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Research Article

Spatiotemporal Analysis of Tuberculosis Incidence in Tumakuru District, Karnataka, India

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Abstract

Tuberculosis (TB) is a standout amongst the most irresistible ailments. Despite the fact that it has been available for more than 5000 years, it is still a standout amongst the most vital general wellbeing issues. Tuberculosis is an illness brought about by a bacterium called Mycobacterium tuberculosis. Its rate has expanded and diminished after some time, yet it has dependably been a steady risk to general wellbeing. The aim of the study was to correlate the disease rate among the taluks of Tumakuru district and assess the rate of Tuberculosis infection. This study is enlightening for medical asset allotment and to have better concentrate on general wellbeing intervention strategies to control Tuberculosis epidemic. This study proposed to make use of an open source Quantum Geographic Information System (QGIS) for spatial analysis in order to investigate spatial patterns of Tuberculosis by the District Health and Family Welfare Office (DHO), Tumakuru to determine the distribution of tuberculosis epidemic among the taluks of Tumakuru district.

Keywords: Tuberculosis; Geographic Information System; Quantum Geographic Information System; Spatiotemporal; Epidemics.

Introduction

Tuberculosis (TB) is a respiratory infectious disease caused by the bacillus, Mycobacterium tuberculosis, which has been a global public health concern for decades. Tuberculosis is spread through the air when people who have active TB in their lungs cough, speak or sneeze [1]. Tuberculosis has emerged as possibly one of the contemporary threats to global development and security. According to WHO estimates, India has the world's largest tuberculosis epidemic. Tuberculosis is the most common HIV-related opportunistic infection. The changing parts of irresistible diseases rely on upon the spatial circulation of pathogens and hosts. The spread of irresistible pathogens from tainted to helpless hosts falloffs with expanding separation between people [2].

Geographic Information System data frameworks (GIS), worldwide situating and remote detecting have been progressively utilized as a part of general wellbeing since from 1990[3]. Recent areas of application of GIS methods in philanthropic crises include peril, susceptibility and risk assessments; quick appraisal and overview strategies; disease distribution and epidemic investigation; and program monitoring and assessment. The principle utilization of GIS in these ranges is to give maps to basic leadership and backing. GIS is additionally used to enhance information gathering in the field (for instance, quick wellbeing evaluations or ethical quality reviews) [4].

Spatial data refers to data that includes location. The common sources of spatial data are through CCTV cameras, satellite remote sensing, radar, sensor networks, etc. [5]. Spatial analysis is the procedure of looking at the areas, traits and connections of components in spatial information and other descriptive strategies keeping in mind the end goal to address a review or increase helpful learning. Spatial analysis extricates or makes new data from spatial information [6].

Spatiotemporal means belonging to both space and time or having both spatial and temporal qualities. Spatiotemporal data refers to the data which have both spatial dimension and

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temporal dimension. Analysis of spatiotemporal data is spatiotemporal analysis.

The investigation of ailment transmission is the examination of the cases, circumstances and final consequences of prosperity and illness conditions in portrayed masses [7]. The study of disease transmission is the foundation of the general wellbeing. The study of disease transmission prompts distinguishing variables of illness and focuses for preventive medicinal services. Epidemiology is the cornerstone of the public health. Epidemiology leads to identifying factors of disease and targets for preventive healthcare. Real zones of epidemiological study incorporate disorder transmission, outbreak examination and disease survey. The study of disease transmission has created approach utilized as a part of general wellbeing concentrates on and clinical examination.

The literature review begun by naming and describing tuberculosis and then establishing to illustrate the importance of studying the spatiotemporal distribution of TB to be investigated and possibly by others. This project was informed by spatial analysis and GIS developments and the need of information of interest to epidemiologist, to come up with user friendly GIS based model to capture, store, analyses, visualize and manage TB in Kitui County [4]. Decision making based on geography is basic to human thinking. As such, it should be appreciated that understanding of the geography and relationships of people to their location help to make informed decisions about human life [4]. Year insightful investigation of the spatiotemporal relationship of the geo-referenced information shows that the data acquired through such examination can add to more successful in spending plan assignment, drug dissemination and enlistment of human gifted assets, and also directing the outline of immunization projects. Consequently, the ebb and flow writing survey was directed to demonstrate the worldwide spatial and fleeting appropriation of TB and significance of exploration in regards to overall spatial and transient dispersion of tuberculosis in TB control programs [2].

In traditional approaches, the data is stored in hard copies. It is very difficult to maintain the hard copies of data. There are chances of data redundancy and loss of data. The major drawback of traditional methods of storing data in hard copies is that it consumes much time in storing and retrieving data from hard copies.

Methodology

The data is collected from individual organizations as well as from the database. The collected data will be stored in database. The data were obtained from DHO, Tumakuru for the period of 2013-2015. The data is given to a system enabled with GIS as input for processing and mapping (Figure 1). Processing includes spatial analysis and modeling. The results of processing are used for mapping. Mapping includes classification and generating of charts of infected patients. The generated outputs are used for visualization and these are helpful for decision makers.

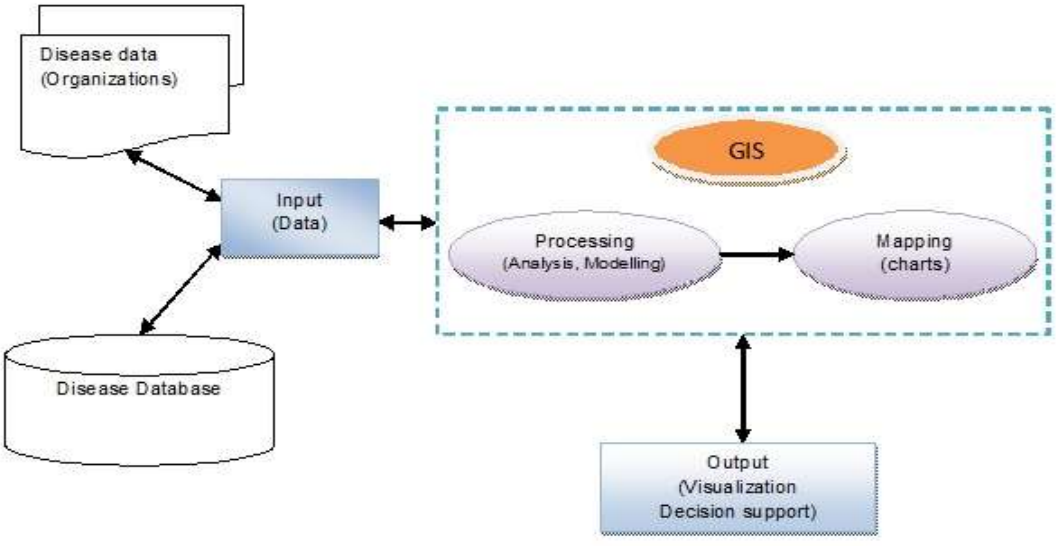

Figure 1. Architecture of proposed framework

Results and discussion

Spatiotemporal analysis for the percentage of people cured from 2013-2015

Figure 2 depicts the spatiotemporal analysis of people cured for the period 2013-2015. The percentage of Cured people in all taluks is increasing for the period of 2013 – 2015. Tiptur taluk has highest percentage of Cured people among all the taluks.

Spatiotemporal analysis for the percentage of people died from 2013-2015

Figure 3 interprets percentage of people died from 2013-2015. The percentage of Died people in all taluks is increasing for the period of 2013 – 2015. Tumakuru taluk has highest percentage of died people among all the taluks.

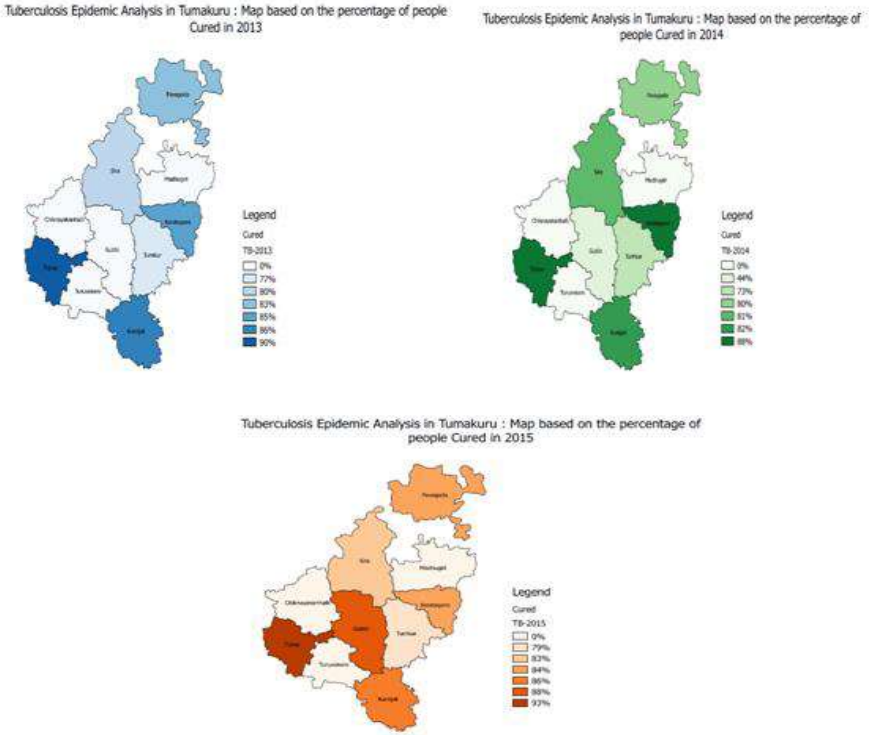

Figure 2. Spatiotemporal Analysis for the percentage of people Cured from 2013-2015

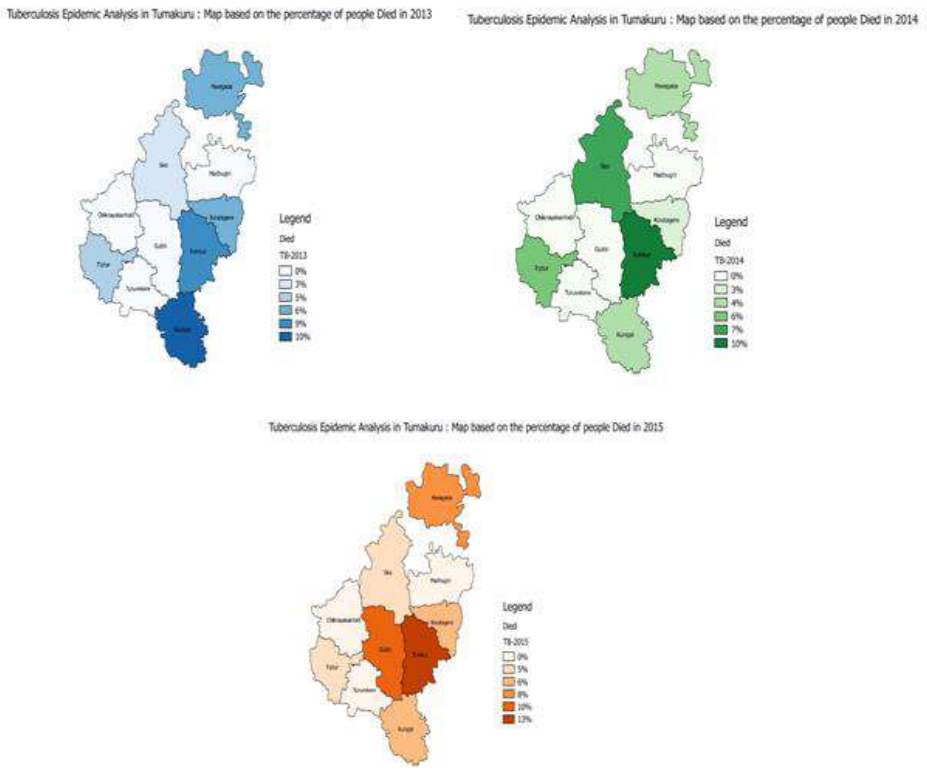

Figure 3. Spatiotemporal analysis for the percentage of people died from 2013-2015

Spatiotemporal Analysis for the number of Suspects examined from 2013-2015

Figure 4 interprets analysis of number of suspects examined from 2013-2015. The number of Suspects examined in all Koratagere, Kunigal, Pavagada and Sira taluks is decreasing for the period of 2013 – 2015. In Tumakuru and Gubbi taluks the number of Suspects examined is increasing for the period of 2013-2015. Tumakuru taluk has highest number of Suspects examined among all the taluks.

Spatiotemporal Analysis for the number of Total cases detected from 2013-2015

Figure 5 depicts the analysis of number of total cases detected from 2013-2015. The number of Total cases detected in all taluks is decreasing for the period of 2013 – 2015. Tumakuru taluk has highest number of Total cases detected among all the taluks.

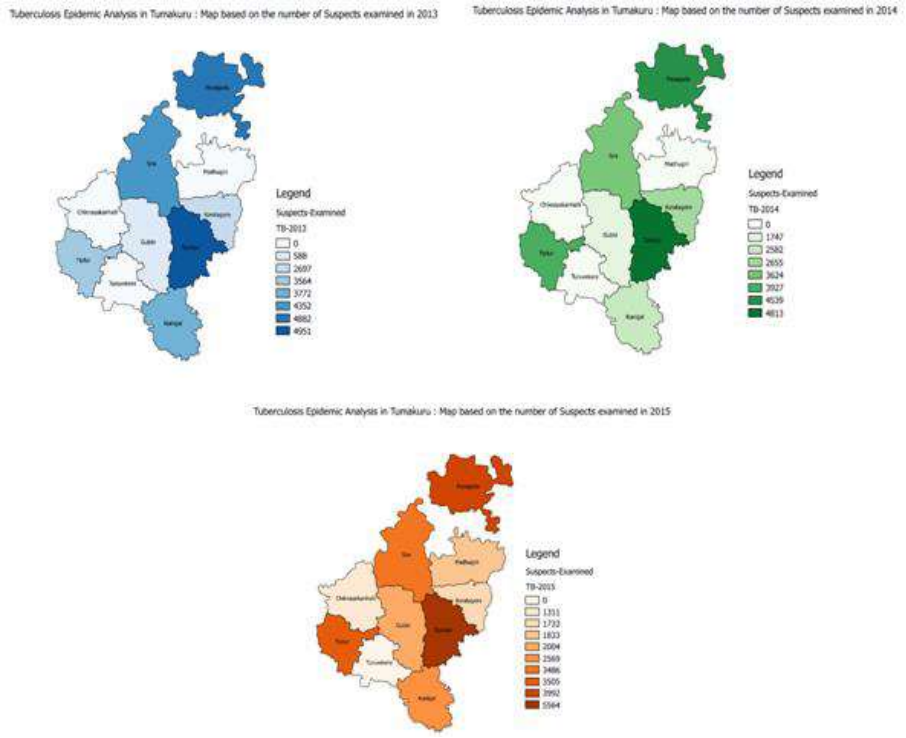

Figure 4. Spatiotemporal analysis for the number of Suspects examined from 2013-2015

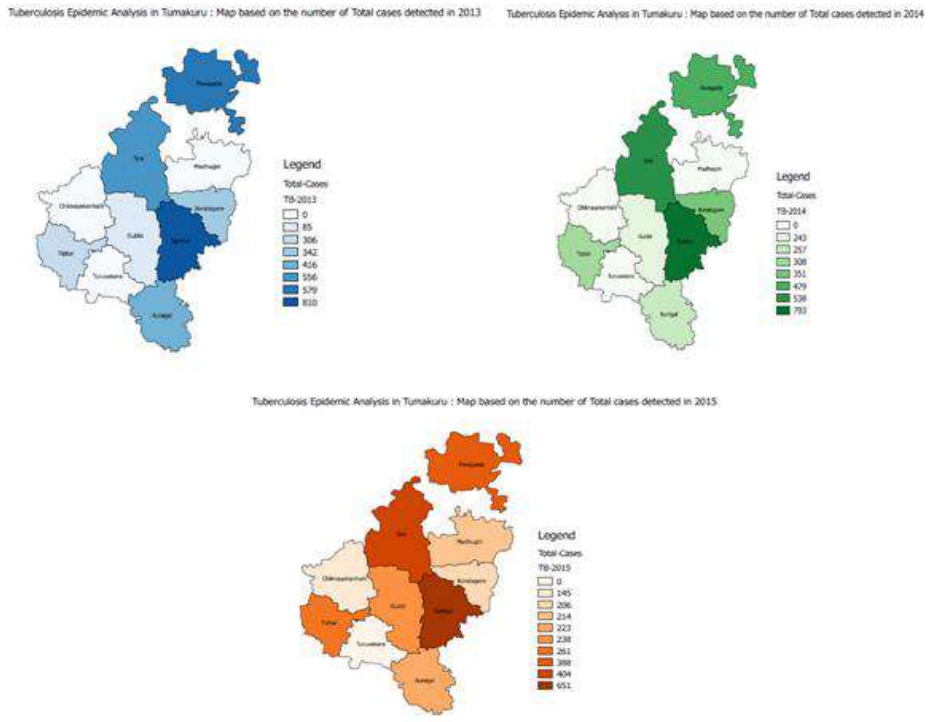

Figure 5. Spatiotemporal analysis for the number of Total cases detected from 2013-2015

Spatiotemporal Analysis for the number of people Diagnose Positive from 2013-2015

Figure 6 interprets the analysis of number of people diagnosed positive from 2013-2015. The number of people diagnosed Positive in all taluks is decreasing for the period of 2013 – 2015. In the year 2013, Pavagada taluk has highest number of people diagnosed Positive. In the next consecutive years i.e., 2014 and 2015, Tumakuru taluk has highest number of people diagnosed Positive.

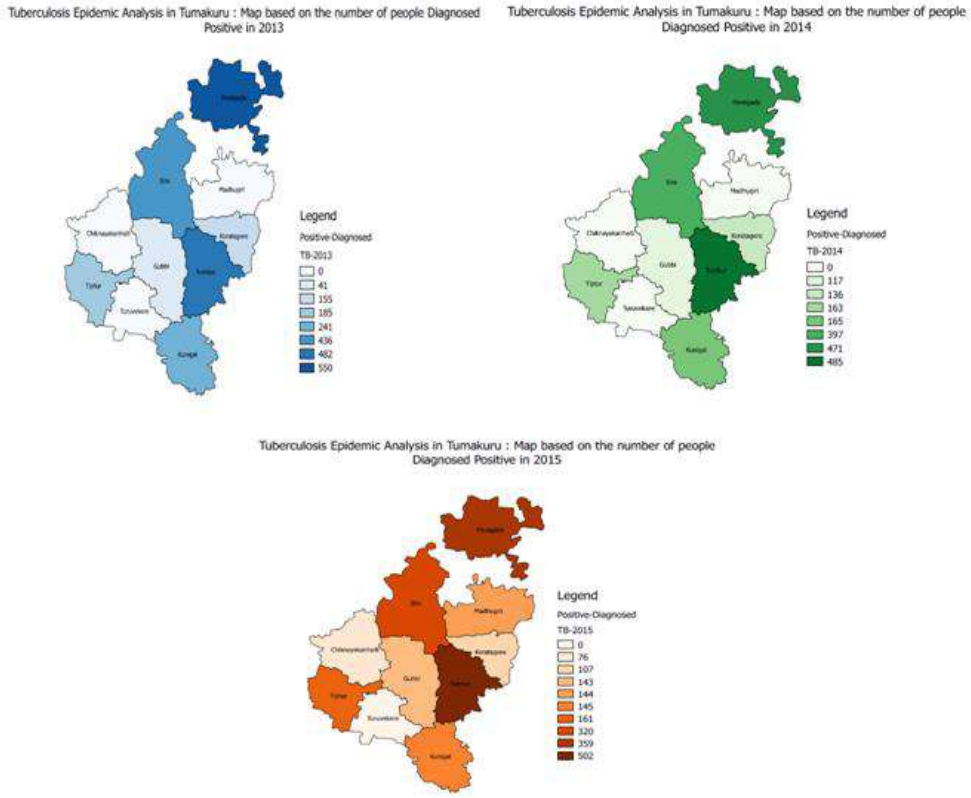

Figure 6. Spatiotemporal Analysis for the number of people Diagnose Positive from 2013-2015

Conclusions

The importance of using Geographic Information System (GIS) in this study will visualize the spread of disease to control its epidemic moves around Tumakuru district with respect to location and time. It also supports decision makers and health practitioners to bring a relocate from conventional approaches to a new technology empowered with public health care system. The expansion of medical informatics, declining cost in computer systems and accessibility of medical geo-referenced data are integrated with GIS technology to visualize the spatiotemporal analysis of Tuberculosis (TB) Epidemiology in Tumakuru district. The proposed system will estimate the probability of TB progression in infected patients, to understand the natural history of Tuberculosis disease for developing the guidelines to establish the treatment and care. It also helps in prioritizing and allocating resources for health services, especially in developing countries.

Conflicts of Interest

Authors declare no conflict of interest.

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