Comparing Socio- epidemiological, Clinical Features and Treatment Outcome of Adolescent and Adult TB in Bardhman and Malda districts of West Bengal state in India

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Abstract

Data from five tuberculosis treatment units was collected from Malda and Bardhman districts in West Bengal, India for treatment success rate and dropout rates. The objective was to study, compare and contrast the socio-epidemiological and clinical features of TB between adults and adolescents including treatment success and dropout rates under the revised national tuberculosis control program of government of India. The study cohort was of the year 2011; both primary and secondary data was collected using patient TB cards, TB registers and interviews with patient and/ or patient guardians. Of a total of 1,327 patients registered during this period in the five treatment units, data from 729 registered patients was randomly selected for the study. The cohort data was studied for adolescents aged between 10-19 years and adults aged between 20-45 years. Our results show that adolescents had higher education than adults, had similar socio- economic status, and proportionately had more extra pulmonary tuberculosis than adults. Unlike adult women, females comprise a much higher proportion of TB patients in the adolescent cohort, possibly showing that the protective effect that adult women have against tuberculosis is not as strong among adolescent girls. Finally, treatment success rates are much higher in adolescents than adults. In conclusion, the socio-demographics, clinical picture and treatment outcomes for TB among adolescents are different than that of adults.

Keywords: **Tuberculosis, adolescents, adults, males, females, treatment, India.**

Introduction

About one third of the world's population is infected with Tuberculosis (TB), a disease that has plagued humankind for more than 4,000 years. [1, 2] It is a common infectious disease in humans and affects more people now than it ever has before. [1, 2] Many studies have shown that it is a disease of poverty, often affecting the poorest and most marginalized members of a community. [3, 6] Studies have also shown that TB is more common in males, the possibility of infection increases with age, and that children and adults experience different forms of the disease. [3, 7] Further, diabetes, malignancies, organ transplantation, and chronic renal failure predispose individuals to TB infection. [8] TB is also strongly associated with HIV. [9] HIV is generally credited as the reason for the dramatic increase in TB seen around the world. [10] For example, since the rise of HIV, TB has increased by a factor of six in South Africa [5] and has increased by 20% in the United States [2]. Other risk factors include malnutrition, tobacco smoking, alcoholism, overcrowding and inadequate housing. [11]

This study focuses on TB among adolescents, specifically a cohort in eastern India. Almost one third of all TB cases worldwide are located in India, and, consequently, it has one of the largest and fastest growing direct observation treatment programs in the world. [3] Risk factors for TB infection in India are similar to those seen worldwide, but many studies have described factors that are especially relevant to India. Low education

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levels, chronic diseases such as diabetes, and having a kitchen connected to the house were found to be important risk factors in southern India. One study noted that India's crowded urban centers create a significant risk compared to the country's rural areas, especially for children living in slums. HIV is also a major concern but it does not appear to significantly affect younger age groups. [11] That said, most of the studies about TB were conducted in southern India. [3, 4, 11] This report focuses on east India, specifically the state of West Bengal.

Adolescent TB is unique as it has characteristics both of children and adults. There are no diagnostic guidelines. These two factors combined may lead to delayed diagnosis, for example, adolescents exhibit higher proportion of extra- pulmonary TB in comparison to adults and hence the diagnosis and treatment may get delayed. There are few, if any, comparative studies to the best of our knowledge which document participation and outcomes for TB treatment for adolescents in a large public health program in India and none are from the state of West Bengal. The objective of the study is to elucidate the difference between adults and adolescent TB experiences in a large TB program in two districts of West Bengal, in India.

Methods

IMPACT Project

This study came out of the Initiative to Manage People Centered Alliances in Control of TB (IMPACT) Project, a five year project led by CARE and funded by USAID's Child Survival and Health Grants Program. The project was implemented from 2008 to 2013 in Murshidabad, Bardhaman, Haora, Hugly and Malda districts of West Bengal, India. IMPACT worked closely with India's Revised National TB Control Program (RNTCP) in an effort to reduce morbidity and mortality associated with TB.

Study area and population

The data collected for this study comes from two of the five districts included in the IMPACT Project, namely Bardhaman and Malda districts. The data came from five treatment units (TUs), Memari, Panagar and Bhatar in Bardhaman district and Gazole and Habibpur in Malda district. A TU is the central point from which TB activities are managed at the sub- district level. They are usually based in a Community Health Center (CHC), a District TB Center (DTC), Taluk Hospital (TH) or a Block Primary Health Center (BPHC).

Each TU has a designated Medical Officer- TB Control (MO-TC) who, in addition to other responsibilities, works with RNTCP. Additionally, there is a Senior TB Treatment Supervisor (STS) and a Senior TB Laboratory Supervisor (SLS), both full- time RNTCP contractual staff dedicated to TB work. These staff members are supervised by the District TB Officer (DTO) and MO-TC.

Generally, TUs cover around 500,000 people, or 250,000 in more sparsely populated areas such as tribal, desert, remote and hilly regions. The data for this study came from 5 blocks, an administrative unit in India that generally has populations between 100,000 and 200,000 people. There are a total of 24 Peripheral Health Institutions (PHIs) located within these blocks, 9 of which are Designated Microscopy Centers (DMCs). These DMCs are the only locations for testing sputum within the study area, serving a population of 1,317,043.

This is a descriptive prospective study. Of the five possible districts where the project was being implemented by CARE, Bardhman and Malda were randomly selected for the study. Within the two districts, CARE's impact project was being implemented in 5 Tus. Out of 5 CARE TU's three were randomly selected and another two adjacent non- CARE TUs were selected for the study. In the study area, a total of 1,327 TB patients were registered and began treatment during 2011. Out of these, 729 patients were randomly sampled and included in the analysis. The age of the study population ranged from 10 to 45 years in line with the study objective of comparing adult TB to adolescent TB for epidemiological, socio-demographic and treatment outcomes. 105 patients fell into the adolescent category of ages 10-19 years and 627 patients fell into the adult category of ages 20-45 years.

The key outcomes the study looked for were adolescent and gender differences in socio-demographics, type of TB and treatment success.

Data Collection

We gathered data from each TU's TB register regarding patients' smear status, type of case, type of disease, category and treatment outcome. Both primary and secondary data was collected. Each TB patient that had been put on treatment in a particular TU was recorded in the TB register. Information catalogued in the register included name and address, type of disease, results of sputum tests, and treatment outcomes. Each patient that had been put on treatment was also given a treatment card which included information such as initiation of treatment, number of doses taken, patients' prescriptions, and patient details. These cards were kept at the DOT center and maintained by the DOT provider during the course of the treatment. We collected information from these cards about initiation of

treatment and number of doses taken. After acquiring verbal consent from each patient and at least one of their parents or an adult caregiver, we collected data on patient's literacy, occupation, income, information about the poverty line and any kind of support (food or money) received from the Panchayat Raj Institution (PRI), the local self-government institution in rural areas. These data were collected through semi- structured patient interviews conducted by trained social workers. SPSS Version 20 was used to analyze the data.

Results

Socio- Demographics

This study looks specifically at the differences in the experience of TB between adolescents aged 10-19 years and adults aged 20-45 years. Table 1 shows the demographic and health information based on age and gender. Of the 729 patients that either saw success or defaulted on their treatment, 105 patients were adolescents (38 females and 67 males) and 627 patients were adults (164 females and 463 males).

	Adolescents (N=105)		**Adults (N=624)**	
	Female	**Male**	**Female**	**Male**
Total N	38	67	164	463
Literacy				
Illiterate	5	9	97	229
Literate	33	58	65	229
Poverty Level				
Below Poverty Line	29	38	97	318
Above Poverty Line	9	29	67	145
Caste				
Scheduled Tribe	19	44	90	271
Scheduled Caste	11	16	55	156
Higher Caste	8	7	19	36
Family Income (Rupees)				
Below 2000	14	43	97	254
Above 2000	24	24	67	209
Pulmonary/Extra-Pulmonary				
Pulmonary	9	14	33	43
Extra-Pulmonary	29	53	131	420
Missing	0	0	0	0
HIV Status				
Negative	12	30	50	188
Positive	1	0	0	0
Not Tested	25	36	114	275
Outcome				
Default	1	3	13	50
Treatment Success	35	62	147	402
Missing	2	2	4	11
Category				
Cat-I	36	58	145	382
Cat-II	2	9	19	81

Note: Total N=729

Table 1.Socio-Demographic and health and TB outcome information of study population based on age and gender

Table 2 shows Pearson Chi-Square Analyses comparing adolescents (aged 10-19 years) and adults (aged 20-45 years) and table 3 shows Pearson Chi-Square Analyses comparing adolescents (aged 10-19 years) and adults (aged 20-45 years). It was shown that there was a significant difference in the gender balance between adolescents and adults (χ^2=4.53, p<0.05). Females comprised 36.2% of the adolescent group compared to only 26.2% in the adult group. Conversely, males only comprised 63.8% in the adolescent group compared to 73.8% in the adult group.

Variable	**χ2**
Literacy	55.539***
Poverty Level	0.226
Caste	4.694
Family Income	0.105
Pulmonary/Extra-Pulmonary	7.361**
HIV Status	12.269**
Outcome	4.085*
Category	2.094

*$p < .05$
** $p < .01$
*** $p < .001$

Table 2.Pearson Chi-Square Analyses Comparing Socio-Epidemiological and Treatment Outcomes by Adolescent (aged 10-19) and Adult (aged 20-45) Age Groups

	Female		**Male**
Variable	**χ2**		**χ2**
Literacy	26.883***		31.537***
Poverty Level	3.875*		3.800
Caste	2.404		2.754
Family Income	6.200*		2.063
Symptoms	0.238		8.217**
HIV Status	4.390		7.478*
Outcome	1.267		2.567
Category	1.324		0.685

*$p < .05$
** $p < .01$
*** $p < .001$

Table 3.Pearson Chi-Square Analyses Comparing Socio-Epidemiological and Treatment Outcomes by Adolescent (aged 10-19) and Adult (aged 20-45) Age Groups by Sex

There was also a significant difference in literacy levels between the adolescent and adult patient groups (χ^2=55.53, p<0.001). Only 14 individuals (13.3%) were illiterate in the adolescent group, whereas 326 individuals (52.6%) were illiterate in the adult group. There are no significant differences in literacy levels between males and females in either the adolescent or the adult patient groups. Poverty levels and caste were not significant in this study and therefore do not appear to differ between adolescent and adult age groups. There is a significant difference in family income between females in the adolescent and adult groups (χ^2=6.20, p<0.05). 63.2% of the female patients in the adolescent group came from families with incomes of 2000 rupees per month or higher whereas only 40.9% from the adult group came from families with incomes of 2000 rupees or higher.

Health Status

This study found a significant difference in the manifestation of TB (pulmonary versus extra-pulmonary) in adolescent and adult patient groups (χ^2=7.36, p<0.01). 21.9% of adolescent patients

experienced extra- pulmonary TB compared to only 12.1% of adult patients. This difference stemmed largely from the male groups, as 20.9% of adolescent male patients had extra- pulmonary TB compared to 9.3% in adult male patients. 23.7% of adolescent female patients had extra- pulmonary TB compared to 20.1% in adult females.

This study shows a significant difference in HIV status between adolescent and adult groups of patients (χ^2=12.27, p<0.01), although this difference is due to the fact that adolescent group had one HIV positive patient and none of the adult patients were HIV positive. Most of the patients in each group had not been tested (58.1% in adolescents and 62.0% in adults).

Using a Pearson Chi-Square test, this study found a significant difference in success rates between adolescent and adult patients (χ^2=4.08, p<0.05). Only 4.0% of adolescents defaulted on their treatment compared to 10.3% of adults. There was not a significant difference in success rates between males or females in either the adult or the adolescent groups. There was also not a significant difference in the number of category I and II patients in the adult or adolescent groups.

Discussion

There is relatively little data specifically about TB in adolescents compared to what is available about adults and children. [7, 12, 13] TB data is often disaggregated by children and adults, with adolescents not being specified as a unique group, [13] despite evidence that the adolescent experience of TB is unique and a critical time period for controlling the disease [7, 13-17]. This is an especially critical period because many studies have shown a peak in incidence of the disease during puberty between the ages of 12 to 19 years. [6, 7, 13] One study stated that there is an almost 8% increase in the risk of infection each year from childhood until the age of 15.[5] There is no other period where there is such a rapid increase in the incidence of TB. [7]

This study adds to the present research that suggests, during adolescence, there is a shift from TB commonly seen in children to adult-type TB. [7, 14, 15] One study, for example, showed that extra-pulmonary TB occurred in almost half of the children involved in the study compared to only 16% in adults. Adolescents share characteristics of both childhood TB and adult- type TB [5] but also experience unique characteristics and therefore this group merits specific attention [15]. In this study, only 12.1% of adult patients exhibited extra- pulmonary TB, compared to 21.9% of adolescent patients. This study also showed a large difference in the number of males that exhibit extra- pulmonary TB between each group.

Studies suggest that adolescents are especially at risk for TB due to a number of social and biological factors. [1, 2, 7, 12, 14, 16, 18-21] Zombini et al. (2013) posits that "sleeping times, irregular meals, extreme physical activities and emotional instability" lead to a greater risk of being infected with TB. Similar to other age groups, the risk of TB also increases with age among adolescents, [12, 21, 22] however some studies show that gender does not protect against TB as in the case of adults [7, 18] In one study, females comprised 63% of the adolescent patients compared to only 33% of the adult patients. [18] The current study also found a larger proportion of females in the adolescent group of patients compared to the adult group of patients. One of the most frequently cited risk factors was the increase in social networks during adolescence compared to childhood, making contact with an infected individual much more likely. [1, 7, 12, 14]

Other studies, including one conducted in India, found that an infected parent or other adult household member is the most significant risk factor for adolescents. [2, 19, 23]

Many studies show that adolescents are also more at risk of not completing treatment regimens, due to not taking enough medication because of growth spurts, as well as emotional and psychological imbalances leading to difficult relationships with health care providers. [16] This study contradicted this finding, though, as only 4% of adolescents defaulted on their treatment compared to 10.3% of adults. This could be due to a number of factors, including differences in education levels, work and household responsibilities, socio- cultural factors, and so on.

This study showed a significant difference in literacy rates between the adolescent group and the adult group, with the adolescent group showing literacy rates of 86.7% compared to 47.4% in the adult group. This is likely due to increased schooling for younger generations. A greater proportion of adolescents also completed their treatment. Further studies are needed to explore the relationship between literacy and education levels and treatment success among adolescents.

Although many studies show that HIV is highly associated with TB, the present study did not find that strong a correlation. Only one patient (in the adolescent group) was confirmed to be HIV positive. This is possibly due to the fact that the vast majority of patients had not been tested for HIV.

Poverty and caste were not significant in this study because both age groups were socio-economically diverse. In both groups, patients came from a variety of backgrounds. That said, female adolescents from families with incomes above 2000 rupees per month had higher rates of TB than other groups. Males in both age groups and females in the adult group all had a higher percentage of patients in the lower income category.

Conclusions

This study suggests that the adolescent experience of TB is unique. The socio- demographic, biological, and clinical characteristics of adolescents are in transition and warrant special attention. This study has brought to light questions regarding the experience of TB based on age and gender. For example, in this study, adolescent males exhibited higher incidence of extra- pulmonary TB compared to their adult counterparts. The findings of our study also suggest that adolescent girls are not as well protected from TB as adult women are. Both these cases illustrate the need for public health programs and clinicians to be aware of these unique characteristics in suspicion of TB in adolescents. Overall though, adolescent treatment success rates in this study were very high and drop- out rates were much lower than those seen in the adult patient groups. Finally, future studies should find out in what ways were the adults and adolescents different in relation to their treatment success and drop- out rates. A better understanding of this success among adolescents may help us design better programs for treatment success among adults.

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