



Prevalence of Latent Mycobacterium Tuberculosis Infection (LTBI) in Saudi Arabia; Population based survey



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ABSTRACT

Background: The annual risk of tuberculosis infection (ARTI) data in Saudi Arabia has not been updated since 1993.

Objectives: To estimate the prevalence of latent TB infection (LTBI) and ARTI in a population-based sample in Saudi Arabia using Tuberculin skin test (TST) and QuantiFERON TB Gold in tube (QFT-GIT) test.

Methods: A population-based cross sectional study was conducted between July 2010 and March 2013. Participants were randomly selected from the population served by the primary healthcare centers of the Ministry of National Guard Health Affairs in Riyadh, Jeddah, Alhassa and Dammam, Saudi Arabia.

Results: A total of 1369 participants were included. The overall prevalence of LTBI was similar using TST and QFT-GIT (9.3% and 9.1% respectively, $p=0.872$) but stratified prevalence rates were variable in all sociodemographic groups except marital status. Additionally, the prevalence rates of LTBI using either test alone showed significant differences by several sociodemographic and behavioral characteristics. The overall ARTI was 0.36% using TST and 0.35% using QFT-GIT.

Conclusions: We are reporting much lower estimates for the prevalence of LTBI and the ARTI in a population-based sample in Saudi Arabia relative to the data that have been used for more than two decades.

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Introduction

Tuberculosis (TB) continues to be a global health problem. It is a leading cause of morbidity and mortality in several parts of the world (World Health Organization (WHO), 2015a). World Health Organization (WHO) estimated that one-third of the world population is currently infected with the TB bacillus, and approximately 5% to 10% of them has been or will become sick

or infectious at some point during their life (World Health Organization (WHO), 2015b).

Latent tuberculosis infection (LTBI) is defined as lack of clinically manifested active TB in a person who has persistent immune response to stimulation by Mycobacterium tuberculosis antigens (Getahun et al., 2015a). LTBI is detected either by tuberculin skin testing (TST) or by QuantiFERON Gold in tube (QFT-GIT) test. This detection provides an opportunity to treat LTBI and prevent progression of TB infection to active TB disease (Getahun et al., 2015b). The annual risk of tuberculosis infection (ARTI) which is defined as the probability of acquiring new tuberculosis infection or re-infection over a period of one year, is a sensitive indicator of the extent of transmission of tubercule bacilli

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as well as the efficiency of case finding and treatment programs (García et al., 1997; Rieder, 2005; el-Kassimi, 1994).

Monitoring TB infection over time is challenged by several factors including the variability of Bacillus Calmette–Guérin (BCG) vaccination, lack of large scale surveys, and limitations of reporting systems (World Health Organization (WHO), 2015a; Alrajhi and Al-Barrak, 2004). As ARTI is the most reliable indicator for trending tuberculosis infection (Alrajhi and Al-Barrak, 2004; Al-Jahdali et al., 2005; Styblo, 1985), there is a need for updated population based estimates of LTBI prevalence. In Saudi Arabia, such data is clearly outdated as the last community-based survey of the epidemiology of LTBI was conducted in 1993 (el-Kassimi, 1994; al-Kassimi et al., 1993; Bener and Abdullah, 1993). Obviously, this data did not reflect the major changes that have happened in socioeconomic standards and TB management in Saudi Arabia in the last three decades. Additionally, the impact of using QFT-GIT in estimating LTBI prevalence and ARTI has never been adequately examined in a population-based sample in Saudi Arabia (Balkhy et al., 2016; Al Jahdali et al., 2013; Al Wakeel et al., 2015). The objective of the current study was to calculate recent estimates of the prevalence of LTBI and ARTI in a Saudi population-based sample.

Methods

Setting

The study was conducted in primary care centers of the Ministry of National Guard Health Affairs (MNGHA). There are over 27 primary care centers serving a population greater than one million, distributed in the three main regions in Saudi Arabia; Central, Western and Eastern regions. Eleven primary health care centers in Riyadh, Jeddah, Alhassa & Dammam served as primary study sites for enrollment of study participants from their catchment areas.

Design

A population-based cross-sectional study was conducted between July 2010 and March 2013. The study was approved by the institutional review board (IRB) of King Abdullah International Medical Research Center (KAIMRC), Riyadh, Saudi Arabia.

Population

The study was conducted among the population eligible to receive healthcare services at one of the selected primary care centers of the MNGHA. Inclusion criteria included Saudi Nationals aged five years or older who were able to frequent one of the study sites. Exclusion criteria included children below five years of age (to exclude the BCG vaccination effect on the results of the study as it is given routinely at birth for all newborns in Saudi Arabia), those with current or previous active pulmonary TB disease, those with diagnosis of TB infection and on anti TB prophylaxis, and those with immunocompromised disease or a condition such as patients with leukemia, lymphoma, other cancers under chemotherapy, hemodialysis, organ transplantation, chronic steroid or immunosuppressive therapy, or HIV (self-reported).

Recruitment

Stratified random sampling technique with age and gender proportional to the distribution of the served primary care population was used to randomly choose the participants. The study coordinator contacted the selected participants, explained

the aim of the study and invited them to join. Study objectives and testing details were explained to each subject or one of his/her parents (in cases of children). Informed consent was obtained before filling out the study questionnaire, which included questions about the participant's socio-demography (age, gender, marital status, education, occupation, family income, and residence), behavior (cigarette smoking and hookah "shisha" smoking), medical history (to ensure absence of exclusion criteria), and family history (tuberculosis).

LTBI testing

From each subject a 3-ml blood sample was collected by venipuncture for the QFT-GIT assay then TST (0.1 mL of tuberculin PPD using 5 unit ampoules) was injected intradermally into the volar aspect of the forearm, and the transverse induration diameter was measured 48–72 hours later. The positive interpretation of a TST is an area of induration of ≥ 10 mm in diameter. QFT-GIT was conducted by the central laboratory of the MNGHA. The cut-off for QFT was TB antigen tube value minus the Nil tube value ≥ 0.35 IU/mL.

Table 1

Sociodemographic characteristics of the study participants.

Characteristics	Value*
Age (years)	
Mean \pm SD	26.3 \pm 19.0
<15	591 (43.2%)
15–44	502 (36.7%)
45–64	204 (14.9%)
≥ 65	72 (5.3%)
Gender	
Male	597 (43.6%)
Female	772 (56.4%)
Marital status	
Single	782 (57.6%)
Married	543 (40.0%)
Divorced/widowed	33 (2.4%)
Education	
Illiterate	175 (13.2%)
Primary school	559 (42.3%)
Mid/high school	455 (34.4%)
University and above	134 (10.1%)
Occupation	
Military	183 (15.3%)
Civilian	67 (5.6%)
Housewife	161 (13.4%)
Student	691 (57.6%)
Unemployed	53 (4.4%)
Retired	45 (3.8%)
Family income	
Median & IQR, SR	SR 8,000 (5,500–10,000)
Median & IQR, \$	\$ 2133 (1467–2667)
\leq SR 6,000 (\leq \$1600)	178 (33.6%)
SR 6,001–9,000 (\$1600–2400)	194 (36.6%)
$>$ SR 9,000 ($>$ \$2400)	158 (29.8%)
Family size	
Median & IQR	8 (6–10)
≤ 5	261 (22.0%)
6–10	691 (58.2%)
> 10	235 (19.8%)
Geographic region	
Central region	763 (55.7%)
Eastern region	313 (22.9%)
Western region	293 (21.4%)
Cigarette smoking	
Never	1220 (90.0%)
Current &/previous	136 (10.0%)
Hookah (shisha) smoking	
Never	1282 (94.8%)
Current&/previous	70 (5.2%)

* Number (percentage) unless mentioned otherwise. SD, standard deviation; IQR, inter-quartile range.

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