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A Puzzling Scenario in Tuberculosis Prevalence of Two Eastern States of India

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Abstract:
Tuberculosis stands as a major threat to global public health even after efforts and interventions both at national and international levels to fight the disease. The 22 High Burden Countries account for 80 percent of the world's TB cases. India, the second most populous country in the world, has more new tuberculosis cases annually than any other country. The disease is supposed to be strongly correlated to socio economic gradients of the population. A prime killer in the developing countries, TB has inspired many studies. Taking cue from NFHS 3 (2005-06) reports, I intend to present a contrasting picture of tuberculosis prevalence in two eastern states of India – West Bengal and Orissa which has the potential to serve as ground for future research .

1. Introduction

Tuberculosis (TB) is a major global health problem. It ranks as the second leading cause of death from infectious disease worldwide, after the human immunodeficiency virus (HIV). TB is an infectious disease caused by the bacillus *Mycobacterium tuberculosis*. It typically affects the lungs (pulmonary TB) but can affect other sites as well (extrapulmonary TB). The disease is spread in the air when people who are sick with pulmonary TB expel bacteria, for example by coughing, talking, sneezing etc. TB is an opportunistic infection (OI). The probability of developing the disease post infection is higher, lower the body immunity due to malnutrition, etc. It is a leading cause of death among HIV positive people. The most common and accepted method for diagnosing TB worldwide is sputum smear microscopy as it clinches diagnosis. Treatment for drug-susceptible TB involves a 6-month regimen of five first-line drugs: Isoniazid, Rifampicin, Ethambutol, Pyrazinamide and injection Streptomycin. Treatment for multi drug resistant TB (MDR-TB), defined as resistance to Isoniazid and Rifampicin (the two most powerful anti-TB drugs) spans a minimum of 20 months, and requires more expensive and toxic second line drugs. Expected effect from improved diagnosis and treatment may be negated by an increase in risk factors (such as poverty and malnutrition, HIV infection, diabetes, tobacco and alcohol use, indoor air pollution, poor ventilation, crowded and unhygienic living conditions, etc.) that fuel the progression of latent TB to active disease.

The World Health Organization (WHO) declared TB a ***global public health emergency*** in 1993. For effectively fighting the disease in countries across the world, it developed the DOTS (Directly Observed Treatment, Short course) strategy which is a 5-component package comprising:

- political commitment,
- diagnosis using sputum smear microscopy,
- a regular supply of first-line quality assured anti-TB drugs,
- short-course chemotherapy and
- a standard system for recording and reporting the number of cases detected by National TB Control Programmes (NTPs) and the outcomes of treatment.

Some targets that have been set to combat the burden of TB worldwide are:

1. The Millennium Development Goals set for 2015

Goal 6: Combat HIV/AIDS, malaria and other diseases

- Target 6.c: Halt and begin to reverse the incidence, prevalence and death rates associated with TB
- Indicator 6.9: Incidence, prevalence and death rates associated with TB
- Indicator 6.10: Proportion of TB cases detected and cured under DOTS

2. The ''*Stop TB''* Partnership (WHO, 2006) targets set for 2015 and 2050

- By 2015: Reduce prevalence and death rates by 50%, compared with their levels in 1990
- By 2050: Reduce the global incidence of active TB cases to <1 case per 1 million population per year

Even with all such interventions and efforts, the global burden of TB remains enormous with an estimated 8.7 million incident cases (equivalent to 125 cases per 1,00,000 population) of TB in 2011 of which 0.5 million were children and 2.9 million were women and 13 percent of incident cases were co-infected with HIV ; 1.4 million deaths from TB (990 000 deaths among HIV-negative individuals and 430 000 among people who were HIV-positive) ; 12 million prevalent cases of TB equivalent to 170 cases per 1,00,000

population (Global Tuberculosis Report, WHO,2012). Geographically, the burden of TB is highest in Asia and Africa. Mortality and incidence rates are falling in most of the 22 High Burden Countries (HBCs) that house 63% of the world's population and account for over 80% of the world's TB cases.

India has had a National Tuberculosis Control Programme (NTCP) in place since 1962. However, it had low treatment success rates and high death & default rates. Moreover, the HIV-AIDS epidemic and multi-drug resistant TB worsened the situation. The NTCP was reviewed in 1992 and the Revised National TB Control Programme (RNTCP) was formulated with adoption of the WHO recommended DOTS strategy after a successful pilot testing from 1993-96 in Delhi, Kerala, Gujarat, Maharashtra and West Bengal. Large scale implementation of the RNTCP with the DOTS as its backbone began from 1997 and nation wide coverage of the RNTCP was achieved by March 2006 (GOI, 2012).

Yet**,** India remains one of the 22 high burden countries with the largest number of incident cases (2.0 million-2.5 million) in 2011. A nationwide Annual Risk of Tuberculosis Infection (ARTI) study conducted in 2002-03 estimated the incidence of new smear positive TB cases as 75 per 1,00,000 population.

Analysis needs to be done to find whether the heavy burden of TB in a country is due to high global population share or due to high incidence of TB. According to the Global Tuberculosis Report, WHO, 2012, among these countries, only few countries have higher share in global population than the share of global incidence of TB. They are China, Brazil, Russia, Nigeria and Thailand. The rest have higher burdens of TB incidence compared to their population pressure. The highest difference arises in South Africa, Pakistan and India.

TB accounts for 17.6 percent of deaths from communicable disease and 3.5 percent of deaths from all causes of mortality in India (WHO, 2004). More than 80% of the burden of tuberculosis is due to premature death, as measured in terms of DALYs lost. As per the Department of Measurement & Health Information(WHO, 2004), TB accounted for an estimated 8478000 total DALYs lost or 808 DALYs lost per 1,00,000 population in India in 2002.

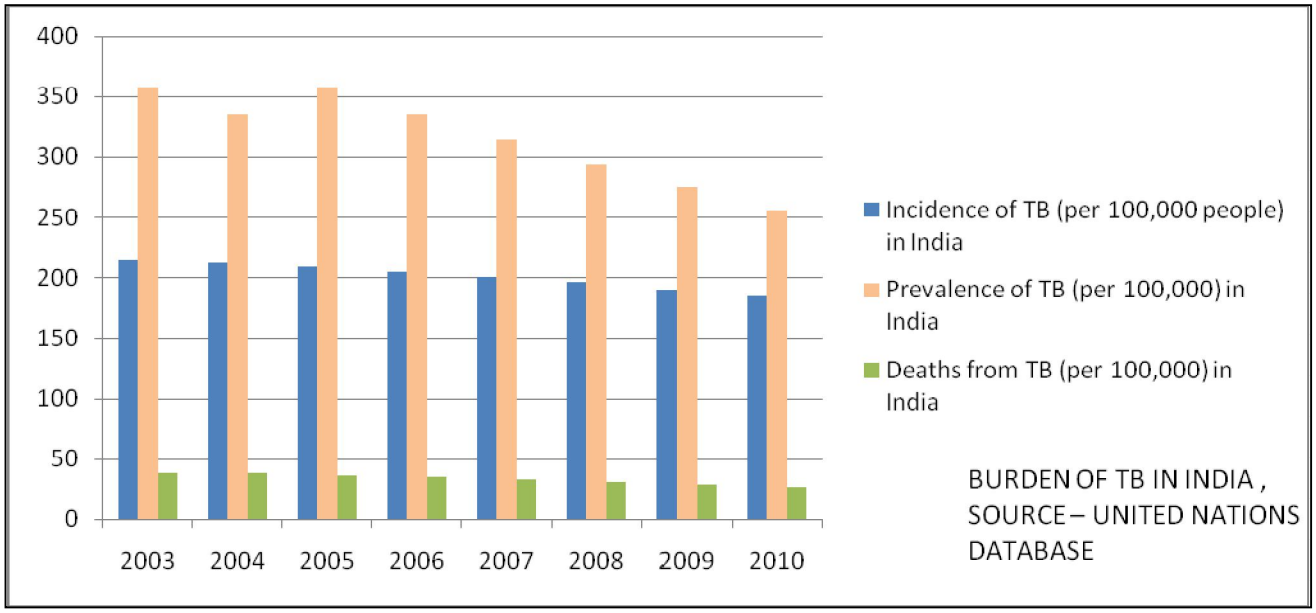

Figure 1: Incidence, Prevalence & Deaths from TB in India
Source: United Nations Database

We now look at the trend of incidence (*number of new and relapse cases of TB arising in a given time period, usually 1 year*), prevalence (*number of TB cases at a given point in time*) and mortality (*number of deaths caused by TB exclusive of TB+HIV related deaths in a given time period, usually 1 year*) from TB. If we take the year 2006 to be a landmark year in terms of achievement of nationwide coverage by the RNTCP in India, then we observe in Figure 2 that from 2006 down to 2010, although prevalence of TB has steadily declined, incidence of TB and deaths from TB have remained more or less stagnant. That implies, although the curative aspect has being taken care of to some extent, the preventive aspects have not been satisfactorily attended to.

Tuberculosis is supposed to be strongly correlated to socio economic gradients of the population. TB primarily affects people in their most productive years of life i.e. in the age group 15-59 (Figure 2) with important socio-economic consequences for the household. Studies suggest that India loses an estimated 23.7 billion US dollars to TB annually in the form of direct and indirect costs: on an average, 3 to 4 months of work time is lost as result of TB, resulting in an average lost potential earning of 20-30% of the annual household income. This leads to increased debt burden, particularly for the poor and marginalized sections of the population with added problems of social exclusion, instances of being thrown out of job on TB status becoming public, etc.

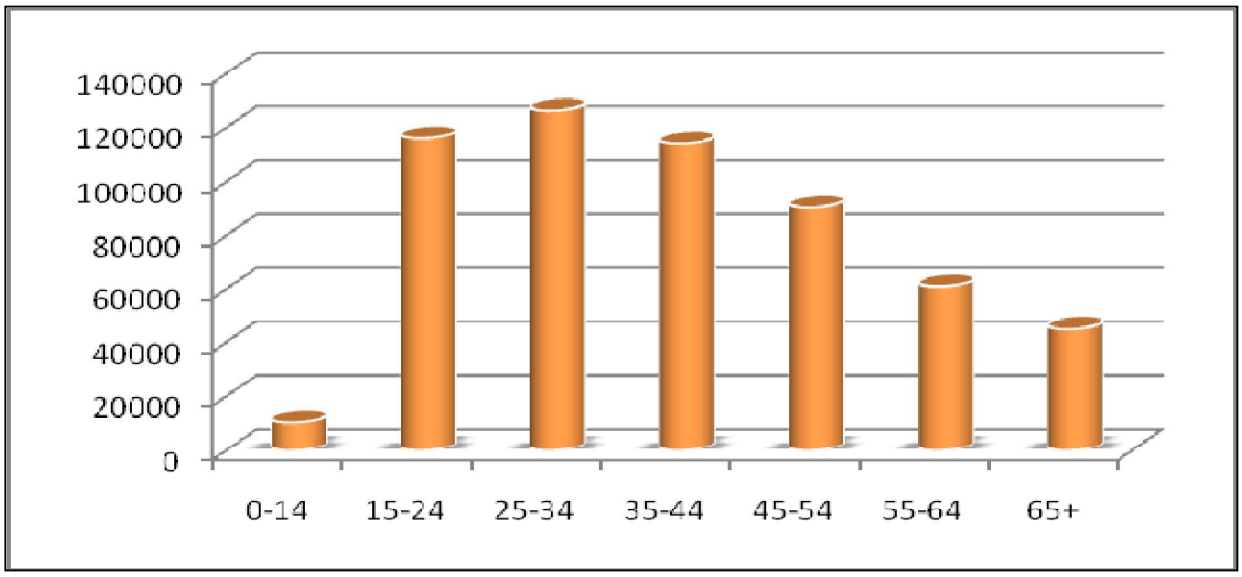

Figure 2: Incidence of TB by Age group-RNTCP, 2006
Source: GOI, 2006

2. Literature Review

Tuberculosis being a prime killer in the developing countries, many studies have been done on this. Helden et al (2003) emphasized that TB is not just a medical problem, but also a problem of social inequality and poverty. The poor will remain a breeding ground for TB until it is realized that it is not only the microbe that is causing the disease. It is always the result of gross defects in social organization and in the management of individual lives. Biomedical research needs to be combined with political, social, economic and cultural research in the search for answers.

In case of India, Ghosh and Kulkarni (2004) have looked into whether household and individual characteristics play a role in the pattern of causes of deaths, and more specifically, the proportion of deaths due to communicable diseases in various age-sex groups in India where both large income inequalities and social stratification have traditionally been well defined. The paper finds that epidemiological transition is in progress, but its advance was found to vary along socioeconomic lines with growing prevalence of non communicable diseases among the better-off, educated and urban population, while communicable diseases remain relatively more prevalent among the rural based, illiterate or semi literate poor masses and the socially weak.

The paper by Hossain et al (2012) has tried to assess and compare the socioeconomic position of actively detected cases from the community and the cases routinely detected under NTP in Bangladesh -to assess whether the NTP actually reaches the lower sections of the population. It was found that

- Nearly 60% of the TB cases detected routinely under the DOTS programme belonged to the upper fraction of the population while
- 75% of the prevalent cases detected in the survey belonged to lower sections of the population.

Despite availability free of charge, DOTS is not equally accessed by the poorer sections of the population.

Mishra et al (1999)'s paper's objective was to examine the relation between use of biomass cooking fuels and prevalence of active TB among persons aged 20 years and above in India. Results strongly suggest that exposure to cooking smoke (from biomass fuels compared with cleaner fuels) substantially increases the risk of active TB in India and this was found to be true even when the effects of a number of potentially confounding variables are statistically controlled by holding them constant.

Courtwright and Turner (2010) has reviewed the available literature on TB stigma to identify the causes of TB stigma and to assess the impact of stigma on TB diagnosis and treatment. Three themes identified in the existing literature were:

- studies that characterize and measure TB stigma,
- studies that explore the effect of TB stigma on TB diagnosis and treatment, and
- studies that describe interventions to reduce TB stigma and the impact of these interventions on TB diagnosis and treatment

K. Gehtakrishnan et al (1988) attempted to assess why there are so many undetected cases of tuberculosis when diagnostic facilities are available in each and every district of India and why patients default on treatment even when drugs are freely available. Misconceptions and persistence of negative attitudes towards TB were identified as reasons. Most people were not convinced of the curability of the disease discouraging patients from continuing treatment.

Chandrashekhar T Sreeramareddy et al 2013 deals with knowledge about symptoms and transmission of tuberculosis determines health seeking behavior and helps in prevention of tuberculosis transmission in the community. This study has found that knowledge about TB transmission in the general population of India was very poor and misconceptions about TB transmission prevailed. Among traditional mass media, only the frequency of listening to radio was associated with knowledge about TB transmission.

3. Emperical Findings on Tuberculosis from Nfhs 3 (2005-06)

National Family Health Survey 3 (2004-05) reports the incidence of tuberculosis among population. The basic findings from NFHS 3 report are:

- 94% of those who reported to be suffering from TB also reported to have been medically treated for the disease.
- The number of persons suffering from TB that had been medically treated differed greatly by sex, residence, and age.
- Overall, the risk of TB was much higher for men than for women, for rural residents than for urban residents and for higher age groups.
- Incidence of TB is higher in rural areas than in urban areas, questioning the usual myth that this disease depends on population density.
- Reported cases of TB are significantly higher among men in both rural and urban areas. This, however, hints towards a gender bias in self reported morbidity.
- Prevalence of this disease is heavier among the old age people, who are more prone to malnutrition and lack of access. The earlier Figure 4 showed that the share of working age is higher among the new smear-positive patients coming to DOTS centers. Thus it clearly shows that the access to health care is biased against the old age population.
- 71 % of India's households and 91% of rural households used solid fuels for their cooking. Exposure to high levels of toxic air pollutants raises the probability of serious health consequences including TB.
- Prevalence of TB was reported to be higher for:
  - households using straw, shrubs, or grass for cooking than households using electricity, liquid petroleum gas, natural gas, or biogas etc.
  - households cooking in the house without having a special room for cooking than households that cooked in a separate room of the house
  - Households burning solid fuels without using a chimney than households cooking on an open fire or chullah but utilizing a chimney.
- Levels of crowding were not sufficient to explain differentials in prevalence. Prevalence of TB was found to be the highest among households that had the least number of people sleeping per room.
- The percentage of both men and women who had "heard of a disease called Tuberculosis" increased with an increase in wealth index as well as an increase in education level attained.
- Differentials in knowledge by education and wealth status were greater than the urban-rural differentials.
- Knowledge of mode of transmission of TB rose steadily with increases in the wealth index among both women and men.
- 79% percent of women and 86% of men who had heard of TB knew that it could be cured.
- One in every six women and men wanted the TB positive status of a family member to remain a secret. This level of secrecy is seen to prevail generally across all population subgroups. There is no decrease in stigma with increase in education or wealth.

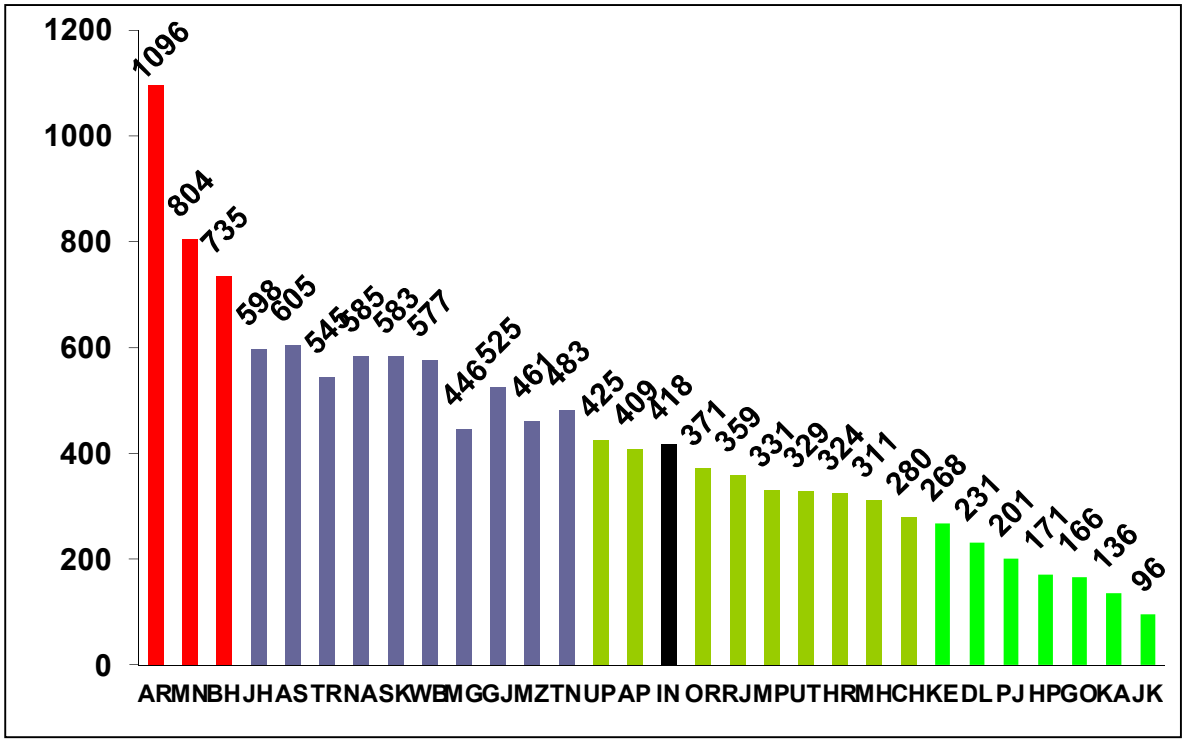

Figure 3: State-wise TB Prevalence (per 1,00,000 population)
Source: NFHS 3, 2005-06

- There is high inter-state variation in TB prevalence. From Figure 3 we see that Arunachal Pradesh (1096 per 1,00,000 population), Manipur (804 per 1,00,000 population) and Bihar (735 per 1,00,000 population) exhibited the highest rates of TB prevalence. The all India average prevalence rate was 418 per 1,00,000 population.

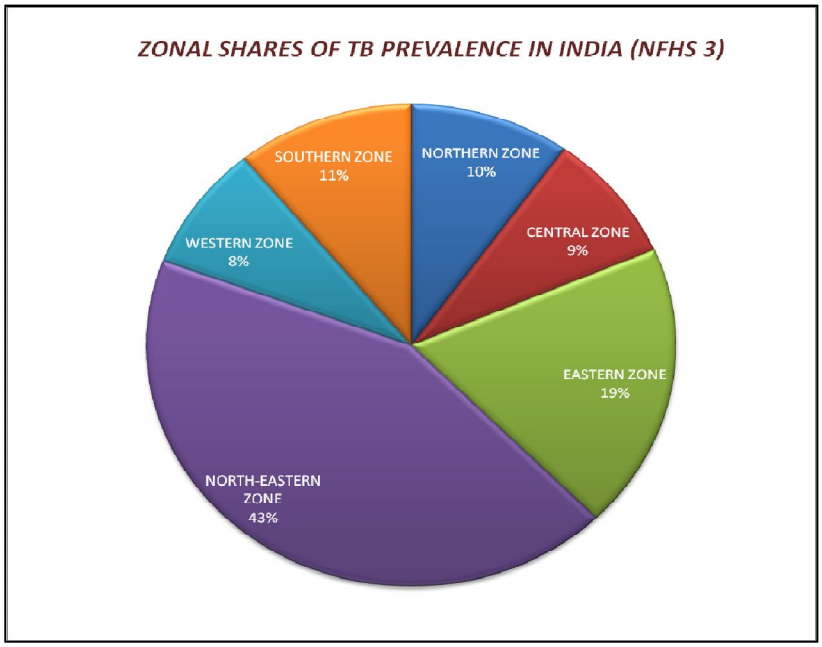

Figure 4: Zonal shares of TB prevalence in India
Source: NFHS 3, 2005-06

Prevalence of TB by state indicated geographical clustering of the disease (Figure 4). All states in the East Region (with the exception of Orissa) and the Northeast Region exhibited prevalence levels above the national average.
Since the Northeastern states are culturally heterogeneous, I have focused on two states in the Eastern zone –West Bengal and Orissa which happened to present a very contrasting picture in terms of TB prevalence. West Bengal recorded a prevalence rate of 577 per 1,00,000 population which was higher than the all India average of 418 per 1,00,000 population. Orissa on the other hand recorded a prevalence rate of only 371 per 1, 00, 000 population which was lower than the all India average. This was despite the fact that West Bengal was a relatively better performing state than Orissa.
A few characteristics of these two states are presented below:

- Per Capita Net State Domestic Product at 2004-05 prices was Rs. 23808.28 in West Bengal as against Rs. 18194.00 in Orissa in 2005-06.
- As per NFHS 3 reports, 24.5 % of households in West Bengal owned a BPL card as against 47.8% in Orissa.
- Disparity between the percentages of population under the highest and lowest wealth indices was lower in West Bengal as compared to Orissa which indicates that West Bengal had lower inequality in income distribution than Orissa (Fig. 5).
- Percentage of population with no education was lower in West Bengal than in Orissa (Fig. 6).

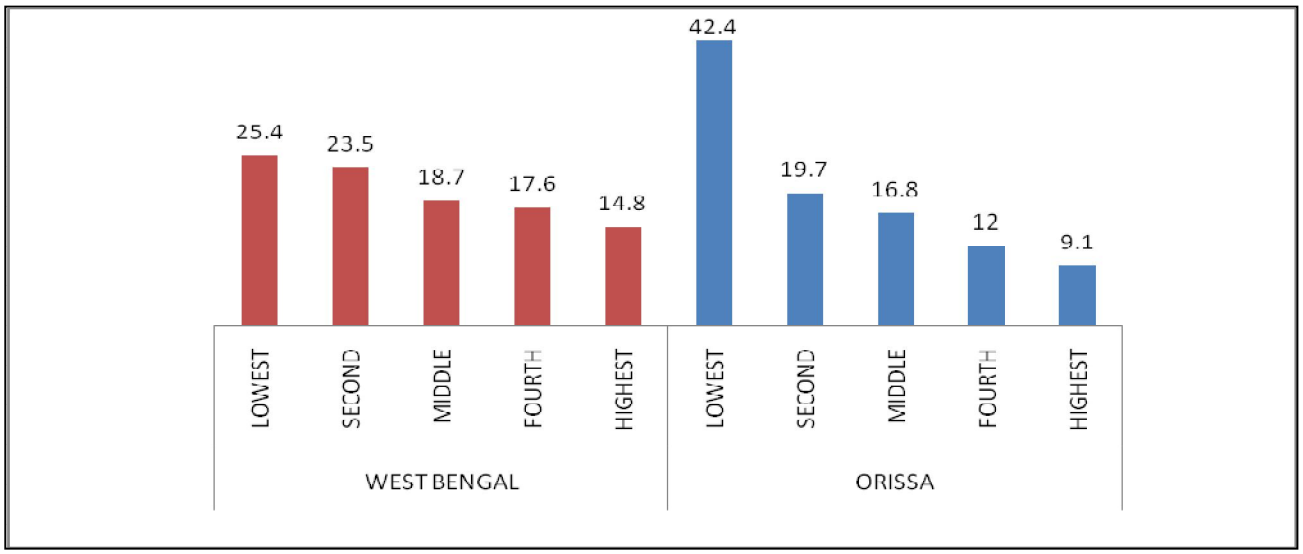

Figure 5: Percentage of population under different wealth indices in West Bengal & Orissa
Source: NFHS 3, 2005-06

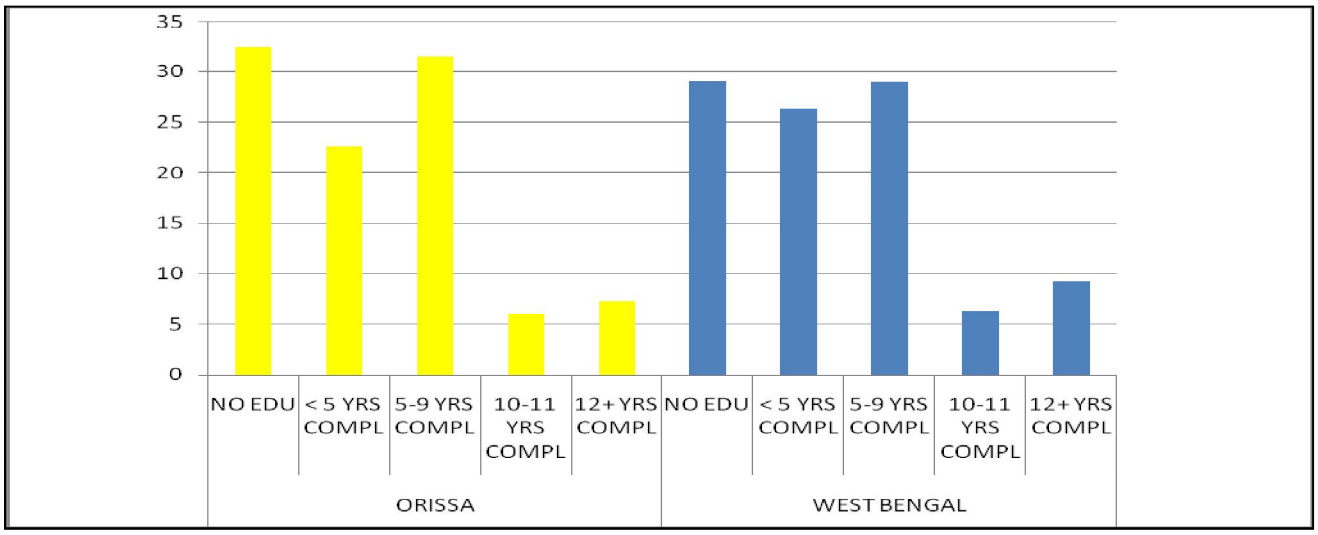

Figure 6: Percentage of population under different education levels in West Bengal & Orissa
Source: NFHS 3, 2005-06

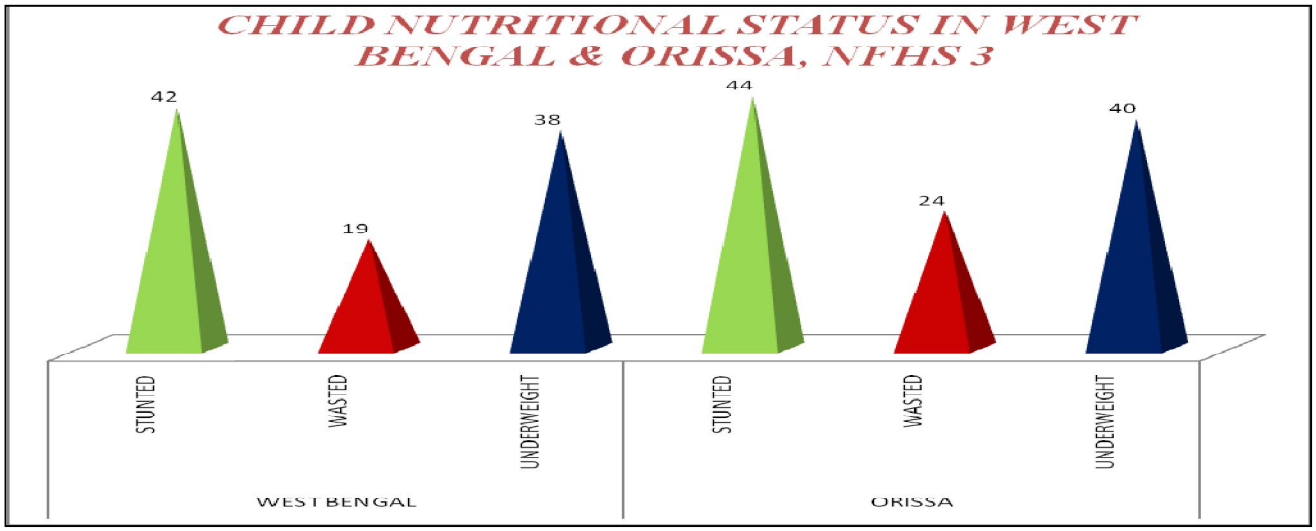

Figure 7: Nutritional Status of children in West Bengal & Orissa: Percentage of children under three years
Source: NFHS 3, 2005-06

- From Figure 7, we find that the percentages of stunted (low height for age), wasted (low weight for height), as well as underweight (low weight for age) children were all lower in West Bengal as compared to Orissa.
- Yet, the rate of TB prevalence among the <15 age group was 133 per 1,00,000 population. The corresponding figure was 52 for Orissa.
- West Bengal had 90% children of 12-23 months who received BCG vaccine as against 84% in Orissa.

4. Conclusion

It is clear from the above discussion that West Bengal and Orissa are two eastern states where most of the socio-economic conditions are better for the former. Yet, TB prevalence is significantly higher in West Bengal. This appears as a puzzle if it is to be believed that the disease is supposed to be strongly correlated to socio economic gradients of the population and needs further research to look into into what might have explained a higher burden of tuberculosis in West Bengal than in Orissa despite the former being a better performing state in 2005-06. The apparently puzzling picture hints at problems like access, awareness, stigma, etc. across the two states.

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