

## Prevalence & annual risk of tuberculous infection among school children in Bangalore rural district

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### Summary

The data on tuberculin tests carried out among school children in Devanahalli taluk of Bangalore rural district during 2005-06 was analyzed to estimate the Annual Risk of Tuberculous Infection (ARTI) and to study the trends from the past. A total of 2459 children 5-14 yrs of age were tuberculin tested in 25 selected schools. The injections were administered using 1 TU PPD RT23 with Tween 80, on the mid-volar aspect of left forearm and maximum transverse diameter of induration was measured at about 72-96 hours after the test. Of these, 2235 were satisfactorily test-read; the proportion of children with BCG scar was 64%.

The prevalence of tuberculous infection estimated by mirror image technique was 5.8% and the ARTI was computed at 0.6% from the estimated prevalence. When compared with the findings of an earlier survey in peri-urban villages of Bangalore during 1990-94, the average per annum decline in ARTI was 3%. This trend may not be wholly attributable to implementation of RNTCP, since it was similar to the decline observed earlier in rural areas of Bangalore district between 1961-1986.

**Keywords:** Tuberculosis, Infection, Prevalence, Annual risk, Tuberculin test

### Introduction

Tuberculosis (TB) is a major public health concern in India. Every year there are about 1.8 million new cases of TB and among them 0.8 million are infectious cases of sputum smear positive pulmonary TB<sup>1</sup>. Two persons die due to TB every 3 minutes, over 1,000 every day and almost 4,00,000 every year<sup>1</sup>. The Revised National Tuberculosis Control Programme (RNTCP) is a big initiative taken by Government of India to overcome this problem. By end of the year 2005, the entire nation has been covered under RNTCP activities.

Among the various epidemiological indicators for assessment of TB situation in any community, Annual Risk of Tuberculous Infection (ARTI) is currently preferred, since disease surveys are too expensive and health information system suffers from inadequacies. ARTI is defined as the probability of acquiring new infection or re-infection over the course of one year. It also reflects the overall impact of the load of infectious cases and the efficiency of TB control activities. In this direction a nation-wide tuberculin survey was conducted by National Tuberculosis Institute (NTI), Bangalore in collaboration with Tuberculosis Research Centre (TRC), Chennai and other institutes to estimate zonal and national ARTI. This nation-wide

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survey has provided for the very first time national/zonal ARTI estimates. Subsequent state specific ARTI surveys are being planned/ conducted by various State Governments under the financial support from Central TB Division (CTD) and technical guidance from NTI. For this NTI had been provided responsibilities to organize training for state officials and technical co-ordination.

To start with State - specific ARTI surveys, two training programmes for state officials from Andhra Pradesh and Kerala states were conducted at NTI during 22<sup>nd</sup> August 2005 to 24<sup>th</sup> September 2005 and 17<sup>th</sup> January 2006 to 23<sup>rd</sup> February 2006 respectively. The field work for both the training programmes was undertaken in selected schools of Devanahalli Taluk, Bangalore rural district. These training programmes were conducted following the standard guidelines. During these training programmes, trainees were trained in field organization of tuberculin surveys including planning, tuberculin testing & reading of reaction sizes. Measurements of tuberculin reactions were also performed by reference readers who are highly experienced NTI's standard tuberculin readers. Based on the data gathered from the tuberculin reaction readings of standard readers, it was desired to study the transmission of TB infection in the selected schools of Devanahalli Taluk by estimating prevalence of tuberculous infection and thus computation of ARTI thereof. An effort is also undertaken to study the trend in ARTI in this area.

### **Materials and Methods**

The list of Government lower primary and higher primary schools were obtained from Block Education Officer, Devanahalli Taluk. Tuberculin testing was undertaken in 25 government schools.

Two to three days prior to the day of testing, individual school authorities were informed and a suitable date was assigned for tuberculin testing/reading. On the day of testing, all the children studying in standard 1<sup>st</sup> to 8<sup>th</sup> (aged 5-14 years) were registered and tuberculin tested. Tuberculin testing was done by the Mantoux technique on the mid-volar aspect of left forearm with 0.1 ml of 1TU PPD RT23 with Tween 80, using the disposable tuberculin syringes and needles. An assistant to the tester recorded the test as satisfactory if it raised a pea-sized wheal with steep border and clear pits. It was recorded as unsatisfactory if there was leakage during injection or, if the tuberculin was administered subcutaneously. The BCG scar status of each child was ascertained by examination of both the shoulders. If a pea shaped shiny lesion was seen in the left shoulder, the child was indicated as BCG vaccinated otherwise not. The tuberculin used during the 1<sup>st</sup> and 2<sup>nd</sup> training programmes were obtained from BCG Vaccine Laboratory, Guindy (Batch no.138) and Staten Serum Institute, Copenhagen, Denmark (Batch no. 643A) respectively. The reading was done between 72-96 hours after the tuberculin test and the maximum transverse diameter of the induration was recorded.

As a service component, detailed history of symptoms if any and history of contact was ascertained from children who elicited tuberculin reaction  $\geq 15$ mm. Those with suspicion of TB were referred to the Community Health Centre, Devanahalli for further investigations and treatment, if required.

### **Statistical Methods**

The frequency distribution of reaction sizes were plotted as histograms, to define the criteria of estimating the prevalence of tuberculous infection. ARTI was derived from the estimated

prevalence of infection by using the following equation<sup>2</sup>.

$$R = 1 - (1 - P)^{1/a}$$

Where 'P' is the estimated prevalence of infection and 'a' is the mean age of the test read children. The mean age was calculated as 10.14 after adding 0.5 years to the mean age in completed years.

The data was analyzed using the SPSS software. The analysis was performed irrespective of BCG scar status as suggested in one of the earlier studies that tuberculin surveys may be conducted irrespective of BCG scar status among children<sup>3</sup>.

## Results

A total of 2,461 children aged 5-14 years studying in standard 1<sup>st</sup> to 8<sup>th</sup> were registered during both the training programme. Of these, 2,459 were subjected to tuberculin testing. Out of the total tested children, 2,362 (96.1%) were satisfactorily tested and 97 (3.9%) children were unsatisfactorily tested. Of 2,362 satisfactorily tested children, 2235 were test-read. Of these, the presence of BCG scar was observed among 1,423 (63.7%). BCG scar was not seen in 799 (35.7%), while it was doubtful in 13 (0.6%).

The frequency distribution of tuberculin reaction sizes in the overall study group is presented in figure 1. Neither a clear anti-mode nor a mode could be observed from the frequency distribution of reaction sizes. Therefore, the prevalence of infection was estimated by mirror-image technique assuming the mode at 20 mm, since in this study area, mode among sputum smear positive TB cases has consistently been observed at 20 mm, when the same testers and readers as in the present study had performed the tests<sup>4</sup>. The prevalence of infection was thus estimated as 5.8 % (C.I. 5.4% - 6.2%) and the ARTI rate computed as 0.6 %.

The frequency distribution of tuberculin reaction sizes among the test read children by BCG scar status is presented in figure 2. The frequency distributions of tuberculin reaction sizes are observed to be similar in the two groups – with and without BCG scar. A majority (82%) of the children with BCG scar had insignificant reaction of <10 mm.

## Discussion

The study results provide the current information about the extent of transmission of tuberculous infection among children of Devanahalli Taluk, Bangalore rural district. The prevalence of infection in the overall study group is 5.8 % and the computed ARTI of 0.6 % is comparatively lower than reported by earlier studies in this area. In one of the studies conducted during 1990-94 among children residing in peri-urban villages of Bangalore City, the ARTI rate reported was 0.9%<sup>5</sup>. In Nationwide ARTI survey (2000-2003), the estimated ARTI for the south zone was 1.0% and national ARTI average was 1.5%<sup>6</sup>.

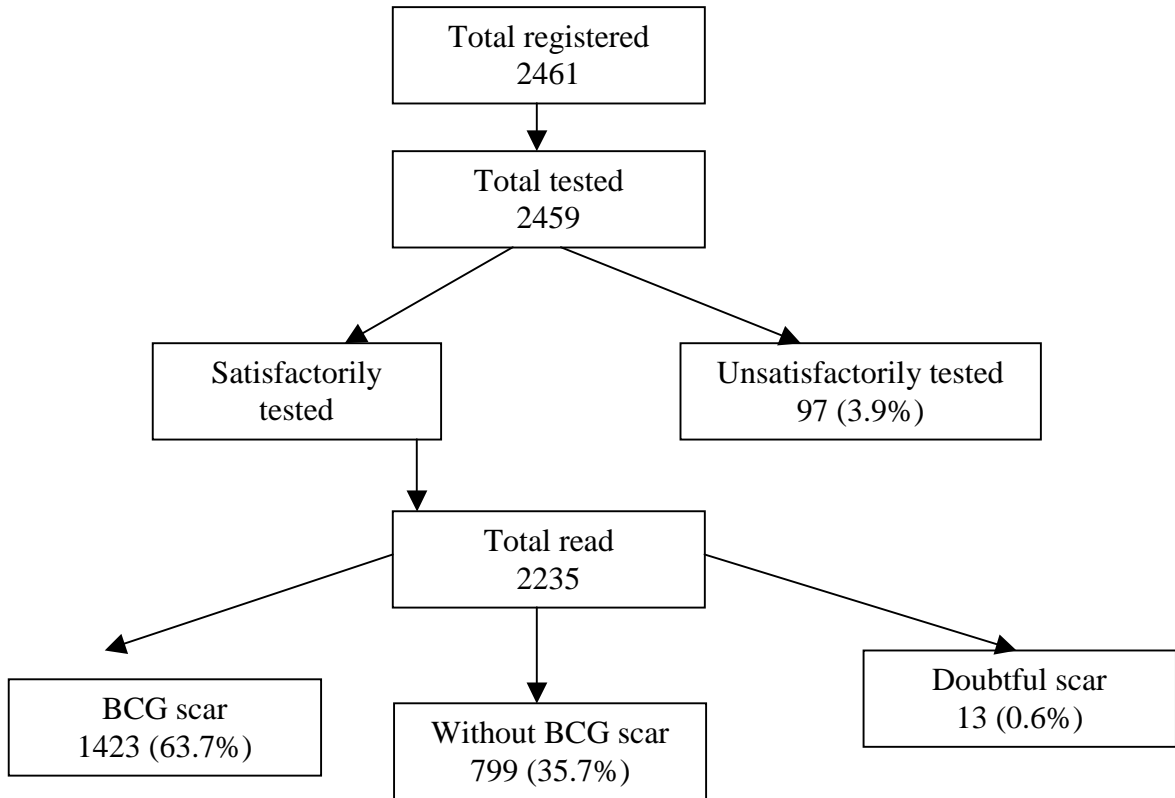
To have an idea about the trends of disease transmission in the study area, the present survey findings were compared with the estimates from the previous study conducted during 1990-94 in peri-urban villages of Bangalore which included Devanahalli taluk<sup>5</sup>. The average per annum decline in ARTI was thus observed as 3%. However, 3% per annum decline in ARTI observed from this study was found to be similar to the earlier studies conducted in rural areas of Bangalore district (1961-1986), where ARTI was reported declining at an average rate of about 3.2% per year over the 23 years period of observation in the study area<sup>7</sup>. Therefore, the trend observed in the present study may not be wholly attributable to effective implementation of RNTCP services in this area.

A limitation of the study has been the lack of clear cut-off-points in the form of mode/antimode. However such predicaments have been observed in many other parts of the globe owing to declining proportions of reactions due to tuberculous infection distributed over a large range of reaction sizes on the frequency graph.

Finally, the trends observed in this area may not apply to other parts of the country. There is thus, need to conduct more studies of this nature to study the trends. For instance, a study conducted by Tuberculosis Research Centre (TRC), Chennai in Tiruvallur district represented a substantial 6% annual decline in ARTI after implementation of RNTCP in the district<sup>8</sup>. Currently a repeat tuberculin survey is also being conducted by National Tuberculosis Institute, Bangalore among school children to study the ARTI trends in Bangalore City which shall throw more light on the current extent of transmission of TB infection, its trend and impact of RNTCP in the area.

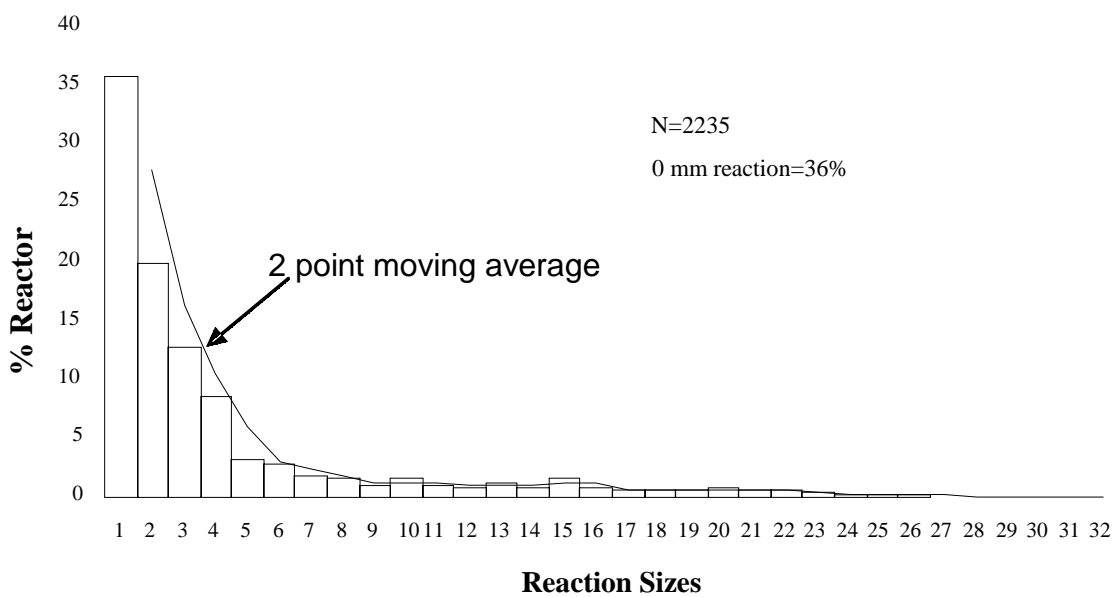
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**Flow chart: Study population**

**Figure 1: Frequency distribution of reaction sizes (overall)**



**Figure 2: Frequency distribution of reaction sizes by BCG scar status**

