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Spatio-temporal Analysis of Health Facilities in Mysuru District

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Abstract: Health is one of the most important aspects in the development of a nation. Development and Prosperity of a country is also determined by the status of health conditions of a region. Health facilities are most essential services required by the peoples of that area. Planning for more health facilities in respect to the spatial and temporal changes and location of medical centres are required for the improvement of health of the people. Accessibility to health facilities is the key factor for the inhabitants of the region. The main aim of the Government is to develop organised health care facilities in Rural and Urban area. Presence of Medical centres, type of hospitals, number of beds, work-load factors, Population, Doctor-population ratio, area served by medical centres is most important in the study of health facilities in a region. Health status is one of the indicators of Human Development Index, which is introduced by UNDP.

Keywords: District Hospital; Sub-district Hospital; Community Health Centre; Primary Health Centre; Sub-centres; Work-load factor.

1. Introduction

Health is an important aspect in better quality of life. The development and prosperity of a country are determined by the health of the people. Health facilities are most essential services required by the inhabitants of an area. Planning for more health facilities in respect to the spatial and temporal changes and location of medical centres are essential for the improvement of quality of life. Accessibility to health facilities is the key factor for the inhabitants of the region. In 1946, the World Health Organization (WHO) has defined health as "a state of complete physical, mental and social well being and not merely the absence of disease or infirmity". From 1990, Health status was one of the indicators of Human Development Index introduced by UNDP. Indian definitions of health date back to early Ayurvedic texts framing health in a broader sense in our country. The Sanskrit word '*Swasthya*' means '*to be in equilibrium with the self*' i.e., those who are in equilibrium in the above manner are considered to be healthy'. 12th Five year plan (Volume-III, Chapter-20) defines 'health is a state of complete physical, mental and social well-being'. The determinants of good health are access to various types of health services and an individual's life style choices, personal, family and social relationships. The goal of National Health Policy [1] is to attain the highest possible level of health and well-being of all belonging to different age groups through a preventive and promotive health care orientation in all developmental policies and universal access to good quality health care services without anyone having to face financial hardship as a consequence. It can be achieved through increasing access, improving quality and reducing the cost of health care services.

Karnataka State Health Policy [2] is also in accordance with National health policy. It has Universal access to quality and affordable healthcare services to all and inclusion of health in all developmental policies. This policy will be in force for the next 10 years in the state. Objectives of the present research includes: 1. to know the distribution of Health Centres in two time period in the study area; 2. to Understand the Workload Factor, Population and area served by each Medical centre in the study area.

2. Materials and Methods

For the present study, data has been obtained from District Statistical Office, which was published 'District at a Glance'. The data is also collected from District health Office, Ministry of Health and Family Planning, Government of India and Government of Karnataka. District Census Hand book is obtained from Census of India. Simple statistical tools, Work Load Factor and thematic maps are used to analyze the collected data.

2.1. Study Area

Karnataka state consist 30 districts. Among these Mysuru forms a distinct cultural centre. It is located in southern part of Karnataka State. It lies between 12^0 to 20^0 $17'$ North latitudes and 75^0 and $19'$to 77^0 and $17'$ East longitudes. It covers an area of 6320 km^2 and accounts for 3.29% of the state's total geographical area. It ranks 14th place in the state in terms of area. But it ranks 4th place in population in the state. The district has 30,01,127 people in 2011 census [3]. The district comprises seven taluks namely H. D. Kote, Hunsur, K.R. Nagar, Mysuru, Nanjangud, Periyapatana and T.Narasipura. Among these, H.D.Kote taluk is the biggest (1618 km^2) and K.R.Nagara is the smallest (596 km^2) taluks of the district in terms area. The district is surrounded by

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Chamarajanagar district in the east and south, Mandya district in the north, Hassan in the north-west, Kodagu district and Kerala state in the west. **Figure 1** shows the location of the study area.

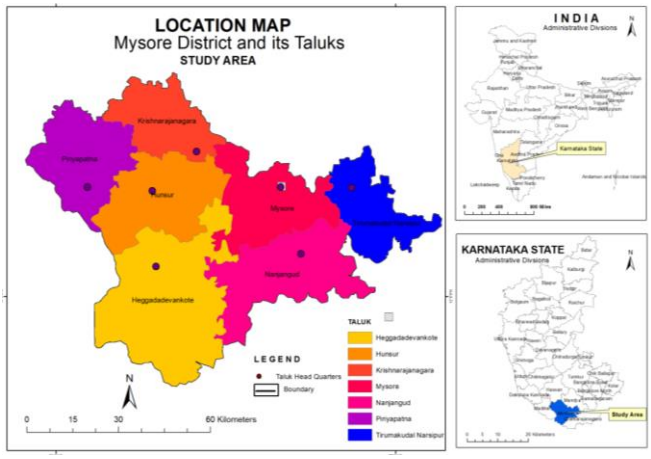

Figure 1 Location of Chamarajanagara district

3. Results and Discussions

3.1. Types of Medical Centres

From the beginning of the first year plan, the Centre and State Governments are giving more emphasis on health sector. The National Health Mission (NHM) is a flagship program of health sector in the century. It restores the strength for Rural and Urban health sectors. It comprises four components namely National Rural Health Mission (NRHM), National Urban Health Mission (NUHM), Tertiary Care Programme and Human Resources for Health and Medical Education. Most of the people in the country are still depending on the public health system. From the past two decades private sector is also playing a major role in health services. The public health system has a three tier system - Primary, Secondary and Tertiary. It consists of District Hospitals, Sub-district/Sub-divisional Hospitals, Community Health Centres (CHC), Primary Health Centres (PHC) and Sub-centres. National Health Mission has appointed Accredited Social Health Activists (ASHA) workers at every village. In our state, for every 1000 people, one ASHA worker has been appointed in plain and is lesser in Tribal areas [2].

The primary care services include the larger package of comprehensive primary health care will be called *'Health and Wellness Centres'.* Primary care must be assured in these centres. Under this, a health card is issued to every family and is eligible for a defined package of services anywhere in the country. It consists of ASHA and Sub-centres anywhere in the country. Secondary care services include district hospitals, Sub-district/Sub-divisional hospitals, Community Health Centres and Primary health centres (PHC's). Tertiary care services are organized on the lines of Regional, Zonal and Apex referral centres. It includes Medical Colleges, Nursing Institutions and establishment of AIIMS (All India Institute of Medical Sciences). In this paper an attempt has been made to know about the spatial pattern of District Hospitals, Sub-divisional Hospitals, Community Health Centres, Primary Health Centres and Sub-centres. *Indian Public Health Standards (IPHS-2012)* has defined these centres.

3.2. District Hospital

It is defined as a hospital at the secondary referral level responsible for a district of a defined geographical area containing a defined population. These hospitals will be established where the population is between 5 to 30 lakhs. It is linked with health centres, sub-district/sub-divisional hospitals, Community Health Centres, Primary Health Centres and Sub-centres. A district hospital should be able to serve 85 to 95% of the medical needs in the district. Based on number of beds, these hospitals are grouped as Grade-I (500 beds), Grade-II (400 beds), Grade-III (300 beds), Grade-IV (200 beds) and Grade-V (100 beds).

3.3. Sub-district / Sub-divisional Hospitals (3 to 100 beds)

These are intermediary hospitals between District Hospitals and Community Health Centres. They act as first referral units for taluk / block population. They will get referred cases from neighbouring Community Health Centres, Primary Health Centres and Sub-centres. So Sub-district hospital means 'a hospital at the secondary referral level responsible for the Sub-district / Sub-divisional of a defined geographical area consisting a defined population (from 1 to 5 lakh)'.

3.4. Community Health Centres

These are established at Hobli level. It provides secondary level of health care services. It provides specialist health care to the rural population. It will provide services to 80,000 people in tribal and hilly or desert areas covering 4 Primary Health Centres. In plain region it provide services to 1,20,000 population (4 PHC's). It consist 30 beds and mostly serves in rural areas.

3.5. Primary Health Centres

Bhore Committee in 1946 gave the concept of a Primary Health Centre. It is a basic health unit to provide preventive health care to the rural population. The central council of Health at its first meeting held in January 1953 had recommended the establishment of these hospitals in community development blocks to provide Comprehensive Health Care to the rural population. The 6th Five year plan (1983-88) proposed reorganization of these on the basis of population. In plain areas these centres were established for every 30,000 people, whereas in Hill/Tribal/Desert regions it will be established for every 20,000 people. They are providing 24 x 7 nursing facilities. They will act as first point to a qualified doctor of the public sector in rural areas.

3.6. Sub-Centres

It is the most peripheral and first point of contact between the primary health care system and community. It connects the people in grass root level. It is the first step of a ladder in a referral pyramid of health facilities. In plain areas, these centres were established for every 5000 people and in hilly/tribal/desert areas they will be started for every 3000 people.

Here an attempt has been made to know the spatial distribution of Medical centres in Mysuru district in two different periods. Allopathy, Indian System, Community Health Centres, Primary Health Centres and Primary Health Units. It includes both public and private hospitals. **Table 1** shows the distribution of Medical centres in taluks of Mysuru District.

3.7. Spatial Distribution of Medical centres

Table1 Distribution of Medical Centres in Mysuru District: 2001-02 (parenthesis indicate percentage to district)

Sl. No.	Taluks	Allopathy Hospitals	Indian System Hospitals	No. of Pvt. Hospitals/clinics	PHC's & CHC's	PHU's	No. of Beds	No. Medical shops
1	H.D.Kote	1	-	-	14	5	128 (2.06)	23 (2.87)
2	Hunsur	1	1	2	14	6	202 (3.25)	34 (4.23)
3	K.R.Nagar	1	-	2	8	4	167 (2.69)	38 (4.73)
4	Mysuru	8	2	49	14	18	5008 (80.59)	615 (76.59)
5	Nanjangud	1	2	2	19	-	313 (5.04)	27 (3.36)
6	Periyapatana	1	-	-	13	5	159 (2.56)	24 (2.99)
7	T.Narasipura	1	-	4	14	3	237 (3.81)	42 (5.23)
DISTRICT		**14**	**5**	**59**	**96**	**41**	**6214**	**803**

During 2001-02, the district has 215 health centres with 6214 beds. All the taluk headquarters have one Sub-district/Sub-divisional hospitals with 50 beds capacity. But in Periyapatana and T.N.Pura taluks, these hospitals have 30 beds. Mysuru taluk which also consist Mysuru Urban area as a district headquarter has maximum number of hospitals (76.59%) and beds (80.59%) of the district as shown in **Table 1.** Least number of beds are to be found in H.D.Kote taluk (2.06%) followed by Periyapatana (2.56%) and K.R.Nagara taluk (2.69%).

There were 803 medical shops in the district. More than 3/4th of these are found in Mysuru taluk, which includes Mysuru City. Lowest number of these are found in H.D.Kote (2.87%) followed by Periyapatana (2.99%), Nanjangud (3.36%) taluks.

Table 2 Distribution of Medical Centres in Mysuru District: 2015-16 (parenthesis indicate percentage to district)

Sl. No.	Taluks	Allopathy Hospitals	Indian System Hospitals	No. of Pvt. Hospitals/clinics	PHC's	CHC's	No. of Beds	% of change in Beds (for 15 years)	No. Medical shops (14-15)	% of change in Med. Shops (for 14 years)
1	H.D.Kote	20	1	38	18	1	369 (4.38)	188.28	37 (2.43)	60.87
2	Hunsur	23	2	53	22	0	311 (3.69)	53.96	57 (3.74)	67.65
3	K.R.Nagar	17	1	52	15	1	314 (3.73)	88.02	54 (3.54)	42.10
4	Mysuru	44	1	1280	37	3	6478 (76.9)	29.35	1214(79.66)	97.40
5	Nanjangud	22	2	85	19	2	400 (4.75)	27.79	59 (3.87)	118.52
6	Periyapatana	23	1	40	22	0	278 (3.30)	74.84	42 (2.76)	75.00
7	T.Narasipura	18	-	49	14	3	274 (3.25)	15.61	61 (4.00)	45.24
DISTRICT		**167**	**8**	**1597**	**147**	**10**	**8424**	**35.56**	**1524**	**89.79**

After a gap of 14 years of time, when we observe the distribution of medical centres in the district, there is a huge change in different aspects. After 2001-02, National Health Mission was established in the country. It became a flagship programme of the country, which gave more emphasis on the development of medical centres in public sector. It has been reflected in the district also. These changes can be observed in **Table 2.**

The number of hospitals increased significantly during this period. It has gone up from 215 to 1929 during this period. Allopathy hospitals and Private hospitals / clinics have greatly increased during this time. We can also observe that 35.56% of beds have also increased. More than 3/4th hospital beds in the district are found in Mysuru city only. In all the taluks, the numbers of beds have increased significantly as compared to 2001-02. Highest percentages of change in beds are found in H.D.Kote taluk (188.28%) and lowest has been found in T.Narasipura taluk (15.61). Nearly 90% of medical shops have been increased during this period. It went up from 805 to 1524 shops. Highest change has been found in Nanjangud taluk (118.52) and lowest in K.R.Nagar taluk.

3.8. Range of Medical Centres

In 2001-02, there were 215 Medical Centres in the district. There is a drastic increase of these centres in the next 14 years. In 2015-16, there were 1772 Medical Centres in the entire district as shown in **Table 3**. The increase has been recorded in all the taluks. As noticed earlier, the implementation of National Health Mission has greatly provided impetus for the development of these centres.

Highest increase is found in Mysuru taluk from 91 to 1325 which is about 97% increase in every year. The other taluks like K.R.Nagar (26%), Nanjangud (25%), Periyapatana (17%), Hunsur (16%), T.Narasipura (15%) and H.D.Kote have recorded 14% of annual increase in the number of Medical Centres. So there is a record annual increase of 52% of these centres in the district.

Table 3 Range of Medical Centres in Mysuru district during 2001-02 & 2015-16

Sl. No.	Taluks	Area (km^2)		Population		No. of Medical Centres		Population served by each medical centre		Area served by each medical centre (km^2)	
		01-02	**15-16**	**2001**	**2011**	**01-02**	**15-16**	**01-02**	**15-16**	**01-02**	**15-16**
1	H.D.Kote	1619	1618	242615	263706	20	59	12131	4470	80.95	27.42
2	Hunsur	897	898	258138	282963	24	78	10756	3628	37.38	11.51
3	K.R.Nagar	605	596	239155	252657	15	70	15944	3609	40.33	8.51
4	Mysuru	815	797	1024410	1281768	91	1325	11257	967	8.96	0.60
5	Nanjangud	982	974	358415	384922	24	109	14934	3531	40.92	8.94
6	Periyapatana	815	812	224022	243076	19	64	11791	3798	42.89	12.69
7	T.Narasipura	599	600	278156	292035	22	67	12643	4359	27.23	8.96
DISTRICT		**6269**	**6307**	**2624911**	**3001127**	**215**	**1772**	**12209**	**1694**	**29.16**	**3.56**

According to 2001 census the district has 26,24,911 people. There are 215 medical centres in the district during this period. In an average each medical centre is serving 12209 people. In several taluks it is higher than the district average. K.R.Nagara taluk has highest number of people served by a medical centre (15944). It is followed by Nanjangud (14,934) and T.N.Pura (12,643) taluks. It shows that there is more pressure on each medical centre in these taluks. But lowest has been found in Hunsur taluk, where a medical centre cater services 10,756 people.

There has been a significant change in population served by each medical centre after a gap of 14 years. Now a Medical Centre in the district is serving 1694 people against 12209 people in 2001-02. Except Mysuru taluk, all other taluks medical centres are serving more than the district average. A Medical Centre is serving 967 people in Mysuru taluk, where as it is serving 4470 people in H.D.Kote, 4359 people in T.Narasipura, 3798 people in Periyapatana taluks. All the results showed that, due to increase of medical centres in each taluk during this period is more than the increase of population during the same period.

During 2001-02, a medical centre in the district covers an average of 29.16 km^2 of area. But in H.D.Kote taluk, a medical centre covers an area of 80.95 km^2, because most of the area of this taluk is under forest and in semi malnad region. In Periyapatana taluk one hospital covers nearly 43 km^2 of area. It is followed by Nanjangud (41 km^2) and K.R.Nagara (40 km^2). But it is less in T. N. Pura (27.23 km^2) and Mysuru Taluk (8.96 km^2) than the district average. The rest of the taluks have more than the district average as shown in **Table 3**. As a district headquarter and major urban centre, Mysuru taluk has one health centre for every 9 km^2 of area during this period.

Table 4 Talukwise Workload factor in Mysuru District (2001-02 &2015-16)

Sl. No.	Taluks	Population		No. of Beds		Workload Factor	
		2001	2011	01-02	15-16	2001-02	2015-16
1	H.D.Kote	242615	263706	128	369	1895	715
2	Hunsur	258138	282963	202	311	1278	910
3	K.R.Nagar	239155	252657	167	314	1432	805
4	Mysuru	1024410	1281768	5008	6478	205	198
5	Nanjangud	358415	384922	313	400	1145	962
6	Periyapatana	224022	243076	159	278	1409	874
7	T.Narasipura	278156	292035	237	274	1174	1066
DISTRICT		**2624911**	**3001127**	**6214**	**8424**	**422**	**356**

After a period of 14 years, we observe that area served by each medical centre, has been drastically reduced from 29.16 km^2 to 3.56 km^2 during this period. Except Mysuru taluk, all other taluks have more area than the district average. In Mysuru taluk, every 0.60 km^2 area is covered by a medical centre. It shows that there is a concentration of health facilities in the taluk, which also consist Mysuru city.

3.9. Work Load Factor

It is a simple ratio between the population of a district and the number of beds. It is a method to determine the load of population per indoor bed. Higher the ratio, the more is the work load. It means that there is more pressure on Human resource and it shows lack of infrastructural facilities. This technique has been developed by MC Glashan (1968) to analyse the disparities between population distribution and existing medical facilities.

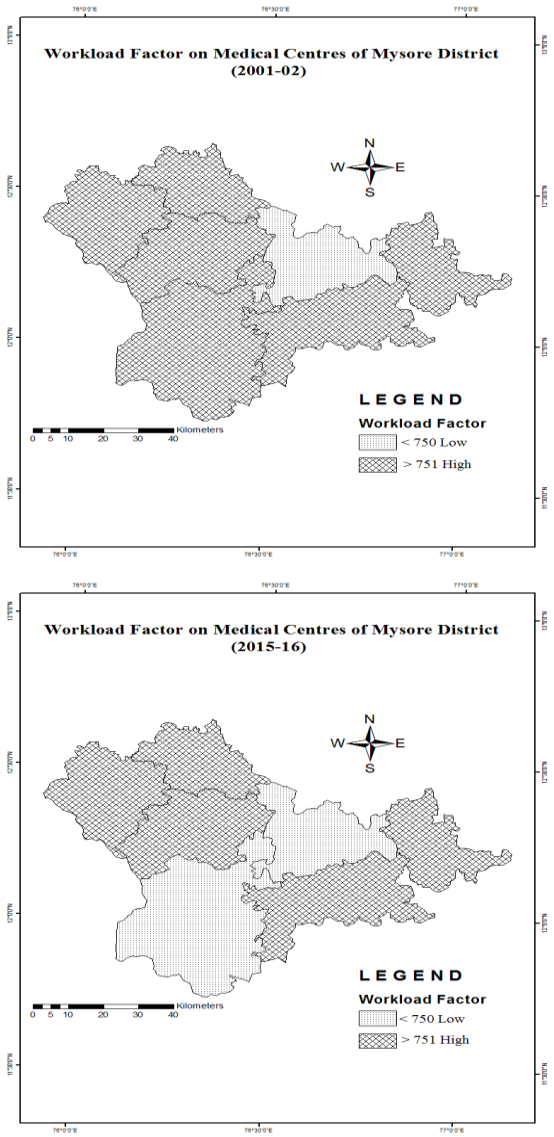

Figure 2 Work load factor on Medical centres of Mysuru district

When work load factor has been computed for the district, it is 422 persons per bed. Highest work load factor has been found in H.D.Kote taluk (1895) and lowest is is in Mysuru (205) taluk. It shows that between the taluks the work load factor is unevenly distributed. Except Mysuru taluk, all other taluks have more Work Load factor than the district average as shown in **Table 4**. Future development of health services has to be done in these taluks.

In 2015-16, the work load factor of the district has been reduced to 356 as shown in the **Table 4**. It can be observed that there has been significant increase in number of beds in the district. There has been reduction of work load factor in all the taluks. Highest change has been recorded in H.D.Kote taluk with 62% of change, followed by K.R.Nagar (44%), Periyapatna (38%), Hunsur (29%) and Nanjangud (16%) taluks. Lowest change has been observed in Mysuru taluk with only 3% variation. These spatial and temporal changes can be observed in **Figure 2**.

4. Conclusion

From this analysis, it shows that the number of Medical centres is more in city (Mysuru taluk) than the other taluks, whereas most of the people are residing in rural areas. So there is a need to develop more medical centres in these regions. There is a need for development of Government and Private Health centres in this period. There is a need to further increase these kinds of centres. In the same time, it is essential to enhance the number of beds in rural areas, where it is insufficient. Inter-taluk disparities are to be reduced. These measures can reduce the burden on urban medical units and the people in rural areas will get good health facilities. It also decreases the movement of people from rural to urban areas and reduces the expenditures.

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