

Spatio-temporal analysis of Dengue and Chikungunya Disease Mapping in Coimbatore District, Tamil Nadu, India

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Abstract

Dengue is a disease caused by any one of four closely related viruses (DEN-1, DEN-2, DEN-3, or DEN-4). Chikungunya is a viral infection that is transmitted to humans by mosquitoes carrying the chikungunya virus. The district is located at North Latitude between $10^{\circ} 10'$ and $11^{\circ} 30'$ and East Longitude between $76^{\circ} 40'$ and $77^{\circ} 30'$. The region is bounded by Kerala state on the West and is surrounded by Tirupur, Nilgiris, and Erode districts. The main objective stands to study Spatio-temporal analysis of Dengue and Chikungunya Disease Mapping in Coimbatore District. A 'Z' score can be positive or negative indicating whether it is above or below the mean and by how many standard deviations. The main result of this study is The chikungunya was highly affected in the year of 2015 (2.5). The dengue was highly affected sultur block in the year 2015 (2.7) and thus the fever was lowly affected in Anamalaiand Sulthanpet block in the year 2019 (-1).

Keywords: 1. Health 2. Dengue 3. Chikungunya 4. 'Z' Score

Introduction

Disease that results from an infection transmitted to humans and other animals by blood-feeding arthropods, such as mosquitoes, ticks, and fleas. Examples of vector-borne diseases include Dengue fever, West Nile Virus, Lyme disease, and malaria. Chikungunya is a fever caused by Chikungunya virus transmitted by *Aedes aegypti* mosquitoes which breeds in clean water stagnation in artificial containers. Dengue (pronounced den' gee) is a disease caused by any one of four closely related viruses (DEN-1, DEN-2, DEN-3, or DEN-4). The viruses are transmitted to humans by the bite of an infected mosquito (*Aedes aegypti*). The *Aedes aegypti* mosquito is the vector of dengue/DHF. It is estimated that there are over 100 million cases of Dengue worldwide each year. Chikungunya is a viral infection that is transmitted to humans by mosquitoes carrying the chikungunya virus. The mosquitoes responsible for spreading the disease are *Aedes aegypti* and *Aedes albopictus*. The main symptom is a sudden onset of fever, often accompanied by joint pain.

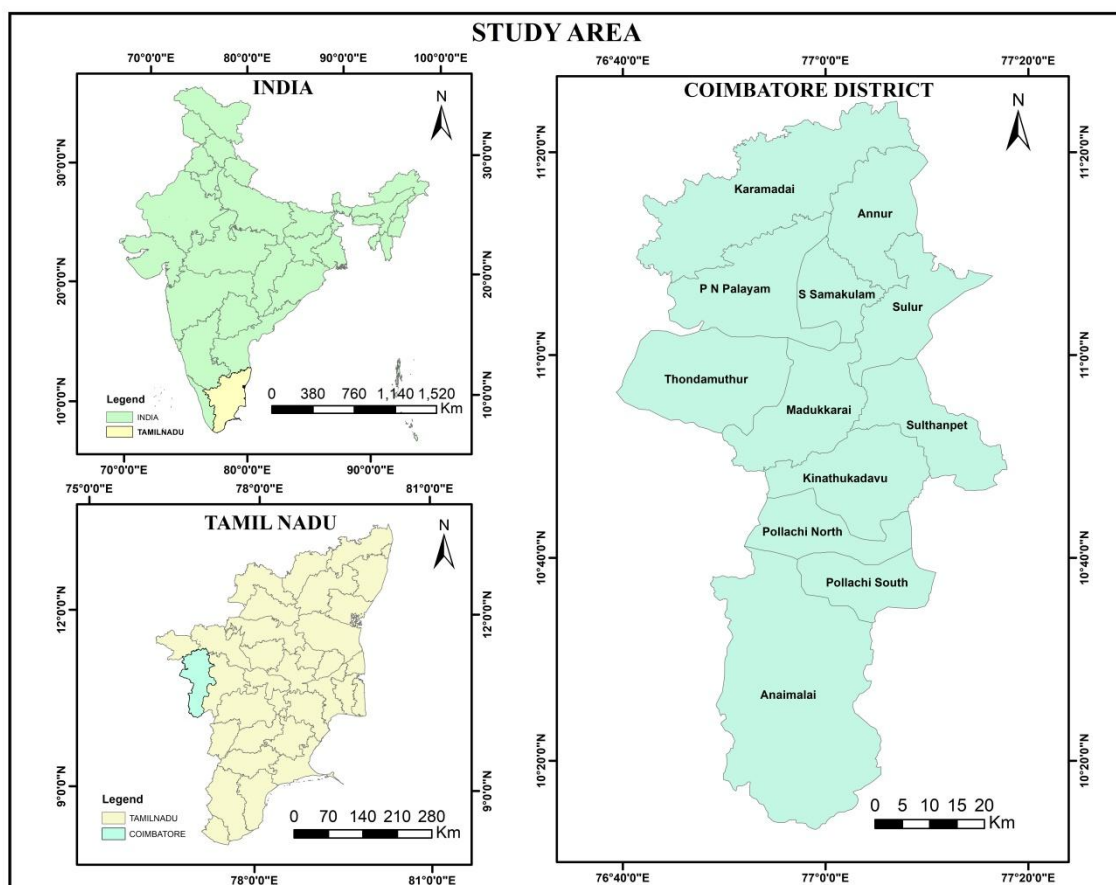
Study Area

Coimbatore is the third largest district of the state, one of the most industrialized cities in Tamil Nadu, known as the textile capital of South India or the Manchester of the South India. Coimbatore, District is situated on the banks of river Noyyal between $11^{\circ} 00'$ of north latitude and $77^{\circ} 00'$ of East longitude. In the rain shadow region of the Western Ghats, Coimbatore enjoys a very pleasant climate all the year round, aided by the fresh breeze that flows through the 25 kms long Palakkad gap. The rich black soil of the region has contributed to Coimbatore's flourishing

agriculture industry and, it is in fact the successful growth of cotton that served as a foundation for the establishment of its famous textile industry. The first textile mill came as far back as 1888 after that many textile mills were started and provided many employment opportunities to within as well as neighbouring Districts. The result has been a strong economy and a reputation as one of the greatest industrial cities in South India.

In 2011, Coimbatore had population of 3,458,045 of which male and female were 1,729,297 and 1,728,748 respectively. In 2001 census, Coimbatore had a population of 2,916,620 of which males were 1,482,228 and remaining 1,434,392 were females. Coimbatore District population constituted 4.79 percent of total Maharashtra population. In 2001 census, this figure for Coimbatore District was at 4.67 percent of Maharashtra population. There was change of 18.56 percent in the population compared to population as per 2001. There are more than 25,000 small, medium, large scale industries and textile mills are situated. Coimbatore is also famous for foundry and automobile industries, manufacturing of textile industry equipment's, spares, motor pump sets, wet grinders and varied engineering goods and services.

Figure 1



Objectives of the study

Keeping in view the domain of research, following objectives have been set up for the present study:

- To study the spatial pattern of primary health centres in the study area.

- To examine the Spatio-temporal analysis of Dengue and Chikungunya Disease Mapping in Coimbatore District.

Methodology and Data Base

The main source of data is based on the secondary data available from district directorate office. The demographic characteristics and other variables are collected from Tamil Nadu census data. The base map particulars and related information were gathered from Coimbatore corporation office.

Methodological Interpretation of ‘Z’ Score

A ‘Z’ score is a statistical measurement of a score’s relationship to the mean in a group score. A ‘Z’ score of a means the score is same as the mean. A ‘Z’ score can be positive or negative indicating whether it is above or below the mean and by how many standard deviations. ‘Z’ score can also be explained as in addition to showing a score’s relationship to the mean, the ‘Z’ score shows statistician data set. ‘Z’ scores also allow the analyst to convert scores from different data sets into scores that can be accurately compared to each other. One real life application of ‘Z’ score is a usability testing.

Statistics is the branch of science that deals with collection, sorting and arrangement of data in such a way as to derive an influence regarding the subject of investigation. Various tools of mathematics are employed to form hypothesis from the collected data and desired conclusions from this hypothesis. Standard scores are also known as ‘Z’ scores, Z values, standard variables and normal score are numerical figures that indicate the number of standard deviations, above or below, that a particular observation has with relation to a given mean value.

‘Z’ score is arrived at by calculating the difference between the original datum (raw score) and the mean of the given population sample. For this the population mean is deducted from the raw score and the difference so derived is divided by the standard deviation of the population. The Z score formula is as follows.

$Z = \frac{x - u}{\sigma}$, Where

X = raw score

U = mean of the given population sample

σ = standard deviation of given population sample.

Intra-Regional Variation of Dengue and Chikungunya Disease in Coimbatore District- ‘Using Z’ Score Analysis

The present study is the incidence of Vector Borne Diseases in the blocks of Coimbatore District from the year of 2015 and 2019. The analysis exhibited that within the study area, it is possible to identify areas of higher, moderate and low incidence. Further, the temporal dimension also has made a value of “Z” score. Such spatial variations in the incidence of these diseases as well as the intensity of vulnerability of an area to the disease have to be taken into account for any planning of control measures. The analysis makes it clear that a common approach of control measures for the study area or the District as a whole may be ineffective. On the other hand, region specific control measures could help better control of the disease.

Chikungunya and dengue fever

Table1

Sl. No.	Name of the Block	Chikungunya		Dengue Fever	
		2015	2019	2015	2019
1	Karamadai	-0.6	-0.4	-0.1	0.4
2	S.S. Kulam	-0.6	-0.4	-0.7	0.4
3	Madukkarai	2.5	2.1	0.6	0.6
4	Kinathukadavu	-0.6	-0.4	-0.7	-1.0
5	Pollachi North	-0.6	-0.4	-0.7	-1.1
6	Pollachi South	-0.6	-0.4	0.4	-0.6
7	Anamalai	-0.6	-0.4	-0.3	-1.0
8	Thondamuthur	-0.6	-0.4	-0.3	0.3
9	P N Palayam	1.3	-0.4	0.6	0.4
10	Sulur	0.7	2.1	2.7	2.3
11	Sulthanpet	-0.6	-0.4	-1.1	-1.0
12	Annur	0.1	-0.4	-0.5	0.4

Source: District Health Office, Coimbatore

Figure 2

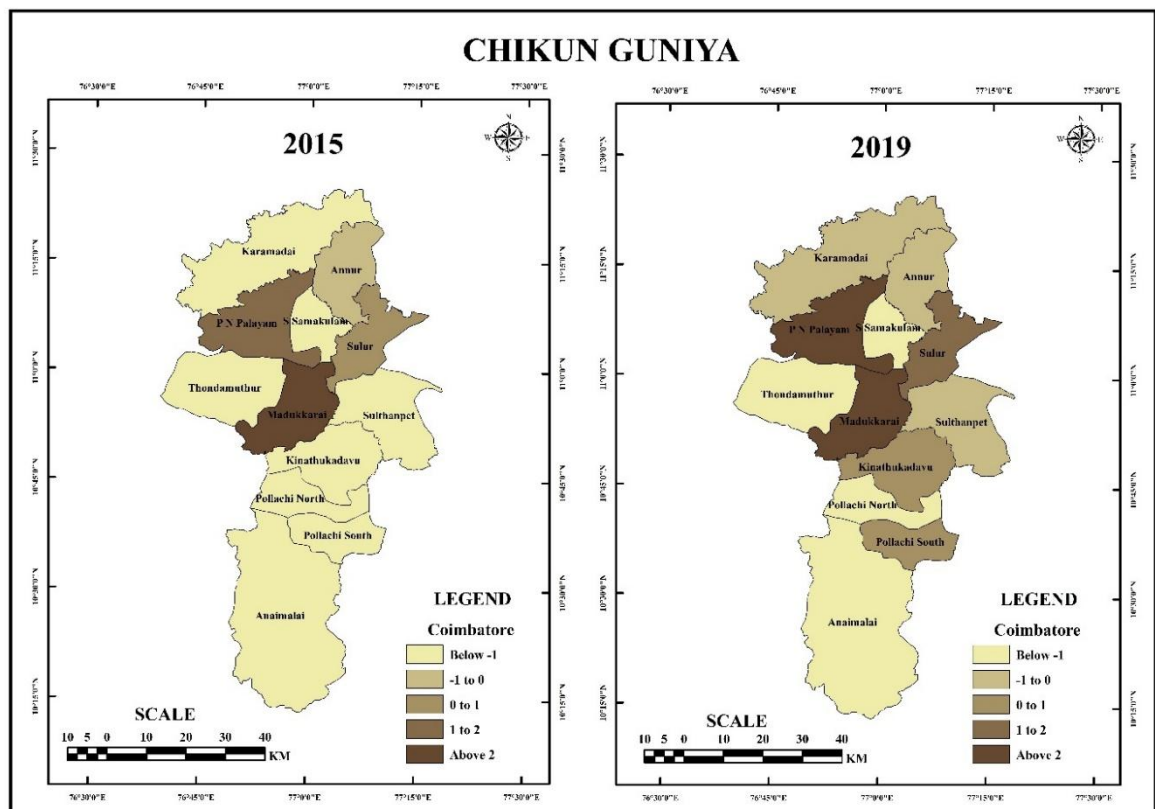
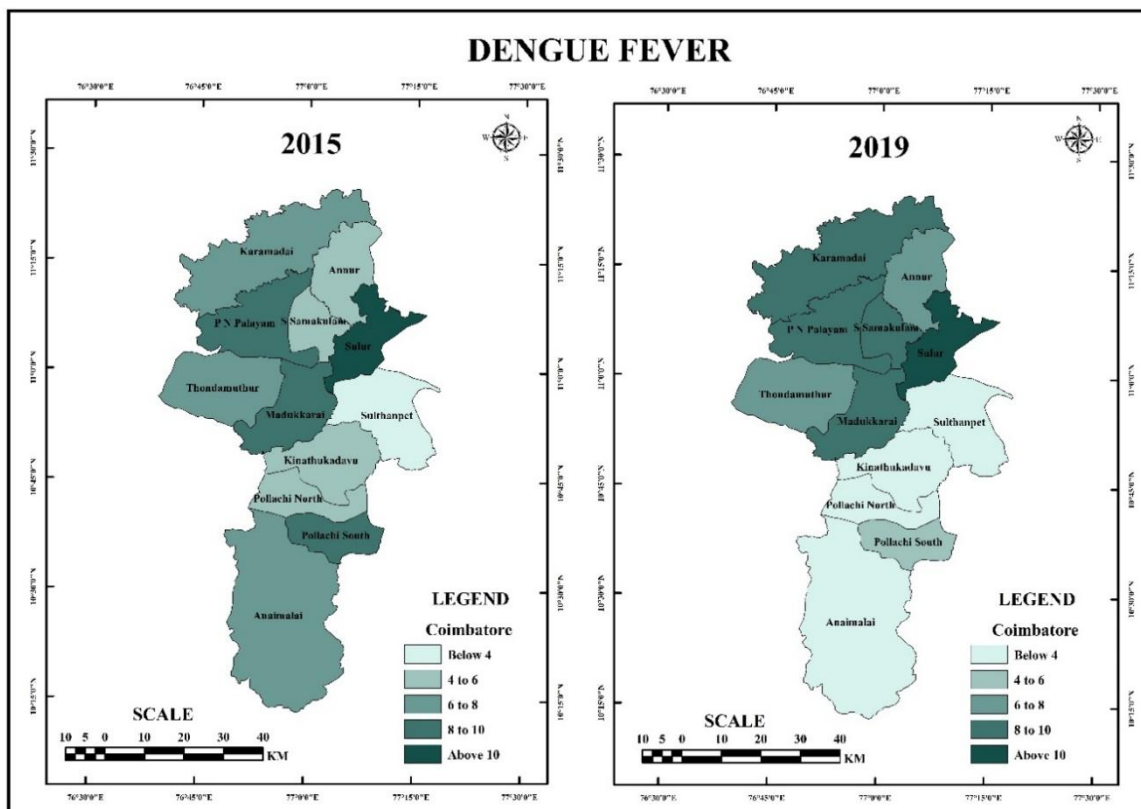


Figure 3



Result and discussion

According to the “Z” score value of chikungunya was highly affected in Madukkarai (2.5) and thus the chikungunya was moderately affected in Sular (0.7) on the lowly affected in the other blocks of -0.6 “Z” score value in the year of 2015.

And the chikungunya was highly affected in Madukkarai (2.1) and Sular (2.1) on the other blocks are lowly affected blocks (-0.4) at the same time the “Z” score value is not affected in the year of 2015 and 2019.

“The chikungunya was highly affected in the year of 2015 (2.5)”

According to the “Z” score value of dengue fever was highly affected in Sular (2.7), in the year of 2015 and thus the fever was lowly affected in S.S.Kulam, Kinathukadavu, Pollachi North (-0.7) and moderately affected in Madukkarai (0.6) P.N.Palayam (0.6) in the year of 2015.

According to the “Z” score value of dengue fever was highly affected in Sular (2.3) in the year of 2019, thus the fever lowly affected in Pollachi North (-1.1) and other blocks are affected in moderately (0.4).

“The dengue was highly affected Sular block in the year 2015 (2.7) and thus the fever was lowly affected in Anaimalai and Sulthanpet block in the year 2019 (-1)”

Conclusion

The research findings indicated that the distribution of dengue and Chikungunya Disease cases in Coimbatore District is spatially varied. The highest concentration of cases is observed in the urban areas. Particularly in Sular and Madukkarai blocks have high concentration of these diseases. This can be attributed to the settlement patterns of the population, such as the use of water and plastic

containers for water storage, which create breeding grounds for mosquito larvae. By examining in this study area we can identify some difficulties in the distribution of Dengue and Chikungunya Disease. Healthcare facilities are not increasing with the population, this create gap between ratio of population and health centre facilities.

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