

P-ISSN: 2706-7483  
E-ISSN: 2706-7491  
IJGGE 2021; 3(1): 34-41  
Received: 15-01-2021  
Accepted: 19-03-2021

**V Saravanabavan**  
Principal Investigator, RUSA  
Phase-II, Assistant Professor,  
Department of Geography  
School of Earth and  
Atmospheric Sciences, Madurai  
Kamaraj University, Madurai,  
Tamil Nadu, India

**Aneesh P**  
PG Project Fellow,  
Department of Geography  
School of Earth and  
Atmospheric Sciences, Madurai  
Kamaraj University, Madurai,  
Tamil Nadu, India

**Happy Maria Babu**  
PG Project Fellow,  
Department of Geography  
School of Earth and  
Atmospheric Sciences, Madurai  
Kamaraj University, Madurai,  
Tamil Nadu, India

**M Harieswari**  
PG Project Fellow,  
Department of Geography  
School of Earth and  
Atmospheric Sciences, Madurai  
Kamaraj University, Madurai,  
Tamil Nadu, India

**D Balaji**  
Research Scholar, Department  
of Geography School of Earth  
and Atmospheric Sciences,  
Madurai Kamaraj University,  
Madurai, Tamil Nadu, India

**C Vinothini**  
Research Assistant, RUSA  
Phase-II, Department of  
Geography School of Earth  
and Atmospheric Sciences,  
Madurai Kamaraj University,  
Madurai, Tamil Nadu, India

**Corresponding Author:**  
**V Saravanabavan**  
Principal Investigator, RUSA  
Phase-II, Assistant Professor,  
Department of Geography  
School of Earth and  
Atmospheric Sciences, Madurai  
Kamaraj University, Madurai,  
Tamil Nadu, India

## Patient's perception and level of primary health care utilization in east block of Madurai North taluk: A geo-health study

**V Saravanabavan, Aneesh P, Happy Maria Babu, M Harieswari, D Balaji and C Vinothini**

### Abstract

Health is a multi-dimensional process involving the wellbeing of the whole person in the context of his environment. Health is one of the major dimensions in the socio economic development. The development in the health condition and in the field of health studies is essential for the sustainable economic and social development, thus increasing the life expectancy and the health condition of the people. The main objectives of the study were; 1. To analyse the patient perception and satisfaction level who avail these healthcare services. 2. To analyse the travel pattern and movement pattern of patients from their residence to the PHC with respect to their age and sex indicators. The east block of Madurai north taluk is situated in southern part of Tamil Nadu, Madurai north taluk-east block is located in the north eastern part of the Madurai district on coordinates of 9°55' 41." N to 9°92' N latitude and 77°58'29" E to 77°97' E longitude. The data for the present was collected from primary and secondary source of data, the primary data was based on the questionnaires collected from the patients. The random sampling technique is adopted to collect the primary data in 6 of the primary health centers. Altogether about 120 respondents have been interviewed totally from the study area for the present study purpose. It include mapping of the study area, overlay analysis and buffering using GIS software of ARC GIS. The Study describes about patients perception and utilization pattern of PHC's in east block in Madurai also describes the travel pattern and healthcare planning of PHC's in Madurai-east block.

**Keywords:** patients perception, PHC-health utilization, overlay analysis, buffer analysis

### 1. Introduction

Health is one of the major dimensions in the socio economic development [1-4]. The development in the health condition and in the field of health studies is essential for the sustainable economic and social development, thus increasing the life expectancy and the health condition of the people. The social value of health care have recently emphasized the ecological approach to human health, as the human system involves constant adjustment to deterioration in the social, biological and physical environment [5-7].

Diseases are not uniformly distributed over the surface of the earth [8-10]. There are different patterns of distribution of various diseases [11, 12]. When a systematic study is made about the spatial distribution of disease in which the diseased person lives in relation to the environment thus comes a new field that is medical geography [13, 14]. The commission defined medical geography as the study of geographical factors concerned with cause and effect of health and disease. Since then the analysis of health and disease through man-environment relationships has attracted the attention of geographers to work in medical geography and has emerged as a specialized branch of geography [15-17].

One of the fastest growing fields in geography is medical geography, or the study and application of geographic concepts and techniques to health related problems [18-20]. Like its mother field, Health geography has seen major shifts in its ideology, approach, methodology and scope in the last few decades. The traditional perspective of medical geography or Health geography, the implementation of geographical concepts and techniques to study health and disease, has remained the same to this day [21-24].

However, the field has recently grown to integrate novel principles of the social, physical, and biological sciences as well as to embrace recent technological developments in computing power.

Increasingly, medical scholars are seeking the assistance of geographers while geographer are venturing into the realms of health research [25-28].

Medical geography or Health geography is a comparative study of the incidence of diseases and the distribution of physiological traits in people belonging to different communities throughout the world and the correlation of these traits with different aspects of the environment [29-32]. In the west medical geography has been used rather as an etiological research tool with emphasis on reducing mankind's load of suffering from ill-health. Perhaps the specialization lies in the type of data which individual geographer can most often use.

The concept of primary health care is based on practical, scientifically sound and socially acceptable methods and technology [33-36]. Such care is delivered in multiple settings, such as community nursing centers, health maintenance organizations, and community based clinics [37-40]. "Essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community and the country can afford to maintain at every stage of their development in the spirit of self-determination" [41].

Primary health care system is designed to meet the health needs of community through the available knowledge and resources [42, 43]. In recent years two major themes have emerged in the delivery of health care: firstly, health

services should cover the full range of preventive, curative and rehabilitation services and secondly, the best way to provide primary health to vast majority of undeserved rural people and urban poor is to develop effective 'primary health care' services supported an appropriate referral system. The scope of the present study is to analyse and evaluate the primary health care delivery system in Madurai north-east block and the satisfaction level of patients who avail these facilities. The present study also helps to understand the actual location of the health centers and also understand the health status

**2. Study area**

The east block of Madurai north taluk is situated in southern part of Tamil Nadu on coordinates of 9°55'41." N to 9°92' N latitude and 77°58'29" E to 77°97' E longitude.

Madurai east is a block placed in the Madurai north taluk of the Madurai district of Tamil Nadu. Placed in semi-urban area of tamilnadu.it is in among the 14 blocks of Madurai district. (Fig 1).

Madurai east block is almost a plain region with few hills and the main hill region is alagar hill. The study area is surrounded by small and tiny hills. Madurai east block is situated in the north eastern part of the Vaigai River in Madurai district. The town is found at an elevation of 150 meters from mean sea level. The general slope of the taluk is towards east. The taluk has an average elevation of 100 meters above mean sea level.

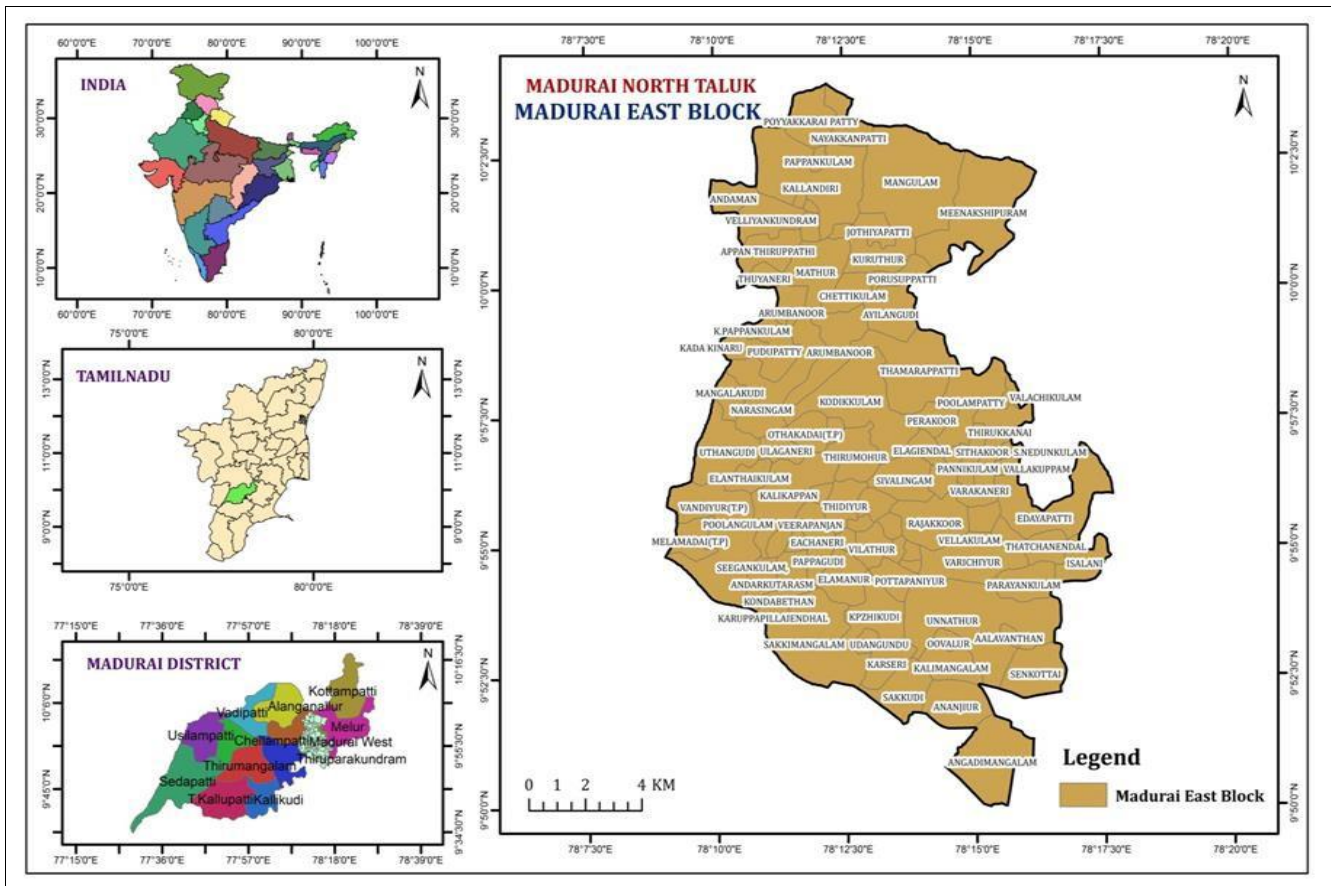


Fig 1: Location of study area

**3. Aims and Objectives**

The main objectives of the study are;

- To analyse the spatial distribution of primary health centers in north taluk-east block and to map out them

using GIS software.

- To analyse the patient perception and satisfaction level who avail these healthcare services.

#### 4. Methodology

The data selected for the present study were biased on the availability of the data from primary as well as secondary sources. The primary data was collected by administering a questionnaire to the patients who visited the healthcare in the block. The secondary data was collected from records of health centers considered, from the census handbooks and from deputy directorate health service office.

##### 4.1 Primary data

The primary data was collected by administering questionnaire to the patients at all the three health centers who utilize those centers. The samples were selected on the basis of random sampling method and the number was considered on the basis of the total number of patients visited the individual centers. The information collected through questionnaire are the socio economic conditions of the patients, reasons for the visit and preference of other health care centers, time and distance travelled, level of satisfaction about the care provided.

##### 4.2 Secondary data

Demographic and social variables of the east block were obtained from statistical handbook on east block and of Madurai for the year 2019 from the assistant director statistics.

The other statistical data were collected from respective offices (DDHSS-directorate of deputy health service society). The study area map and related information were obtained from the statistical handbook of east block.

##### 4.3 Techniques used

For the purpose of this project to important techniques used in present study area statistical techniques and cartographic interpretation. It include mapping of the study area, overlay analysis and buffering using GIS software of ARC GIS. The primary survey conducted was based on the method of stratified random sampling and a total 120 samples were collected.

#### 5. Patients perception and level of health care utilization

A detailed field work was carried out at all level, to study the socio-economic characteristics of the respondent. The field work was designed with the help of a suitable scientific frame work of sampling, namely the stratified random sampling. There were totally 120 respondents who were interviewed by direct questionnaire method. The survey was at best carried off from six government primary health centers of Madurai East Block.

##### 5.1 E-structure

The age group is a major aspect in health care studies. An analysis of various age groups would reveal the type of illness they suffer from a specific disease. In the sample survey, about 18.3% of the respondents were between the age group of >50 and 23.3% of them were the age group between 40-49. Likewise around 11.6% of the respondents are in 30-39 age group and 31.6% of respondents are in 20-29 age group respectively. Around 8.3% of respondents belong to the age group of <10 and the least visitors to the PHC fall in the age group of 10-19, whose percentage is only 6.6. (Table 1).

##### 5.2 Gender

Gender is also a major aspect in health care studies. Most of

the respondents who visited the PHC were female. The female respondents constitute 56.66% and male respondents constitute 43.3%. (Table 2).

##### 5.3 Marital status

Regarding the marital status of respondents, 66.6% are married and 30% of respondents are unmarried or single. Remaining 3.3% of respondents are widowed. (Table 3)

##### 5.4 Educational status

Education is a major indicator of social characteristics. Most of the respondents does not even have primary education and belongs to the illiterate category. Among these respondents 21% are illiterates. 15% of the respondents have high school education, 11% of them have primary education, 7% of the respondents belong to the other category which includes technical studies, polytechnic etc. And only 4% of the respondents have the college level educational qualification. (Table 4).

##### 5.5 Housing

To analyse the social status of respondents the most important factor is the housing. About 21.6% respondents have concrete house and 28.3% of the owned tiled houses. Similarly 26.6% of respondents owned house made up of asbestos. Remaining 23.3% of them are living in huts. (Table 5).

##### 5.6 Drinking water sources

Most of the respondents in this area use boiled water for the drinking purpose. About 66.6% of the people use tap water for drinking and 20% of them use the water from well and the remaining 8% of them use water from the tube well. (Table 6).

##### 5.7 Diseases that affect people

On the basis of the study conducted in the east block, around 22.8% of the people are suffering from fever and 17.1% of them are suffering from body pain. About 10% of them are suffering from knee pain and 8.5% of them are suffering from leg pain. 7.1% of the respondents suffer from head ache. Likewise 4.2% of the people suffer from Tuberculosis and 4.2% of them suffer from diabetics. And the rest 25.7% of the respondents belong to the other category which includes the pregnant women. The respondents who are suffering from diabetics, knee pain and leg pain are mostly the old people. (Table 7).

#### 6. Medical services

Medical services are meant for people who avails these facilities, in the east block 51.6% of the respondents are satisfied with the medical facilities in the PHC's, 91.6% of the respondents are satisfied with the medical facilities. About 8.3% of the respondents are not fully satisfied with the medical facilities

##### 6.1 Infrastructural facilities

All the PHC's in east block has better and high infrastructural facilities like, inpatient facilities, laboratory, injection rooms, and chairs for sitting. About 76.6% of the respondents are satisfied with the infra structural facilities available in the PHC's and 23.3% of them are unsatisfied with these infrastructural facilities.

**Table 1:** Age group

Age group	Respondents in percentage
<10	8.3
10-19	6.6
20-29	31.6
30-39	11.6
40-49	23.3
>50	18.3

**Table 2:** Gender

Gender	Respondents in %
Male	43.3
Female	56.6

**Table 3:** Marital status

Marital status	Respondents in %
Single	30
Married	66.6
Widowed	3.3

**Table 4:** Educational status

Educational qualification	Respondents in %
Illiterates	21
Primary education	11
High school	15
College	4
Others	7

**Table 5:** House types

House types	Respondents in %
Hunts	23.3
Asbestos	26.6
Tiled	28.3
Concrete	21.6

**Table 6:** Source of drinking water

Source	Respondents in %
Tap	66.6
Well	20
Tube well	13.3

**Table 7:** Diseases of respondents

Diseases	Respondents in %
Body pain	17.1
Leg pain	8.5
Knee pain	10
Fever	22.8
Diabetics	4.2

**Table 8:** Experience before treatment

Experience	Respondents in %
Very bad	45.4
Worst	54.5

**Table 9:** Experience after treatment

Experience	Respondents in %
Completely recovered	12.7
Recovered	56.3
Some what	27.2
Not at all	1.8
Same	1.8

**Table 10:** Waiting time to meet the doctor

Waiting time	Respondents in %
<15 minutes	28.3
15-30 minutes	50
1 hour	16.6
>1 hour	5

## 6.2 Availability of medicine

Most of the PHC's itself provide all types of medicines for the patients. So 99% are satisfied with the availability of medicines and only 1% of them are not fully satisfied.

## 6.3 Experience before treatment

Among the respondents 45.4% of the respondent's condition was very bad and 54.5% of the respondent's condition was worst before the treatment. (Table 8).

## 6.4 Experience after treatment

Most of them have an opinion that they have recovered from the disease. About 56.3% of the people have recovered and 12.7% of the respondents have completely recovered. While 27.2% of the respondents have somewhat recovered and 1.8% of them says that they have not at all recovered and the remaining 1.8% of respondents is in the same condition of that of before. (Table 9).

## 6.5 Waiting time to see the doctor

The time taken to see the doctor is an important problem in the functioning of a health centre. Most of the people wait for a long time to see the doctor because of the less number of doctors available in the PHC. In the case of the east block about 28.3% of the respondents have to wait for less than 15 minutes. 50% of the respondents have to wait for 15-30 minutes to see the doctor, likewise 16.6% of them have to wait for an hour and 5% of the respondents have to wait for more than 1 hour to see the doctor. (Table 10).

## 6.6 Doctors manpower

The major problem of all the PHC is the less number of doctors and their regularity.

Absence of doctors is a major problem faced by the respondents. About 49% of the respondent's state that the doctor's manpower is adequate and 40% state that the doctor man power is inadequate. Likewise 6% of them state that doctor manpower is highly inadequate and the remaining 5% opinioned that doctors manpower is more than adequate.

## 6.7 Perception on treatment

Regarding the perception on the treatment, about 51.6% of the respondent's state that it was satisfactory and 30% of them state that it was highly satisfactory. Likewise, 8.3% of them state that it was good treatment. About 5% of them say that the treatment was excellent and the rest 5% of them say that the treatment was not satisfactory. The treatment in the PHC's of east block is fully free, so there is no cost for treatment. All the medicines available in PHC's are also free of cost.

## 6.8 Distance travelled to reach the health centre

Distance travelled to reach the health centre is important to development of health centre. People travel from long distance to take treatment in the health centre. The above Table Shows the distance travelled to reach the health centre

in the study area. About 13.3% of the respondents took less than 1 km to reach the health centre and 23.3% of them were of the opinion that it took 1-2 km to reach the health centre. Around 41.6% of the respondents needed 2-5 km and 21.6% of them reached the centre in more than 5 km.

**7. Overall travel behaviour pattern using overlay analysis**

The age structure is one of the prominent factors in the health care studies and health analysis [44]. An overlay analysis of the different age groups and sex pattern has helped to reveal and identify the travel behavior of the patients [45]. Among the total respondents the age group belonging to 35-64 constitutes the larger population of the patients i.e. 31.6%. The age group of 15-34 in the mean age group in the higher percentage i.e. 29.16%. The next comes

the age group >64 is constitutes 22.5% of the patients, the age group belonging to 0-14 has the lowest percentage of patients i.e. 16.6%.

The Madurai east block has Kallendri has the main PHC with all facilities compared to a private health centre or hospital and it has additional 5 PHC which is located in Kalimangalam, Sakkimangalam, Othakadai,, Rajakoor and Ailangudi. In the sample survey conducted on 120 patients distributed over 6 PHC it was evident that the patients were almost satisfied with the health care facilities available and medicines in the block. About 36.6% of the respondents resides near to health centre (<3KM) and about 41.6% resides (>3KM) from the hospital and 2.6% of the people resides 5-6.5 KMS of the PHC. The region is well connected to all other villages via road.

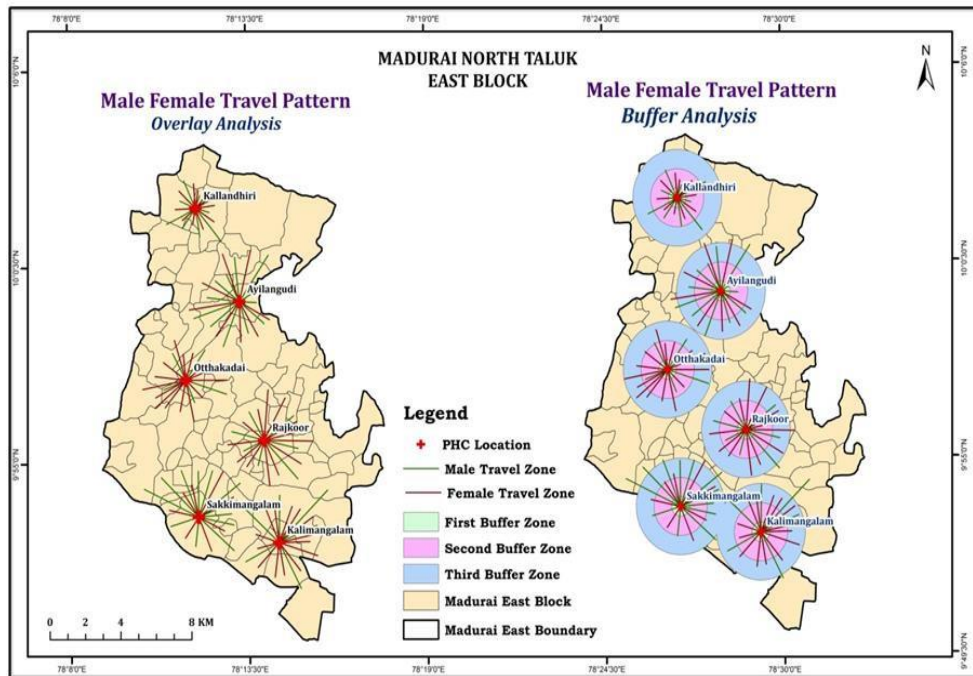


Fig 2: Male and female travel pattern in the study area

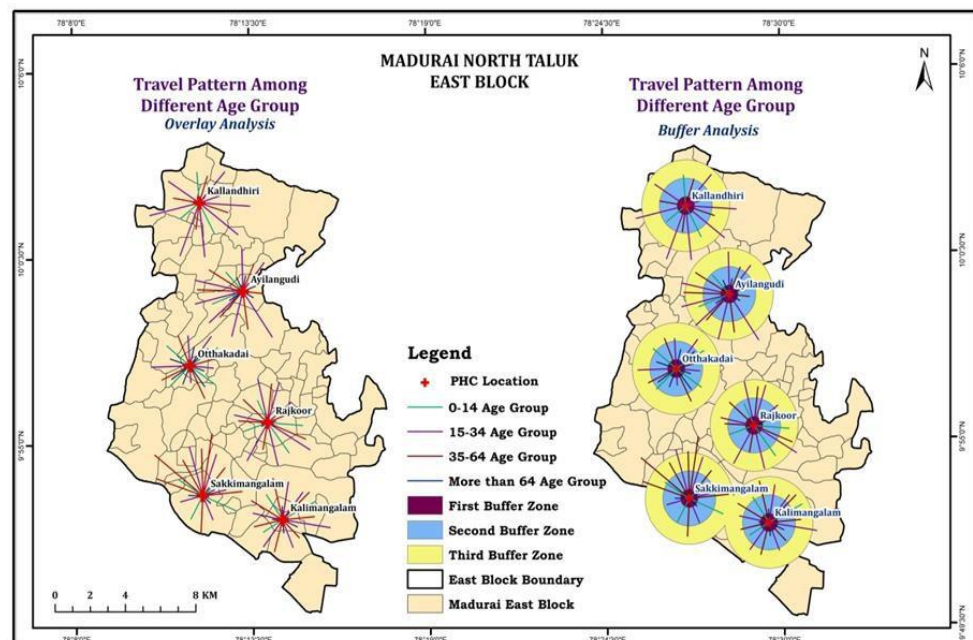


Fig 3: Different age group of travel pattern in the study area

## 8. Male and female travel pattern using buffer analysis

Three buffer zones are created to represent the travel pattern of each PHC in the Madurai north taluk east block. The first buffer zone represents area up to 1KM from the PHC. This is the highly accessible area and shows maximum utilization. The second buffer represents area up to the average distance from the area of maximum utilization. The second buffer zone is less accessible compared to the zone of maximum utilization. The third buffer zone extends from the second buffer zone up to 2 KM. (Fig 2) this is the zone of very low accessibility. The patients coming from this region are usually males. Females prefer very short distance travel >64 year age group also travel very short distance to reach the PHC.

### 8.1 Travel pattern among different age group

There are three buffer zones. The first buffer zone extends up to 1 KM from the PHC shows frequent travel of age groups belonging to >64 and 0-14 years of age. (Fig 3). In all the six PHC's first buffer zone is the maximum accessible region and second buffer zone is average accessible and third buffer zone is in accessible for the region of less utilization. Only limited number of people comes from the third buffer zone and they are male patients. This travel pattern reveals the general movement pattern of patients in the Madurai north taluk east block to the health centers. The general analysis more number of outpatients are migrating to the Kallendri main block PHC situated in the Kallendri. This data was collected from the secondary data from year 2014 up to present. Patients come here for higher level of treatment which is not available in the other additional PHC in this block.

While taking the case of Kallendri PHC all the patients comes from almost all the directions and southern part of the region has more number of patients travelled longer distance. The north eastern part of the Madurai north east block is very less accessible to health centers as it is far located from the PHC's. Ailangudi PHC is the less accessible to people because they travel long distance to reach the PHC and majority of the male patients travel longer distance. In Othakadai PHC most of the patients comes from the south west part of the block while taking the case of Rajakoor PHC peoples comes from all the surroundings of the PHC. Sakkimangalam and Kalimanagalam PHC are spaced close to each other. Thus in Sakkimangalam PHC majority of the people comes from the northern part of the PHC and they are mainly males and a few females. Kalimnagalam PHC is located in the southern edge of the block and most of the patients come from the northern part of the PHC.

This include both male and female patients from the overall analysis it is clear that male patients travel longer distance to reach the health care centre and female travel short distance. The eastern ends, southern tip and western ends of the block do not have the accessibility to any of the PHC thus making this area very isolated. When taking this block as a whole the southern region is highly accessible as all the three PHC's are closely located compared to the northern region.

## 9. Conclusion

Thus the analysis shed light on the various aspects of respondents such as physical, economical and level of treatment availability and on various other hospital facilities

such as sanitation, the individual perception of the patients and this satisfaction level which the medical facilities available in the Madurai north taluk east block. This study deals with the analysis of social and economic background of the respondents and the individual perception of each respondents and the satisfaction level of the respondents with the medical facilities and the accessibility of the Madurai north taluk east block. Most of the female patients prefer short distance for travel. Fig. so only a very number of them is from the third buffer zone. The age structure of the respondents reveals a variation in the utilization rate of the health care facilities. The respondents belonging to the age group of 20-29 forms the larger proportion of the respondents. The economic background of the respondent's influence their type of health service utilization and the health condition to a greater extend, this is highly evident from the present study.

## 10. Acknowledgements

The authors gratefully acknowledge the RUSA-Phase II (Rashtriya Uchchar Shiksha Abhiyan), Department of Geography, School of Earth and Atmospheric Sciences, Madurai Kamaraj University, Madurai, 625021 for their Financial support in carrying out the publishing of this research work.

## 11. Ethical approval

Ethical approval not required. This article does not contain any studies with human participants or animals performed by any of the authors. Since only the Secondary data collected at various centers are used in the study.

## 12. Conflict of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

## 13. References

1. Grady SC, Wadhwa V. Today and tomorrow: Reflections on health and medical geography. *Social science & medicine* 2015;133:212-5. <https://doi.org/10.1111/j.1538-4632.2009.00780.x>
2. Saravanabavan V, Reshma CU, Preethi S. Determinants of reproductive health in working women in Thrissur district, Kerala. *Geo Journal*. Springer 2019, 1-5. <https://doi.org/10.1007/s10708-019-10051-z>
3. Brown T, McLafferty S, Moon G. A companion to health and medical geography. Chichester: Wiley-Blackwell 2010. ISBN: 978-1-405-17003-1.
4. Saravanabavan V, Abeesh P. Environmental health status of fishermen in Mahe district. *International Journal of Geography, Geology and Environment* 2020;2(2):95-102. P-ISSN: 2706-7483, E-ISSN: 2706-7491.
5. Balaji D, Saravanabavan V. Geo spatial variation of dengue risk zone in Madurai city using autocorrelation techniques. *Geo journal*. Springer 2020, 1-21. <https://doi.org/10.1007/s10708-020-10143-1>
6. Reshma CU, Sheheersha SK, Saravanabavan V. A case study on the influence of socio-economic status of women on infant healthcare in Kerala state. *International Journal of Physical and Social Sciences*. 2015;5(1):128.
7. Saravanabavan V, Sudharsan R, Balaji D, Rahamath Nisha R. Patient's perception and epidemiological

- characteristics of dengue in Madurai city-using factor analysis. *International Journal of Mosquito Research* 2014;1(2):18-24.  
<http://www.dipterajournal.com/pdf/2014/vol1issue2/PartA/4.1-218.pdf>
8. Rahamath Nisha R, Saravanabavan V, Balaji D. Knowledge, attitude and practice in dengue endemic areas in Madurai District. *International Journal of Contemporary Medical Research* 2020;7:3.  
 DOI: <http://dx.doi.org/10.21276/ijcmr.2020.7.3.4>
  9. Balasubramani K, Saravanabavan V, Kannadasan K. A Comparison of Approaches for Automated Watershed Delineation: A Case study of Nagal Ar Watershed. In *Proceedings of the National Seminar on Geospatial Technology for Resource Evaluation and Management*, Department of Geography, Madurai Kamaraj University 2012, 200-208.
  10. Saravanabavan V, Shanmuganandan S. Application of Multivariate analysis in the identification of major dimension of multi bacillary leprosy in Tamil Nadu. *The transaction institute of Indian geographers* 1995, 75-80.
  11. Eswari S, Saravanabavan V. A Geo Medical analysis of Diarrhoeal diseases among Children in Madurai City, Tamil Nadu, India. *International Journal of Current Research* 2020;12(03):10684-9.
  12. Rahamath Nisha R, Saravanabavan V, Sureshkumar R. Emerging COVID-19 Epidemiology in Tamil Nadu India using GIS. *International Journal of Contemporary Medical Research* 2020;7(8):H10-H17. DOI: <http://dx.doi.org/10.21276/ijcmr.2020.7.8.15>
  13. Saravanabavan V, Eswari S, Vimala Vinnarasi J, Ganesan J, Sudharsan R. Spatial temporal variation of leptospirosis disease in Madurai city-Medico-geographical analysis. *International Journal of Geography, Geology and Environment* 2020;2(1):21-7.
  14. Balaji D, Saravanabavan V. A geo medical analysis of dengue cases in Madurai city-Tamil Nadu India. *Geo Journal*. Springer 2019, 1-6.  
<https://doi.org/10.1007/s10708-019-10006-4>
  15. Bhat LS, Learmonth AT. *Medical geography: a trend report. A Survey of Research in Geography* 1972, 244-51.
  16. Saravanabavan V. Bicycles and health-a geo medical study of Madurai city. In *Velo Australis and Velo- City' 96*, International Bicycle Conference, Jan 1997 Fremantle, Western Australia 1996;19(1).
  17. Ganesan J, Saravanabavan V. Nutritional Problems of Anaemia Disorders Among the Tea Plantation Labourers in Nilgiris District- A Geo Medical Study. *International Journal of Research Studies in Science, Engineering and Technology* 2018;4(4):360-1366.
  18. Eswari S, Saravanabavan V, Balaji D. Infant neonatal and post neonatal mortality in Madurai district, Tamil Nadu, India: A Geomedical Study. *International Journal of Geography, Geology and Environment* 2020;2(2):102-112. P-ISSN: 2706-7483, E-ISSN: 2706-7491.
  19. Rahamath Nisha R, Saravanabavan V. Dengue vector breeding ecology in Madurai district: Heat map cluster analysis. *International Journal of Mosquito Research* 2021;8(1, Part B):95-104. DOI: <https://doi.org/10.22271/23487941.2021.v8.i1b.503>
  20. Saravanabavan V. Patients perception and travel behavior pattern in primary health care center in Haripad block-A micro Geo-medical study. *Journal of Language in India* 2013;13(4):194-207.
  21. Meade MS, Earickson R. *Medical geography*. New York: Guilford Press 2000.
  22. Sheheersha SK, Saravanabavan V. Geo-Medical Analysis of the Detection of Cervical Pre-Cancer Cases Using Telemedicine System in Kerala State, India. *IOSR Journal of Dental and Medical Sciences* 2020;10(11):12. DOI: 10.9790/0853-1907100816
  23. Vimala Vinnarasi J, Saravanabavan V. Tuberculosis types and its characteristics in Dindigul District-A Geomedical study using GIS. *International Journal of Geomatics and Geosciences* 2017;7(3):262-74.
  24. Saravanabavan V, Aswathi Lekha CS, Aparna T, Rahamath Nisha R, Balaji D, Kannadasan K *et al*. Spatio-temporal variation of dengue in Kozhikode District, Kerala: A medico geographical study. *International Journal of Mosquito Research* 2021;8(1, Part B):130-40.
  25. Kearns RA, Joseph AE. Space in its place: developing the link in medical geography. *Social Science & Medicine* 1993;37(6):711-7.  
[https://doi.org/10.1016/0277-9536\(93\)90364-A](https://doi.org/10.1016/0277-9536(93)90364-A)
  26. Saravanabavan V, Balaji D, Preethi S. Identification of dengue risk zone: A geo-medical study on Madurai city. *Geo Journal*. Springer 2019;84(4):1073-87.  
<https://doi.org/10.1007/s10708-018-9909-9>
  27. Mayer JD. *Geography, ecology and emerging infectious diseases*. *Social science & medicine* 2000;50(7-8):937-52. [https://doi.org/10.1016/S0277-9536\(99\)00346-9](https://doi.org/10.1016/S0277-9536(99)00346-9)
  28. Saravanabavan V, Reejo RJ, Neethidevi A, Jayashree R. Travel and health care utilization pattern of patients in Vadipatti panchayat union: A micro level study using GIS. *Journal of Deccan Geographer* 2006;44(2):97-108.  
<https://www.researchgate.net/publication/332403707>
  29. Meade MS. *Medical geography*. The Wiley Blackwell Encyclopedia of Health, Illness, Behavior, and Society 2014, 1375-81.  
<https://doi.org/10.1002/9781118410868.wbehibs204>
  30. Saravanabavan V, Balaji D, Rahamath Nisha R, Preethi S, Vadivel S. Geo-ecological association of dengue disease in Madurai city-using multivariate analysis. *International Journal of Mosquito Research*. 2020;7(2):37- 45. ISSN: 2348-5906.
  31. Eswari S, Saravanabavan V, Balaji D. Infant neonatal and post neonatal mortality in Madurai district, Tamil Nadu, India: A Geo medical Study. *International Journal of Geography, Geology and Environment* 2020;2(2):102-112. P-ISSN: 2706-7483, E-ISSN: 2706-7491.
  32. Saravanabavan V. GIS analysis of pedestrian problem and spatial risk areas for each buffer zone in urban cities A case study of Madurai city in Tamil Nadu, India. In 1st International symposium held on 19-21 April, 2011 at South Eastern University of Sri Lanka 2011. <http://ir.lib.seu.ac.lk/handle/123456789/862>
  33. Saravanabavan V, Shanmuganandan S. Identification of Health Care Delivery System for Paucibacillary Leprosy in Tamil Nadu. *Calcutta* 1997;59(3):216-224. ISSN. NO 0375-6386.
  34. Rahamath Nisha R, Saravanabavan V. Occupational

- Health: A Special Reference to Lung Disease in Petrochemical, Metal and Building Material Industrial Workers in Melur Taluk Madurai District 2020;7(7). ICV: 98.46, ISSN 2454-7379.
35. Saravanabavan V, Shanmuganandan S. Leprosy and Multidrug therapy in Tamil Nadu, India: A Factor Analysis. *The Indian Geographical Journal* 1998;73(1):41-50. ISSN. NO. 0019-4824.
  36. Balasubramani K, Veena M, Kumaraswamy K, Saravanabavan V. Estimation of soil erosion in a semi-arid watershed of Tamil Nadu (India) using revised universal soil loss equation (rusle) model through GIS. *Modeling Earth Systems and Environment*. Springer 2015;1(3):1-7.  
<https://link.springer.com/article/10.1007/s40808-015-0015-4>.
  37. Saravanabavan V, Balaji D, Reshma CU, Sheheersha SK, Sudharsan R, Vinnarasi JV *et al.* Urban disease ecology and its spatial variation of Chikungunya in Madurai City, Tamil Nadu, India: a geo-medical study. *Geo Journal*. Springer 2020, 1-6.  
<https://doi.org/10.1007/s10708-020-10192-6>
  38. Sheheersha SK, Reshma CU, Saravanabavan V. Sanjeevani Comprehensive Cancer Control Programme and Mobile TeleMedicine (SCCP&MTM) for rural poor: Design features, technical feasibility and usability. *International Journal of Applied Management Research (IJAMR)* 2015;7(1):212-16.
  39. Saravanabavan V, Shanmuganandan S. Impact of MDTon changing scenario of Leprosy in Tamil Nadu. *The Journal of Region, Health and Health Care* 1996;1(2):19-27. ISSN.NO 02159.
  40. Rahamath Nisha R, Saravanabavan V, Sureshkumar R. Emerging COVID-19 Epidemiology in Tamil Nadu India using GIS. *International Journal of Contemporary Medical Research* 2020;7(8):H10-H17. ISSN (Online): 2393-915X; (Print):2454-7379.  
DOI: <http://dx.doi.org/10.21276/ijcmr.2020.7.8.15>
  41. Ghebreyesus TA. Strengthening our resolve for primary health care. *Bulletin of the World Health Organization* 2020;98(11):726-A.
  42. Sudharsan R, Saravanabavan V, Devanathan D. Patient Satisfaction and Perceptions about Quality of Healthcare at a Primary Healthcare Centre of Thanjavur District, Tamil Nadu. *International Journal of Research in Science and Technology* 2019;9:2249-0604.
  43. Sheheersha SK, Saravanabavan V. An analysis of the role of sunayanam mobile ophthalmology unit for preventing blindness among rural poor in Thiruvantahapuram district. 'Geospatial Technologies for Resource Evaluation and Management' Jayalakshmi Publication 2015;140:412-4.
  44. Valery PC, Bernardes CM, De Witt A, Martin J, Walpole E, Garvey G *et al.* Patterns of primary health care service use of Indigenous Australians diagnosed with cancer. *Supportive Care in Cancer* 2020;28(1):317-27.
  45. Fisher R, Lassa J. Interactive, open source, travel time scenario modeling: tools to facilitate participation in health service access analysis. *International journal of health geograph* 2017;16(1):1-5.