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Yield of tuberculosis contact investigation in a low-incidence country

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Summary *Background:* Tuberculosis (TB) contact tracing is a valid public health measure to control the spread of TB infection in low-burden settings. The aim of this study was to assess the yield of the Piedmont TB contact investigation program and to evaluate the role of its main determinants.
Methods: The Piedmont TB notification systems were used to identify index TB cases. All cases were classified by contagiousness (sputum-smear-positive, AFB+; culture-positive, CULT+; other-than-defined). TB contacts were screened for active and latent TB infection by clinical manifestations and Tuberculin Skin Test (TST).
Results: 833 index TB cases with at least one contact were identified; 4441 contacts were screened, and 3942 (82.8%) were evaluated. TB contacts aged ≤35 years, regular and household contacts had a higher probability of being evaluated; foreign-born TB contacts were the least traceable. Higher rates of TB infection were observed in contacts at 35 years of age or younger who also lived in the same household with index cases or exposed to AFB+ or CULT+ index cases.
Conclusion: More efforts should be focused on young TB contacts, since they are likely to be new infections. An early identification and treatment of TB Infection in this group contributes to the prevention and control of TB transmission. The program should also be extended to the contacts of CULT+ cases.

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Article's main point

The program yield was 94%. TBI prevalence was 45.0% with an active TB incidence 40-times higher than the population one. Household TB-contacts aged ≤35 years had the highest probability of being evaluated. Culture-positive contacts, independently of sputum-culture results, showed the highest risk of TBI.

Introduction

Tuberculosis (TB) is the result of infection with *Mycobacterium tuberculosis* (*M. tuberculosis*), and remains a public health issue worldwide. Since the 1950s the incidence of TB has fallen dramatically in high- and middle-income countries,[1,2] while it has recently emerged as a public health concern in many low-income countries.[3] The World Health Organization (WHO) estimated that globally in 2012 there were 8.6 million incident cases of TB, and 1.3 million deaths from the disease.[4]

Public health measures to control the spread of TB infection have included different strategies focused on both prevalent and incident cases. The first priority of TB control programs is to identify and treat all individuals with active TB.[5] Where adequate resources exist and when active TB cases are being successfully treated, efforts should be directed towards contact tracing strategies to allow the early identification of TB contacts, i.e., individuals exposed to someone who has been diagnosed with TB, and to offer appropriate treatment for both latent TB (LTB) infection and active TB.[5,6] TB contact tracing, and partner notification have been revealed as a valid tool to stem the tide of TB infection, in particular among disadvantaged groups.[3,7]

The transmission of *M. tuberculosis* depends on several factors such as the bacteriological status and contagiousness of the index TB case, the susceptibility and immune status of the exposed TB contact and the characteristics of the environment within which such contact occurs.[8,9] Under conditions particularly favorable for transmission, an individual with undiagnosed active TB may potentially cause a TB outbreak in confined settings such as schools, prisons and other congregate settings.[7,10]

Several studies have investigated the performance of TB contact tracing programs in selected populations, focusing in particular on multidrug-resistant TB,[11] migrant subgroups,[12,13] or specific geographical areas.[14] A meta-analyses investigated also the performance of TB contact tracing programs in low- and middle-income countries[3] and, to the best of our knowledge, only one study has reported on the country-wide performance of a TB contact tracing program from a high-income country.[15]

The objectives of the present study were: to assess the yield of the Piedmont TB contact investigation program, and to evaluate both the role of its main determinants, and the role of selected risk factors for TB infection (such as TB case contagiousness, demographic and social TB case and contacts conditions, closeness of contact with the index TB case), among TB contacts identified in the city of Turin, a large metropolitan area in the north of Italy.

Methods

The Region of Piedmont has been running since 1999 a TB contact investigation program for its territories in agreement with Italian Ministry of Health guidelines[16,17] and according to the international guidelines for TB control strategies in the European region of the WHO.[5,18] The investigation is conducted for all new TB cases reported to the health authorities, with the aim of identifying potentially infected TB contacts in need of treatment[19] for a more precise description of the Piedmont TB surveillance system see Baussano et al., 2006.[20]

According to the stone-in-the-pond method, for each suspected or confirmed pulmonary TB case active TB contact investigation (by phone, mail, through personal invitation or inspections in congregate settings) was conducted among household members, close contacts, and regular contacts.[21] Occasional contacts were investigated through passive investigation, (e.g. when requested by a general practitioner or when voluntarily presented) as per CDC guidelines.[5]

TB data are kept in mandatory regional registries and no informed consent is required to obtain and store the information for public health and research purposes; an informed consent to collect clinical and demographical information on TB contacts was obtained. Encrypted personal identification codes guaranteed anonymisation.

TB case definition

The Regional Compulsory National Notification System and the Piedmont TB Surveillance System of Treatment Outcomes were used to identify pulmonary TB cases. The two systems together capture more than 80% of the TB cases occurring in the Piedmont Region.[20]

The present study included TB cases residing in the metropolitan area of Turin (Piedmont Region) with a diagnosis of active pulmonary TB between 1 January 2002 and 31 December 2008. We included in the analyses all TB cases that were either confirmed by bacteriology/radiography or diagnosed by a clinician.[22]

TB cases were classified into three main categories of contagiousness, according to laboratory or clinical results: i) sputum smear examination positive for acid-fast bacilli and culture positive (AFB+); ii) sputum smear examination negative, but sputum culture positive for *M. tuberculosis* complex (CULT+); and iii) 'other than defined' cases (OtD), i.e., both sputum smear and culture negative or missing, but clinically and/or radiologically diagnosed as being compatible with TB, and subsequently given a full course of anti-TB treatment. For each TB case included, information on sex, age, place of birth, social condition (such