

GIS Based Analysis of Spatial Disparities in Health Care Facilities of Ghazipur District, India

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Abstract

Health is fundamental aspect to the national progress in any sphere. Due to various socio-economic and political factors, there exists a widespread inequality in the distribution of health care facilities in India. The study area Ghazipur district, is a part of an alluvial plain of the mid- eastern corner of the middle Ganga valley, located in eastern Uttar Pradesh of India. The main objectives of this paper is to analyses the spatial variation of health care facilities in the district in GIS platform and to provide effectives measures and planning for the health care facilities. The present study is based on statistical data regarding the availability of different types of health care facilities and family welfare facilities at district hospital, community health centres (CHCs), and primary health centres (PHCs) and Sub-centres integrated with GIS. The ratios are calculated with the help of absolute figure of different health care facilities in blocks as per lakh population of Ghazipur district. The data regarding the population is obtained from District Census Handbook. ArcGIS 10.3 software was used to create maps for spatial distribution of health care facilities in the district. The present study reveals that health care facilities are not equally distributed in all the blocks of the district in respect of hospitals, doctors and number of beds. The study is also reflects a huge gap across block level in terms of population distribution of health care facilities.

Keywords: Health Care Facilities; GIS; Spatial Inequality; PHCs; CHCs

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Introduction

Health is not only an important commodity for individuals, but an essential component of development which is vital for economic growth and sustainable development. Any deficiency in health sector infrastructure can create a hurdle for the advancement of the nation.

India is mostly a rural country, where about 69 percent of population still resides in rural area [1]. Though healthcare facilities in India have undergone a change at an unprecedented scale, yet substantial proportion of the population is unable to receive even minimally adequate healthcare at needed time. Unequal distribution of healthcare facilities, low income and high cost of medical care are major constraints in accessibility and affordability of healthcare facilities [2, 3]. Our health policy envisages a three tier structure comprising the primary, secondary and tertiary health care facilities to bring health care services within the reach of people. Uttar Pradesh has seen fairly significant investment in health infrastructure in the decades since independence. Although impressive, on most counts it was barely able to keep pace with the increase in population. Compared to the entire country, availability of health infrastructure and availability in other states, Uttar Pradesh generally performed badly and the

physical health infrastructure in the state is still much below the country average. For instance, the population covered by a Sub-Centre in the state is 7080 and the average distance is 3.4 km. while the country average is 5109 and the average distance is 1.3 km. It is estimated that 11percent of people in Uttar Pradesh are not able to access medical care due to location reasons.

The primary tier is designed to have three types of health care institutions, namely, a Sub-Centre (SC) for a population of 3000-5000, a Primary Health Centre (PHC) for 20,000 to 30,000 people and a Community Health Centre (CHC) as referral Centre for every four PHCs covering a population of 80,000 to 1.2 lakh (Rai & Nathawat, 2013b). The district hospitals were to function as the secondary tier for the rural health care, and as the primary tier for the urban population [4]. The tertiary health care was to be provided by health care institutions in urban areas which are well equipped with sophisticated diagnostic and investigative

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facilities. In rural areas the health care services are provided through the network of primary health centers (PHC's) and sub-centers. However, the country has not been able to achieve the target goal of 'health for all'. The utilization of health facilities is required to be investigated in detail for satisfactory analysis (Singh & Singh, 1996). People are not spread evenly across the Earth's surface, and populations differ along many dimensions including age, gender, culture, and economic status—that affect their need for health care, their ability to travel to obtain health care, and the types of services they are willing and able to utilize [4, 2, 3]. The Alma-Ata conference mobilized a "Primary Health Care Movement" to tackle the politically, socially and economically unacceptable health inequalities in all countries [3]. The translation of these values into tangible reforms has been uneven [5]. Inequality in the distribution of health care facility is a common manifestation of these factors and a general feature of health care system in India. Rai and Nathawat, 2013a; 2013b; 2017 claim that the distribution of health care institutions in India is influenced by locational preference. Hema and Muraleedharan (1993) focused on the need for health care services because of discrepancies between actual health and desired health status due to medical interventions and provision of related services. Name and Bailey (2000) tried to explore the relationship between distance and the utilization of health care by a group of elderly residents in rural Vermont. Berman [6] and Patilet.al.,(2002) discussed the important dimensions of health and health care for tackling health human resource challenges in India. Duggal (1997) addressed the undesirable characteristics of the health sector in India and its neglect of rural areas. Distribution of health care

facilities is one of the most effective in assuming the utilization pattern of health care facilities in an area [7].

A number of problems arise in the rational distribution and utilization of health care facilities on account of spatial variations and Ghazipur is no exception. In order to know the distribution pattern of health care facilities in any region, it is pertinent to first assess the distribution of health care facilities in spatiotemporal perspective. It has now become essential to analyse the availability of health care facilities in the study area in terms of suggested norms of Indian health care policy. It will also help in providing proper health services to the rural population and framing strategy for national distribution of health care facilities and its proper utilization among the population [8-10]. Health care facilities of Ghazipur district are based on primarily modern allopathic system of treatment. To assess the distribution pattern of health care facilities, data has been collected from District Statistical Handbook. Present study shows the block wise distribution of health care facilities, namely Allopathic, PHCs, CHCs, and Sub-Centers, Ayurvedic, Homeopathic and Unani health centers during 2015-2016. Clearly, the allopathic hospitals are mostly confined to urban centers [11, 12]. (Figure 1).

Study Area

Ghazipur district is a part of alluvial plain located in the mid-eastern corner of the middle Ganga valley, in eastern Uttar Pradesh of India (Fig. 1). It covers an area of 3,377 Sq.km with a total population of more than 3.6 million, with a population density of 1072 persons per Sq.km [13, 14]. The district has 3,364

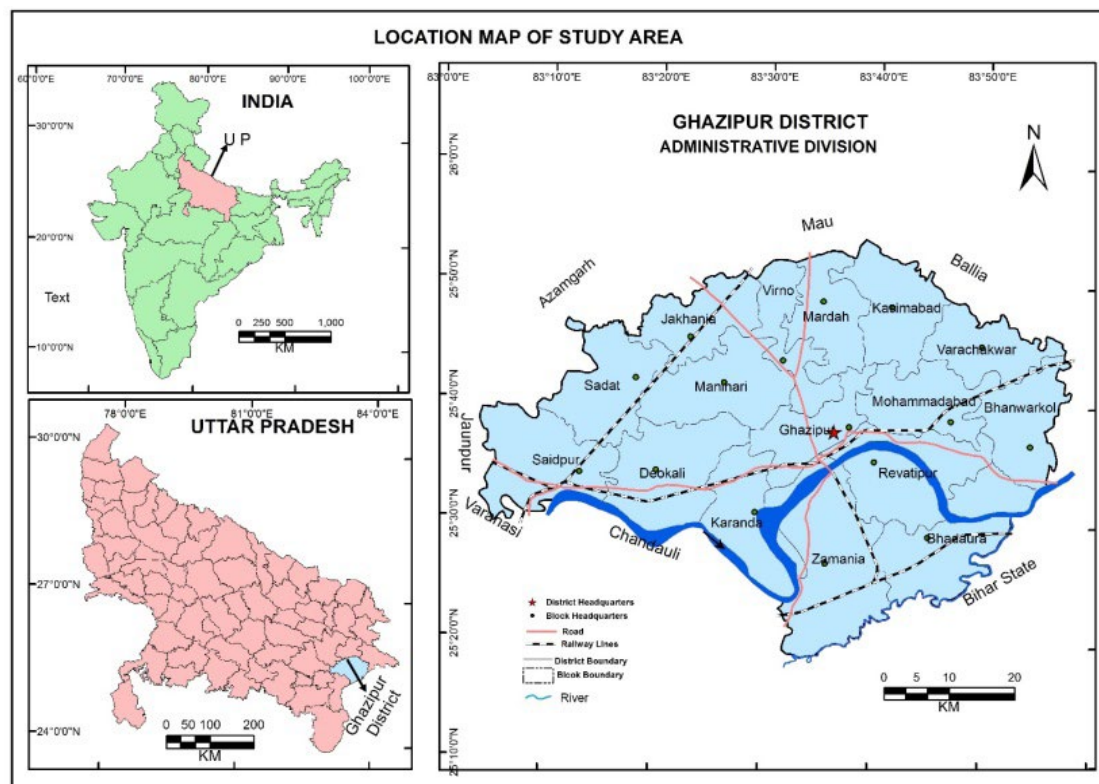


Figure 1 Study Area.

villages. For a considerable length in the south-west, the district is bordered by the river Ganga and its tributary Gomati separates it from Varanasi and Jaunpur district, while in the south-east river Karmanasa forms its boundary with Bihar. For administrative purposes, the district has been divided into five Tehsils; namely Jakhania, Saidpur, Ghazipur, Mohammadabad and Zamania. These Tehsils are further divided into 16 Development Blocks Jakhania, Manihari, Sadat, Saidpur, Deokali, Virno, Mardah, Ghazipur, Karanda, Kasimabad, Varachawar, Mohammadabad, Bhanwarkol, Zamania, Revatipur and Bhadaura.

Objectives

The main objectives of this study are to find out the block wise spatial variation of health care facilities and to provide effectiveness measures and planning for the health care facilities in the study area [15, 16].

Materials and Methods

The present study is based on statistical sources, the Statistical Handbook of Ghazipur district 2015-2016 providing data regarding the availability of different types of health care facilities and family welfare facilities at District hospital, CHCs, PHCs and Sub-centers. The ratios are calculated by the help of absolute figure of different health care facilities in blocks as per lakh population of Ghazipur district. The data regarding the population is obtained from District Census Handbook. ArcGIS-10.3 software was used to create maps for spatial distribution of health care facilities in the district. The original map of Ghazipur district was scanned and registered/geo-referenced to specify its location by inputting coordinates (Table 1).

The distribution of health care facilities bears a close relation with the hierarchy and population size of the settlements. Transport and communication network also influence the health care facilities [3]. These facilities are provided in Ghazipur district through Allopathic, Homeopathic, Ayurvedic and Unani hospitals, Community Health Centres, Primary Health Centres and Sub-

Centers. The block wise distribution of health care facilities during 2015-16 shows 61 PHCs, 12 CHCs and 381 Sub-Centers (Table.1). The available data reveals that Zamania, Mohammadabad, Sadat, Saidpur, Kasimabad, Deokali, Bhanwarkole, Bhadaura, Jakhania, Manihari, Ghazipur and Barachawar development blocks have better facilities in compare to Revtipur, Mardah, Virno and Karanda blocks endowed with poor status of health facilities. The Allopathic hospitals are mostly confined to urban centres with 6 in Manihari, Deokali, Varachawar and Revatipur blocks, 5 in Sadat, Kasimabad and Bhadaura blocks, 4 in Jakhania, Saidpur, Ghazipur, Karanda, Mohammadabad, Bhanwarkol and Zamania blocks, 3 in Virno and Mardah blocks. Out of total 39 Ayurvedic hospitals 5 in Mohammadabad block followed by 4 in Saidpur, and Deokali blocks, 3 in Virno, Karanda, Bhanwarkole and Revatipur blocks, 2 in Jakhania, Sadat, Ghazipur, Varachawar and Bhadaura blocks and 1 in Manihari, Mardah, Kasimabad, and Zamania blocks. while Homeopathic hospitals, 3 in Jakhania block, 2 in Saidpur, Virno, Mardah, Ghazipur, Kasimabad and Mohammadabad blocks and 1 in Manihari, Deokali, Karanda, Varachawar and Zamania blocks. While Unani hospitals, 2 in Kasimabad and Bhanwarkol blocks, 1 in Jakhania, Manihari, Sadat, Saidpur, Ghazipur, Mohammadabad and Zamania block (Figure 2), (Table 2).

Density is one of the most important indicators of health care facilities. The size of blocks varies notably in the study area as a result availability of health care facilities is unequally distributed. In Ghazipur district blocks also do not show uniformity in terms of population and distribution of health care facilities e.g. number of hospitals, doctors and number of beds. The statistical data (Table 2) reveal that only 2 blocks (Karanda and Mohammadabad) have a higher number of hospitals per 1,00,000 population (5.5 and 5.4 respectively), followed by Revatipur (4.99), Deokali (4.86), Virno (4.82), The lowest hospitals are found in Zamania (2.67), Bhadaura (3.11), Mardah (3.22) and Sadat blocks with (3.74) per 1,00,000 population (Figure 3, 4).

In Ghazipur district health care facilities are not uniformly distributed in terms of population. Thus, it reveals that most

Table 1. Distribution of Health Care Facilities in Ghazipur District.

Block Name	Allopathic hospitals	PHCs	CHCs	Sub- Centre	Ayurvedic Hospitals	Homeopathic Hospitals	Unani Hospitals
Bhadaura	5	4	1	25	2	0	0
Bhanwarkol	4	3	1	24	3	0	2
Deokali	6	5	1	26	4	1	0
Ghazipur	4	4	0	22	2	2	1
Jakhania	4	3	1	24	2	3	1
Karanda	4	4	0	17	3	1	0
Kasimabad	5	4	1	27	1	2	2
Manihari	6	5	1	24	1	1	1
Mardah	3	3	0	20	1	2	0
Mohammadabad	4	3	1	29	5	2	1
Revatipur	6	5	1	21	3	0	0
Sadat	5	4	1	27	2	0	1
Saidpur	4	3	1	28	4	2	1
Varachawar	6	5	1	23	2	1	0
Virno	3	3	0	18	3	2	0
Zamania	4	3	1	26	1	1	1
Total	73	61	12	381	39	20	11

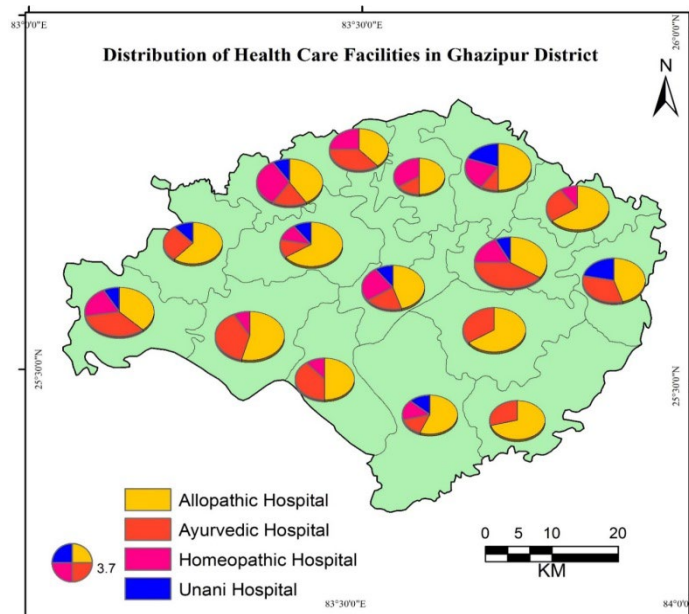


Figure 2 Distribution of Health Care Facilities in the Study Area.

Table 2. Distribution of Health Care Facilities in Terms of Population.

Block Name	Population	Area (sq.km)	No. of Hospital	No of Doctor	No. of Bed	Density in Terms of Population		
						Hospital	Doctor	Bed
Bhadaura	225324	209.22	7	5	54	3.11	2.22	23.97
Bhanwarkol	191085	251.23	9	9	62	4.71	4.71	32.45
Deokali	226207	221.19	11	13	41	4.86	5.75	18.12
Ghazipur	210159	158.67	9	13	72	4.28	6.19	34.26
Jakhania	221776	203.63	10	12	50	4.51	5.41	22.55
Karanda	144106	154.37	8	9	24	5.55	6.25	16.65
Kasimabad	239768	227.78	10	8	28	4.17	3.34	11.68
Manihari	217280	223.97	9	6	58	4.14	2.76	26.69
Mardah	186435	184.9	6	7	32	3.22	3.75	17.16
Mohammadabad	221471	173.7	12	7	30	5.42	3.16	13.55
Revatipur	180368	227.13	9	5	28	4.99	2.77	15.52
Sadat	213766	221.97	8	8	28	3.74	3.74	13.10
Saidpur	235540	218.49	11	16	70	4.67	6.79	29.72
Varachawar	204173	199.2	9	7	24	4.41	3.43	11.75
Virno	165940	154.07	8	7	24	4.82	4.22	14.46
Zamania	262510	270.18	7	4	46	2.67	1.52	17.52
Total	3345908	3299.7	143	136	671	69.27	66.01	319.16

of the blocks except Ghazipur, the district is far behind the norms and standards suggested in National Health Policy. For making rural health care services more meaningful to the rural community, it is needed to focus on fundamental changes to the approach to the entire health care delivery system in general and rural health care facilities in particular. In spite of several significant achievements, the health care system existing in the district suffers from some weaknesses and deficiencies. There has been pre-occupation with the promotion of curative and clinical services through city based hospitals which have by and large catered to certain sections of the urban population. In the district the infrastructure of sub-centers, primary health centers and

rural hospitals built up in the rural areas touches only a fraction of the rural population. It is essential to analyse the relationship between population and health care facilities [17, 18].

Suggestions and Discussion

Greater emphasis is needed on health care covers which range from preventive health medicine to health education. It should be made integral with preventive, promotive, curative and rehabilitative health care for promoting sustainable health care system in the district. Efforts should be made to promote and exchange experiences on health sector reforms through appropriate consultations, documentation, and information

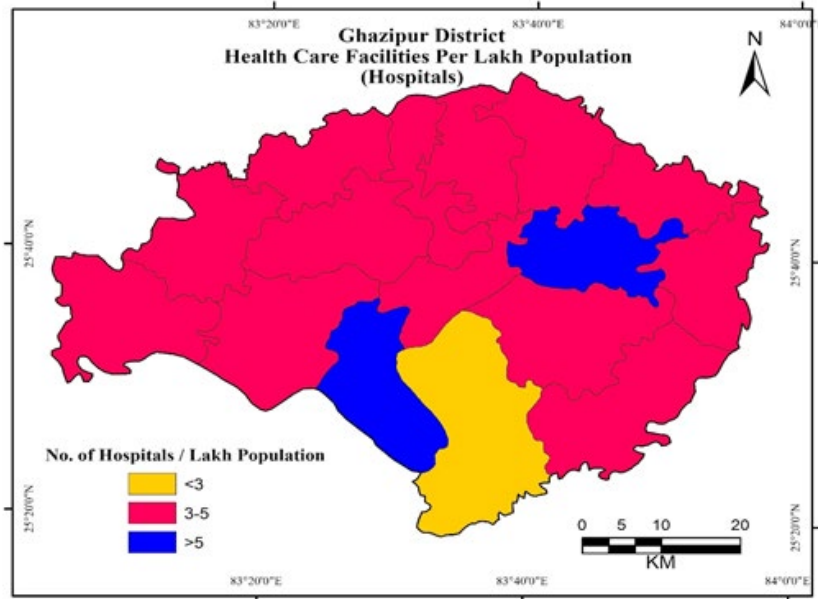


Figure 3 Distribution of Hospitals in Ghazipur District.

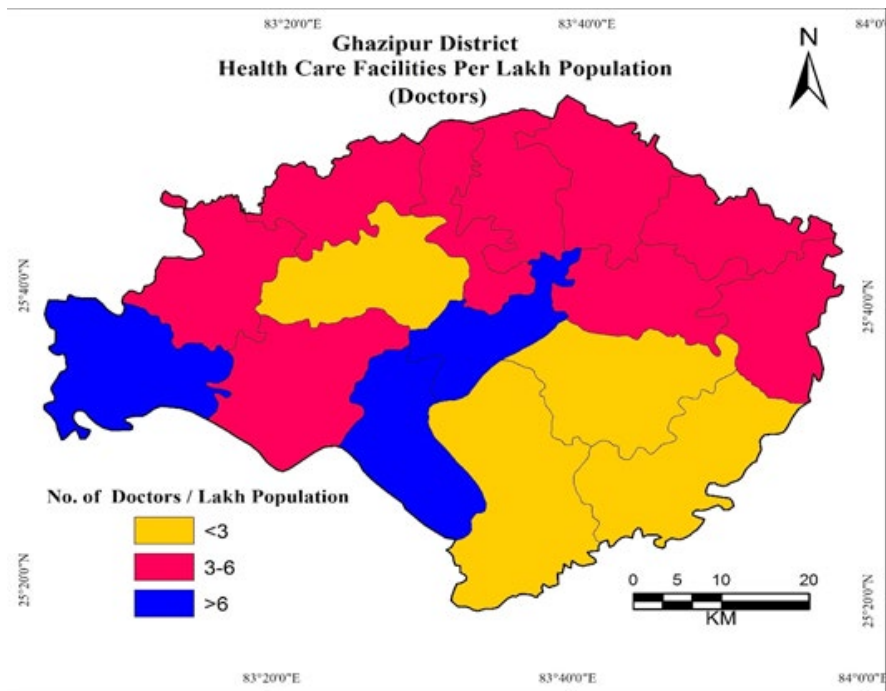


Figure 4 Distribution of Doctor's in Ghazipur District.

technology. To meet the challenge, the health services have been progressively decentralized and democratized so as to reach basic medical and health services to the remotest corner in the district. The minimum requirement programmes is one of the significant steps related with availability of health care facilities in any area through which health infrastructure in rural areas can be expanded and further strengthened to ensure primary health care to the rural population. In fact, the goal of health for all can only be reached through a fully democratic

process. It must be health for the people, health of the people and health by the people which is possible only through a democratic, decentralized, and participatory system in which the people in a community have the authority, resources and expertise to prepare and implement all plans for their welfare including health. In the district institutional arrangements such as large infrastructure and qualitative changes like availability of medicines, presence of doctors and availability of basic amenities at health care institutions are to be made on a sustained basis.

For ensuring good health for all in the district, the extension of health services is highly needed, including adequate health infrastructure and services at primary health centers, sub-centers and community health centers, as well as Availability of doctors, residential quarter for doctor and other staff, making people aware of the health services available at primary health institutions; and accelerating training programmes to doctors and other health workers. A key task is also to utilize the potential for fulfilling the motivational and financial gaps and meet the challenges of providing quality health services in remote rural regions. There is an urgent need to transform public health care into an accountable, accessible and affordable system of quality services. It requires a comprehensive planning as revised in National Health Policy addressing the existing inequalities and work towards promoting a long-term perspective plan exclusively for rural health is the current need. As the majority of the people in Ghazipur district depend on public health care system, the most important thing is to recruit the required number of doctors and staffs for the public health institutions. Availability of doctors and other medical staffs at sub-centers, primary health centers and community health centers must be ensured by making adequate number of postings and constructing residential quarters for them. A vigorous attempt should be made to meet the shortage of doctors and allied manpower at the primary health centres, especially those which are deemed to serve people living in least accessible region. The on-going efforts of the government to build up private-public partnership and involve the Panchayats more effectively in the participatory management of health care services are expected to ensure better health care services in the district.

Summary and Conclusions

In Ghazipur district, the pattern of disparity in the distribution of health care facilities is well pronounced. The provision of rural health care facilities is not sound enough from operational

point of view. The inadequacy of health facilities is reflected in the large distance travelled by rural people for availing these facilities. In the study area, the doctor-population ratio for Ghazipur district ranges between 1.52 (lowest) in Zamania and 6.79 (highest) in Said pur blocks in the study area. Within the district, the distribution pattern of doctors also follows the trend of urbanization. Availability of beds is an important indicator of the poor health facilities in Ghazipur district, with less than 700 hospital beds for 3.3 million persons which is relay worst condition in terms of availability of health facilities in Uttar Pradesh. In the district, Ghazipur is the only block showing sufficiency of both number of hospitals, doctors and beds. On the basis of detail analysis and examination of data in relation to medical facilities in the Ghazipur district, it has been concluded that there are imbalances and more detail about relationship between population and distribution of health care facilities like, hospitals, doctors and beds in different blocks of the district. The study area is served by physicians of four medicine system viz. Allopathic, Ayurveda, Homeopathic and Unani. Primary health centers are basically based on allopathic system; however, with the consideration of development of health care facilities, there is a need of sanctioned the doctors post to each primary health centers in the district. There is urgent need to strongly emphasize the process of strengthening the infrastructural facilities at community health centers and primary health centres level to utilize their full potential. Besides, additional PHCs, CHCs and sub-centres should be established in the Ghazipur district to reduce the gap between existing and required health care facilities. All the PHCs should be renovated and equipped according to their need. Health care facilities existing in Ghazipur district still suffers from some weaknesses and deficiencies such as availability of doctors, paramedical employees, availability of medical infrastructural facilities etc.. To meet the challenge there is a need for progressive decentralization of health care facilities so as to reach basic medical and health services to the remotest areas of the district.

References

- 1 Berman P (2009) Tackling health human resource challenges in India: Initial observations on setting priority for action. *India Health Beat* 1.
- 2 Bhandari L, Dutta S (2007) Health Infrastructure in Rural India. *India Infrastructure Report* 265-271.
- 3 Datar A, Mukherji A, Sood N (2007) Health infrastructure & immunization coverage in rural India *Indian J Med Res* 125: 31.
- 4 Duggal R (1997) Health care budgets in a Changing Political Economy. *Economic and Political Weekly* 32: 1197-1200.
- 5 General IR, General R (2011) Census of India Registrar General and Census Commissioner.
- 6 Hema R, Muraleedharan VR (1993) Health and Human Resources Development. *Economic and Political Weekly* 28: 2328-2330.
- 7 McLafferty SL (2003) GIS and health care. *Annual Review of Public Health* 24: 25-42.
- 8 Nemet GF, Bailey AJ (2000) Distance and health care utilization among the rural elderly. *Social Sci Med* 50: 1197-1208.
- 9 Patil AV, Somasundaram KV, Goyal RC (2002) Current health scenario in rural India. *Australian J Rural Health* 10: 129-135.
- 10 Rai PK, Nathawat MS, Onagh M (2012) Application of Multiple Linear Regression Model through GIS and Remote Sensing for Malaria Mapping in Varanasi District, INDIA. *Health Science Journal* 6: 731-749.
- 11 Rai PK, Nathawat MS, Rai S (2013) Using the Information Value Method in Geographic Information System (GIS) and Remote Sensing for malaria mapping; A Case Study from India. *Informatics in Primary Care* 21:43-52.
- 12 Rai PK, Nathawat MS (2013) Application of GIS & Statistical Methods to Select Optimum Model for Malaria Susceptibility Zone and Verification of the Susceptibility Methods by Area Under Curve (AUC): A Case Study, *Scientific Annals of "Alexandru Ioan Cuza" University of Iasi-Geography series* 59: 73-94.
- 13 Rai PK, Nathawat MS (2013) GIS in Health Care Planning: A Case Study from India, *Forum Geographic Journal (Romania)*, 12: 152-163.
- 14 Rai PK and Nathawat MS (2014) Utilization of Health Care Services in

- Varanasi District: A Geographical Analysis, *Geografia, Malaysian J Soc and Space* 10: 14-33.
- 15 Rai PK, Nathawat, M.S. (2017). *Geo informatics in Health Facility Analysis*, Springer International Publishing, Switzerland.
- 16 Singh J, Singh RC (1996) A study of fertility pattern and family planning in rural families of Varanasi District (Uttar Pradesh). *National Geographical J* 42: 133-44.
- 17 Singh J, Kumra VK (1995) Utilization Pattern of Health Care Facilities in Rural Area of Varanasi. *Geographical Review of India*, 57: 156-168.
- 18 Van Lerberghe W (2008) *The world health report 2008: primary health care: now more than ever*. World Health Organization.