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Distribution and determinants of tuberculosis in the Kingdom of Saudi Arabia from 2005 to 2012

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ABSTRACT

Tuberculosis (TB) remains a public health threat in the Kingdom of Saudi Arabia (KSA) with many challenges that limit its prevention and control. To understand how to meet these challenges, this study calculated the TB incidence rates (IRs) in KSA from 2005 to 2012, which were stratified by nationality, sex, and administrative regions. Furthermore, laboratory capabilities were assessed by determining the proportion of laboratory-confirmed TB cases. The overall TB IRs decreased from 15.80/100,000 population in 2005 [95% confidence interval (CI) = 15.29–16.31] to 13.16/100,000 population in 2012 (95% CI = 12.74–13.58). The IRs were greater for males than for females from 2009 to 2012. The IRs of non-Saudis were approximately two times those of Saudis during the study period. Mecca had greater IR during the study period compared with other regions [25.13/100,000 (95% CI = 24.7–25.56)]. Among non-Saudis, those from Indonesia and Yemen had the greatest proportion of TB cases (15.4% and 12.9%, respectively). Individuals <15 years of age comprised 14.2% of the TB cases. Employed non-Saudis had the greatest proportion of TB (32%), followed by unemployed Saudis (22.38%). The proportion of laboratory-confirmed cases of reported TB was 57% from 2005 to 2012. For effective prevention and control, TB screening should be implemented for non-Saudi workers at ports of entry and laboratory-screening capacity for TB should be evaluated.

1. Introduction

Tuberculosis (TB) is a major public health threat with an estimated 9 million new cases per year and 2 million attributable deaths [1]. In 2014, TB ranked alongside human immunodeficiency virus (HIV) as the single most common cause of death among all other infectious diseases, with the number of deaths from TB surpassing that from HIV in the following years [2]. Reduction of TB infection rates is a Millennium Development Goal, but the infection remains a major public health problem. The World Health Organization (WHO) has recently released a strategy for the post-2015 era, which aims to end the global TB epidemic by 2035 [3].

The Kingdom of Saudi Arabia (KSA) is a fast-developing country that has experienced tremendous changes over the previous decades. By improving its standard of living, KSA has succeeded in minimizing infectious disease-related mortalities. With it rapid development, the country has become a major destination for many immigrants from developing countries who currently make up about one-third of the Saudi population [4]. In addition, 2–3 million pilgrims travel to KSA yearly to perform Hajj, mostly from developing countries. These factors have caused major shifts in the status of many infectious diseases and presented many challenges to KSA in controlling infectious diseases, including TB.

According to the Central Department of Statistics, KSA has a population of around 30 million. One-third of this population is composed of non-Saudi immigrants. The incidence rate (IR) for TB has ranged from 11/100,000/year to 16/100,000/year since 2000 [5]. From 1991 to 2010, 64,345 cases of TB were diagnosed in KSA [6]. Pulmonary TB, the infectious type, accounts for 73% of these cases [6]. Because of factors such as the high number of immigrants and pilgrims, TB is not fully controlled in KSA. The mortality rate among TB patients reached a peak in 2003 when it was reported to be 7.2% among Saudis and 6.2% among non-Saudis [7]. Since then, the incidence and mortality rates have decreased, but the problem persists.

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TB remains a public health problem in KSA with many challenges that limit its control and elimination. Furthermore, no previous study has tried to assess the sensitivity of the TB screening program in KSA. In addition, previous studies on the trends of TB have focused only on sex, region, age group, and nationality (Saudi or non-Saudi). This study aims to investigate the trends of the IR of TB in KSA over an 8-year period (2005–2012) stratified by sex, nationality, and the 13 administrative regions. In addition, this study aims to identify the distribution of TB cases among age groups, occupation, and immigrant nationalities.

In this study, the reported laboratory results of TB tests were analyzed to determine which TB cases were confirmed based on WHO guidelines [8]. This helped us identify the capacity of the TB laboratory testing programs overall and by region. The results of this study demonstrated the need to perform a formal evaluation of the TB program in KSA.

2. Methods

TB is an infectious disease requiring mandatory reporting [4]. Surveillance for TB cases is population based and conducted in both primary health centers and hospitals [9]. All suspected TB cases were reported monthly to the Ministry of Health (MoH) from all KSA regions [6]. For suspected cases in health centers, the diagnosis can be confirmed using methods such as mycobacterial culture, sputum smear microscopy, radiography, histopathology, and molecular techniques [9]. However, the reported data contain only results from the laboratory tests of smear and culture, possibly because these options are more commonly available in all laboratories than other laboratory tests.

TB case data were obtained from the Saudi MoH as deidentified, individual-level data collected from 2005 to 2012. KSA has a national disease registry in which all reportable health conditions, including infectious diseases, are reported to the MoH [4]. This study's data provided results from the culture, smear, and radiography analysis of each reported case.

This study estimated the IR and 95% confidence interval (CI) of TB for the population in KSA from 2005 to 2012 to investigate the trend of the IR over the study period. The IRs were estimated and stratified by nationality, sex, and administrative regions. IRs were estimated using the number of cases per year over the total population per 100,000 individuals.

Two population databases were used. The first was the Saudi Central Department of Statistics, whose data were used to estimate the IR for the total population and by nationality and sex. Because the population data stratified by region were not available in the Central Department of Statistics database, another database from the MoH was used to obtain the region-level data. Nationality was classified as Saudi or non-Saudi, and regions were grouped into the 13 administrative regions.

The proportion of TB cases was also calculated by nationality, age category, and employment status. Age was divided into categorical variables of 5-year duration. Employment status was grouped into four categories, namely, employed, unemployed, student, or prisoner. Because prisoners live in crowded conditions, and are therefore more susceptible to TB transmission, they were categorized separately. Students were also categorized separately because schools are usually crowded and can act as foci to spread the infection to the community.

This study also calculated the proportion of laboratory-confirmed cases of the reported TB cases for each region based on the WHO diagnostic criteria of confirming cases by either positive culture or smear [8]. All calculations and analysis were done using Excel 2013 (Microsoft, Redmond, WA, USA).

2.1. Ethical considerations

This study was determined to be Institutional Review Board exempt because all analyses were performed on secondary data deidentified prior to analysis. Prior to data collection, all portions of the study were reviewed by Emory University's Institutional Review Board and determined to meet the criteria for exemption.

3. Results

The total number of TB cases included in this study that have been diagnosed between 2005 and 2012 was 32,435. The overall TB IR in KSA decreased from 2005 to 2012. The rate difference between 2005 (IR = 15.8; 95% CI = 15.29–16.31) and 2012 (IR = 13.16; 95% CI = 12.74–13.58) was statistically significant according to the CIs (Table 1).

The TB IRs of both males and females were similar from 2005 to 2008 (Fig. 1); however, from 2009 to 2012, the IRs of males were

Table 1
Reported cases of tuberculosis and incidence rates, by year, in the Kingdom of Saudi Arabia, from 2005 to 2012.

Year	*N*	IR[a]	95% Confidence interval
2005	3687	15.80	15.29–16.31
2006	3875	16.06	15.55–16.57
2007	4084	16.37	15.87–16.87
2008	4156	16.12	15.63–16.61
2009	4149	15.56	15.09–16.03
2010	4558	16.54	16.06–17.02
2011	4083	14.39	13.95–14.83
2012	3843	13.16	12.74–13.58
Total	32,435		

[a] IR = incidence rate per 100,000 population.

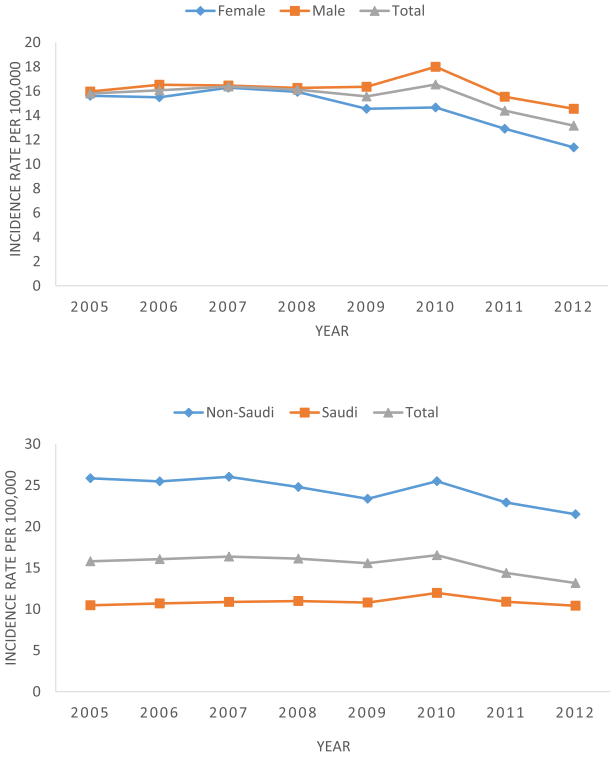

Fig. 1. Incidence rates of reported cases of tuberculosis, by sex and nationality, in the Kingdom of Saudi Arabia from 2005 to 2012.

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