Original Research Article

Assessment of tuberculosis spatial hotspot areas among smear positive pulmonary tuberculosis patients attending JSS: a tertiary health care centre from Mysore district, South India

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ABSTRACT

Background: Tuberculosis (TB) is a disease of public health concern, with a varying distribution across settings depending on socio-economic status, HIV burden, availability and performance of the health system. In 2017, TB caused an estimated 1.3 million deaths (range, 1.2–1.4 million) among HIV-negative people, and there were an additional 300 000 deaths from TB (range, 266 000–335 000) among HIV-positive people. The current TB program reports are often compiled and reported at higher administrative units and there is limited information about the spatial distribution of the disease. Hence, we aimed to assess the spatial distribution and hot spot areas of the disease among the patients attending a tertiary care centre in Mysore over a period of 3 years.
Methods: This is a taluk based study, the spatial analysis and hot spot area identification was done by collecting the demographic data from the smear positive pulmonary tuberculosis patients attending JSS a tertiary care centre from Mysore district. Hot spot areas and areas with TB transmission are identified and estimated using GIS software tool. Distribution of TB incidence was mapped with the population density from 2016-2018.
Results: Spatial mapping of smear positive tuberculosis revealed that majority of cases were recorded from Mysore city followed by T. N. Pura and Hunsur taluk regions.
Conclusions: This study emphasized on finding hot spot areas and local clusters involved in TB transmission.

Keywords: Tuberculosis, Spatial distribution, Hot spot areas, GIS software

INTRODUCTION

Spatial analysis and demographical studies provides a framework to study the life style facilities of people, and is directly related to the effect of health among the people.[1] Hypothesis by Hippocrates around 2400 years ago states that the places we live is directly related to personal health. He stated very strongly that personal health depends on the air, water that we breathe and consume.[2] As a part of the health initiatives, the government and its partners had aimed to improve disparities in the health care system and integrated communication using information technology as a priority to elevate community health. Tuberculosis (TB) is an infectious disease which have been affecting and claiming lives of millions and is most commonly being observed in developing countries at the worst.[3] The magnitude and severity of the infection varies across several geographical settings, this may be due to low socio-economic status, poverty, other life style facilities like over-crowding, poor sanitization and other barriers such as inadequate health services and socio economic barriers.[4-8] Geographic Information System (GIS) is an advanced information system which has an ability to capture, store, analyse, manage and present demographic data. Overlaying of demographic data in form of layers

allows ease in interpretation of spatial results which is difficult with traditional research and other statistical analysis.[9,10] Tuberculosis with varying distribution and also a disease of public health concern, there is a limited information about the spatial distribution and hot spot regions across India. Hence, our study aimed to assess the spatial distribution and to find the hot spot areas among smear positive pulmonary tuberculosis patients attending our hospital from Mysore district, South India.

METHODS

Study area and setting

The present study was conducted as a taluk based study from Mysore, Karnataka state, South India, which is located at12.30°N 74.65°E and has an average altitude of 770 metres (2,526 ft) and is spread across an area of 128.42 km^2. The zone is divided into 7 districts with an estimation of 3 lakh population according to 2011 census and covers a geographic region of 6,854 square kilometres.

Ethical considerations

As the study is based on secondary data extraction and analysis available in the laboratory registers, waiver for the institutional ethical clearance was requested to the Institutional Ethics Committee (IEC) and the same was obtained.

Data collection and analysis

Smear positive pulmonary tuberculosis data diagnosed from our hospital during January 2017- December 2018 was considered. Demographic data of the patients was collected from case records and Hospital information systems. Demographic data with similar names and different locations were identified by linking their location codes and true address was found out. The whole data of the patients was crosschecked twice by investigators and co-investigators to rule out double entry of the patients details. The data was further segregated into taluk wise and the data from 7 taluks of Mysore district was geo-coded using the address of the patients and a point map was created and the same was aggregated to thematic map to know the hot spot areas with more number of cases, for which Arc GIS 10.2 software was used to prepare the thematic map.

RESULTS

A total of 497 smear positive pulmonary tuberculosis patients were recorded during the study period. From which 134 cases were excluded as they were recorded from neighbouring locations other than Mysore district and few among them were follow-up cases. Thematic mapping was done to the extracted data. The overall thematic map of smear positive pulmonary tuberculosis from Mysore district is prepared and presented as (Figure 1), and it observed that Mysore city has the most number of cases recorded followed by T.N. pura and Hunsur taluks. The remaining taluks showed moderate or low number of cases than compared to Mysore region. From results it is interpreted that Mysore city have recorded more cases. This might be because of availability of health care facilities in urban areas. The visual understanding of the map denotes clustering of cases in urban regions (Mysore) and sparse distribution of the cases in rural areas of the study area. The map (Figure 2) represents the situation of the infection/disease in study area and has been used to identify the area with hot spot regions with more number of cases recorded during the study period.
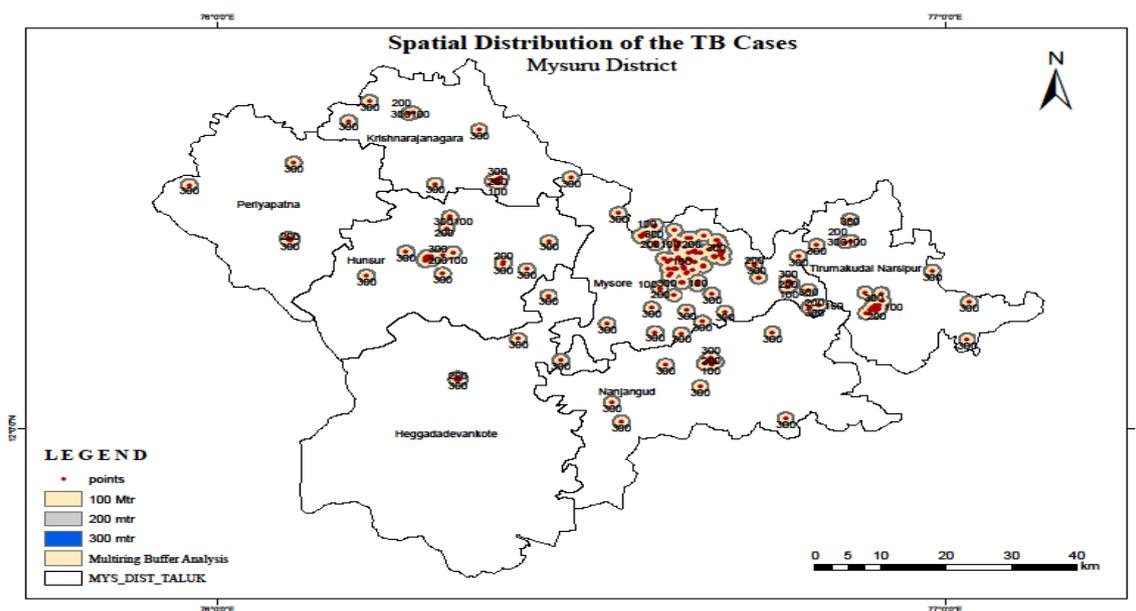

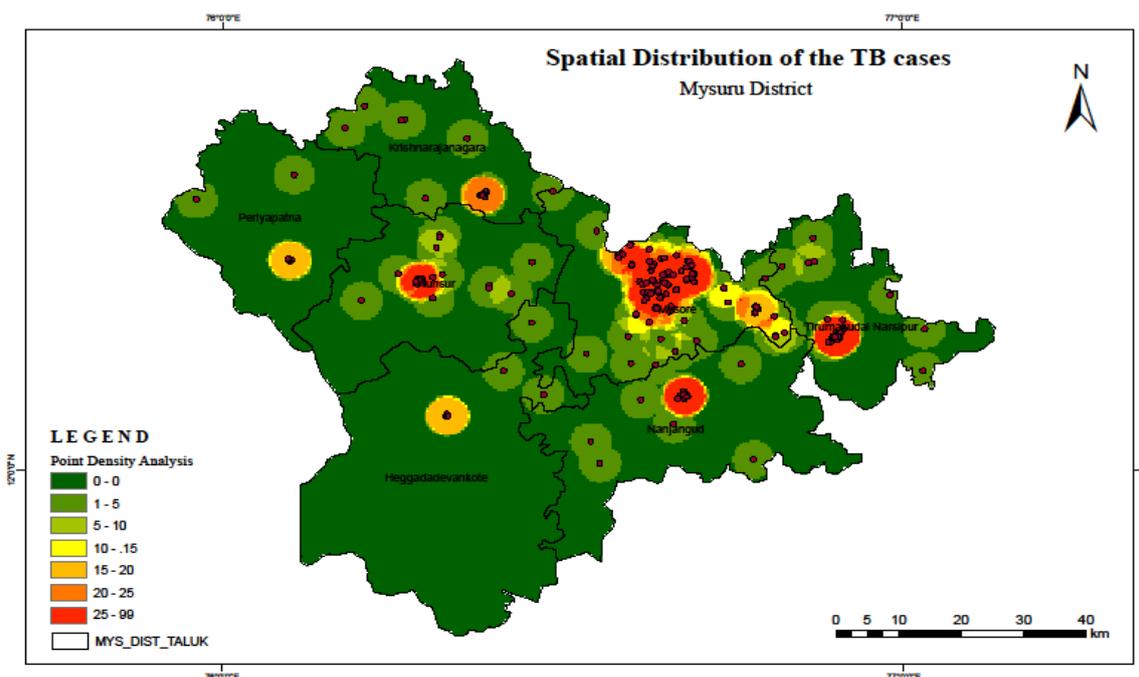**Figure 1: Point map of smear positive pulmonary TB cases.**

Figure 2: Hot spot regions of smear positive pulmonary TB cases.

DISCUSSION

Spatial mapping of a disease is directly proportional to human interventions. This method promotes scientific approach and temporal fluctuation of disease.

Procedural advancement in mapping technologies can easily be interlinked to the physical and social phenomenon of public health and the pattern of disease, its spread and intensity in a particular area and scale of time.[11] Our present study aimed to assess the hot spot areas in Mysore district with smear positive pulmonary tuberculosis patients by implementing Arc GIS 10.2 software. This study showed that distribution of smear positive pulmonary tuberculosis cases was highest in urban areas and less in rural areas when compared to urban areas. This might be because of availability of health care facilities in urban areas. This analysis would be really difficult, requires man power and also would require economical consumption if done with routine tracing methods or routine statistical analysis.

Moreover, the present study only analysed the significant clusters of TB, which were smear positive. Further more research is needed by focusing more on effects of socio-economic status and environmental factors for high number of clusters in particular regions. Disease prevalence is frequently associated with many aspects of socio-economic status, such as overcrowding, unemployment, low educational level, and poor housing quality.[12-16]

The disease spreading and the hot spot area analysis can be easily demonstrated using temporal analysis. Such type of studies can also help us to understand the growth of urban facilities and penetration of lifestyle into rural areas. Moreover, spatial clustering of TB was also associated with the migrant population, patient care factors and environmental factors.[12,17,18] After detecting the statistically significant clusters of TB in the region, a survey-based study is intended to identify the role of these factors in the spread of TB. Hence, from our findings we suggest that health authorities should better understand the hot spot areas should be given priority which would help in focused interventions and also strengthen TB surveillance.

Limitations

The major limitation of our study is it was not a population based survey and the data was extracted from the TB registry and hospital information system (HIS) based on the surveillance and regular diagnosis of smear positive pulmonary tuberculosis patients. Cases which were not either diagnosed or with delay diagnosis or smear negative but culture positive cases were missed.

CONCLUSION

We assessed the TB hot spot areas from Mysore district from the data extracted from smear positive pulmonary Tb patients and found a spatial variation. TB cases in our study was not uniformly distributed in our geographical setting and showed a non-random distribution. These findings can be further used by the authorities to guide TB control programs which would help to devise effective TB control strategies by concentrating the geographical areas with hot spot regions. Incorporating other factors such as socioeconomic factors and genotype of TB strains circulating in this geographical setting

would help us to understand the transmission dynamics and also the possible causes of high disease rates can be assessed.

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