

# Tehsil Wise Study and Analysis of Health Centers using GIS (Chittorgarh, Rajasthan, India)

Kawaljeet Singh<sup>1</sup>, B. L. Pal<sup>2</sup>

<sup>1</sup>M. Tech Scholar, Mewar University, Gangrar, Chittorgarh, Rajasthan, India

<sup>2</sup>Assistant Professor, Department of CSE, Mewar University, Gangrar, Chittorgarh, Rajasthan, India

**Abstract:** *Healthcare is the birth right of the citizens of any country. Most of the developed countries have implemented universal healthcare systems. However many developing countries like India are striving for the universal healthcare. The objective of WHO (World Health Organization) is to promote and coordinate healthcare across the world. India has been in close relationship with WHO since 1948 and is committed to provide affordable healthcare to the citizens of its country. For India the biggest challenge is the population. Moreover more than 70% people live in rural areas. The access to primary health care in rural area is very limited. In this direction Indian government launched National Rural Health Mission (NRHM) to improve the healthcare services in the rural areas. Rajasthan is among the 18 states of India which was identified by NRHM with very low healthcare. There many government policies and organizations (NGOs) are being run, still there is need to focus a lot on rural health development programs. The healthcare in India comprises of three tiers, Sub Centre (SC), Primary Health Centre (PHC) and Community Health Centre (CHC). There are various population norms provided by Ministry of Health for the opening of health centers in the rural areas. This study is to find the gap between the existing number of health centers and required number of health centers according to norms provided by the government in the Kapasan and Nimbahera Tehsils of Chittorgarh District, Rajasthan, India.*

**Keywords:** GIS, MAP, ARCGIS, ARCMAP10.1, Community Health Center, Healthcare, Health Centers, Gap, Primary Health Center, Rural, SubCenter,

## 1. Introduction

The health status of the poor and socially excluded population over large parts of India is poor. Indian government is committed to provide 'affordable healthcare' to all, predominantly through public sector since independence through various schemes and programs. In India healthcare is delivered through a three tier structure consisting of primary, secondary and tertiary levels so that the people of rural as well urban areas can access the healthcare services within the reachable distance from their house. The primary tier has 3 types of medical centers namely a Sub Center (SC) for the inhabitants in the range of 3000-5000, a Primary Health Center (PHC) for the inhabitants in the range of 20000-30000 and a Community Health Center (CHC) which acts as a referral center for every 4 PHCs. At the secondary level there are district hospitals for the urban inhabitants. The tertiary medical care is usually to be provided by medical care establishments in cities which can be effectively furnished with sophisticated diagnostic as well as investigation facilities. Despite a huge net work of medical care centers in India, there is a wide difference between the rural in and urban areas when it comes to accessibility and availability regarding medical care infrastructure, since the cities are have better equipment and facilities. Additionally, since providing healthcare is a state matter the availability and accessibility of medical care services in rural areas in the state varies. [1]. The launching of NRHM in 2005 was for the architectural correction of the medical care delivery system with the convergence of various health programmes. The new modifications inside the NRHM document was primarily made up of decentralization, communitization, organizational structural reforms within healthcare sector, inter-sectoral convergence, public and private joint venture in healthcare market. The vision of NRHM was to provide effective medical care to inhabitants throughout the country. In the beginning 18

states were selected which had weak public health indicators and weak infrastructure. [2]. The study is expected to provide information on the availability of health centers at Community Health Centre (CHC), and Primary Health Centre (PHC) and Sub Centre (SC) level in the Chittorgarh District of Rajasthan. GIS was utilized to investigate the spatial distribution of the health centres. The main finding of this study was the large gap in the existing and required no of health centers according to norms in some of the tehsils of Chottorgarh district. It is found that no. of SCs, PHCs and CHCs in the Kapasan and Nimbahera are not adequate to satisfy the medical needs of the inhabitants. Therefore it is recommended to add more medical centers in the areas and improve the availability of medical care.

## 2. Literature Survey

(Vikram Ranga et al[6]) suggested that Health care access is a big problem at the global level for the health planners. It is a multistage and multidimensional concept. Where the stages are potential and realized (Joseph and Phillips, 1984; Guagliardo, 2004) and dimensions are availability, accessibility, affordability, acceptability and accommodation (Penchansky and Thomas, 1981). Geographical information system (GIS) research focus on the spatial dimension i.e. accessibility (McLafferty, 2003), while the rest of the dimensions can be considered as non-spatial. According to potential accessibility all members of a population (i.e. a centroid/population weighted centroid) are potential users of the medical facilities present within a defined distance or driving time and realised accessibility is the actual use of the health care provider by the members of a population. Potential accessibility can be used to find areas short of health care providers. For health planners potential accessibility is very useful for the allocation of health centres. Most of the research in GIS on the health care is for assessing potential spatial access. The ratio of health care

centers to population within an area is the simple way to find out the accessibility of health care services.

(Planning Commission Government of India February 2011[2]). Indian economy ranks 3<sup>rd</sup> in the world and if keep growing at the same pace, it will be in the list of most developed nations of the world. India has technologies and knowledge required for providing health care to its citizens. Even though there are gaps in providing the health care and they are widening further. The National Rural Health Mission (NRHM) tried to strengthen the public health systems across the states in rural areas. Since these developments were uneven and States with better capacity were able to take advantage of NRHM financing sooner, while high focus States had first to revive or expand their nursing and medical schools and revitalize their management systems. Because of these large gaps and more time taken to develop capacity to absorb the funds, gaps between the health services according to norms and actual are getting worse in high focus states.

### 2.1 Geographical Information System (GIS)

(Fortney J et al ) [3]. The geography of healthcare is about the analysis of spatial organization (number sizes, types, and locations) of health services. It also includes the information about the changes in spatial organization with the time, how the people will access the health services and the impacts of the changes on the healthcare.

Sara L. McLafferty [4]. The health care in many countries like US has changed a lot since last couple of decades. Geographical Information System and related spatial analytic methods can be used to describe and understand the changes in the spatial organization of health care. These tools can also be used to examine the relationship between changes in the spatial organization of health care and health outcomes and access, and to explore how health care delivery can be improved. In the recent years due to the advancement in computing power and GIS based locational analysis, GIS is contributing a lot in the health care services from personal health services to information for prevention of diseases, early diagnosis, treatment and rehabilitation (Gatrell, 2002).

### 3. Problem Statement

An enormous system of health establishments has become created, in rural and urban areas, and large sources, though inadequate necessity, gone into setting up and employing the health and family welfare programmes. Even so, these accomplishments are uneven, using marked disparities across states and districts, and between urban and rural individuals. Inadequate and badly maintained health infrastructure can be a main barrier with regard to using health services throughout rural areas which mostly focus on maternal and child health for the very poor. Poor infrastructure will certainly as a result certainly be a main hindrance throughout attaining the millennium growth aims.

Development involving PHCs and also sub-centres, need much more PHCs and also sub-centres to be able to match the demand in medical sector sometime soon. At present, in

the area under study there are 21 CHCs, 47 PHCs and also 361 sub-centres. In view of the norms provided earlier mentioned, we should measure the recent predicament involving medical center network.

### 4. Objective

The key purpose from the study is to measure the current situation from the Rural Healthcare Centers at different levels in the study area. The primary objectives of the research are underneath:

- To help measure the present levels of coverage of medical care centers especially for rural people.
- To handle a certain issues determined, such as evaluation of appropriateness of the current inhabitants norms and location of CHCs, PHCs along with SCs in the context of increasing accessibility to rural people.
- To execute Geographical Information System (GIS) mapping of each and every healthcare facilities in the rural places.

### 5. Proposed System

#### 5.1 Methodology

##### 5.1.1 Preparation for the assessment

- Review of literature regarding health facility studies in India and abroad.
- Situation analysis in one district of Rajasthan to determine which tehsils state needs to be evaluated.
- Indicators: - Norms for Health Facilities for evaluation is given in the Table 1.

##### 5.1.2 Procedure and data collection

- Map of the study area (Chittorgarh District) showing local boundaries obtained from the Google Maps.
- Additional information was gleaned from other sources such as academic journals, gazettes, brochures, Internet and statistical publications.
- Health Care Centers data and information were sourced from NRHM site
- Surveyed various villages of Kapasan and Nimbahera Tehsils for the health centres.

Two tehsils Kapasan and Nimbahera of Chittorgarh District, were selected for present study. Chittorgarh district is divided in 10 tehsils (Census, 2011), out of which six tehsils and one Girwa tehsil partly covered in TSP areas. In 10 tehsils, 21 CHCs, 47 PHCs and 361 SCs are functioning in areas of selected district.

#### 5.2 Study Area

The study area is Chittaurgarh district located between 23° 32' and 25° 13' north latitudes and 74° 21' and 75° 49' east longitudes in southeast Rajasthan, India covering an area of 10,856 sq.km. The district is part of Udaipur Division and is divided into five sub-divisions namely Begun, Chittaurgarh, Kapasan, Nimbahera and Pratapgarh [15]. Total number of villages in the district is 2415 and it also has 8 urban towns. Rural and Urban population of the district is 15.15 lakh and 2.89 lakh respectively [16].



Figure 1: Map of Chittorgarh District (Source Google Maps)

### 5.2.1 Tehsil Demographics

Kapasan is a Tehsil in Chittorgarh District of Rajasthan State, India. Kapasan Tehsil Head Quarters is Kapasan town. It belongs to Udaipur Division. It is located 36 KM towards west from District head quarters Chittorgarh. 317 KM from State capital Jaipur towards North. The population of Kapasan Tehsil is 199,340(178,471 in Rural and 20,869 in Urban areas) according to Census 2011 by Indian Government. There are 43,083 house holds in the tehsil(100,101 males and 99,239 females).Kapasana has 34,537 people who belong to scheduled cast and 22,831 people belonging to scheduled tribe. It has 95,436 literates(61,943 males and 33,493 females)[11]. The population in Nimbahera tehsil is 219,790(157,841 in the urban and 61,499 in rural) according to census 2011 by Indian Government. There are 45,835 House Holds (111,791 males and 107,999 females) in the Nimbahera Tehsil. It has 34,727 schedule cast and 25,738 scheduled tribes.. The literacy rate in the tehsil is -131,846(80,577 males and 51,269 females)[12].

### 5.3 Distribution of Health Care Facilities

As per the resolution by World Health Organization Indian government decided to expand health care amenities in every state as well as set up an excellent network involving of primary healthcare centers. Healthcare services are planned at 3 levels, every level gets support from the higher level, the lower level refers the patients to the higher level. It was planned to open a community center for every 120,000 inhabitants in plain area (for 80,000 inhabitants of hilly as well as tribal areas), a primary healthcare center for every 30,000 inhabitants in plain area (for 20,000 inhabitants in hilly as well as tribal areas) and a sub-center for 5,000 inhabitants in plain area (for 3,000 inhabitants in hilly place as well as tribal areas). Medical care services throughout rural regions are being provided by these medical centers as well as district health care centers.

Table 1: Population Norms for the Health Facilities(Source: Department of Health and Family Welfare: Annual Report, 2012-2013)

Sr. NO.	Geographical Unit	Facility Type	Population Norm	Functions
1	Village	Sub Centre	5000 in Plain 3000 in Hills and Tribal & Desert Area	Maternal & Child Health, Family Welfare, Nutrition, Immunization, Diarrhea, and Communicable disease control
2	Block	PHC	30,000 in Plain, 20,000 in Hills and Tribal & Desert Area	Referral Unit for 6 Sub-centers. Curative, Preventive, Promotive and Family Welfare Services
3	Tehsil	CHC	1,20,000 in Plain, 80,000 in Hills and Tribal & Desert Area	Referral Unit for 4 PHCs, Emergency Obstetric care-Specialist consultation

The Chittorgarh District has one district hospital, 21 CHCs, 47 PHCs and 361 SCs. There are three dispensaries, 28 Delivery points, 1 Trauma Center providing health care services to the inhabitants (Fig. 2). Table 1 show Tehsil wise healthcare centers. Variations in medical care centers were analyzed at tehsil/district levels. The Chittorgarh Tehsil has the highest number of SCs(61) followed by Tehsils Rawatbhata (38), Begun (37), Nimbahera(33), Bari Sadri(30), Kapasan(28) and Gangrar (22). The Kapasan and Nimbahera tehsils has number of SCs, PHCs, and CHCs quite below as per required by norms(in the Table 1) .

Table 2: Tehsil Wise Existing Health Centers (Source: Statistical Profile of Rajasthan and NRHM Rajasthan)

	Population Census 2011			Existing Health Centers		
	Total	Rural	Urban	SC	PHC	CHC
Bari Sadri	116,266	100,553	15,713	30	4	2
Begun	135,340	114,635	20,705	37	1	2
Chittaurgarh	159,389	93,182	66,207	61	6	5
Kapasana	199,340	178,471	20,869	28	4	1
Nimbahera	219,790	157,841	61,499	33	5	2
RawatBhata	140,128	102,429	37,699	38	5	1
Gangrar	103,940			22	4	2

## 6. Analysis and Findings

In the study area the gap of the health centers requirement lies between -29 to 12 for the Sub Centers (SCs), -1 to 4 for the Primary Health Centers (PHCs) and -1 to 1 for the Community Health Centers (CHCs). In these minus (-) figures indicate surplus number of health centers.

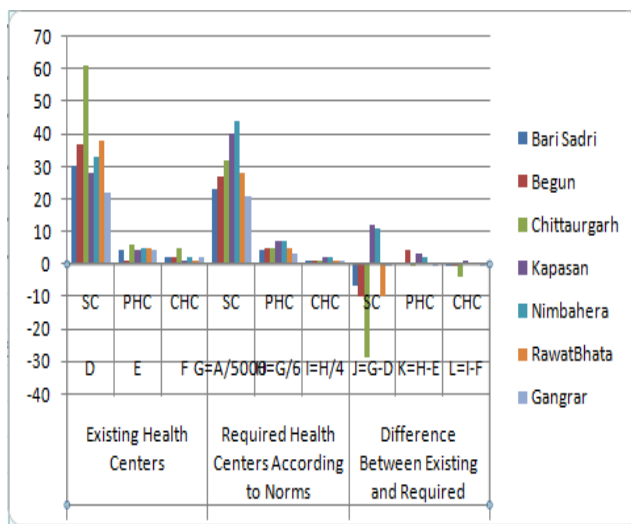
The requirement calculation is based on the norms published by the department of health and family welfare. Requirement values has been segmented into four classes representing near equal distribution to yield four hospital requirement zones, viz. low, moderate, high and very high. After calculation it is found that the area come under very high and high requirement class is Kapasan and Nimbahera tehsils with the shortage of 12 and 11 SCs respectively where as Barisadri, Begun, Chittorgarh and Rawatbhata tehsils come under low and moderate requirement classes in Chittorgarh district. It is interesting to note that Chittorgarh city has surplus number of sub centers. So, to fulfill the objective of healthcare facilities centers, a well-coordinated



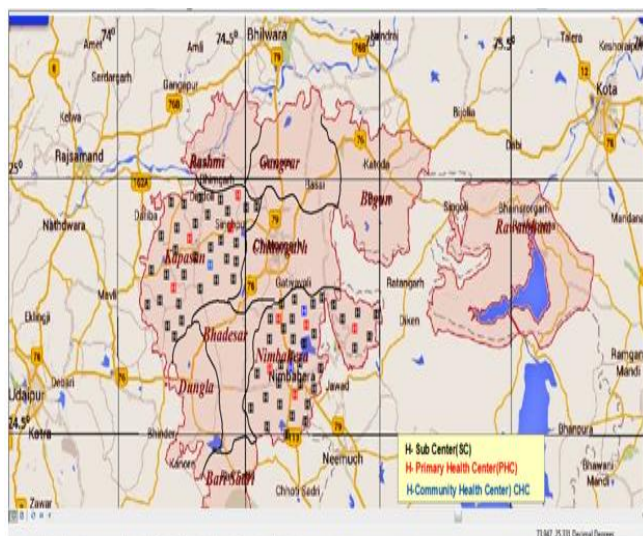
comprehensive step is needed by the state and central governments.

**Table 3:** Status of Health Centers in Chittorgarh District, Rajasthan, Negative numbers shows surplus health centers in the Tehsil)

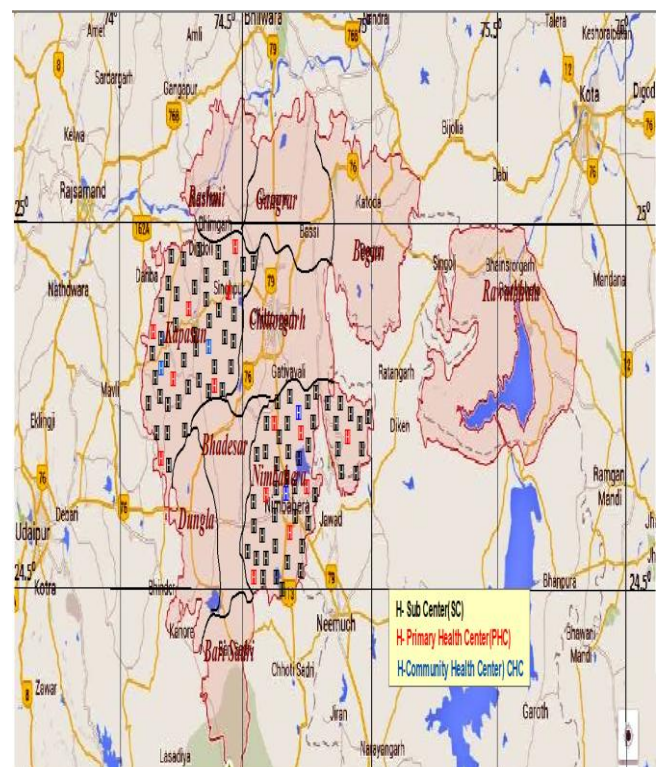
	Populati on Census 2011	Existing Health Centers			Required Health Cnters (According To Norms)			Shortfall Between Existing and Required		
	A	B	C	D	E=A/5000	F=E/6	G=F/4	H=E-B	I=F-C	J=G-D
	Total	SC	PHC	CHC	SC	PHC	CHC	SC	PHC	CHC
Bari Sadri	116,266	30	4	2	23	4	1	-7	0	-1
Begun	135,340	37	1	2	27	5	1	-10	4	-1
Chittaurgarh	159,389	61	6	5	32	5	1	-29	-1	-4
Kapasan	199,340	28	4	1	40	7	2	12	3	1
Nimbahera	219,790	33	5	2	44	7	2	11	2	0
RawatBhata	140,128	38	5	1	28	5	1	-10	0	0
Gangrar	103,940	22	4	2	21	3	1	-1	-1	-1



**Figure 2:** Tehsil wise Comparison Chart of Existing and Required Health Centers(Source:Department of Health and Family Welfare Report 2012-2013, : Statistical Profile of Rajasthan and NRHM Rajasthan )



**Figure 2:** The Existing Health Care Centers in Kapasan and Nimbahera Tehsils of Chittorgarh District



**Figure 3:** The Required Health Care Centers in Kapasan and Nimbahera Tehsils of Chittorgarh District according to the Norms.

## 7. Result

There is a big shortfall for health care centres in Kapasan and Nimbahera tehsils according to the norms provided by the department of health and family welfare. The urban areas like Chittorgarh Tehsil have surplus number of health centres.

## 8. Conclusion

The existing number of health centers in the study area are unsatisfactory. These unsatisfactory numbers shows that there is a need for much more effective public healthcare

system for the rural people. The urban area of Chittorgarh District i.e. Chittorgarh Tehsil has excess number of health care centers while there is a big shortage in the rural areas. As the calculation in the study does not include the tribal population (due to lack of data for the tribal areas), the requirement numbers can be even much more. There is need for well defined planning by the government to fulfill the health care needs of the people in the rural areas.

- [15] Ground Water Scenario, Ministry of Water Resources, Government of India, Available at: [cgwb.gov.in/District\\_Profile/Rajasthan/Chittorgarh.pdf](http://cgwb.gov.in/District_Profile/Rajasthan/Chittorgarh.pdf)  
 [16] Chittorgarh Online Website (Accessed 2015), Available at: <http://chittorgarhonline.in/about.aspx>

## References

- [1] S.P. Pal,(1999) "Functioning of Community Health Centres (CHCs)" Available at [http://planningcommission.nic.in/reports/peoreport/peo/peo\\_chc.pdf](http://planningcommission.nic.in/reports/peoreport/peo/peo_chc.pdf)
- [2] Planning Commission Government of India February 2011, "Evaluation Study of National Rural Health Mission (NRHM) In 7 States" Available at [planningcommission.nic.in/reports/peoreport/peoevalu/peo\\_2807.pdf](http://planningcommission.nic.in/reports/peoreport/peoevalu/peo_2807.pdf)
- [3] Fortney J, Rost K, Zhang M, Warren J. 1999. The impact of geographic accessibility on the intensity and quality of depression treatment. *Med. Care* 37:884–93
- [4] Sara L. McLafferty, GIS and Healthcare, *Annu. Rev. Public Health* 2003. 24:25–42 Available at <http://www.unm.edu/~lspear/geog525/annurev.publhealth.24.012902.pdf>
- [5] Amlan Majumder,"An Analysis Of The Primary Health Care System In India With Focus On Reproductive Health Care Services", *Artha Beekshan* Vol. 12, No. 4 (2004), pp. 29-38
- [6] Vikram Ranga, Pradeep Panda, "Spatial access to in-patient health care in northern rural India", *Geospatial Health* 8(2), 2014, pp. 545-556
- [7] D.R. Joshi(2006-07), "Quality of Rural Health Care Systems in Rajasthan", Available at <http://prcs-mohfw.nic.in/writereaddata/research/534.pdf>
- [8] "Census of India", Office of Registrar General & Census Commissioner, India. Available at <http://www.censusindia.gov.in/> (accessed 2015).
- [9] "RHS Bulletin", ministry Of Health & F.W., Government Of India: March 2006 <http://mohfw.nic.in/NRHM/State%20Files/gujarat.htm>
- [10] World Health Organization country office for India <http://www.whoindia.org/EN/Section3/Section108.htm>
- [11] "Population Statistics Census 2011", Available at <http://ourhero.in/population/sub-districts/kapasan-sub-dist-660>
- [12] "Population Statistics Census 2011", Available at <http://ourhero.in/population/sub-districts/nimbahera-sub-dist-663>
- [13] Praveen Kumar RAI, M.S.NATHAWAT, "GIS in Healthcare Planning: A Case Study of Varanasi, India", *Forum geografic. Studii și cercetări de geografie și protecția mediului* Volume XII, Issue 2 (December 2013), pp. 153-163
- [14] National Health Mission(Accessed July 2015), Ministry of Health and Family Welfare, Government of India. Available at : <http://nrhm.gov.in/nrhm-components/health-systems-strengthening/infrastructure.html>