Inter District Disparities in Health Infrastructure Development in Kashmir: A Principal Component Analysis

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Abstract

Health is a state of physical, mental and social wellbeing in which disease and infirmity are absent. Generally, the context in which an individual lives is of great importance. It is increasingly recognized that health is maintained and improved not only through the advancement of health science but also through the development of health infrastructure. The current study is an attempt to analyze the development of this health infrastructure in the districts of the Kashmir. The study was based on secondary data. The study uses Principal Component Analysis for the investigation of the data and a health infrastructure development index was constructed for all the districts. The study finds that there is a huge inequality in the health infrastructure development among the districts of the Kashmir valley. Only 10 percent districts have come under highly developed category, 50 percent districts have come under developed category, 20 percent districts have come under backward category and 20 percent districts have come under highly backward category.

Keywords: *Health, Disparity, Principal Component Analysis, Jammu and Kashmir.*

1. INTRODUCTION

The constitution of World Health Organization defines health as, "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (Naik, 2014). The nations of the world have agreed that enjoins the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political beliefs and economic or social conditions (De, 2017).

When we think about economic development and human welfare, improvements in health may be as important as improvements in income (Bloom and Canning, 2008). Improving the health and longevity of the poor is a fundamental goal of economic development (Weil, 2014). Improvement in health facilities not only increases living standard of skilled, semi-skilled and un- skilled work force but also enhance their productivity.

Improving health status, therefore, has become one of the paramount national objectives and the basis to sustain and stimulate optimum level of economic efficiency and development in a country (Naik, 2014).

In India the health care services suffer from a shortage in health infrastructure. There is a shortfall not only in terms of physical infrastructure but also human resources in health, measured even against the minimal norms prescribed by the government (Bhandari and Dutta, 2007). The setback in the growth of health manpower during the reforms period has certainly affected the health sector's overall performance. Much of the health manpower has either shifted from the public to the private sector during the period or increasingly migrated abroad (Kadekodi and Kulkarni, 2006). With a view to meet the growing healthcare needs of the people, the Government of India has been augmenting the best health care facilities for its citizens, with a view to provide preventive and curative healthcare facilities at their door steps (Koka, 2017).

For making health services better, both the physical infrastructure in terms of district hospitals, sub district hospitals, community health centres, public health centres and sub centres and human resources in terms of doctors and other medical staff is a pre requisite. Government of Jammu and Kashmir is also making efforts to make health accessible,

acceptable and affordable to all its citizens. This research paper will highlight the disparities in development of health infrastructure among the districts of the Kashmir valley by using principal component analysis technique.

2. DATA AND METHODOLOGY

The study is based on secondary data. The data has been collected from the directorate of health services Kashmir and Census documents 2011. Six health infrastructure indicators have been taken from each district of Kashmir and the Principle Component Analysis technique is used to construct a Health Infrastructure Development Index to examine the health infrastructure development in the Kashmir valley. Following six indicators have been used to construct a Health Development Index for all the 10 districts of Kashmir valley:

1. No. of District Hospitals per 10,000 Population; denoted as A1
2. No. of Sub District Hospitals per 10,000 Population; denoted as A2
3. No. of Primary Health Centres per 10,000 Population; denoted as A3
4. No. of New Type Primary Health Centres per 10,000 Population; denoted as A4
5. No. of Sub Centres per 10,000 Population; denoted as A5
6. No. of Doctors per 10,000 Population; denoted as A6

Objective: The objective of the study is to find the inter district disparity in the development of health sector in Kashmir Valley.

3. RESULTS AND DISCUSSION

For the purpose of administration, the state of Jammu and Kashmir has three divisions viz., Jammu, Kashmir and Ladakh. Jammu division has ten districts Jammu, Samba, Udhampur, Reasi, Doda, Kishtwar, Ramban, Kathua, Rajouri and Poonch. Kashmir division also has ten districts Anantnag, Kulgam, Pulwama, Shopian, Srinagar, Ganderbal, Budgam, Baramulla, Bandipora and Kupwara. Ladakh division has two districts. Our study is confined to the ten districts of Kashmir region.

Health infrastructure indicators in Kashmir are shown in the table 1.

Table: 1. Health Infrastructure Indicators in Kashmir

District	Population	A1	A2	A3	A4	A5	A6
Anantnag	10,78,692	.009	.055	.241	.305	1.260	2.169
Baramulla	10,08,039	.010	.060	.307	.525	1.894	2.777
Budgam	7,53,745	.013	.119	.530	.411	1.870	3.728
Bandipora	3,92,232	.025	.101	.152	.535	1.912	1.988
Ganderbal	2,97,446	.033	.067	.571	.537	1.849	3.664
Kupwara	8,70,354	.011	.080	.379	.367	2.734	1.780
Kulgam	4,24,483	.023	.070	.447	.589	2.756	2.732
Pulwama	5,60,440	.017	.053	.356	.481	1.712	3.745
Shopian	2,66,215	.037	.112	.225	.375	1.990	2.103
Srinagar	12,36,829	.008	.008	.145	.315	.549	1.703

Source: Calculated from the data from Directorate of Health Services Kashmir and Census 2011.

From the above table 1, it can be seen that district Srinagar has the highest population followed by Anantnag and Baramulla while as district Shopian has the lowest population followed by Ganderbal and Bandipora. The table clearly shows district Shopian has the highest number of district hospitals in respect of its population while as district Srinagar has the lowest number of district hospitals in respect of its population. In respect of sub district hospitals, district Budgam stands at first while as district Srinagar stands at last. In respect of public health centres, district Ganderbal comes first and district Srinagar again comes last. As far as new type public health centres are concerned, district Kulgam stands first and district Srinagar again stands last. As far as sub centres are concerned

district Kulgam again stands first and district Srinagar again stands last. The number of doctors per 10,000 populations is highest in district Pulwama while as lowest in district Srinagar. Here it is worth to mention that there are other hospitals in Srinagar that use the modern technology to treat the patients like Govt. Medical College Srinagar and its five associated hospitals, SKIMS medical college, Soura Srinagar and SKIMS medical college, Bemina Srinagar but they have not been taken into this study.

The data needs to be normalized before applying the statistical tools to give the correct results. The following equation was used to convert the data into normalized form:

$$\mathrm{NV}id = 1 - \left[\frac{\mathrm{BA}i - \mathrm{OA}id}{\mathrm{BA}i - \mathrm{WA}i}\right]$$

Where, NVid is the normalized value of the indicator of the particular district, BAi is the best value of the indicator, OAid is the observed value of the indicator of that district and WAi is the worst value of the indicator.

Table: 2. Normalized Value of Health Infrastructure Indicators in Kashmir

District	Normalized value A1	Normalized value A2	Normalized value A3	Normalized value A4	Normalized value A5	Normalized value A6
Anantnag	0.0344828	0.423424	0.225353	0	0.322157	0.228207
Baramulla	0.0689655	0.4684685	0.380281	0.774648	0.609425	0.525955
Budgam	0.1724138	1	0.903755	0.37324	0.59855	0.991675
Bandipora	0.5862069	0.8378378	0.016431	0.80986	0.617581	0.139569
Ganderbal	0.862069	0.5315315	1	0.816902	0.589035	0.960333
Kupwara	0.1034483	0.648649	0.549296	0.21831	0.990032	0.037708
Kulgam	0.5172414	0.558559	0.708921	1	1	0.503918
Pulwama	0.3103448	0.405406	0.495306	0.619719	0.52696	1
Shopian	1	0.936937	0.187794	0.246479	0.652923	0.198586
Srinagar	0	0	0	0.035212	0	0

Source: Calculated from table 1

I calculate the Weights of every indicator by using Factor Components and Eigen Values from Principal Component Analysis (PCA) shown in table 3.

Table: 3. Total Variance Explained

| Component | Initial Eigen values | | |
	Total Initial Eigen values	% of Variance	Cumulative %
1	2.879	47.976	47.976
2	1.297	21.620	69.596
3	.763	12.722	82.318
4	.683	11.390	93.708
5	.313	5.214	98.921
6	.065	1.079	100.000
Extraction Method: Principal Component Analysis.			

Here it is worth to mention that only those components are extracted whose total initial Eigen value is above 1. It can be observed from table 3 and table 4 that 2 components have been extracted because only 2 components have the total initial Eigen value above 1 (2.879 and 1.297).

Table: 4. Component Matrix[a]

Indicator	Component 1	Component 2
No. of District Hospitals per 10000 population	.587	.473
No. of Sub District Hospitals per 10000 population	.635	.533
No. of Public Health Centres per 10000 population	.770	-.487
No. of New Type Public Health Centres per 10000 population	.737	-.083
No. of Sub Centres per 10000 population	.743	.342
No. of Doctors per 10000 population	.664	-.655
Extraction Method: Principal Component Analysis.		
a. 2 components extracted.		

Table: 5. Rotated Component Matrix[a]

Indicator	Component 1	Component 2
No. of District Hospitals per 10000 population	.750	.080
No. of Sub District Hospitals per 10000 population	.826	.071
No. of Public Health Centres per 10000 population	.202	.888
No. of New Type Public Health Centres per 10000 population	.463	.579
No. of Sub Centres per 10000 population	.768	.282
No. of Doctors per 10000 population	.009	.933
Extraction Method: Principal Component Analysis.		
a. Rotation Method: Varimax with Kaiser Normalization.		

After the computation of Total Initial Eigen values and Rotated Component Matrix, we have to calculate the weights of every indicator by using the following formula.

$$W_i = \sum_{i=1}^{6}(|C_{in}| \times EV_n)$$

Where, W_i is the weight of the ith indicator, C_{in} is the nth component of ith indicator and EV_n is the total initial Eigen value of that component and is fixed.

Table: 6. Weights of the Health Infrastructure Indicators

Indicator	Rotated Component Matrix Component 1	Rotated Component Matrix Component 2	Total Initial Eigen values 1 — 2.879	Total Initial Eigen values 2 — 1.297	WEIGHTS
No. of District Hospitals per 10000 population	.750	.080	2.1592	.1037	2.2629
No. of Sub District Hospitals per 10000 population	.826	.071	2.3780	.0920	2.4700
No. of Public Health Centres per 10000 population	.202	.888	.5815	1.1517	1.7332
No. of New Type Public Health Centres per 10000 population	.463	.579	1.3329	.7509	2.0838
No. of Sub Centres per 10000 population	.768	.282	2.2110	.3657	2.5767
No. of Doctors per 10000 population	.009	.933	.0259	1.2101	1.2361
TOTAL WEIGHTS					12.3627

Source: Calculated from table 3 and table 5

By using the above formula the weights were calculated for each indicator as can be seen in the table 6. The fourth column of the table shows the weights of every indicator and also total weight of indicators was calculated and depicted.

The Health Infrastructure Development Index of each district of Kashmir was determined with the help of Normalized values and Weights of each indicator by using the following equation:

$$\text{HIDI}_d = \frac{\sum_{i=1}^{6}[NVi \times Wi]}{\sum_{i=1}^{6} Wi}$$

Table: 7. Health Infrastructure Development Index in Kashmir

DISTRICT	HIDI	RANK
Anantnag	0.213	9
Baramulla	0.46	8
Budgam	0.645	3
Bandipora	0.557	5
Ganderbal	0.761	1
Kupwara	0.473	7
Kulgam	0.729	2
Pulwama	0.522	6
Shopian	0.595	4
Srinagar	0.003	10

The table 7 portrays that district Ganderbal with the Index value 0.761 occupies the top position which depicts that the district is highest developed as far as health infrastructure is concerned. The reason is that the district Ganderbal has the second highest number of district hospitals per 10,000 populations, highest number of primary health centres per 10,000 population and third highest number of doctors per 10,000 population. District Srinagar with the Index value 0.003 has the lowest rank among 10 districts of Kashmir valley. It is again noted here that the study do not include the top health institutions like Govt. Medical College Srinagar and its five associated hospitals, SKIMS medical college, Soura Srinagar and SKIMS medical college, Bemina Srinagar located in district Srinagar. This could be one of the reasons that the rank of district Srinagar is the lowest of all districts.

On the basis of the values of the health infrastructure development indices, the districts have been classified into following four categories on one-point scale:

S. No.	Category	Range	No. of Districts	%age
1	Highly Developed	0.750 – 1.000	1	10
2	Developed	0.500 – 0.749	5	50
3	Backward	0.250 – 0.499	2	20
4	Highly Backward	0.000 – 0.249	2	20
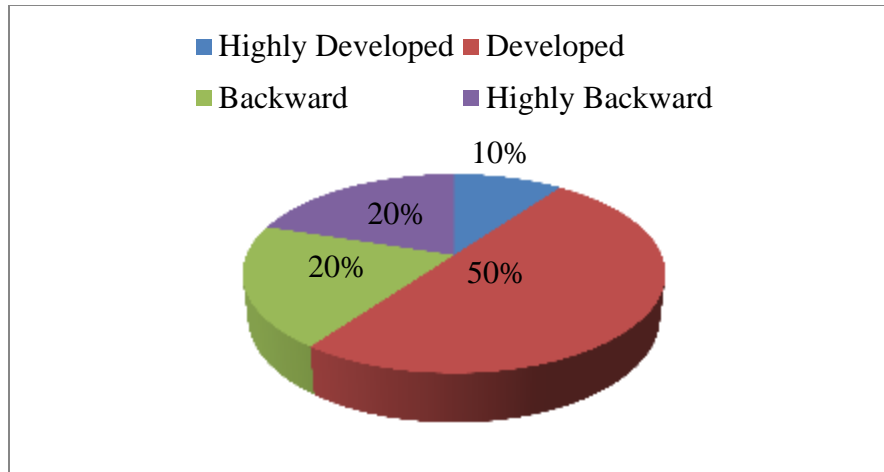
Figure: 1. Percentage of Districts under Different Categories in Kashmir

The districts of Kashmir valley have been divided into four categories; highly developed, developed, backward and highly backward based on their performance in the health infrastructure development index. Districts with index values in the range 0.750 to 1.00 are classified as 'highly developed', the districts with index values in the range 0.500 to 0.749 are classified as 'developed', districts with index values in the range 0.250 to 0.499 are classified as 'backward' and districts with index values between 0.000 to 0.249 as 'highly backward'. Only 10 percent districts have come under highly developed category, 50 percent districts have come under developed category, 20 percent districts have come under backward category and 20 percent districts have come under highly backward category. This shows the disparity in health infrastructure development among the districts of Kashmir valley.

4. CONCLUSION

The study was an attempt to analyze the disparities in health infrastructure development in the districts of Kashmir valley. The study finds that there is an unequal distribution of health infrastructure development in Kashmir. Some districts are highly developed while as some are highly backward. It has been studied that there is a high degree of disparity across districts as reflected in the values of health infrastructure development indices. With huge inequalities within the state imply that there is an urgent need to redesign the public policies that directly affect the development of health infrastructure in the valley of Kashmir.

5. REFERENCES

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