

Sex Difference in Tuberculosis in Afghanistan: A National Cohort Study

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Abstract

Background: In general, tuberculosis rate is higher among men than women globally. The reason for the sex difference in the rate is not clear. The purpose of this study is to examine sex difference in the incidence of smear-positive pulmonary Tuberculosis (TB) in Afghanistan and to discuss it from socio cultural perspectives.

Methods: Patients with smear-positive pulmonary tuberculosis were identified by all health facilities capable to diagnose tuberculosis, throughout Afghanistan. Age-specific incidence rates of smear positive pulmonary tuberculosis for males and females census cohorts of 2005 were compared.

Results: Of the 9,949 smear-positive TB cases identified during 2005, 3,131 (31.5%) were male and 6,818 (68.5%) were female. The annual incidence rates (per 100, 000 population) of TB were 60.0 for female population and 26.7 for male population. In all the age groups, except those aged more than 65 years, those rates were higher for females than for males.

Conclusions: Based on the national registration data, for all the age groups equal to or under 65 years old in Afghanistan, the incidence rates of pulmonary TB are higher in females than in males. Possible factors contributing to this observation are discussed.

Keywords: Sex difference; Incidence rate; Smear-positive; Tuberculosis; Afghanistan

Introduction

Tuberculosis (TB) is a major cause of illness and death worldwide, especially in Asia and Africa. In 2007, 5.5 million cases were reported from 196 countries and territories to the World Health Organization (WHO). In almost all countries, more smear-positive TB cases were reported to have occurred in males than in females [1-3]. That sex difference varies with age and in different parts of the world. In industrialized countries, the apparent rates of TB among male and female children and adolescents were similar, but the rate among females aged 15-34 years was very high in the middle of the twentieth century. However, by 1970 slightly higher rates were found in males of all ages. In developing countries, the apparent rates for both sexes during the last few decades were similar to those in industrialized countries in the middle of the twentieth century. In Nicaragua, Kenya, Tanzania, and China, for example, similar rates of smear-positive pulmonary TB were reported in males and females up to the age of 14 years, above which males had higher rates [4]. However, the higher rates among young-to-early-middle-aged women that were observed in the middle of the twentieth century in industrialized countries with high incidence rates of TB have not yet been reported from developing countries [5,6].

This difference in rates is due to at least five factors: females having less access to diagnostic facilities in some settings [7,8], under-reporting of respiratory morbidity [9], greater stigmatization among females [10], fewer females than males submitting sputum specimens [11], females submitting sputum specimens of poorer quality [12], and under-detection of cases in females when Ziehl-Neelsen staining is used [13]. Nonetheless, the difference in apparent rates has also been said to reflect a real epidemiologic difference between males and females [14-17]. That epidemiologic difference may arise as a consequence of differences in biological functioning (i.e., as consequence of sex per se) and differences in exposure that are related to differences in the social roles of males and females (i.e., to gender differences).

Regarding Afghanistan, the WHO estimated that the incidence rate of TB was 168 cases, including 76 sputum smear-positive cases, per 100,000 population in 2007, which is one of the highest rates in the Eastern Mediterranean Region [3]. In contrast to the incidence estimates, only 49 new sputum smear-positive cases were reported per 100,000 population in 2007. The female/male ratio of reported cases was approximately 2.2 for several years. In the WHO's reports, that figure is shown in the country profile and attached tables, but it is not discussed (WHO global reports archive). From a recent regional analysis of the sex differential among smear-positive cases reported to the WHO from 1997 to 2005, notable exceptions to the global pattern of male preponderance were found in Afghanistan, Iran, and the Khyber-Pakhtunkhwa and Baluchistan provinces of Pakistan [6]. Remaining to be studied are the age structure of the sex differential and country-specific conditions that could account for it. Here we report details of the higher apparent rates of TB among females of all ages in Afghanistan and discuss it from sociocultural perspectives.

Methods

In this study, we compared incidence rate, number of notified incident cases of smear-positive pulmonary tuberculosis per 100,000 populations, in the males and females national cohorts for 2005 in Afghanistan [18]. The global TB control report, which contains data on

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reported cases of TB for 2005, was downloaded from the WHO archive [1]. We studied the records of all patients with smear-positive TB who registered for TB treatment within the national surveillance system of Afghanistan and whose cases were reported to the WHO. The diagnosis of smear-positive TB required that Acid-Fast Bacilli (AFB) be visible on microscopic examination of two or more sputum samples, or that there be one sputum sample positive for AFB in addition to clinical and radiologic features compatible with TB (or on culture if smear-negative). In almost all cases the diagnosis was made in DOTS health centers.

In Afghanistan, the data on TB cases come from routine service reports of the national TB control program (NTP). Province-level data are totaled by each regional TB coordinator and then region-level data are compiled by NTP staff, and eventually reported to the WHO. To estimate rates of reported TB in different age groups, we abstracted data on total population, sex, and age groups for 2005 from a national census report, in a manner similar to the one used by the WHO to report smear-positive TB cases by sex and age [18]. Statistical analyses were done with STATA (STATA Corp, Houston, TX, US, version 10).

Results

During the study period, 9,949 smear-positive pulmonary TB cases were reported to the WHO, resulting in an apparent annual rate of 43.1 (male 26.7 and female 60.0) per 100,000 population. Of those cases, 3,131 (31.5%) occurred in males and 6,818 (68.5%) occurred in females.

Table 1 shows the apparent TB rates by age and sex. The rates were

higher in females than in males in all age groups, except the group ≥ 65 years old. In both males and females, the rates were consistently higher in older people than in younger people. The figure 1 shows the rate ratio (female rate/male rate). The overall rate ratio was 2.2. Sex differences were greatest in people of reproductive age (15-44 years), among whom the rate ratios ranged from 2.7 to 3.5. In contrast, the female/male rate ratios among those in the 55-64 and the ≥ 65 groups were 1.3 and 1.0.

Discussion

Observed TB rates in Afghanistan

In 2005, the overall apparent TB rate (per 100,000 population) in Afghanistan was 43.1, which is comparable to the rates observed in other high-burden countries including Ethiopia (49), Thailand (47), India (45), and China (36). The rate in 2005 was higher than the rates in 2000-2004 (14-34), and lower than those in 2006-2007 (48-49), which indicates steady progress in case detection.³ This was mainly due to expansion and integration of TB services in the Basic Package of Health Services (BPHS), primary health services offered in health posts, basic health centers, comprehensive health centers, and district hospitals, and in other provincial and regional hospitals throughout the country [19].

Sex difference in rates

The apparent overall TB rate per 100,000 population was higher in females than in males overall (60.0 vs. 26.7), and it was also higher in

Age groups	Population		Smear-positive TB case		Rate per 100,000
	N	%	N	%	
Females					
0-14	5,722,599	50.3	320	4.7	5.6
15-24	2,093,677	18.4	1,651	24.2	78.9
25-34	1,533,795	13.5	1,959	28.7	127.7
35-44	1,053,519	9.3	1,302	19.1	123.6
45-54	577,697	5.1	869	12.7	150.4
55-64	255,326	2.2	471	6.9	184.5
≥ 65	134,667	1.2	246	3.6	182.7
Total	11,371,280	49.2	6,818	68.5	60.0
Males					
0-14	5,816,189	49.6	151	4.8	2.6
15-24	2,069,741	17.6	606	19.4	29.3
25-34	1,540,091	13.1	560	17.9	36.4
35-44	1,089,308	9.3	472	15.1	43.3
45-54	670,968	5.7	453	14.5	67.5
55-64	322,002	2.7	470	15.0	146.0
≥ 65	223,403	1.9	419	13.4	187.6
Total	11,731,702	50.8	3,131	31.5	26.7
Both sexes					
0-14	11,538,788	49.9	471	4.7	4.1
15-24	4,163,418	18.0	2257	22.7	54.2
25-34	3,073,886	13.3	2519	25.3	81.9
35-44	2,142,827	9.3	1774	17.8	82.8
45-54	1,248,665	5.4	1322	13.3	105.9
55-64	577,328	2.5	941	9.5	163.0
≥ 65	358,070	1.5	665	6.7	185.7
Total	23,102,982	100.0	9,949	100.0	43.1

Source of data: WHO 2007 report and CSO & UNFPA 2006

Table 1: Number of reported cases per 100,000 populations by sex and age in 2005.

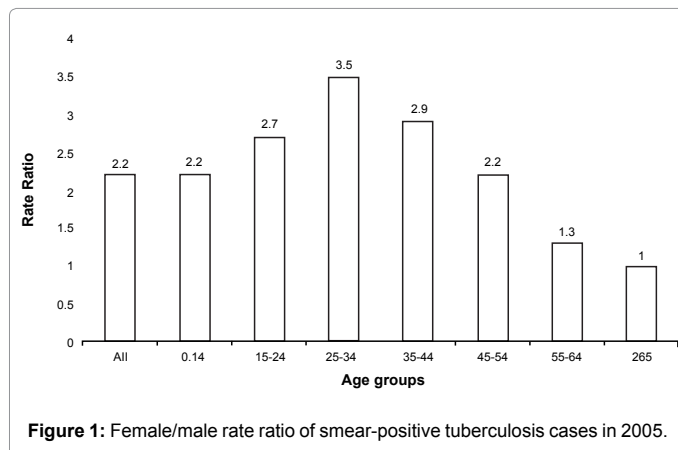


Figure 1: Female/male rate ratio of smear-positive tuberculosis cases in 2005.

each age group. In females, the rate of TB was higher in Afghanistan than in neighboring and nearby high-burden countries, and higher than in all WHO regions except Africa. The rates in nearby countries were 52.1 for females and 146.7 for males in Bangladesh, 41.6 and 49.9 in Pakistan, 32.7 and 84.7 in India, and 25.7 and 63.6 in China. This pattern was consistent across all the regions [1].

Among countries near Afghanistan, exceptions to the global pattern of male preponderance of TB are found in Iran and in Pakistan. In Iran, the rate is slightly higher in females than in males, but the magnitude of the sex difference is substantially lower than in Afghanistan (rate ratios of 1.1 to 1.2 in Iran, and 2.2 in Afghanistan). In Pakistan, the relation between sex and TB rates varies between provinces. In Punjab and Sindh provinces, females account for less than half of the reported smear-positive TB cases but in Khyber-Pakhtunkhwa and Baluchistan provinces the percentage of females is about 60%, which is slightly lower than their percentage in Afghanistan (68.5%). The two provinces are immediately to the east and south of Afghanistan and have populations of similar ethnicity [6].

The present findings cast doubt on the attribution of lower TB rates among females to epidemiologic differences rather than to differential access to health care [14-17]. They also do not support the contention that TB among females is under-diagnosed or under-reported [7-13]. Even in Afghanistan's rigid social and religious system, in which women are secluded from much of public life, more cases were in fact reported among females than among males. We are not aware of any other studies that can address higher rates of tuberculosis among all age groups in detail.

In Afghanistan, even though almost all reports of TB cases came from DOTS health facilities, which are public, differential use of health services, might have contributed to the sex difference in the rates of TB. In Afghanistan, women often use public health services, which have TB-diagnostic facilities and are either free or charge only a nominal fee. In contrast, men often use private health services, which may have shorter waiting times but which can lack TB-diagnostic facilities and are more expensive. In our study of diagnostic delays in eastern Afghanistan, out of 1,471 patients who had had a productive cough for more than two weeks, 371 (66.1%) men and 552 (61.2%) women initially went to private health care facilities following onset of symptoms (part of the data has published [20]). Despite substantial use of private health facilities, the high cost of anti-TB drugs eventually drives almost all patients with TB to receive TB treatment from DOTS health facilities. Surrounded by poverty, the DOTS centers provide anti-TB drugs for free, and also offer free food packages. Further study

is needed to understand the effects of the use of different sources and food incentives on TB diagnosis, and how diagnoses made by private health-care providers are recorded by the NTP.

Embarrassment or fear of stigma attached to TB might have contributed to the delay in treatment –increase risk of TB infection and then risk getting TB- and eventually the rate. Studies have found higher score of stigma for women than men in the central [21] and eastern part (unpublished data) of Afghanistan. Higher score of social consequences of having stigma, score of a scale, was associated with patient delays [22]. Presence of stigma attached to tuberculosis in women might invoke them to hide tuberculosis symptoms or its diagnosis, which exposes others particularly women to the risk of TB infection. Because the women stays at home and have limited authority to get out of home or go to neighbor house without males' permission. Large scale nationally representative studies are required to confirm the role of stigma in health care seeking, treatment, and spread.

Age-related differences in rates

In both sexes, the rates of TB increased with age. The rate of males substantially increased after age 45. It was 67.5 in age 45-54 and 287 per 100,000 in age ≥ 65 . However, the sex difference was greater in the middle age groups including 15-24, 25-34, and 35-44 groups. The female/male rate ratios were 2.7, 3.5, and 2.9, respectively. The findings are in contrast with Chan-Yeung et al. [5], who found that the sex difference in TB was greater in older than in younger groups in Hong Kong. Our findings are also in contrast with findings of a study recently conducted in Viet Nam which found prevalence rate of smear positive tuberculosis 351.1 for men and 69.3 per 100,000 for women that significantly increase with ages [23]. This might be due to a difference in the rate of progression from TB infection to disease. Studies in different countries have shown that progression of TB from infection to disease is likely to be faster for women in their reproductive years than for men of similar age, and then faster for men after 40 years of age [4]. The latter could account, in part, for the apparent "peak" that we found in the female/male rate ratios in the 25-44 age groups. Nonetheless, unlike the findings of Chan-Yeung et al. [5], the rate ratios we found did not appear to change monotonically across most of the age groups.

Girls aged 0-14 years had 2.2 times the rate of TB as did boys in the same age group. That result is in line with the findings of Ottmani & Uplekar [6], who reported that from 1997-2005 in all WHO regions the female-to-male ratio of reported cases was consistently greater than 1. However, it contrasts with results from Hong Kong [5] and with observations from the middle of the twentieth century in industrialized and developing countries, where TB rates were similar in girls and boys [4]. Thus, in children and adolescents the effects of sex and/or gender on exposure to TB (TB infection) and on clinical TB rates vary with the setting, that is, as a minimum, they vary between countries and times. This further highlights the importance of gender studies for TB control programs.

Among people in Afghanistan who were aged 15 through 44 years, the rates of TB were at least twice as high in females as in males. Those higher rates among females are consistent with the rates observed in industrialized countries in the middle of the twentieth century, and they differ from those recorded around 1970, when the age and sex patterns shifted and rates became slightly higher in males of all ages. During that time, those countries moved from a period of high incidence rate to a period of low incidence rate: from 100 cases per 100,000 population per year to less than [4].

The causes of sex differences in the TB are not well understood. Higher rates among men than among women have been attributed to higher prevalence of infection among males from early adulthood, which in turn have been attributed to higher probabilities of exposure [4], alcohol abuse, and smoking [24,25]. In Afghanistan, if women are the main source of airborne mycobacteria then differences in the social roles of women and men can result in differences in exposure, because women have more contacts with women than do men. Within a household, adult females are usually not allowed to be together with men in the presence of guests. In large households, men and boys eat together with no women or girls present, and women and girls eat together after the men and boys finish their meal. Young and adolescents girls stay in the same room as their mother or other women in the household rather than in the same room as their father or other men. In addition, the physical separation of females from males is stricter for adults than for children. Adolescent and young-to-middle-aged women are highly influenced by such restrictions. Thus, when the source of infection in a household is a female, exposure to that source would tend to be greater among other females than among males (Figure 2).

While they may have fewer social contacts than men, many women in Afghanistan stay for long periods indoors in homes with poor ventilation and lighting (i.e., away from sunlight that quickly kills tubercle bacilli), whereas many men spend relatively more time outdoors with friends, doing business, or doing agricultural work. Indoor use of biomass fuels has been found to be associated with TB in Mexico and in India [26,27], and having a cooking fire in the sleeping room has been found to be associated with prevalence of TB infection in parts of Afghanistan [28]. Almost all households in Afghanistan use solid fuel for cooking, which is done mainly by women. Thus, TB risk

may be higher among women than men because women spend more time in environments that are more conducive to TB infection.

Other possibilities should also be considered. For example, high rates of TB in women of reproductive age may be attributable to the stress of frequent pregnancies or births, though this is yet unclear [29,30]. In theory, depression and stress could increase the risk of TB via adverse effects on the cell-mediated immune system [31], and symptoms of depression, anxiety, and post traumatic stress disorders are more prevalent among women than men in Nangarhar province [32]. Potentially important factors also include poverty, the cost of care, access to health and other economic resources, low food intake by women, low protein and micronutrients contents of the food, and other psychological, familial, and physical stressors. Large studies of these and other likely biomedical, epidemiological, and social causes are needed for a clearer understanding of the sex differences in TB rates.

Study limitations

These findings should be interpreted carefully. We used data from two sources: the national census (which provided the denominators for the rates) and the TB surveillance system. The census was done during armed conflict, but it is nonetheless the best source of information on population, and those data are used frequently.

Data on cases of TB came from health services records, and thus they depend on passive (not active) surveillance, which is often incomplete. Still, the national surveillance and health information systems were substantially improved during the study period [19]. The reported rates might be lower than actual incidence rates because of barriers to care, a low index of suspicion among the population and among practitioners with regard to TB symptoms, and relatively poor diagnostic capabilities of the health care providers. Also, we estimated the TB rates based on 2006 and on 2007 reports [23] for the projected populations in those years, using an annual population growth rate of 3.9% [18]. In those years, the rates of TB among women aged ≥ 65 years were higher than the rates among men in the same age group, and the women/men rate ratios were 1.3 (2006) and 1.2 (2007). Thus, we have somewhat more confidence in the findings for 2005.

Conclusion

Unlike in other countries, in Afghanistan the apparent TB rates in all age groups were higher for females than for males. Socio-cultural role of women in the society contribute to the differential in the rates. Large multidisciplinary studies are needed to determine whether the reported rates differ in important ways from the actual rates, and to specify the nature of the phenomena. Gender-sensitive strategies in all aspects of the national TB control program should also be encouraged.

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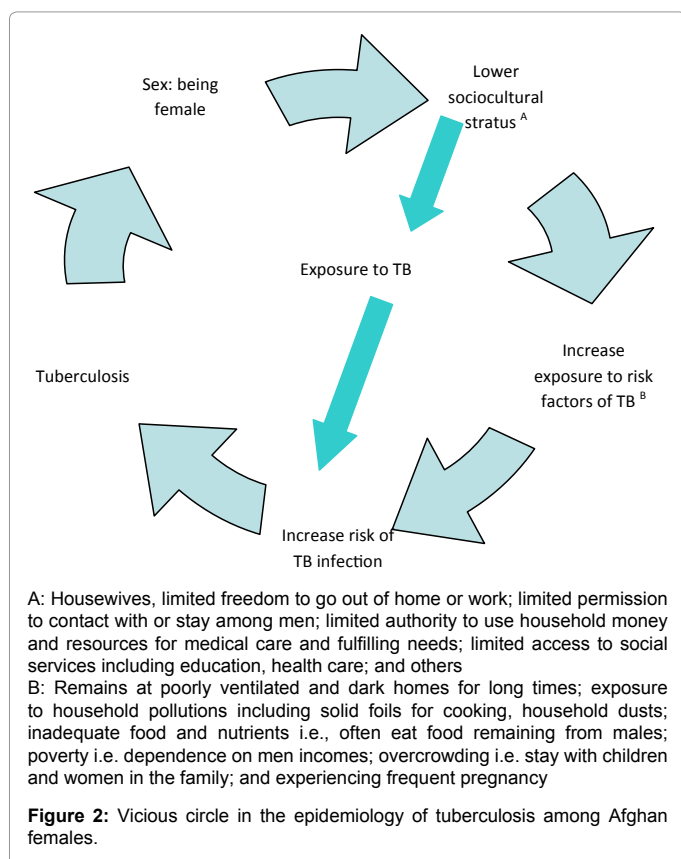
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Competing interests

The author declare that they have no competing interests.

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