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Original Article

Tuberculosis mortality in a rural population from South India

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SUMMARY

Background: General mortality rate (GMR) is an essential indicator for assessing the health status of a community. Tuberculosis (TB) mortality is an indicator for the Millennium Development Goal for 2015.

Methods: This community-based retrospective survey was conducted in 2007–2008 on a sample of 114,605 rural populations living in 56 villages randomly selected from 218 villages in Tiruvallur district, South India, where the DOTS strategy was implemented in 1999. All the permanent residents of the households were registered and information on occurrence of death was recorded. All the deaths were investigated by verbal autopsy (VA) using standardized methods.

Results: A total of 719 deaths were registered. The GMR and tuberculosis mortality rate (TMR) were 648 (95% CI: 568–727) and 39 (95% CI: 25–52) per 100,000 p-yrs, respectively. The GMR increased with age, and was higher in males than females at all ages. The TMR was higher in males than females and the overall male:female ratio was 5:1.

Conclusion: TB was the 6th leading cause of death overall and the 2nd leading cause among men in this area. Strategies to reduce TB death should be implemented and the impact should be monitored by repeat VA studies.

1. Introduction

India has about nine million deaths a year, about one in six of all deaths worldwide and majority of these do not have a certified cause.[1] The Civil Registration System which records births and deaths in India is unreliable due to gross under-registration. The Medical Certification of Causes of Death is largely confined to selected urban settings only. A reliable assessment of disease-specific mortality rates is not yet possible in many parts of India, either because the underlying cause of the terminal illness was never known or because the relevant information was not recorded. Verbal autopsy (VA) is a research tool that has been used to determine probable causes of death in cases where there was no medical record or formal medical attention given. The Global Plan to Stop TB sets out the most effective approaches based on best estimates and projections of the Tuberculosis (TB) epidemic, as well as the

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resources needed to support comprehensive TB control and priority research.[2] In 2006, the Stop TB partnership launched the Global Plan to Stop TB 2006–2015, a roadmap for scaling up prevention and treatment, for research and development, and for financing. The plan's goals included halving TB deaths compared to 1990 levels by 2015 – still a target today.[3] Reduction of TB mortality in the community is an indicator for effectiveness of TB control measures. This retrospective follow-up mortality survey in 2007–2008 collected data on TB mortality in the community from a rural area in South India where DOTS strategy was implemented in 1999.

1.1. *Objectives*

To estimate the general mortality rate (GMR) and TB mortality rate (TMR) for the target population in the Tiruvallur district of Tamilnadu.

2. Methodology

2.1. *Sampling*

Assuming an annual incidence rate of death of 9 (95% CI: 8–10) per 1000 population, the sample size required was calculated to be 34,263 for this mortality survey.[4] This sample size would have yielded about 308 deaths, which may not be sufficient to detect enough TB deaths, which need to be further stratified by age and sex. Further, an increase in sample size would improve the precision of death rate estimates. Therefore, the sample size was increased about threefold to 114,605 persons residing in a sample of 56 villages randomly selected from the 218 villages in Tiruvallur district, South India, where DOTS strategy was implemented in 1999. A stratified cluster sampling design was employed. A simple random sample of village and urban units were selected proportionate to the census population.

2.2. *Registration*

Trained field investigators carried out the house-to-house enumeration during the period from 29/01/2007 to 29/04/2008. All the permanent residents in a household were registered in the survey. During registration, the household number, names of the members in the household, age in completed years, and gender of the individuals were recorded. In addition, information on occurrence of death in each household, on or after 'Pongal festival' day 2007 (15th January 2007) was recorded. 'Pongal' is a major New Year festival in this region. All household forms reporting deaths were handed over to the supervisors for detailed VA to ascertain the underlying cause of death. The Institutional Ethics Committee of National Institute for Research in Tuberculosis, Chennai had approved this study. The consent from the participants was obtained orally after briefing about the study.

2.3. *Follow-up*

Each person was followed up from 'Pongal' day to the date of registration/death/migration (a permanent resident who was moved to another region). The follow-up period was measured in person years (p-yrs). Each household was visited only once (at the time of registration only).

2.4. *VA*

VA is an investigation of chain of events, circumstances, symptoms and signs of illness leading to death, through an interview of the Head of the family or any other adult household member of the deceased. Supervisors were trained on VA methodology, which was developed in Tamilnadu and is being used in Sample Registration System (SRS) in India.[5] Specially trained supervisors conducted the VA. The instrument used was the standard form with addition of TB specific questions to collect past history of TB among the adult deaths irrespective of primary cause of death. The VA form consists of three separate sections. Section I deals with general information of the deceased and the respondent, section II is a semi-structured questionnaire to probe the nature of symptoms and signs the deceased had immediately preceding the death, and section III deals with the written narrative. The narrative was written in the local language as narrated by the respondent and included information on the symptoms in the order of occurrence, the nature of medical help sought, findings of investigation reports, and hospital diagnosis and records whenever available. The supervisors were non-medical graduates with knowledge of local language and trained in VA instrument. The respondents were the family members or close associates of the deceased. The average recall period was 354 days.

2.5. *Salient features of VA instrument*

VA is an epidemiological tool of proven value for determining cause-specific mortality. Open-ended narrative part is the most important factor in the classification of cause of death. This VA instrument had been well validated and could ascertain leading causes of death among the population. A standardized Symptom list was used as a filter to define additional probing questions related to a particular symptom and also to ascertain sufficient information on the symptoms of the illness prior to death if the respondent had difficulty in remembering any major symptom.[5–7]

2.6. *Quality control*

Five percent of household forms and VA forms were randomly selected and crosschecked by coordinators/supervisors and corrected information was considered whenever any discrepancies were found.

2.7. *Cause of death*

WHO recommends that all primary tabulations on causes of death should be based on the underlying cause of death. The underlying cause of death is defined as: ''The disease which initiated the chain of events leading directly to death or the circumstances of the accident or violence which produced the fatal injury.''