Meeting of the Expert Committee to Estimate TB Burden in India
10-11th March 2005, New Delhi

The National Sample Survey (NSS) conducted by ICMR during 1955–58, estimated that India had a prevalence of 4/1000 bacillary pulmonary tuberculosis cases and 16/1000 X-ray abnormal TB suspects. Extrapolating the findings of the NSS provided an estimate of the burden of TB in India for the year 1997 (i.e. at the start of scaling up of RNTCP) of 3.5 million bacillary pulmonary tuberculosis cases and 14 million X-ray abnormal suspects. In 2000, an Expert Committee convened by the GoI, analyzed the data available at that time from comparable studies, and estimated the existing burden for the year 2000 as about 4.32 million bacillary pulmonary tuberculosis cases and 11 million X-ray abnormal suspects, adding up to about 15.32 million. Using recent data from the disease and tuberculin surveys conducted by the Tuberculosis Research Centre (TRC), as well as the 2000-03 nation-wide annual risk of TB infection (ARTI) survey conducted by National Tuberculosis Institute (NTI) and TRC, an estimate of 3.8 million bacillary pulmonary tuberculosis cases and 12.9 million sputum negative X-ray abnormals was made for the year 2000.

Since 1998, the RNTCP has undergone rapid expansion, and by the end of 2004 covered a population of over 940 million. As RNTCP is showing remarkable success in terms of cure rate and nation-wide coverage is planned for in 2005, it is expected that the burden of prevalent cases should decrease considerably over a period of a few years. RNTCP is curing patients successfully, however if the current burden of TB in the country can be ascertained and compared with the burden in a few years time, the long term impact of the programme could be measured. Thus an expert committee was formed to give its assessment regarding:

1. Current (Year 2000) burden of TB in India;
2. Advise on the need or feasibility for large scale national TB prevalence survey(s); and
3. Develop a model to estimate the duration for which centrally supported TB control services will be required in order to make a significant epidemiological impact on the burden of TB in India.

Consensus process

A two-day consultation meeting of the expert committee was held on 10-11th March 2005 at New Delhi under the chairmanship of Dr. S.P.Tripathy, to discuss the above agenda. Ms Rita Teaotia, Joint Secretary (Health), joined the meeting on the second day. List of participants is at Annex 1.

TB burden

Dr C Kollapan and Mr PG Gopi from TRC, Chennai, jointly presented the design of the disease and tuberculin survey at Thiruvallur, and the estimates of burden of TB in India for the Year 2000. Burden of TB in India was estimated using three data sources:

- Prevalence of TB disease among adults and ARTI among children from surveys conducted by TRC in Thiruvallur district, Tamil Nadu, 1999-2001.[1]
- Prevalence of TB among children from a survey conducted by NTI in south India, 1991-1994.[2]
- ARTI estimates in rural and urban areas of the four zones from the nation-wide survey among children conducted by NTI and TRC, 2000-2003.[3]

Using this method, TRC has estimated 3.8 million (95% C.I: 2.8-4.7) bacillary pulmonary tuberculosis cases and 12.9 million (95% C.I: 9.7-16.0) smear negative culture negative X-

ray abnormals. The "X-ray abnormals" include individuals with negative sputum by smear and culture, but whose chest X-ray was read as possible or probable tuberculosis by two independent readers.

The strength of the TRC estimate was attributed to its simplicity, and the use of better information that has now become available such as the prevalence study in Thiruvallur and the nation-wide ARTI survey. This estimate is also more comprehensive than the earlier estimates as it includes pediatric cases in the estimation, and screening involved both X-ray and symptom elicitation. However its main limitation is in extrapolating data acquired from a sub-district population to the entire country, as this assumes that the relationship between the ARTI and the prevalence of disease, as well as TB control measures and outcomes, were similar across the country. Additionally, extra-pulmonary cases have not been included and the impact of HIV on TB prevalence was not considered.

There was unanimous agreement by the meeting on the estimated burden of 3.8 million bacillary pulmonary tuberculosis cases. Discussion centred on the 12.9 million "X-ray abnormals". It was opinioned that the non-specific shadows in the X-rays could be due to various other diseases and would also include patients who will never develop TB disease and therefore the figure of 12.9 million was likely to be an overestimation. Mention was made of the NTI study using Joint Parallel Reading of X-rays, which showed that only 22% of the radiological ("X-ray abnormal") "cases", classified as active cases by conventional method, could actually be confirmed as truly active cases.

TRC data has shown that 13% of the X-ray abnormals were bacillary cases at 2.5 years - considered an underestimate as there was no information on the number of TB patients who could have developed TB and taken anti-TB treatment during the intervening 2.5 year period. Other studies (NTI [4] and Hongkong[5]) had shown that about 30 - 40% of X-ray abnormals break down bacteriologically or radiologically during a 12-month period. In the TRC study, about 30% of the X-ray abnormals also had chest symptoms. Considering all these factors, the Committee agreed that it is reasonable to assume that 30% of the X-ray abnormals at the time of the survey to be active cases of TB. Additionally, it was also decided to account for extra pulmonary cases by estimating the load to be 20% of the 3.8 million bacillary cases. [6] The revised estimate is given at Table1.

Bacillary Pulmonary TB Cases	3.8 million
Abacillary Pulmonary TB cases (30% of the 12.9m sputum negative X ray suspects)	3.9 million
Extra-pulmonary TB (20% of 3.8m bacillary Pulmonary TB Cases)	0.8 million
Total Disease Burden	**8.5 million**

Dr VK Chadha from NTI, Bangalore, made a presentation on the estimated TB burden in India for the year 2004. This was done by:

- Estimating incidence of all TB cases among those individuals remotely infected (46%) and those newly infected (within the last 2 years) or re-infected (4%), with tubercle bacilli alone and for those dually infected with HIV and TB.
- Estimating the proportion of smear positive PTB cases and smear negative (1:1.), and extra pulmonary tuberculosis (20%). [6]
- Estimating average duration of smear positive cases in India (at 11.9 months).
- Estimating point and period prevalence from the incidence and duration of smear positivity of cases.

By undertaking the above exercise, the point prevalence of all cases for 2004 was estimated to be 2.9 million (269 per 100,000), out of which smear positive PTB was 0.8 million (76 per 100,000). The period prevalence of all cases was estimated to be 4.8 million (441 per 100,000), out of which smear positive PTB was 1.6 million (152 per 100,000).

The different approach used in the NTI estimate was appreciated as it would benefit the country to have two methods available for validation of data. As per the suggestion of the committee, NTI re-worked its estimates for the Year 2000 changing the parameters according to data relevant to that year. The revised estimates calculated the duration of disease (sm +ve) to be 1.8 years, which was close to the TRC findings. For the Year 2000, the point prevalence of smear positive cases was estimated by this approach to be 1.3 million (127 per 100,000) and period prevalence to be 2 million (198 per 100,000). NTI methodology involved many assumptions and variables which need to looked at carefully, and therefore the committee recommended that sensitivity analysis be undertaken and range estimates made.

An expert committee in 2000 estimated the burden as 4.32 million (4.84/1000) bacillary cases and 11 million (12.35/1000) X-ray abnormals. The TRC estimate presented was also for 2000. The committee agreed that the Year 2000 would be used as the baseline for estimating the TB burden in India.

TB prevalence – trends/projections

TRC made projections on the trend of TB prevalence based on the observations from the two disease surveys (1999-2001 and 2001-3) conducted in Thiruvallur district. The rate of decline in prevalence between the two surveys was 9.4% and 11.5% for Smear positive and Culture positive respectively. Whilst it is mathematically possible to project the disease burden for the future if it is assumed that the rate of decline remains constant, the committee members considered it too premature to comment on the longer term trends based on the available data and recommended that such an exercise be taken up after data is available from the next survey in 2006.

NTI used a simple mathematical model to estimate the likely trends in prevalence of smear positive Pulmonary TB in DOTS areas over the years. From the model, and assuming that the incidence and treatment outcomes under DOTS remain constant, the period prevalence of smear positive PTB is expected to be reduced by 39% in five years time (7.8% per annum).

The NTI model of trend analysis was found to be logical and realistic. The annual rate of decline at about 8% was similar to the TRC study, thereby cross-validating the findings of the two different methods. It was pointed out that the high decline rates observed in the early years are unlikely to remain constant over later years. However, even if a longer observation period showed a lower annual decline rate, for example 5%, the RNTCP should still be able to meet the MDG target of halving the prevalence of TB by 2015. A suggestion was made that the calculations be made taking 2000 as the baseline year, and the prevalence figure for 2000 as agreed upon by the meeting.

On the question of state-specific trend analysis, it was pointed out that the exercise is feasible but that the primary concern should be to have a national trend analysis which

should be conducted a couple of years after complete nation-wide DOTS coverage has been achieved i.e after 2006.

Prevalence survey

A large scale national disease prevalence survey would be ideal to get a direct estimate of the burden of TB disease in India. However, considering the lack of manpower, labour intensiveness, operational inconvenience and the likelihood that it would not be cost effective in relation to the information generated, the Committee decided against conducting a large scale national survey.

As an alternative, regional or zonal survey sites would be established with the support of the national TB Institutes. In addition to the existing prevalence survey being conducted by TRC in Thiruvallur district, it was proposed that NTI Bangalore, MGIMS Wardha, LRS New Delhi and the Regional Medical Research for Tribals (ICMR) Jabalpur, should initiate survey sites in their respective areas. An additional site could also be considered in the East, possibly initiated by the All India Institute of Public Health and Hygiene, Kolkota.

The selection of survey sites would be finalized taking into account the variability observed in the NSS and ARTI surveys. All sites would use the same protocol as used by the TRC, Chennai for the study in Thiruvallur district.

Consensus

Based on the existing data from TRC and elsewhere, the burden of TB in India in the Year 2000 was 8.5 million, of which 3.8 million were bacillary pulmonary cases, 3.9 million abacillary pulmonary cases and 0.8 million extra pulmonary TB cases. The TRC estimate, which has the virtue of being a *direct* one based on observation, is consistent with the NTI conclusion that is based on a modelling exercise.

The Year 2000 estimate will be taken as the baseline to evaluate the future impact of RNTCP implementation.

Based on the NTI modeling exercise to estimate the likely trends in prevalence of smear positive pulmonary TB in DOTS areas, the RNTCP is likely to meet the MDG target of halving the prevalence of TB by 2015 if the global targets for cure and case detection are achieved and maintained throughout the prorgramme. This should be analysed only after complete nation-wide DOTS coverage.

It is however too premature to draw valid estimates for future trends in prevalence based on the two disease surveys completed by TRC. Such an exercise should be undertaken once data is available from the next survey in 2006.

A nation-wide prevalence survey is neither feasible nor necessary. As an alternative, regional or zonal survey sites should be established to act as sentinel sites, in addition to the existing prevalence survey site at Thiruvallur district. All future disease surveys should be conducted using the same methodology as that used by TRC in Thiruvallur district, and should include the use of both X-ray and symptom elicitation as screening methods.

References

1. Gopi PG, Subramani R, Radhakrishna S, Kolappan C, Sadacharam K, Devi TS, Frieden TR, Narayanan PR. A base line survey of the prevalence of tuberculosis in a community in South India at the commencement of a DOTS programme. *Int J Tuberc Lung Dis* 2003; **7**(12):1154-62.
2. Suryanarayana L, Suryanarayana HV, Jaganatha PS. Prevalence of pulmonary tuberculosis among children in a south Indian community. *Ind J Tub* 1999; **46**: 171-8.
3. Directorate General of Health Services (DGHS), Government of India (GoI), the National Tuberculosis Institute (NTI), Bangalore and the Tuberculosis Research Centre, Chennai. Annual Risk of Tuberculosis Infection in different Zones of India: A National sample survey 2000-2003. Bangalore: NTI, 2004.
4. Aneja KS, Gothi GD, Rupert Samuel G.E. Controlled study of the effect of specific treatment on bacteriological status of "suspect" cases. *Ind J Tub* 1999; **16**(2): 50-57.
5. Hong Kong Chest Service, Tuberculosis Research Centre and British Medical Research Council. Sputum smear negative pulmonary tuberculosis: controlled Trial of 3-month 2-month regimens of chemotherapy. *Lancet* 1979; **1**: 1361-1364
6. Murray C, Styblo K, Rouillon A. Tuberculosis: 236-237; Disease control priorities in developing countries; Published for the World Bank, Oxford University Press, October 1993.

Annex 1 List of participants: (by Institutions/individuals)

1. Dr. S.P. Tripathy, Former Director General, ICMR (Chairman for the committee)
2. Dr. D.R. Nagpaul, Former Director, NTI Bangalore
3. Dr. S. Radhakrishna, Bio-statistician and former WHO consultant
4. Dr. S.K. Jindal, PGI of Medical Education and Research, Chandigarh
5. Dr. P. Narang, Professor and Head, Microbiology, MGIMS, Wardha
6. Dr. P. Kumar, Director NTI, Bangalore
7. Dr. V.K. Chadha, Epidemiologist, NTI, Bangalore.
8. Dr. P.R. Narayanan, Director TRC, Chennai
9. Dr. Santha Devi, Former Deputy Director (Sr Grade), TRC, Chennai
10. Dr. C. Kolappan, TRC Chennai
11. Mr. P.G. Gopi, TRC, Chennai
12. Mr. R. Subramani, TRC, Chennai
13. Dr. Erwin Cooreman, MO (TB), WHO, SEARO
14. Dr. Fraser Wares, STP (TB), WHO, India
15. Dr. S. Sahu, NPO (TB), WHO, India
16. Dr. L.S. Chauhan, DDG (TB), Central TB Division (CTD)
17. Dr. V.S. Salhotra, CMO (TB), CTD
18. Dr. P.P. Mandal, CMO (TB), CTD
19. Dr. Alka Singh, Consultant, CTD
20. Dr. Shruti Sehgal, Consultant, CTD
21. Dr. Yamuna Mundadey, Consultant, CTD
22. Dr. P. Sai Kumar, Consultant, CTD
23. Dr. J. Tonsing, Consultant, CTD