

# The Incidence of Tuberculosis Among Children, Adolescents and Young Adults: An Observational, Hospital Based, Single-Center Study

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## Abstract

**Background:** Historical data show that the risk of tuberculosis increases dramatically during adolescence, and young people face unique challenges in terms of case detection and effective treatment. However, little is known about the burden of tuberculosis among young people in the modern era. This study aimed to assess the regional incidence of tuberculosis among children, adolescents and young adults aged upto 40 years.

**Objective:** This observational, hospital based, single-center study aimed to assess the incidence of tuberculosis among children, adolescents and young adults.

**Materials and Methods:** This study was carried out in the Department of pathology, Himalayan Institute of Hospital trust, University, Swami Ram Nagar, Dehradun with 284 patients over a period of 12 months between March-2008 to March-2009. The data was entered; tabulated and statistical analysis was performed by using Statistical Package for the Social Sciences (SPSS 24.0) and Graph Pad Prism Version 5. A value of  $p < 0.05$  was considered significant.

**Result:** In this study, the maximum cases 30.28% (n=86) were seen in the third decade followed by fourth decade 19.36 % (n=55). The youngest patient recored in our study was of only 2 years old while the oldest patient recored in our study was of 40 years old. Incidence of tuberculosis was highest in the third decade whereas lowest in 1<sup>st</sup> decade of life. In females, 04 cases each were recorded between 21-40 years for tuberculosis of the Female Genital Tract and Breast, whereas no cases were recorded between 0-20 years for tuberculosis of the Female Genital Tract and Breast. In males, 04 cases recorded between 11-30 years for tuberculosis of the Urogenital Tract, whereas no cases were recorded for 0-10 and 31-40 years for tuberculosis of the Urogenital Tract.

**Conclusion:** The current study highlighted the age wise distribution of regional incidence of tuberculosis cases in the study patients.

**Keywords:** Incidence, Children, Adolescents, Young Adults, Tuberculosis.

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## Introduction

Infants and adolescence is increasingly recognised as a period of development that underpins many aspects of future health and well-being [1]. Several countries are now having more children (0-9 years), adolescents (10-19 years) and young adults (20-24-year-olds). Infact, young people aged 10-24 years now comprise a quarter of the world's population [2].

Children, adolescent and early adulthood individuals have a much wider range of social contacts outside of the household. Consequently, adolescence and early adulthood is increasingly recognised as a key risk period for tuberculosis infection, disease and adverse outcomes. Overall, young people suffer a considerable burden of tuberculosis. Age-specific burden of disease estimation for this age group is complicated by incomplete age disaggregation of tuberculosis data, highlighting the importance of continued surveillance system strengthening [3].

In high tuberculosis transmission settings, the incidence of tuberculosis increases rapidly during adolescence to peak in early adulthood. Historical data suggest that the risk of infection with *Mycobacterium tuberculosis* is highest during adolescence and young adulthood, and that between the ages of 12 and 24 years there may also be a transient increase in the risk of progression to disease after infection compared with children or older adults. Furthermore, many comorbidities relevant to tuberculosis emerge or are exacerbated during the adolescent period, including infection with HIV, diabetes, risky substance use (including tobacco use) and mental health conditions. Finally, many adolescent girls and young women face the health challenges associated with pregnancy and childbirth, which may increase their risk of both developing tuberculosis and experiencing adverse outcomes [4-6].

This at-risk age group requires increased attention for case detection, care and

prevention within the global End TB Strategy. A critical first step to addressing the issue of tuberculosis in at-risk groups is to "know your epidemic". The World Health Organization (WHO) first published estimates of the burden of tuberculosis in "children" (children and young adolescents aged 0-14 years) only as recently as 2012. It is currently estimated that there were 1.0 million incident cases of tuberculosis and 210000 tuberculosis-related deaths in children and young adolescents in 2015 [7].

In view of this, this observational, hospital based, single-center study undertaken in Department of pathology, Himalayan Institute of Hospital trust, University, Swami Ram Nagar, Dehradun was aimed to assess the regional incidence of tuberculosis among children, adolescents and young adults aged upto 40 years.

### Method:

Between March-2008 to March-2009, this observational, hospital based, single center study carried out in the Department of pathology, Himalayan Institute of Hospital trust, University, Swami Ram Nagar, Dehradun enrolled 284 patients. The study included data 14,472 patients of both prospective (during March 2008 to 2009) and retrospective cases (past one year of the study period). For prospective cases the cytological material for the study was collected by fine needle aspiration cytology (FNAC). For retrospective cases of past one year were retrieved from the records. TB suspected cases were evaluated by Ziel-Nelson (ZN), Auramine-Rhodamine (A-R) staining techniques and by PCR. All cases which showed tuberculosis were re-evaluated. The study protocol was performed in accordance with the principle of the declaration of Helsinki and after approval by the Institutional ethical review board.

### Statistical analysis:

The data was entered; tabulated and statistical analysis was performed by using

Statistical Package for the Social Sciences (SPSS 24.0) and Graph Pad Prism Version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. A value of  $p < 0.05$  was considered significant.

### Results:

During a period of twelve months between March-2008 to March-2009, 284 patients were enrolled in our study. Their mean age and median was 33.75 and 33.00 years (range, 0–40 years). Our study recorded age-wise distribution of incidence of tuberculosis cases in the study patients in four age-range beginning from 0-10 years, 11-20 years, 21-30 years and 31-40 years.

In our study, the maximum cases 30.28% (n=86) were seen in the third decade followed by fourth decade 19.36% (n=55). The youngest patient recored in our study was of only 2 years old while the oldest patient recored in our study was of 40 years old. Incidence of tuberculosis was highest in the third decade whereas lowest in 1<sup>st</sup> decade of life.

In females, 04 cases each were recorded between 21-40 years for tuberculosis of the Female Genital Tract and Breast, whereas no cases were recorded between 0-20 years for tuberculosis of the Female Genital Tract and Breast. In males, 04 cases recorded between 11-30 years for tuberculosis of the Urogenital Tract, whereas no cases were recorded for 0-10 and 31-40 years for tuberculosis of the Urogenital Tract.

**Table 1: Age wise distribution of incidence of tuberculosis cases in the study patients**

SN	Organs	0-10 years	11-20 years	21-30 years	31-40 years
1.	Reticuloendothelial System	11	35	49	36
2.	Bone and Joints	00	04	10	01
3.	Gastrointestinal Tract	02	02	10	07
4.	Soft tissue	02	01	03	05
5.	Respiratory System	00	01	01	00
6.	Skin	00	00	03	03
7.	Female Genital Tract	00	00	03	01
8.	Urogenital Tract	00	03	01	00
9.	Breast	00	00	03	01
10.	Hepatobiliary	00	00	-	01
11.	Endocrine	00	00	01	00
12.	Central Nervous System	00	00	02	00
	Total (284)	15	46	86	55
	Percentage	5.28%	16.19%	30.28%	19.36%

### Discussion:

This study provides original regional estimates of the large burden of tuberculosis in children, adolescents and young adults aged 10–40 years. The marked increase in the estimated

tuberculosis caseload between early adolescence and young adulthood is consistent with historical observation, and with age-stratified tuberculosis estimates published by the Global Burden of Diseases group in 2013 [7].

The results of our study are in agreement with the studies undertaken by Marais et al (2004) [6], Nduba et al (2015) [8], Enane et al (2016) [9], Dodd et al (2014) [10] and Lestari et al (2011) [11].

According to the current study, the requirements for reporting tuberculosis data to the WHO have expanded over time as tuberculosis control strategies have widened beyond an initial focus on those cases most likely to contribute to transmission, i.e. cases of sputum smear-positive tuberculosis. In 2006, the WHO revised tuberculosis registers to record and report all new tuberculosis cases by type, disaggregated by the age groups of 0–4, 5–14 and >15 years, with new sputum smear-positive pulmonary tuberculosis cases in adults to be further disaggregated into 10-year age groups [12]. Current reporting practices still do not allow direct determination of the numbers of notifications in children, adolescents and young adults.

### Conclusion:

In conclusion, this study provides original regional estimates of the large burden of tuberculosis in children, adolescent and young adults, showing a sharp age-related increase in case numbers. The limitations of the accuracy of these estimates are recognised and highlight the pressing need for further studies of the epidemiology of tuberculosis among children, adolescent and young adults in a range of settings, and for continued strengthening of tuberculosis surveillance systems. Nonetheless, this work provides an important platform for increasing attention to and advocacy for the needs of this neglected and vulnerable group, who must be considered in scaling up efforts to end the tuberculosis epidemic.

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**Ethical approval:** The study was approved by the Institutional Ethics Committee

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