

# SPATIAL ANALYSIS OF PUBLIC HEALTHCARE FACILITIES IN PERIYAPATNA TALUK, MYSORE DISTRICT, KARNATAKA

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## ***Abstract***

This paper aims to attempt the study of availability, accessibility and Infrastructure of public healthcare Facilities in Periyapatna taluk, Mysore District. It also tries to find out the gap between existing public health care facilities and normative requirement of public health care facilities as set by the government of India. The base map of study area has been geo-referenced and digitized using ARCGIS. The Global positioning system (GPS) was adopted to take the coordinate of all the existing Public health centers in the study area. Data is analyzed through simple quantitative techniques like ratios, percentage and the spatial disparity of health centers were measured with the help of Nearest Neighbour Techniques. The results show that the availability of Public healthcare center is unequally distributed and there is scarcity in the availability of infrastructure and workforce among the study area. A large proportion of the residents have to travel a long way to access the health care facilities in western parts of Periyapatna. There is a high inequality in the distribution of public Health centers, infrastructure facilities and Health Workforce in the hoblis of Periyapatna taluk.

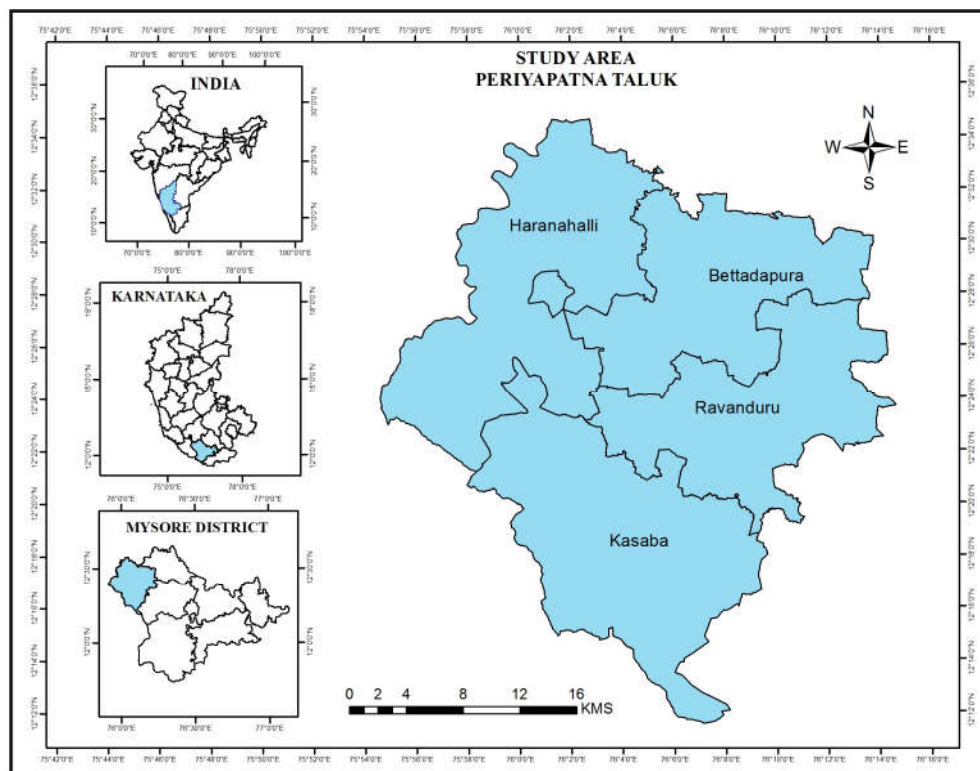
***Keywords: Availability, Accessibility, Nearest Neighbour Techniques, GIS and GPS***

## **INTRODUCTION**

The spatial distribution of healthcare centers is uneven as the human population on the earth's surface and the factors for such uneven distribution is almost similar. The uneven distribution of health centers are observed even at micro level not only between the regions but within the region also depending up on the demand for the health care institution and the supply of the patients. The concern for equitable healthcare access to people is a basic element of many health policies. Governments have been committed to ensuring access to healthcare and success is highly dependent on the nature of existing inequality and in the healthcare needs of the people (Marris et.al, 2005). Thus, access to healthcare is a

multidimensional concept that is subject to the influences of both the geographical, social and economic factors (Onega et.al, 2008). The service availability is another influencing factor for the geographical accessibility of healthcare (Nobles et.al, 2014). Healthcare is concerned with all the issues that are related to the location and facilities. These issues include the optimal location of healthcare centers. GIS is a technique which provides a set of tools for describing and understanding the spatial distribution of healthcare facilities, evaluating accessibility and barriers to health care delivery of health facilities. With this background this paper attempts to study, the Spatial distribution of public healthcare centers and their services in Periyapatna taluk, to find out the gap between existing public health care facilities and normative requirement of public health care facilities as set by the government of India.

## STUDY AREA



Map 1: Location of Periyapatna Taluk, Mysore District

Periyapatna Taluk is one of the seven taluk of Mysore District and the head quarter is Periyapatna Town. They located between latitude  $12^{\circ}34'$  North and longitude  $76^{\circ}01'$  east. The Taluk spreads across an area of 785 sq.kms with an average elevation of about 849 meters. The area is bordered by Hassan District to the North, Hunsur taluk to the South, in the east by K.R.Nagar taluk and in west by Kodagu

District (Map.1). Totally, Periyapatna taluk comprises of 4 Hoblis, 26 Gram Panchayaths, 1 town, 197 inhabited Villages, and 6 uninhabited villages. According to the Census of 2011 Periyapatna taluk had a population about 2, 43,076 lakhs of which male were 1,24,755 and females 1,18,321 respectively. Out of the total population of Periyapatna Taluk 16,685 people lives in urban areas and 2, 26,391 populations are living in rural areas.

## **DATABASE AND METHODOLOGY**

The present study is based on both Primary and Secondary source data. The study was conducted hobliwise in Periyapatna taluk of Mysore district. The secondary related to public healthcare centers are collected from various offices like District Health Office and Taluk Health Office. The Spatial Data Such as, Toposheets of the study area at a scale of 1:50,000 are collect from Survey of India and to generate the spatial village maps involves the extraction of taluk and Hobli boundaries from topographical map. The study area is covered by 5 topographical maps, Toposheets Numbers are, 57 D-2, 57 D-3, 57 D-4, 48 P-14 and 48 P-15. The base map of the study areas has been geo-referenced and digitized using ARCGIS software 10.3, to show the spatial distribution and accessibility of Public healthcare centers. The primary sources of data have been collected from field survey through the questionnaire related to infrastructure and health workforce facilities in the hospital and personal observation. The Global positioning system (GPS) was adopted to take the coordinate of all Public health centers in the study area. The collected information has been compiled and put in the form of maps and tables for further analysis. Data is analyzed though simple quantitative techniques like ratios, percentage and the spatial disparity of Primary health centers were measured with the help of Nearest Neighbour Techniques.

## **RESULTS AND DISCUSSIONS**

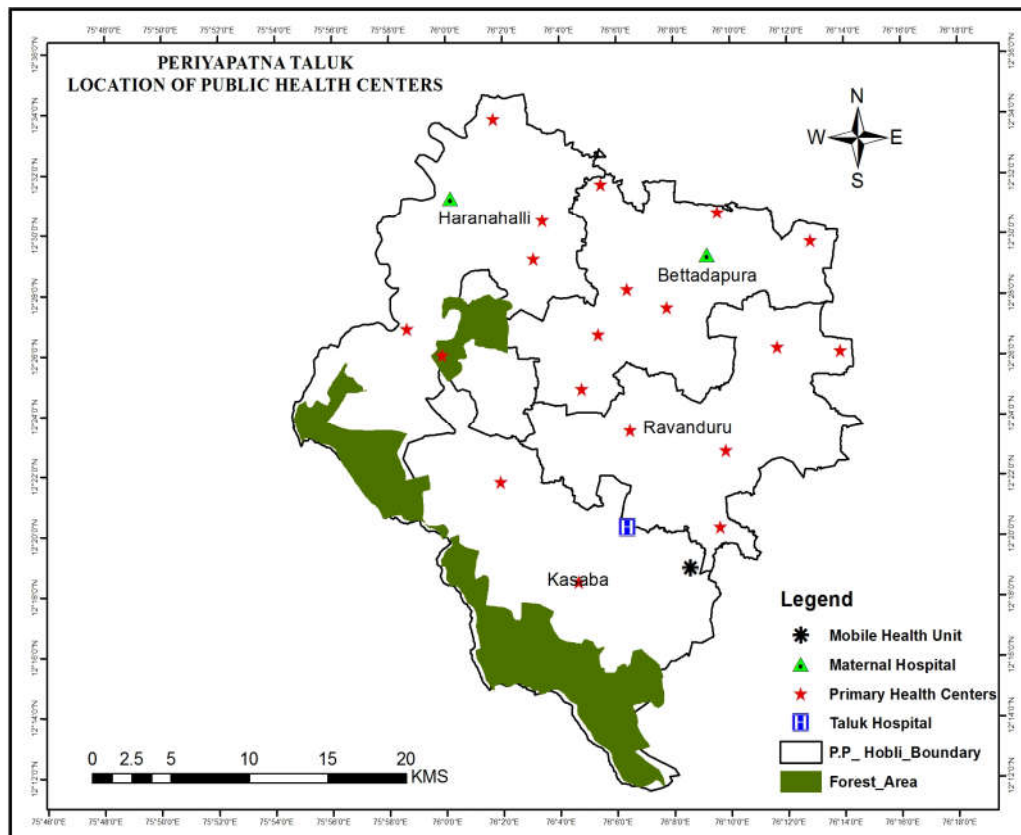
### **Availability and Accessibility of Public HealthCare Centers**

The distribution of public healthcare facilities varies not only in rural and urban areas but also within rural and urban areas. Public Healthcare centers are providing health services to the people for promoting good health for all, but it depends on accessibility of healthcare centers. Therefore, Availability of the health centers are primarily effect on utilize of healthcare facilities. The Periyapatna taluk has 4 hoblis encompasses 91 public health centers, which includes One Taluk Hospital, 19 Primary Healthcare centers, 68 Health sub centers, 2 Maternity and One mobile health units. The Hobliwise distribution of Public healthcare centers has been shown in (Table 1 and Map 2 & 3).

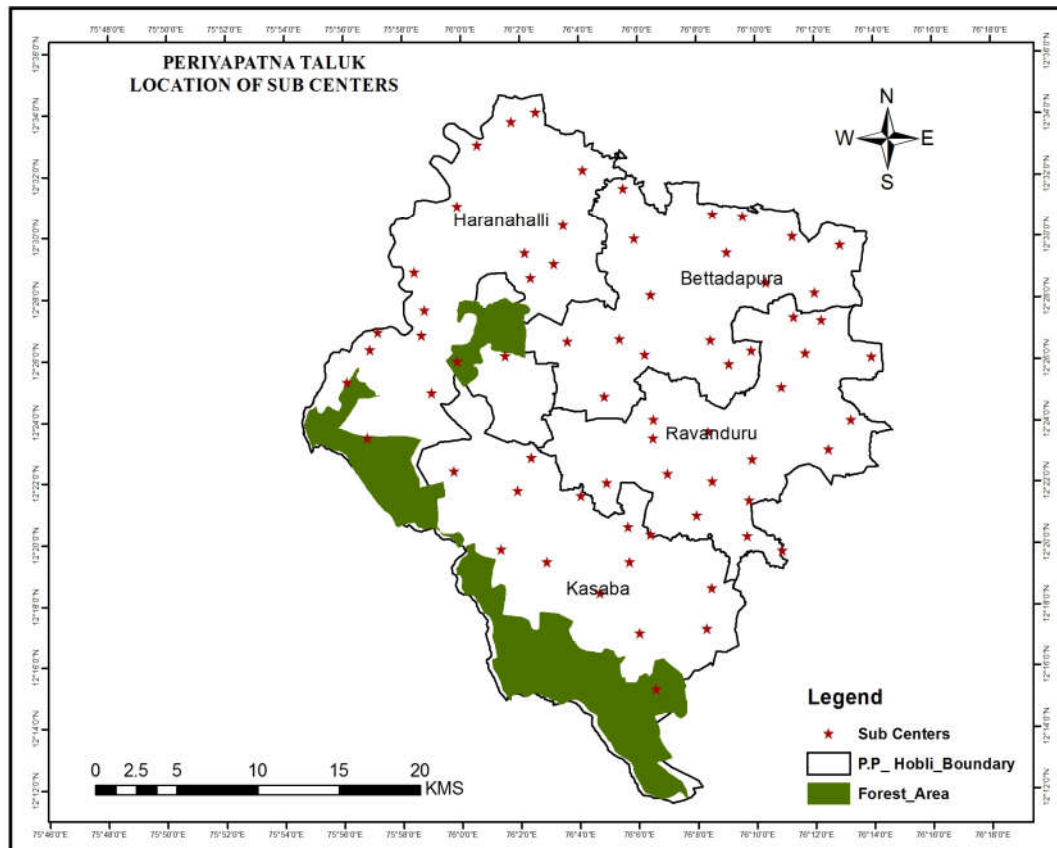
<b>Table 1: Hobli Wise Distribution of Public Healthcare Centers in Periyapatna</b>
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Taluk						
Sl. No.	Hoblis	Health Institutes				
		Population	No. of PHC's	No. of HSC	Maternity	Mobile Health Unit
1	Bettadapura	67026	7	17	1	0
2	Harannahalli	76072	5	19	1	0
3	Kasaba	38531	2	14	0	1
4	Ravanduru	61447	5	18	0	0
<b>Total</b>		243076	19	68	2	1

*Source: District Health Office, Mysore*



Map 2: Hobli Wise Distribution of Public Healthcare Centers



**Map 3: Hobli Wise Distributions of Health Sub Centers**

### Health Care Centers and Population Ratio

As per Government of India, National Rural Health Mission (NRHM), the public health institutions in rural areas are to be upgraded from its present level of a set of standards called Indian Public Health Standards (IPHS). According to NRHM policy the population norms for the provision of Sub-Centers, PHC's and Community Health Centers in plain areas are suggested 5000, 30,000, 1, 20,000 people respectively, where as in the Hilly/Tribal regions it is 3,000, 20,000, 80,000 respectively. The (table 2) shows the Hobliwise Distribution of HealthCare Centers and Ratios of Health Centers to the population. In the study area, 2, 43,076 populations are served by One Taluk Hospital, 19 Primary Health Centers and 68 Health Sub Centers. The Community Health Centre is not located in Periyapatna taluks, as the city has got general hospital, which can cover all the facilities of community health centre.

<b>Table 2: Ratios of Population and Health Centers Services</b>						
<b>Sl. No.</b>	<b>Hoblis</b>	<b>Population</b>	<b>No. of PHC's</b>	<b>PHC Population Ratio</b>	<b>No. of HSC</b>	<b>HSC Population Ratio</b>
<b>1</b>	Bettadapura	67026	7	1:95751	17	1:3942
<b>2</b>	Harannahalli	76072	5	1:15214	19	1:4003
<b>3</b>	Kasaba	38531	2	1:19265	14	1:2752
<b>4</b>	Ravanduru	61447	5	1:12289	18	1:3413
<b>Total</b>		<b>243076</b>	<b>19</b>	<b>1:12793</b>	<b>68</b>	<b>1:3574</b>
<i>Source: Field Survey &amp; Compiled by Author</i>						

The High concentration of PHCs are located in Bettadapura Hobli(7), serving the population ratio of 1:95751, followed by Harannahalli Hobli and Ravanduru Hoblis have( 5) PHC's each with serving population ratio of 1:15214 and 1:12289 Respectively. The lowest concentration of PHC's is located in Kasaba hobli consists of (2) PHC's with serving population ratio is 1:19265. PHC's it acts as a referral unit for 6 Sub-Centers, it reveals that, the each PHC is serving to a population ratio of 1:12793 persons. The highest and lowest numbers of Sub Centers are located in Harannahalli Hobli (19) and Ravanduru Hoblis (18) with serving population ratio of 1:4003 and 1: 3413 respectively. Followed by Bettadapura Hobli (17) with serving population ratio of 1:3942 and the lowest concentration of HSC's is located in Kasaba hobli (14) with serving population ratio is 1:2752, it reveals that, the each HSC's is serving to a population ratio of 1:3574 persons. Though it shows there is regional imbalance in the distribution of healthcare centers among hoblis of the Periyapatna taluk.

### **Health Infrastructure and Workforce Ratio**

As per National Rural Health Mission (NRHM) highlights the healthcare facilities available at different levels namely, Primary and Sub health centers levels in terms of health services, workforce and infrastructure facilities. The Responsibility of healthcare centers is in two folds, providing skilled medical staff in the healthcare centers and Realization of millennium Developed Goals of improving healthcare facilities to reduce the different kinds of diseases. By primary survey and observation in context of availability of workforce and health infrastructure facilities of 19 PHC's and 68 HSCs of the the study area are discussed here. In this survey availability of health workforce and health infrastructure like weighing machine, Blood Pressure instrument, steam sterilizer, labour room, wards, OPD, laboratory facility and with their own building, having public utilities like (electricity, drinking water, vehicle and toilets) are included to identify the shortcoming of physical infrastructure facilities with regards to recommended norms have been discussed under the following subheads. The below (table 3 &4) shows the of availability of health workforce and health infrastructure facilities of PHCs of the study area are

discussed here. In this survey availability of workforce like doctors, nurse, asha and ANMs and infrastructure facilities like beds wards etc., are included.

Table 3 : Ratios of Population and Health Workforce										
Sl. No	Hoblis	Population	Doctors		Nurse		Asha		ANM's	
			No	Ratios	No	Ratios	No	Ratios	No	Ratios
1	Bettadapura	67026	7	1:9575	3	1:2234	44	1:1523	12	1:5585
2	Harannahalli	76072	5	1:1521	4	1:1901	42	1:1811	18	1:4226
3	Kasaba	38531	2	1:1926	2	1:1926	6	1:6421	10	1:3853
4	Ravanduru	61447	5	1:1228	5	1:1228	27	1:2275	24	1:2560
Total		<b>243076</b>	19	1:1279	14	1:1736	119	1:2042	64	1:3798
<i>Source: Field Survey &amp; Compiled by Author</i>										

The Primary Health Centers are the first contact point of medical persons with the community. It acts as a referral unit for 6 Sub-Centers and refers out cases to CHC and higher order public hospitals located at taluk and district level. However, as the population density in the country is not uniform, the number of PHCs would depend upon the case load. Select PHCs, especially in large blocks where the CHC is over one hour of journey time away, may be upgraded to provide 24 hour emergency hospital care for a number of conditions by increasing number of Medical Officers, preferably such PHCs should have the same Indian Public Health Standards norms as for a CHC<sup>[4]</sup>. The PHC essential of health workforce is one medical officer, 3 staff nurses, one paramedical and four other staffs. The above (table.no.3) shows that, Hobliwise distribution of health workforce of the PHC's and ratio's of Health Services to the Population. Among the 4 hoblis in that high concentration of Health Workforce Observed in Bettadapura hobli having (7) Doctors serving the population at the ratio of 1:9575, (3) Nurse with 1:2234, (44) Asha with 1:1523, and (12) ANM'S ratio is 1:15585. Followed by Harannahalli Hobli (5) Doctors serving the population at the ratio of 1:1521, (4) Nurse with 1:1901, (42) Asha with 1:1811, and (18) ANM'S ratio is 1:4226. Respectively, Ravanduru hobli having (5) Doctors serving the population at the ratio of 1:1228, (5) Nurse with 1:1228, (27) Asha with 1:2275, and (24) ANM'S ratio is 1:2560. The lowest concentration of Health workforce observed in Kasaba hobli consists with (2) Doctors serving the population at the ratio of 1:1926, (2) Nurse with 1:1926, (6) Asha with 1:6421, and (10) ANM'S ratio is 1:3853 respectively. It can be observe in the above (table.no.3), though there is high population but the availability of Health workforce are less according to IPHS norms.

Sl. No	Hoblis	Population	Equipments						
			Beds		Wards	Bp Apparatus	Weighing Machine	Vehicle	Wheel Chair, Trolley, etc
			No	Ratios	No	No	No	No	No
1	Bettadapura	67026	33	1:2031	5	11	10	2	3
2	Haranahalli	76072	25	1:3042	5	6	6	1	0
3	Kasaba	38531	6	1:6421	1	2	2	1	1
4	Ravanduru	61447	24	1:2560	5	6	6	1	4
Total		<b>243076</b>	88	1:2762	16	25	24	5	8

*Source: Field Survey & Compiled by Author*

The essential physical infrastructure facilities at PHCs should have 6 beds, with adult weighing machine, Blood Pressure instrument, steam sterilizer, labour room, wards, OPD, laboratory facility and with their own building, having public utilities like (electricity, drinking water, vehicle and toilets). The above (table no.4) shows that, Hobliwise distribution of health Infrastructure facilities available at PHC's and ratio's of Health Services to the Population. Among the 4 hoblis in that high concentration of Health Infrastructure Observed in Bettadapura hobli having 7 PHCs with (33) Beds serving the population at the ratio of 1:2031, 5 Wards, 10 weighing machine, 11 Bp Apparatus and 3 wheel chair/trolley. All the 7 PHCs possess own building, steam sterilizer, labour room, OPD, laboratory facilities, two functional vehicle and public utilities like (electricity, drinking water, and toilets) are in working condition. Followed by Ravanduru Hobli having 5 PHCs with (24) Beds serving the population at the ratio of 1:2560, 5 Wards, 6 weighing machine, 6 Bp Apparatus, one functional vehicle and 4 wheelchair. In this Ravanduru hobli all 5 PHCs possess own building, wards, OPD, facilities and public utilities are in working condition. Respectively, Haranahalli hobli consists of 5 PHCs with (25) Beds serving the population at the ratio of 1:3042, 5 Wards, 6 weighing machine and 6 Bp Apparatus. All the 3 PHCs possess own building, another 2 with rented building, steam sterilizer, wards, OPD, laboratory facilities, one functional vehicle, and public utilities like (electricity) are in working condition except one PHC that is Koppa, in this area drinking water, toilets was not in good condition. The Lowest Concentration of Health Infrastructure facilities Observed in Kasaba Hobli 2 PHCs with (6) Beds serving the population at the ratio of 1:6421, one Ward, 2 weighing machine and 2 Bp Apparatus. Among 2 PHCs One possess own building, another one is rented building, labour room, wards, OPD, one functional vehicle and public utilities like (electricity, drinking water, and toilets) are not in good condition. It can be observe in the above (table.no.4), though there is high population in the study area but the availability of Health Infrastructure facilities are less according to IPHS norms.



Health sub-centers are basic or pre-primary health and medical care service centers at the grassroots level. The staffs of the unit are managed by a male health worker and an auxiliary nurse and mid-waves in each sub-centre to provide curative health/medical services and join the national programmes. The work of these staff members consists of house to house visits for collecting vital statistics of all families and to communicate the health related programmes under the direction of medical officers of the concerned primary health centre-unit. In addition to that they give the treatment for minor ailments, health education in respect of common communicable diseases, family welfare, immunization, vaccination etc. with adequate field staff. These sub-centers are expected to show progress in each month in programmes that are envisaged by each sub-centre. Totally, Study area comprises 68 Health Sub Centre among them 22 HSCs have their own building and remaining they are functioning under rented building. On an average 24.71 percent sub-centers are running in their own building, while 75.29 Percent are running under rented building. In the study area, Most of the Sub-centers have depend on bore well but some of that is not working in the places like Abatoor, Nandinatapura PHCs of kasaba hobli; other sub-centers have hand pump for water supply. Totally, 70% of the sub-centers have depend on bore well, 30% of the sub-centers depend on pipe water supply in their premises. All Sub-Centers do not have telephone connection, electric facilities and water supply only 60% of sub-centers have electricity connection, telephone and water supply.

### **Maternity Hospitals**

Maternity hospital is a hospital that specializes in caring for women while they are pregnant and during childbirth. The hospital also provides care for new-born infants. There are 2 maternity hospitals in study area. The health infrastructure of the maternity hospitals in study area includes 6 Beds, 2 Wards, 3 Laboratory, 2 OPD rooms, 2 Labor Rooms and other facilities which are being utilized to provide the maternal care to the people of Periyapatna. But there are no vehicle facilities available for maternity hospital. The availability of health workforce in the maternity hospitals includes 2 doctors, 2 nurses, one Health Assistants and 4 other health workers which provide the maternal healthcare to the people of the taluk.

### **Mobile Health Units**

The mobile health unit also has the facility to dispense medicine. A doctor travels along with the Mobile Clinic providing up to secondary level consultation. The advantage of such a mobile clinic is that, doctors are not required to live in the villages in order to practice there (the clinic travels from the

district headquarters where it is stationed to villages) and the doctors has the equipment he/she requires to provide an informed diagnosis. Thus the two most common frustrations expressed by doctors required to work in villages are eliminated. In the study area one mobile medical unit are available; the total infrastructure facilities available in these mobile health units are 2 beds, 1 ward. A mobile medical unit, temporarily takes care of casualties on-site before they can be safely transported to more permanent hospital facilities. Health workforce of mobile medical unit comprises of doctors, Pharmacists, Clerks, Drivers and Group D workers. But in the study area health workforce of mobile health units currently working are one Doctor one Pharmacist, one Driver and one Group D worker. Thus, there is a need of more number of mobile health units to the study area. Because most of these regions are cover with forest area and the average distance between the existing health centers in these taluk is more. So that, all the poor and needy rural people will use this facilities in their door step.

### Nearest Neighbour Techniques

The Spatial distributions of health centers are unevenly distributed in the study area. In the present study Nearest Neighbour Technique has been used to observe how these health centers are distributed in Periyapatna Taluk. The 'Nearest Neighbour method, was firstly developed by two botanists, Clark and evens 1954, they have used this techniques to measures the pattern of incidence of different species of plants in a region. Later on, geographers have widely used this technique in order to study the distributional pattern of the places and other phenomena in different geographical regions of the world. As a result, this technique has been used in research to study the Geographical distribution of health centers in the study area. The following formula is as:

$$Rn = 2\bar{d}\sqrt{\frac{n}{A}}$$

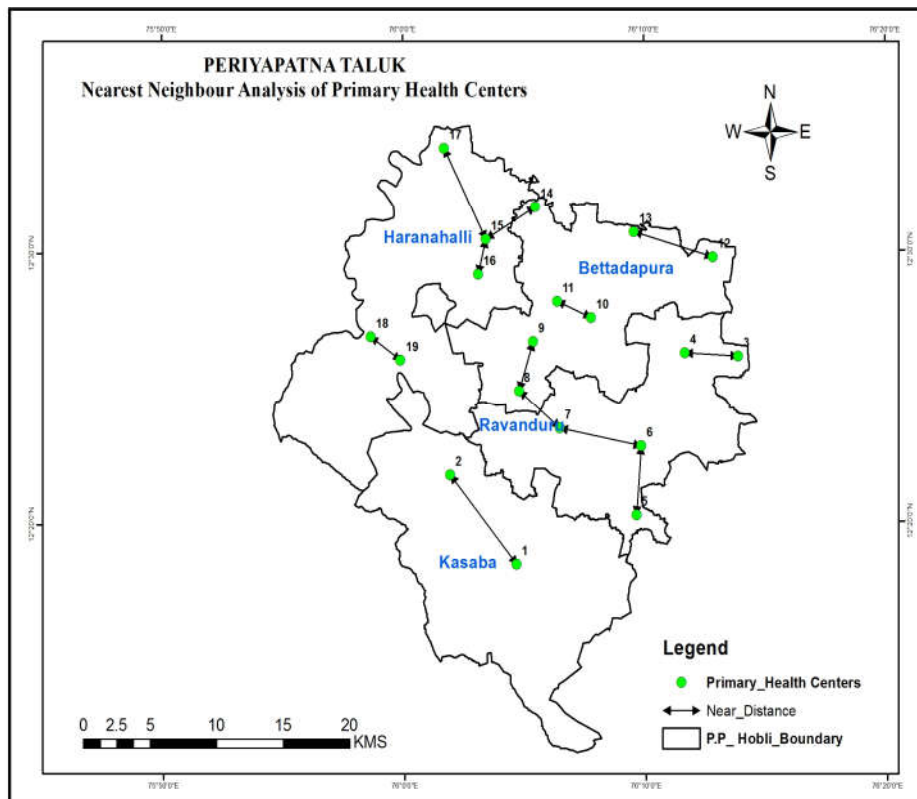
Where:  $Rn$  = The description of the distribution

$2\bar{d}$  = The mean distance between the nearest neighbours (Kms)

$n$  = The number of points (Health Centers) in the study area

$A$  = The area

By using this formula,  $Rn$  values for Four Hoblies of the taluks have been calculated.



**Map 4: Nearest Neighbour Analysis of Primary Health Centers**

Sl. No	Hoblis	Rn Value	Pattern
1	Bettadapura	1:1681	Randomly Distributed
2	Haranahalli	1:4510	
3	Kasaba	1:4221	
4	Ravanduru	1:3843	
<b>Total</b>		1.2904	

*Source: Compiled by Author*

The Nearest Neighbour analysis statistics for all four hoblies of Periyapatna taluk were derived from the distance between nearest health centers. The Rn Value of the study area is 1.2904, it shows that these health centers are randomly distributed, these can be observed in the Map no 4. Since western part of the taluk is forest region, So a large proportion of the residents have to travel a long way to access the health care facilities.

## CONCLUSION

The Study reveals that, the spatial distribution of public Health centers are unevenly distributed among hoblis of Periyapatna taluk. The hobliwise distributions of Public healthcare centers are vary from one hobli to another. Public Healthcare centers are not increasing with the population so there we can identify the gap between them. In the study area the Public health care centers are randomly distributed (Table No: 5), the  $R_n$  value of the health centers in the taluk is 1.2904. To reduce the imbalance in the distribution of public health centers, the establishment of new health care centers should be based on structured criteria and geographical aspects. These health centers are the mirror of the rural mass in the study area. Availability and affordability of means of transport is important factor for utilizing the health services. So, there is a need to give more importance on the development of transport network in Periyapatna taluk. Since western part of the taluk is forest region, a large proportion of the residents have to travel a long way to access the health care facilities. So there is need to establish more mobile health units to provide service to its people in their region at doorstep. In addition to this there is scarcity in the availability of Health Workforce and Health infrastructure in the study area. The proportionate ratio between health workforce and population is in imbalance, because the rate of increase in population is greater than that of increasing rate of health workforce. Thus there is need to improve the infrastructure of existing healthcare centers and increase the number of staffs in the study area for balanced regional development. Majority of the government health centers are not having clean portable water. So, the study recommends that, to provide clean water for health seekers. In fact, health's institutions are dissemination of education of cleanliness but the institutions itself are not having the facility of portable drinking water. The use of advance GIS tools has proved to be boon to the researchers and planner to visualize and conceptualize the health plans and policy. And also the public health administrators are at the advantage of saving time and resources by application of such tools.

## ACKNOWLEDGMENT

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