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Geo-ecological association of dengue disease in Madurai city–using multivariate analysis

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Abstract
Dengue is one of the important diseases in tropical countries like India. The study is to analyze the Geo ecological relationship of dengue in Madurai city, especially ecological and its association with selected socio-economic, environmental, behavioral and medical aspects. The data collections were taken by using the method of stratified Random sampling and a total of 600 questionnaire samples. The data was analyzed by multi variant statistical technique 'Factor analysis' is used to find the major dimensions and interrelationship between dengue and geo ecological variables. The main objective is to analyze the geo-ecological variation and associated factors about the prevalence of dengue. The study identified 14 major dimensions with a total percentage of 75.7. The major findings of the study is that house hold cement containers, plastic containers, and open containers etc.; used for storing drinking water are the main breeding centers of mosquitoes and the increasing or decreasing rate of dengue depends upon on the type of surrounding environment.

Keywords: Geo ecological variables-multivariate analysis-factor dimension

1. Introduction
Health is one of the vital indicators of social wellbeing of the people and a long derivative of socio economic development of a city. The vicious circle of a disease could also be understood in relation to low production, poverty, poor health service, and low income over and under nutrition, malnutrition [1, 2, 3 4]. They not only pose a problem of health and disease but are also responsible for deterioration of social welfare and social deprivation [5, 6]. Hence the present study is an attempt to describe Madurai city in terms of ecological aspects of dengue and to analyze the major dimensions of the disease with reference to dengue and its association with selected socio-economic and environmental factors.
Dengue virus (DENV) is the cause of the most important arthropod-borne viral infection on humans, around the world, particularly tropical and subtropical regions [7]. Dengue is considered a serious health problem; moreover demographic changes, the rapid urbanization and global travel has promoted the appearance of this disease in new geographic regions [8].
Mosquitoes have become a great nuisance and they transmit many disease causing pathogenic microbes. Reduction of mosquitoes and related problems could be very much possible as the eradication of these pestiferous insects is not possible
Dengue is spread through the bite of the female mosquito (*Aedes aegypti*) [9]. The mosquito becomes infected when it takes the blood of a person infected with the virus. After about one week, the mosquito can then transmit the virus while biting a healthy person. The mosquito can fly up to 400 meters looking for water-filled containers to lay their eggs but usually remains close to human habitation [10]. *Aedes aegypti* is a daytime feeder: The peak biting periods are early in the morning and in the evening before dusk.
Dengue cannot be spread directly from person to person. However, a person infected and suffering from dengue fever can infect other mosquitoes. Humans are known to carry the infection from one country to another or from one area to another during the stage when the virus circulates and reproduces in the blood system.
Aedes aegypti has evolved into an intermittent biter and prefers to bite more than one person during the feeding period. This mechanism has made *Aedes aegypti* a very highly efficient epidemic vector mosquito [11].

The mosquitoes thrive in areas close to human population (urban areas) [12, 13, 14, 15]. Dengue mosquito lays its eggs in water-filled containers inside the house and surrounding areas of dwellings [16]. (this includes non-used bottles, containers, discarded waste, tyres etc. which hold water). Adult mosquitoes "usually" rest indoors in dark areas (closets, under beds, behind curtains). Here it is protected from wind, rain and most predators, which increases its life expectancy and the probability that it will live long enough to pick up a virus from one person and pass it on to the next.

Dengue Fever (DF) and *Dengue Hemorrahagic Fever* (DHF) are acute febrile diseases found in the tropics and caused by four closely related virus sero types (DEN-1, DEN-2, DEN-3 and DEN-4) of the genus *Flavivirus*, family '*Flavi viridae*' [17]. It is also known as 'Break bone fever', transmitted to human by *Aedes aegypti* and also by *Aedes albopictus* [18].

Dengue virus (DENV) – mainly transmitted by the *Aedes aegypti* mosquito – is the most common mosquito-borne viral infection worldwide. Severe dengue can be fatal if not properly treated, and every year about 25,000 patients die from dengue infection [19]. *Aedes aegypti* and *Aedes albopictus* are the principal vectors responsible for Dengue

[20].

The technique used in this context is the well known multivariate statistical technique known as "Factor Analysis". There are many health related papers published using Multivariate analysis [21, 22, 23, 24, 25]. Very few papers published relate to vector borne diseases and health care delivery systems (26, 27, 28). The major objectives are

1. To identify the disease related geo ecological environmental conditions. 2. To analyze socio economic and environmental factors of patient's environment and their perception to health care 3. To derive a conceptual framework towards strengthening the foundation for Integrated health care system.

2. Study Area
Madurai city lies between $9^0 50'$ and $10^0 10'$ of North latitude and from $77^0 55'$ and $78^0 30'$ of East longitudes. It has a geographical area of 384,680 hectares and forms a part of the fertile plain of river Vaigai, which runs in the North-West to South-East direction through the city (Fig: 1) For the present study, the study area has to be further subdivided into micro units so as to bring out the spatial differentiation.
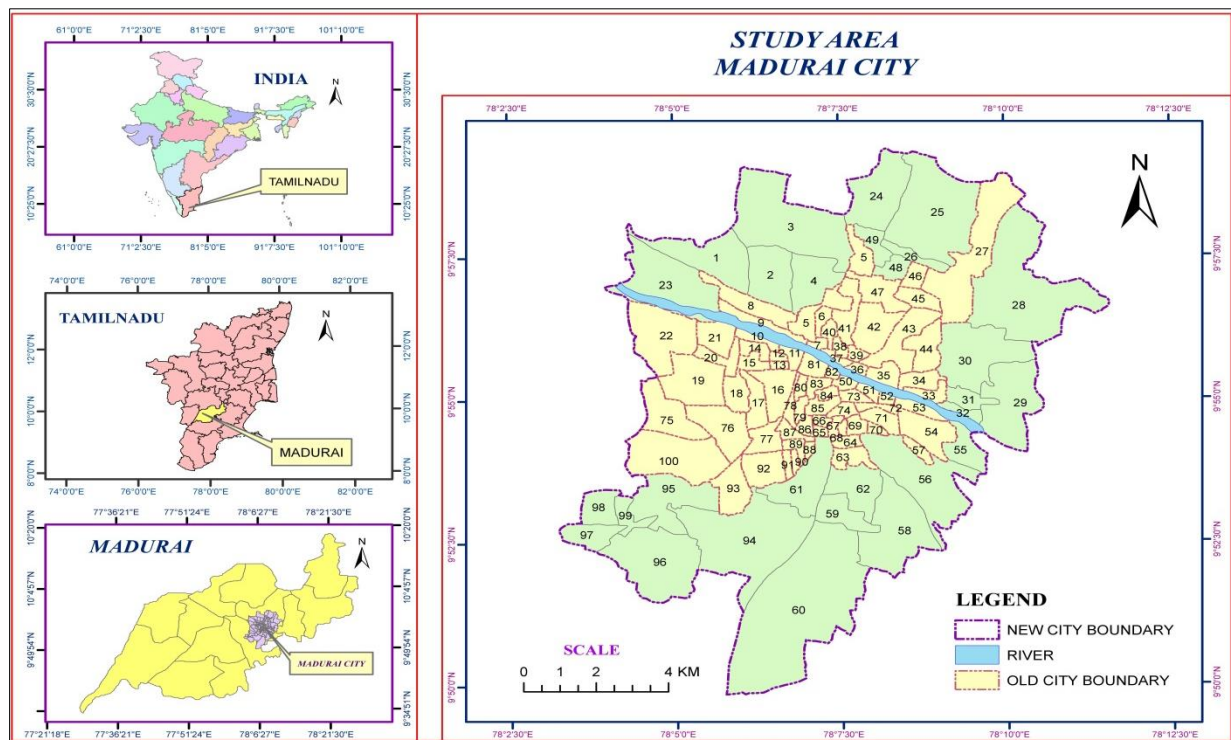

Fig 1: Ward wise boundary of Study area

3. Material and Methods
3.1 Data Collection
The primary data collected for the purpose of this paper was done in the form of questionnaire survey in selected wards of the study area. The patient address was collected from leptospirosis clinic. The data collected were taken by using the method of stratified Random sampling and a total of 600 questionnaire samples were drawn. The primary data in the present study is based on direct Questionnaire schedule method.

The secondary data was mainly collected from Leptospirosis Clinic (Madurai West Zone). The data collected from the above institution are, ward wise - Vector borne disease and

Zoonotic disease between 2009 and 2015. Madurai health profile was collected from the Directorate of Health Department.

3.2 Data analysis and techniques used
The data collected from the questionnaire were coded and transferred into coding sheets for the purpose of deriving the variables and also to carry out the analysis. The present study is to identify the major dimensions for socio cultural, socio economic behavioral characteristics of the patients, and preventive behavior.

The technique used in this paper is the well-known multivariate statistical technique known as "Factor Analysis".

Interco relation matrix was derived in factor analysis, so as to explain the interrelation between variables and the matrix and factor solution matrix was derived using the varimatrix rotation procedure. The result of factor analysis may be synthesized and brought out in the form of tables by naming the dimensions suitably on the basis of high factor loading.

4. Results and Discussion
The inter correlation matrix was subjected to identify 14 major dimensions from a factor structure matrix "38" × "14". This factor loading matrix identified 14 major dimensions with a total percentage of 75.7. (Table 1) The first dimension is on the Source of Drinking water and Disease transmission, that explained a total variance 9.95 with an eigen value of 3.68 and this is designated as the primary dimension of the study (Table 2)

The first 10 factors explained more than 62.5 percent of total variance. The remaining four factors explained only 13 percent of total variance. The second factor with an eigen value of 2.98 explained a total variance of 8.06. The third factor with an eigen value of 2.83 explained a total variance of 7.66.

The factor loadings represented in the table show the variables with their respective loadings. The variance is accounted by each parameter with respect to all factors. The table on primary dimension and each factor dimension shows only the variables significant to their respective factors.

The dimension name report is based on particular dimension with positive and negative factor score value. The study discusses about each dimension variables and named *viz*. I. Source of Drinking Water and Disease Transmission, II. Socio-Economic Status Determining the Health Status, III. Frequency of accessibility to Medical treatment, awareness and Spreading of Disease, IV. Role of Educational Status on Regularity of Treatment etc. (Table 1). The name of dimensions are highly responsible for the incidence of dengue in Madurai city.

4.1 Dimension I: Source of Drinking Water and Disease Transmission
The first dimension is on Source of drinking water and disease transmission explains a total variance of 9.95 with an Eigen value of 3.68. The parameter taken for Drinking water analysis includes source of water, types of containers used and duration of water availability. The main reason for spreading of disease through water is shown in the (Table 2). Most of the population takes water from street pumps under unhygienic environmental conditions. Most of them store water in plastic and silver vessels. The containers are not closed properly.

Table 1: Factor Solution: The Eigen Values and the Total Percentage Variance Explained by Each of the Twelve Factors

Factor No	Name of the Dimension	Eigen value	Percentage Variance	Cumulative percentage
1	Source of Drinking water and Disease transmission	3.68	9.95	9.95
2	Socio-economic status determining the Health status	2.98	8.06	18.1
3	Frequency of Accessibility to Medical Treatment Awareness and spreading of Disease	2.83	7.66	25.7
4	Role of Educational status on Regularity of Treatment	2.61	7.04	32.7
5	Sources of spreading Diseases	2.23	6.04	38.8
6	Types of treatment	2.1	5.66	44.4
7	Number of Rooms in the House	1.94	5.25	49.7
8	Relationship between hygiene and causality	1.73	4.67	54.3
9	Cost of Treatment	1.57	4.25	58.6
10	Mosquito bites and Domestic animals	1.45	3.92	62.5
11	Awareness about Disease	1.37	3.69	66.2
12	Mosquito problem	1.29	3.49	69.7
13	Causes of Disease	1.19	3.21	72.9
14	Quality of Drinking water	1.05	2.83	75.7

These are the reasons for the increase in mosquito breeding eggs in fresh water. The duration of Boiling water (-0.42) are negatively loaded because the people in the study area are not aware of using boiled water, and the fuel cost are very high so that they are not able to boil the water. The people in the regions are economically very low and are not able to buy purified water from outside. This dimension is named as "Source of drinking water and transmission."

4.2 Dimension II: Socio-Economic status determining the health status
The variables grouped in the second dimension reveal an eigen value of 2.98 and variance (8.06). This factor contains 12 variables with positive and negative loadings. (Table 3)
The income status of the people in the region is (-0.52) very low that the loading shows a negative correlation. The income status determines the living standard of the people. Income status decides the type of treatment and amount spent for treatment. The economic status of people in the study region is too low for treatment and medicines [29].

High positive loading on Usage of water in container (0.33) and type of containers (0.39), reflect the sources of major breeding sites of mosquitoes and spreading of the disease. Most people live in compound houses and most of them use common toilets (0.34) under unhygienic condition. The type of the toilet decides the economic status. So the dimension is named as "Socio-economic status determining the health status.

4.3 Dimension III Frequency of accessibility to medical treatment, awareness and spreading of disease
This factor contains 15 variables with positive and negative loading explaining as much as 7.66 of total variance with an eigen value of 2.83.(Table 4)
Season and disease prevalence are highly variable (0.58) in the present study and the duration is one week to fifty days and mostly affects children below 15 years of age. In Madurai city the medical facilities are available in GH, PHC, and

Private hospitals. So people can get treatment frequently when they get affected. So the accessibility of location for treatment is proved. [30] Most of the people are now aware of vector borne diseases (0.42). Study area people use unhygienic water from public taps and hence consume infected water. So they cannot protect themselves from the disease. Corporation has not taken any steps to eradicate mosquitoes through spraying insecticides.

The People do not have any awareness of taking preventive vaccines. Hence the dimension is termed as "Frequency of accessibility to medical treatment awareness".

4.4 Dimension IV Role of educational status on regularity of treatment

Dimension four has an eigen value of 2.61 and the percent of

variance is 7.04. (Table 5) The frequency of treatment among the people is interrelated with educational status (0.51). The age structure patterns among the causalities reveal that (0.44) the disease affects mostly the age group below 15 years.

While looking at sex ratio (0.39) males are mostly affected because they travel out and drink water from outside than females. The environmental surroundings are negatively loaded because of environment pollution and low standard of living like slums area, congested habitats, and unhygienic area. Number of water containers and occurrence of mosquitoes have a positive loading because mosquito breeding takes place with improper storing of water in old cement containers, iron drums, uncovered jars. These are the main reasons for mosquito breeding and educational status determines the regularity of treatment.

Table 2: Sources of Drinking Water and Disease Transmission

Variable Number	Variable Name	Factor loading
3	Marital status	0.47
8	Environmental surroundings	0.34
10	Drinking water sources	0.79
11	Duration of getting water	0.79
12	Using of container facility	0.57
16	Disposing of house waste	0.33
22	Duration of mosquito problem	0.47
23	Aware of vector-borne disease	0.38
24	Initial symptoms of disease	0.55
26	Accessibility of location in treatment	-0.33
30	Spending for the treatment	0.33
33	Experience of after treatment	-0.34
35	Boil the water	-0.42
Eigen Value: 3.68 Percentage of variance: 9.95		

Table 3: Socio-Economic Status Determining the Health Status

Variable Number	Variable Name	Factor loading
5	Income status	-0.52
12	Using of container facility	0.33
13	Types of container for storing	0.39
15	Uses of stored water	0.46
17	Toilet facilities	0.34
20	Experience of mosquito bites	-0.6
25	Types of mosquito bites	0.5
27	Distance of health centre	0.31
29	Sanitary conditions of PHc	-0.4
34	Getting water during travel	-0.5
36	Seasons of Dengue infection	-0.39
Eigen value: 2.98 Percentage of variance: 8.06		

4.5 Dimension V Sources of spreading diseases

This factor contains 10 variables with positive and negative loadings and explains a total variance of 6.04 with an Eigen value of 0.62. The origin of dengue disease is highly loaded because dengue is a viral infection caused by the bite of female Aedes mosquitoes. Dengue occurs more frequently during warm and humid seasons and transmission is more intense in urban areas, including downtown business area. Mosquitoes that transmit dengue (Aedes mosquitoes) are day biters. Most people in the study area store water without proper lids, is another reason for the spread of fever. Income status (0.47) (Table 6) is very low among the people so they do not have enough money to purchase sterilized water cane, mosquito repelents etc., People throw their waste mostly in the streets. The family size (-0.39) in negatively loaded. Most of the families are of nuclear type. Duration of mosquitoes are

high in night time.

4.6 Dimension VI Types of treatment

This factor contains as much as ten variables with positive and negative loading. In this dimension the variables explain highly positive in the family size (0.46), Types of treatment (0.43), Toilet facilities (0.38), Seasons of Dengue (0.35). The negative factors are satisfaction in medical services (-0.45), problem of mosquito bite (-0.44), marital status (-0.36).

Family size is (0.46) highly loaded with most of the houses having less than five members. They are considered as nuclear family. In the variable, Types of treatment (0.43) most of the population depend on Allopathy treatment. The satisfactory condition of medical facilities in the study area for all types of treatment are (-0.45) negatively loaded. (Table 7) The medical services offered by government are not

satisfactory. So people spend money in private sector.

4.7 Dimension VII Number of rooms in the house

The Eigen value of this factor is 2.10 and the percentage of variance is 5.25. The type of house and the number of rooms in a house influence the health of the family members. Number of rooms in the house is an indicator of socio-economic status of the people and also the living environment. The factor loading for the variable of number of rooms is (0.32). (Table 8) If the number of rooms is less, the chance of disease, affecting other family members is very high. Lower number of rooms in the house, lesser is the socio-economic condition of the family, and hence indicates poor health and disease proximity.

4. 8 Dimension VIII: Relationship between hygienic and

disease causality

The 8th dimension explained a total variance of 4.67 with an Eigen value of 4. 67.(Table 9) The high positive factor loadings are Toilet facilities (0.52) disposing of house waste (0.36) and sanitary condition of PHC (0.36). The Negative factors are environmental surrounding (0.37) and use of stored water (-0.37).

Five variables are found while explaining the eight dimension. Toilet facilities are highly loaded and determine the standard of living of people. The disposing of garbage is mostly in the form of indiscriminate throwing in the street. Sanitary conditions of PHCs are not satisfactory when compared to private hospitals. Most of the PHC are in unhygienic conditions. So this dimension is named "Relationship between hygienic condition and Disease causality".

Table 4: Frequency of accessibility to medical treatment, awareness and spreading of disease

Variable Number	Variable Name	Factor loading
3	Marital status	-0.3
4	Educational status	0.32
7	Rooms facility	-0.31
8	Environmental surroundings	0.39
13	Types of container for storing	0.34
14	Condition of container	0.39
15	Uses of stored water	0.32
18	Types of animals in houses	0.32
22	Duration of mosquito problem	0.39
23	Aware of vector – borne disease	0.42
26	Accessibility of location for treatment	0.53
31	Period of treatment	-0.49
34	Getting water during travel	-0.35
35	Boil the water	-0.41
36	Seasons of Dengue	0.58
Eigen Value: 2.83 Percentage of Variance: 7.66		

Table 5: Role of educational status on regularity of treatment

Variable Number	Variable Name	Factor loading
1	Sex Ratio	0.39
2	Age structure	0.44
4	Educational status	0.51
7	Rooms facility	0.32
8	Environmental surroundings	-0.41
13	Types of container for storing	0.47
14	Condition of container	-0.34
16	Disposing of house waste	0.31
19	problem of mosquito	-0.42
24	Initial symptoms of disease	-0.34
32	Regularity of treatment	0.53
35	Boil the water	0.33
37	Origin of dengue	-0.36
Eigen Value: 2.6 Percentage of Variance: 7.04		

Table 6: Sources of spreading diseases

Variable Number	Variable Name	Factor loading
5	Income status	0.47
7	Rooms facility	0.35
9	Family size	-0.39
16	Disposing of house waste	0.42
20	Experience of mosquito bites	0.03
22	Duration of mosquito problem	-0.39
29	Sanitary conditions of PHC	-0.32
33	Experience of after treatment	0.37
35	Boil the water	-0.32
37	Origin of Dengue	0.62
Eigen Value: 2.23 Percentage of Variance: 6.04		

4.9 Dimension IX Cost of treatment

The variables grouped in 9th dimension reveals an Eigen value

of 1.57 and accounts for 4.25 percentage of variance. In this dimension positive loading can be seen in accessibility to health centre (0.38) and spending money for the treatment (0.38), and origin of Dengue fever (0.32). (Table 10) The negative factors are usage of stored water (-0.44), Toilet facilities (-0.37), and Affected with dengue (-0.33) disease.

Accessibility to health centers (0.38 from 38) positively loaded as most of them get their treatment in nearby hospital. The proximity to medical treatment is very low (0.38) as it is highly related with their low income. So they avail Government medical services rather than private sources. Affected with Dengue Fever (-0.33) in negatively loaded since most of the people are affected.

4.10 Dimension X Mosquito bites and domestic animals
This factor contains as much as five variables with positive and negative loading explaining a percentage of total variance of 3.92 and an Eigen value of 1.45.(Table 11)
Experience of mosquito bites is (0.48) highly loaded in this

dimension because dengue fever is caused by mosquito. Mosquito bites are high in the study area because of open ditches in Madurai city. People do not use mosquito repellents. Types of animals in houses (0.35) are a significant in this regard. But it is not a significant source of infections. So this dimension is named as problems of "Mosquito bites and domestic animals".

4.11 Dimension XI Awareness about disease
The 11th dimension highlights the awareness about disease. This factor contains as much as 4 variables with positive and negative loading explaining as much as 3.69 percentage of total variance with an Eigen value of 1.37.(Table 12)
Initial symptoms of disease (0.42) are positively loaded in this dimension. At the initial stage people thinks it as normal fever, head ache, and joint pains. When the condition exists continuously only they take blood test and get proper treatment for the dengue fever. So this dimension is named as "Awareness about disease"

Table 7: Types of Treatment

Variable Number	Variable Name	Factor loading
3	Marital status	-0.36
9	Family size	0.46
14	Conditions of containers	0.32
17	Toilet facilities	0.38
18	Types of animals in houses	-0.32
19	Problem of mosquito	-0.44
21	Affected with Dengue	0.32
25	Types of treatment	0.43
28	Satisfaction of medical services	-0.45
36	Seasons of Dengue	0.35
Eigen Value: 2.10 Percentage of Variance: 5.66		

Table 8: Numbers of Rooms in the House

Variable Number	Variable Name	Factor loading
2	Age structure	-0.32
4	Educational status	0.37
5	Income status	0.65
7	Rooms facility	0.32
14	Condition of container	0.47
29	Sanitary condition of PHC	-0.34
Eigen Value: 1.94 Percentage of Variance 5.25		

Table 9: Relationship Between Hygienic and Disease Causality

Variable Number	Variable Name	Factor loading
8	Environment surroundings	-0.37
15	Uses of stored water	-0.37
16	Disposing of house waste	0.36
17	Toilet facilities	0.52
29	Sanitary condition of PHC	0.36
Eigen Value: 1.73 Percentage of Variance: 4.67		

Table 10: Cost of Treatment

Variable Number	Variable Name	Factor loading
9	Family size	0.38
15	Uses of stored water	-0.44
17	Toilet facilities	-0.31
21	Affected with Dengue	-0.33
27	Distance to health centre	0.38
30	Spend for the treatment	0.38
37	Origin of Dengue	0.32
Eigen Value: 1.57 Percentage of Variance: 4.25		

4.12 Dimension XII Mosquitoes problem

Vector borne disease is more prevalent in affecting the health

of the people. More diseases are due to mosquito menace. In the present study, mosquito problem found in Madurai city is grouped in Dimension twelve and is presented in (Table 13). This dimension explained a total variance of 3.49 with an eigen value of 1.29. The presence of mosquitoes in an area shows that there may be open cement containers, water logging in drainage, dumping of waste etc., Mosquito is a carrier of many disease causing germs. A sizeable percentage of population in Madurai city is not aware that mosquitoes breed in stagnant water bodies in the streets. From the above table factor loading of mosquito problem (-0.38) is negatively correlated. The study area has reported to have more number of Malaria, dengue, and Chickenkuniya patients.

It may be concluded that mosquito problem, is the most likely chance for a person to be affected by certain disease. In the study area it is reported that the mosquito problem is severe to very severe. Hence, the presence of mosquitoes affects the health of the people.

4.13 Dimension XIII Causes of disease

The 13th dimension explained the total variance of 3.21 with an Eigen value 1.19

The positive loadings are seen in Awareness of vector-borne (0.34), Initial symptoms of disease (0.34), and Use of boiled water (0.33). The Negative loading have been in sex ratio (-0.40) Income status (-0.31), and Types of treatment (-0.31). (Table 14)

The major cause of disease is mosquito bite. Most people sleep outside during night due to lack of room facilities and heat. The animals in the house also cause some disease to the people.

Table 11: Mosquito bites and Domestic animals

Variable Number	Variable Name	Factor loading
2	Age structure	0.46
18	Types of animals in houses	0.35
20	Experience of mosquito bites	0.48
28	Satisfaction of medical services	-0.36
30	Spend for the treatment	0.37
Eigen Value: 1.45 Percentage of Variance: 3.92		

Table 12: Awareness About Disease

Variable Number	Variable Name	Factor loading
11	Duration of getting water	-0.38
12	Using of container facility	0.32
24	Initial symptoms of disease	0.42
28	Satisfaction of medical services	0.44
Eigen Value: 1.37 Percentage of Variance: 3.69		

Table 13: Mosquitoes Problem

Variable Number	Variable Name	Factor loading
7	Rooms facility	-0.3
18	Types of animals in houses	0.3
20	Experience of mosquito problem	-0.38
26	Accessible of location for treatment	0.44
32	Regularity of treatment	0.34
Eigen Value: 1.29 Percentage of Variance: 3.49		

Table 14: Causes of Disease

Variable Number	Variable Name	Factor loading
1	Sex Ratio	-0.4
5	Income status	-0.31
23	Aware of vector-borne	0.34
24	Initial symptoms of Disease	0.34
25	Types of treatment	-0.31
35	Boil the water	0.33
Eigen Value: 1.19 Percentage of Variance: 3.21		

Table 15: Quality of Drinking Water

Variable Number	Variable Name	Factor loading
18	Types of animals in house	0.33
34	Getting water during travel	0.39
Eigen Value: 1.05 Percentage of Variance: 2.83		

4.14 Dimension XIV Quality of drinking water

The 14th dimension explains the total variance of 2.83 with and Eigen value of 1.05. (Table 15) Source of water available during travel (0.39) and the Types of Animals in house (0.33) have positive loading factor. However, only a few studies have been conducted on primates and domestic animals that

could potentially be a reservoir of dengue viruses. Since domestic dogs share habitats and vectors with humans, this study aimed to investigate whether domestic dogs living in different ecological settings in dengue endemic areas [31]. In this study is not experience for sources of vector from animal sources in Maduai city

Most people do not take water while traveling. These people take water from bus stations or railway stations which may be impure. They do not buy the purified water bottle, because it is highly expensive. So this dimension is named as "Quality of drinking water".

5. Conclusion
The health care systems are essential part in modern society. The health care of the people is mainly concerned with the differences in environmental and way of life in various geographical areas. Increasing or decreasing the rate of dengue depends upon the type of living environment. The study revealed that the incidence of dengue cases is spatially distributed in entire Madurai city. Lower socioeconomic status was independently associated with increased risk of dengue, indicating that within slum communities with high levels of absolute poverty, factors associated with the social gradient influence dengue transmission

In this study, factor loading matrix identified 14 major dimensions with a total percentage of Eigen value 75.7. The following dimensions are highlighted *viz*., Sources of drinking water, socio economic status, accessibility, education status, house and hygiene condition, surrounding environment. These are responsible factors for spreading mosquito and origin and transmission of dengue disease. The first and primary dimension 'source of drinking water and disease transmission' accounts for 9.95 of total percentage of variance and eigen value 3.68. The sample Survey identified that majority of the respondents have no awareness towards vector control measures since they are not aware of the fact that mosquitoes breed in their water holding containers kept indoor or outdoor.

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