A Study of Gender Differentials in the Prevalence of Tuberculosis Based on NFHS-2 and NFHS-3 Data

PP Sharma, Ashok Kumar1, Padam Singh2
LRS Institute of TB and Respiratory Diseases, (Near Qutab Minar), Sri Aurobindo Marg, New Delhi, 1Department of Statistics, MD University, Rohtak, Haryana, 2Member National Statistical Commission, 2nd Floor, Sardar Patel Bhawan, New Delhi, India

ABSTRACT

Background: Worldwide, the case notification rate of tuberculosis has been reported to be higher for men than women. In India also, the prevalence of TB is higher among males as compared to females but it is important to study the trend of gender gap in the prevalence of tuberculosis over the years. Objective: To examine the trend in gender gap in the prevalence of TB over the years. Materials and Methods: The unit level data of NFHS-2 (1998-99) and NFHS-3 (2005-06) has been utilized. Gender gap in the prevalence of TB has been estimated for the two rounds of the surveys. The delta (Δ), the difference in gender gap in two surveys, has been estimated and decomposed by background characteristics such as place of residence (urban/rural), religion (Hindus/ Muslims/others), caste (SC/ST/OBC/others) and standard of living (SLI) (low/medium/high) categories. Main Findings: Overall, the prevalence of TB has remained almost same in the two surveys [432/lakh in NFHS-2 and 418/lakh in NFHS-3; Z=1.19, P=0.275]. The gender gap has increased to 217/lakh in NFHS-3 in comparison to 145 per lakh in NFHS-2. The increase in gender gap is significantly higher in rural areas [of 98 per lakh; 167/lakh in NFHS-2 vs 265/lakh in NFHS-3; P<0.05] as compared to corresponding increase in urban areas [of 30 per lakh; 88/lakh in NFHS-2 vs 118/lakh in NFHS-3, P>0.05]. The increase in delta (Δ) (difference in gender gap in two surveys) is accounted for as 88% by the rural areas and 12% by the urban areas. Conclusion: The increase in gender gap in the prevalence of TB is more in rural areas as compared to urban areas. The increase in rural areas is mainly contributed by Hindus, SC and ST and low and medium SLI categories and in urban areas, the contribution is mainly by Hindus, other castes and high SLI categories.

Keywords: Gender gap/difference in tuberculosis, India, National Family Health Survey, prevalence of tuberculosis, tuberculosis

Introduction

Worldwide, more men than women are known to be suffering from tuberculosis. As the tuberculosis affects the most productive age groups, the impact of the disease is felt by the children and their families. In India also, the prevalence of TB is higher among males as compared to females. However, the gap in the prevalence of TB among males and females has shown a widening trend over years which needs an in-depth examination.

Present study is an attempt to examine the difference in gender gaps in the prevalence of tuberculosis among different religions, social groups (caste), standard of living and residence categories.

Materials and Method

For the present study, the unit level data of NFHS-2 (1998-99)(1) and NFHS-3 (2005-06)(2) has been utilized. The information in these surveys relate to more than 90,000 households.

In NFHS, the questions asked about TB were Does any usual resident of your household suffer from tuberculosis For each household member identified as suffering from TB; the respondent was asked has the person suffering from TB received medical treatment for tuberculosis. In the present study, a case of tuberculosis is defined as those who have reported to be medically treated for tuberculosis.
The information on the background characteristics of households such as religion and caste as well as residence (rural/urban) has been collected. Each household has been assigned standard of living index (SLI) code based on housing characteristics and ownership of assets. On the basis of these, each household has been classified into low, medium and high standard of living (SLI) categories. All individuals in the same household are assigned the same SLI category.

The prevalence of TB has been calculated separately for males and females respondents according to religion, caste groups (SC, ST, OBC, others) and standard of living index (low, medium and high) categories. This has been used in studying the gender gap and also its decomposition by religion, caste, SLI categories for rural and urban areas.

Statistical analysis
The analysis was focused on the following factors:
• Calculation of gender gaps for 1998-1999 and 2005-2006.
• Computing of difference in gender gaps for 1998-99 and 2005-2006.
• Testing for the significance of the difference in gender gaps.
• Decomposing the difference in gender gaps by background characteristics.

These are explained as follows:

The gender gaps in the prevalence of TB was calculated as the difference in the prevalence of TB among males and females.

The parameter of interest was:

\[ \Delta = \frac{(P_M - P_F)_{NFHS3} - (P_M - P_F)_{NFHS2}}{\text{Var}(P_M - P_F)_{NFHS3} + \text{Var}(P_M - P_F)_{NFHS2}} \]

\[ = \frac{(P_M - P_F)_{NFHS3} + \text{Var}(P_M - P_F)_{NFHS2}}{\text{Var}(P_M - P_F)_{NFHS3} + \text{Var}(P_M - P_F)_{NFHS2}} \]

\[ = \frac{(P_M - P_F)_{NFHS1} + (P_M - P_F)_{NFHS2}}{\text{Var}(P_M - P_F)_{NFHS3} + \text{Var}(P_M - P_F)_{NFHS2}} \]

\[ \text{SE}(\Delta) = \sqrt{\text{Var}(\Delta)} \]

Test of significance for \( \Delta \) was done by Z-score as follows:

\[ Z = \frac{(\Delta)}{\text{SE}(\Delta)} \]

Thereafter, the decomposition of \( \Delta \) into its constituents was calculated.

The overall share of rural and urban areas in delta is calculated as follows:

Let

- \( \Delta_R \) = Difference in gender gap in rural areas.
- \( \Delta_U \) = Difference in gender gap in urban areas.
- \( n_R \) = Sample size in rural areas in NFHS-3.
- \( n_U \) = Sample size in urban areas in NFHS-3.
- \( C_R \) = Share of rural areas in delta (\%).

\[ C_R = \frac{(n_R)(\Delta_R)}{\left( (n_R)(\Delta_R) + (n_U)(\Delta_U) \right) \times 100} \]

Similarly, share of urban areas in delta is given by

\[ C_U = \frac{(n_U)(\Delta_U)}{\left( (n_R)(\Delta_R) + (n_U)(\Delta_U) \right) \times 100} \]

Further, these deltas (difference in gender gaps) in urban and rural areas were decomposed by background characteristics such as religion, social groups and standard of living. The same is explained for one of the characteristics say caste.

Let \( n_{SC} \) = Sample size for SC.
- \( n_{ST} \) = Sample size for ST.
- \( n_{OBC} \) = Sample size for OBC.
- \( n_O \) = Sample size for others.
- \( \Delta_{SC} \) = Difference in gender gap in SC.
- \( \Delta_{ST} \) = Difference in gender gap in ST.
- \( \Delta_{OBC} \) = Difference in gender gap in OBC.
- \( \Delta_O \) = Difference in gender gap in others.

The decomposition of \( C_R \) by caste for SC, ST, OBC and
others is given by
\[ C_n = \left[ \binom{n_{SC}}{(\Delta_{SC})} + \binom{n_{ST}}{(\Delta_{ST})} + \binom{n_{OBC}}{(\Delta_{OBC})} + \binom{n_{O}}{(\Delta_{O})} \right] \times C_r \]

\[ C_{ST} = \left[ \binom{n_{SC}}{(\Delta_{SC})} + \binom{n_{ST}}{(\Delta_{ST})} + \binom{n_{OBC}}{(\Delta_{OBC})} + \binom{n_{O}}{(\Delta_{O})} \right] \times C_r \]

\[ C_{OBC} = \left[ \binom{n_{SC}}{(\Delta_{SC})} + \binom{n_{ST}}{(\Delta_{ST})} + \binom{n_{OBC}}{(\Delta_{OBC})} + \binom{n_{O}}{(\Delta_{O})} \right] \times C_r \]

\[ C_{O} = \left[ \binom{n_{SC}}{(\Delta_{SC})} + \binom{n_{ST}}{(\Delta_{ST})} + \binom{n_{OBC}}{(\Delta_{OBC})} + \binom{n_{O}}{(\Delta_{O})} \right] \times C_r \]

The decomposition has been done similarly for religions and SLI categories.

This analysis helps in identifying the factors showing significant contribution in delta (\( \Delta \)).

**Results and Discussions**

**Sample characteristics**

The details of samples covered under NFHS-2 and NFHS-3 are given in Table 1.

NFHS-2 covered a population of 4,91,100 of which 73% belonged to the rural areas and 27% to urban areas. Both genders were approximately equally represented. While classifying the population according to the religions, it had been found that about 82.6% belonged to Hindus (including Sikhs and Jains). Muslims comprised 13.7% of population and 3.8% to all other religions. Further, 19.3% belonged to SC, 9.4% to Scheduled Tribes, 34.2% as OBC and 37.1% as other castes. On the basis of standard of living categories, 32.5% of the sample belonged to low standard of living, 47.4% to medium and 20.2% to high standard of living groups as shown in Table 1.

NFHS-3 covered a population of 5,22,027 of which 31% belonged to urban and 69% to rural areas. Further, according to the religions, 82.2% belonged to Hindus (including the Sikhs and Jain religions). 14.3 % belonged to Muslims and 3.5% to all other religions. Further 20% were from SC, 9% as ST, 41% as OBC and 30% as other caste groups. As per SLI categories, 27% belonged to low standard of living, 34% to medium and 40% to high standard of living categories.

**Gender gap**

The overall prevalence of TB combined for urban and rural areas was 432 per lakh (1 lakh = 100,000) in NFHS-2 and 418 per lakh in NFHS-3. This decline was not statistically significant (\( \chi^2 = 1.19; P = 0.275 \)) as shown in Table 1a.

In both the NFHS surveys, the prevalence of TB among males is found to be higher than the females [Table 2]. The gender gap being 145 per lakh in NFHS-2 has increased to 217 per lakh in NFHS-3, the difference being statistically significant (\( Z = 2.747, P < 0.05 \)).

While comparing the gender-wise prevalence of TB, it was found that the increase in the prevalence of TB among males was not statistically significant [502/lakh in NFHS-2 vs. 526/lakh in NFHS-3, Z=1.18, P>0.05]. Whereas, among females, there was a statistically significant decline in the prevalence of TB in NFHS-3 in comparison to NFHS-2[357/lakh in NFHS-2 vs 309/ lakh in NFHS-3, Z=2.89, P<0.05] and this decline in TB

**Table 1: Percentage distribution of population by sample characteristics in NFHS-2 and NFHS-3**

| Sample characteristics | NFHS-2 | NFHS-3 | Combined (U+R) % |
|------------------------|--------|--------|-----------------|
| Total HH population    | 130336 | 360764 | 491100          |
|                       | 27.0   | 73.0   | 100.0           |
| Sex                   |        |        |                 |
| Male                  | 51.9   | 51.1   | 51.9            |
| Female                | 48.1   | 48.9   | 48.1            |
| Religion              |        |        |                 |
| Hindu                 | 76.5   | 84.8   | 82.6            |
| Muslim                | 18.7   | 11.9   | 13.7            |
| Others                | 4.8    | 3.4    | 3.8             |
| Caste                 |        |        |                 |
| SC                    | 15.9   | 20.6   | 19.3            |
| ST                    | 3.9    | 11.3   | 9.4             |
| OBC                   | 31.3   | 35.3   | 34.2            |
| Others                | 49.0   | 32.8   | 37.1            |
| Standard of living    |        |        |                 |
| Low                   | 12.7   | 39.6   | 32.5            |
| Medium                | 45.9   | 47.9   | 47.4            |
| High                  | 41.4   | 12.5   | 20.2            |

\( \chi^2 = 1.19; P = 0.275 \) as shown in Table 1a.
prevalence among females was observed particularly in rural areas [391/lakh in NFHS-2 vs 337/lakh in NFHS-3, Z=2.67, P<0.05].

Religion-wise gender gap in the prevalence of tuberculosis
Table 3 presents the results on gender gap for religions. While comparing the gender gap in NFHS-2 and NFHS-3, it is observed that combined for urban and rural areas, there is a significant increase in gender gap among Hindus from 149 per lakh in NFHS-2 to 224 per lakh in NFHS-3 (Z=2.71, P<0.05). The increase of 23 per lakh for Muslim was not statistically significant. Further, this increase in gender gap among Hindus was statistically significant in rural areas (172 per lakh in NFHS-2 vs 266 per lakh in NFHS-3 Z=2.757, P<0.05) and not in urban areas (Z=1.06, P>0.05).

Caste-wise (Social groups) gender gap in prevalence of tuberculosis
Table 4 presents results on gender gap for caste groups. Among the total population (combined for urban and rural) it is observed that there is a statistically significant increase in gender gap in NFHS-3 in comparison to NFHS-2 among Scheduled Tribes [181/lakh in NFHS-2 to 504/lakh in NFHS-3; Z=3.223, P<0.05] and other caste groups [56/lakh in NFHS-2 to 176/lakh in NFHS-3; Z=2.953, P<0.05]. However, the increase in gender gap is not statistically significant among the Scheduled Castes [202/lakh in NFHS-2 to 314/lakh in NFHS-3; Z=1.69, P>0.05] and OBC, though in reverse direction.

While, analyzing the data for rural areas, it is found that the gender gap was significantly higher in NFHS-3 in comparison to NFHS-2 among Scheduled Castes [202/lakh in NFHS-2 to 367/lakh in NFHS-3; Z=2.113, P<0.05]; Scheduled Tribes [208/lakh in NFHS-2 to 517/lakh in NFHS-3; Z=2.88, P<0.05] and other castes [93/lakh in NFHS-2 to 249/lakh in NFHS-3; Z=2.792, P<0.05]. However, no significant increase was observed in urban areas for any of these castes.

Standard of living (SLI) category-wise gender gap in prevalence of tuberculosis
Table 5 presents the results on gender gap for standard of living. It has been found among the total population (combined for urban and rural) that there is a statistically significant increase in gender gap in the prevalence of tuberculosis in NFHS-3 in comparison to NFHS-2 among all the SLI categories, for low SLI [276/lakh in NFHS-2 to 409/lakh in NFHS-3; Z=2.732, P<0.05], for medium SLI [121/lakh in NFHS-2 to 224/lakh in NFHS-3; Z=2.486, P<0.05] and for high SLI [9/lakh (opposite direction) in NFHS-2 to 99/lakh in NFHS-3; Z=3.04, P<0.05].

While analyzing the data for rural and urban areas separately, it is found that in rural areas the gender gap has increased significantly in NFHS-3 in comparison to NFHS-2 in low SLI [270/lakh in NFHS-2 to 411/lakh in
Surprisingly in urban areas, among high SLI groups, the gender gap is found to have increased significantly in NFHS-3 over NFHS-2 [-16/lakh (opposite direction) in NFHS-2 to 101/lakh in NFHS-3; Z=2.61, P<0.05]. The increase was not significant in low SLI [-2/lakh (opposite direction) in NFHS-2 to 97/lakh in NFHS-3; Z=1.79, P>0.05].

In NFHS-3, the gender gap was significantly higher in rural areas than the urban areas only for medium SLI [91/lakh in urban vs 264/lakh in rural; Z=2.389, P<0.05].

**Difference (Delta (Δ)) in gender gaps in NFHS-3 vs NFHS-2**

**Overall decomposition of delta (Δ)**

Overall, an increase of 72 per lakh has been observed in the increase in gender gap in NFHS-3 over NFHS-2.

Although an increase in gender gap has been observed in both rural and urban areas, it is higher in rural areas (98 per lakh) [167 per lakh in NFHS-2 and 265 per lakh in NFHS-3] as compared to corresponding increase of 30 in urban areas [88 per lakh in NFHS-2 against 118 per lakh in NFHS-3]. It may be mentioned that the delta (Δ) in gender gap is three times higher in rural areas than in urban areas.

On the basis of the calculations shown in the section ‘Materials and Method’, this difference Δ is accounted for as 88% by the rural areas and 12% by the urban areas [Table 6a].

**Contribution of background characteristics in delta (Δ)**

Of the total 88% contribution of delta by rural areas, it is observed that its decomposition by religion is 72% by Hindus, 9% by Muslims and 8% by others.
decomposition by caste is SC 38%, ST 39%, others 43% and in opposite direction OBC as 31%. By standard of living (SLI) categories, the decomposition is low SLI 33%, medium SLI 36% and high SLI 19% as shown in Table 6b.

Similarly, of the 12% share of urban areas, It is observed that its decomposition by religion is Hindus 15% and Muslims 3% in opposite direction. The decomposition by caste is ST 11%, other castes 37% and in opposite direction SC 4% and OBC 32%. The decomposition by standard of living (SLI) categories indicates that the contribution is by high SLI only.

Discussion

Many studies\(^{(3-6)}\) have reported the gender difference in tuberculosis, but analyzing the difference in gender gap in two consecutive national NFHS surveys and its contribution according to place of residence, religion, caste and standard of living has been done in the present study only. To our knowledge, this is the only study in which the two Indian national surveys have been studied for gender gap in the prevalence of tuberculosis.

The serious question is why there is an increasing trend in the gender gap which has been observed in the two surveys.
Table 5: Standard of living (SLI) category-wise difference [delta (Δ)] in gender gap

| SLI and sex | % population in NFHS-2 out of 491100 | % population in NFHS-3 out of 522027 | Gender gap in NFHS-2 | Gender gap in NFHS-3 | Delta (Δ) D2-D1 | Significance of delta (Δ) |
|-------------|--------------------------------------|--------------------------------------|----------------------|----------------------|------------------|-----------------------|
| Urban       |                                      |                                      |                      |                      |                  |                       |
| Low         | M                                    | 1.70                                 | 799                  | 1.41                 | 760              | Z=0.447               |
|             | F                                    | 1.62                                 | 474                  | 1.43                 | 363              | 325                  |
| Medium      | M                                    | 6.26                                 | 409                  | 3.79                 | 419              | Z=0.301               |
|             | F                                    | 5.72                                 | 295                  | 3.49                 | 328              | 114                  |
| High        | M                                    | 5.57                                 | 147                  | 10.48                | 291              | -23                  |
|             | F                                    | 5.25                                 | 163                  | 9.73                 | 190              | -16                  |
| Rural       | Low                                  | 14.55                                | 750                  | 11.38                | 878              | Z=2.25*               |
|             | F                                    | 14.23                                | 480                  | 11.99                | 467              | 270                  |
| Medium      | M                                    | 17.92                                | 482                  | 12.87                | 588              | Z=2.88*               |
|             | F                                    | 16.87                                | 357                  | 12.88                | 324              | 125                  |
| High        | M                                    | 4.66                                 | 249                  | 9.36                 | 287              | -23                  |
|             | F                                    | 4.42                                 | 251                  | 9.31                 | 190              | -9                   |
| Urban+Rural | Low                                  | 16.25                                | 755                  | 12.79                | 865              | Z=2.732*              |
|             | F                                    | 15.85                                | 479                  | 13.42                | 456              | 276                  |
| Medium      | M                                    | 24.18                                | 463                  | 16.67                | 549              | Z=2.486*              |
|             | F                                    | 22.59                                | 342                  | 16.37                | 325              | 121                  |
| High        | M                                    | 10.24                                | 194                  | 19.85                | 289              | -9                   |
|             | F                                    | 9.67                                 | 203                  | 19.04                | 190              | -9                   |

1 lakh=100,000, SLI=Standard of living index; M=Male, F=Female; *P<0.05 significant; Delta (Δ)=Difference in gender gap; Total population of NFHS-2=491,100; Total population in NFHS-3=522,027

Table 6a: Difference [delta (Δ)] in gender gap in the prevalence of TB and contribution in [delta (Δ)] by place of residence

| Place of residence | Gender gap/lakh in NFHS-2 | Gender gap/ lakh in NFHS-3 | Delta (Δ) | (% Population) | Contribution in delta |
|--------------------|---------------------------|---------------------------|-----------|----------------|-----------------------|
| Overall            | 145                       | 217                       | 72        | 31%            | 12%                   |
| Urban              | 88                        | 118                       | 30        | 69%            | 88%                   |
| Rural              | 167                       | 265                       | 98        | 69%            | 88%                   |
| Urban+rural        | 100%                      | 100%                      | 100%      | 100%           | 100%                  |

*Delta (Δ)=Difference in gender gap in NFHS-3 and NFHS-2; *Total population in NFHS-3=522,027; *Calculations done as per formula in materials and method; 1 lakh=100,000

Many reasons can be speculated for this widening trend in the gender gap. Few of them are given below:

- Some worldwide studies[7,8] have shown that males are having higher risk factors like smoking, alcoholism and drug addiction to get tuberculosis than females. In one of the study from Hong Kong, Leung et al.[7] has mentioned that smoking accounted for 32.8% [95%CI,14.9-48.0%], 8.6% [95%CI,3.3-15.1%] and 18.7% [95CI,7.7-30.4%] of the TB risk among males, females and the entire cohort, respectively. In comparison to never-smokers, current smokers had an excess risk of pulmonary tuberculosis TB [adjusted HR 2.87,95%CI,2.00-4.11,P<0.001].

- Also, during this period, it has also been found that there is an increase in the human immunodeficiency virus infection cases and HIV infection is found to more prevalent among the male population as compared to females.

In one of the study by Silveira et al.[9] in a sample of 204 HIV diagnosed cases, tuberculosis prevalence was reported to be 27%. It was also mentioned that the variables which were found to be potential risk factors were being of the male gender [odds ratio 2.49, confidence interval 1.15-5.39] and using illicit drugs [odds ratio 2.1, 95% confidence interval 1.02-4.31].
Another probable reason could be that there is higher under reporting by females because of social issues and stigma, as in the strategy of DOTS treatment, the patient has to visit the DOTS centers on alternate days for taking supervised treatment. The unmarried girls and women want the diagnosis of the TB to be kept confidential. In one of the studies, Ahsan et al. observed that 55% of cases wanted the diagnosis of TB to be kept confidential to avoid being labeled as TB patients. A total of 85.6% of female TB patients had problems in their relationship with their spouse and family members after being diagnosed with TB. There is also a lack of health seeking behavior among women.

**Conclusion**

The present study mainly examines an increasing trend in gender gap over a period of five years from NFHS-2(1998-1999) to NFHS-3(2005-2006).

Although the overall prevalence of TB has remained the same in the two survey periods, the gender gap in the prevalence of TB has widened. Particularly, the prevalence of TB among females has shown a significant decline.

Studying the delta (Δ) in gender gap, it is noted that the increase in gender gap is more in rural areas than the urban areas. Of the total increase, 88% is accounted by rural areas and 12% by urban areas. Further, the increase in rural areas is contributed by Hindus, SC and ST castes, low and medium SLI categories. In urban areas, the contribution is mainly from Hindus, other caste groups and high SLI categories.

The study requires an in-depth examination using other sources of data including service statistics on treatment seeking behavior under RNTCP for the corresponding years.

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