium tuberculosis* transmission among healthcare workers (HCWs) has been well known for many years. The kind of job and the incidence of tuberculosis (TB) in the community conditions the risk of TB infection among HCWs.^{1–3} The introduction and compliance of TB prevention and control programs in health institutions is also important. These programs must include a periodical medical surveillance of workers at risk (determining baseline risk and periodical follow-up), correct isolation measures and early diagnosis and treatment of patients with TB. Several studies confirm that the risk for TB infection among HCWs in hospitals in which these measures have been introduced is similar to that of the general population.^{4,5}

In a recent review article of studies regarding tuberculosis infection (TI) among HCWs in countries with low incidence of TB, the authors concluded that there is still a high risk for TB among those who work in certain areas.⁶ One reason for this increase of risk for TB among HCWs in countries with low incidence of TB could be the delay in diagnosis.^{7,8} Another explanation could be an increase of immigrant HCWs who come from countries with a high prevalence of TB.

There is scant data about the incidence of latent tuberculosis infection (LTBI) in HCWs in Spain. Most studies have focused on prevalence, and have taken place in countries in which TB epidemiology differs from that in Spain. The introduction of a specific LTBI surveillance program among HCWs in our hospital has permitted us to analyse baseline LTBI prevalence, which was 25.7%, up to 44.2% at the beginning of the study period (1988–1992) to 15.5 at the end of this period (2003–2007).⁹

The classical screening test in surveillance protocols for HCWs with workplace exposure to TB is tuberculin skin test.² In recent years a new test appeared based on detection of interferon gamma (IFN- γ) released as a response to the *in vitro* stimulation of T cells from peripheral blood sensitized with specific antigens of *M. tuberculosis*.^{10,11} In a previous study performed in our hospital, we obtained a good agreement between two different tests based on IFN- γ (T-SPOT.TB and Quantiferon Gold in tube) for the diagnosis of LTBI in HCWs. These tests are not influenced by previous BCG vaccination and were more related to workplace exposure than TST, thus being more useful to detect recent infection.¹²

The surveillance program in our hospital is prospective, and HCWs with baseline negative TST are periodically evaluated with TST. The objectives of this study are to determine the incidence of LTBI, to identify risk factors for tuberculosis skin test conversion among HCWs, and to analyse the trends during a 20-year follow-up period.

Methods

Study design

In the framework of a health surveillance programme, we analysed the data collected prospectively from a dynamic cohort of HCWs between January 1, 1988 and December 31, 2007.

Setting

Hospital Germans Trias i Pujol (HGTiP) is a 600-bed tertiary referral hospital near Barcelona (Spain), with 3000 HCWs. It is referral hospital for more than 700,000 people. In 2009 there were 27,000 hospital admissions and 110,000 admissions in the emergency room. The number of patients admitted with TB has changed over time. In the first years there were about 150 patients per year with TB, while lately there are about 50 per year. Incidence of TB in the community has also changed over the years, with an incidence of 45/100,000 inhabitants in the year 1990 to an incidence of 25.1/100,000 in the year 2007^(13,14) In our hospital, from the year 1994, coinciding with new CDC guidelines for prevention and control of nosocomial transmission of TB,¹⁵ a series of measures was reinforced. These measures included, among others, improvement of ventilation systems of several rooms for isolation of patients with TB, improvement of the protocol of action for the patients admitted in the emergency room (ER) and the promotion of use of personal high-efficiency particulate air masks.

Study population

HCWs underwent a health examination at the Preventive Medicine Service, and met the following inclusion criteria: negative TST at the first visit, direct contact with patients and/or biological samples and at least one follow-up visit with TST. Clerical, maintenance and laundry workers were not included in the study.

Skin testing

Since 1988 our hospital has had a TB surveillance program for HCWs. In an initial health examination by the Preventive Medicine Service (either in the first visit when they start working at the hospital, or at any moment of their working life), HCWs with no previous history of TB or no previous positive TST, TST was performed. The test is administered by a trained nurse using the Mantoux method i.e. 0.1 ml of 2 TU of Tuberculin PPD RT 23. The test is read 48–72 h after application. When TST is negative and there is risk for occupational TB exposure, this test is performed once

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