An Exploratory Analysis of Public Healthcare Data: A Case Study of Jammu & Kashmir State

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ABSTRACT— *With the rapid applications of ICT in public healthcare system, there is growing clamor for data analytics for effective implementation of programmes and policies and efficient use of resources available. The public healthcare system of India has grown leap bound but policy formulation on the basis of public healthcare data is still not being carried out. Health Planners and management personnel rely mainly on the basis of previous experiences to formulate ad hoc decisions rather than seeking relevant data. The purpose of this paper is to address this area by exploring the administrative data especially facility level data of Jammu & Kashmir State and its use in resource management effectively. In this paper, we conduct an exploratory secondary data analysis of facility level data of Jammu & Kashmir, India by using SPSS Modeler, a data mining tool. The public healthcare data is obtained from HMIS database. We analyze data to identify patterns by exploring the structure of public healthcare institutions prevalent in J&K along with the distribution of patients in different districts. We found high variation and significant differences among districts as far as healthcare facility distribution is concerned. There are significant relationships among public healthcare institutions available in each district of J&K. We observed that although there is significant distribution of healthcare facilities but still the distribution pattern is not uniform. We recommend suggestions which can improve the patient services and overall performance of public healthcare institutions.*

Keywords— Public Healthcare, HMIS, Community Health Centre, Primary Health Centre, Sub-centre

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1. INTRODUCTION

Public healthcare generally refers to government funded health-care services available to all members of the population. It is a cost- effective health care system being setup to support the health care needs of a community or population funded directly by the government or a government approved schemes/committee [1]. The Public healthcare system in India comprises a set of state-owned health care facilities funded and controlled by the government of India [2]. Some of these are controlled by agencies of the central government while some are controlled by the State governments. The Union Ministry of Health & Family Welfare controls the central government interests in these institutions. The Public Healthcare organizations at Centre or State level increasingly are required to collect and externally report more data, whether for healthcare facility, infrastructure, quality services, or patient satisfaction initiatives [3]. Owing to this, more data are required in public domain available to healthcare organizations and the general public for standardization and analysis. The use of public healthcare data analytics holds much promise for the healthcare planners. Providers can use public healthcare data analytics to learn about patient populations, enhance preventive care and makes policy decisions by accessing key data such as demographics and chronic conditions. Such data may also affect life or health insurance coverage. Employers may decide which coverage options are available to employees based on reported data. Because of this, healthcare organizations must ensure that they gather and report quality healthcare data.

In India, the public healthcare data and information and their analysis have been extensively used to measure health indicators, along with their comparative analysis for planning and management of quality health services and research. Various agencies like *Central Bureau of Health Intelligence* (CBHI), *Registrar General of India* (RGI); *National Health Systems resource Centre* (NHSRC); and the *National Sample Survey Organization* (NSSO) predominantly provide health

related data through demographic and / or economic surveys on vital statistics, consumption, utilization and expenditure of health services.

Healthcare services are provided through the network of public health centers spread throughout rural and urban areas of the country. Each centre maintains record of its activities in one or more of the primary registers. A web based Health MIS (HMIS) portal was also launched in October, 2008 *http://nrhm-mis.nic.in* to facilitate data capturing at District level. The HMIS portal has led to faster flow of information from the district level and about 98% of the districts are reporting monthly data since 2009-10 [4]. The HMIS portal is now being rolled out to capture information at the facility level.

There has been a growing emphasis in India on Health Management Information System (HMIS) as a part of the National Rural Health Mission (NRHM) initiative to enable capturing of public health data from both public and private institutions in rural and urban areas across the country in order to strengthen the evidence based planning of health programmes [14]. Hence, one of the core strategies of NRHM in achieving its goals is to strengthen capacities for data collection, assessment and review for evidence based planning, monitoring and supervision. Management Information System is designed to collect and report information on a programme, which allows managers at all levels to plan, monitor, and evaluate the operations and the performance of the whole programme. HMIS is a systematic process of collection, compilation, reporting, analysis and use of information on health care services. The information is generally helpful in planning, problem solving and decision making in health care service provisioning. Health management information incorporates all the data needed by policy makers, service providers/clinicians and health service users to improve and protect population health. Proper use of HMIS is expected to contribute significantly to improve the health program performance and ultimately achieving its stipulated goals.

2. PUBLIC HEALTHCARE IN J&K

The health facilities of Jammu & Kashmir include 2249 Sub-Centres, 633 PHCs, 119 CHCs, 30 hospitals (31st March, 2014) with maximum hospitals in Srinagar [5]. The health facilities of Jammu region includes 1071 sub-centres, 283 PHCs, 49 CHCs and 13 District Hospitals. The health facilities of Kashmir Province include 1178 sub-centres, 350 PHCs, 64 CHCs and 17 District Hospitals as described in Table 1.0. The vision of NRHM was to establish functional health facilities in the public domain through revitalization of the existing infrastructure and fresh construction or renovation wherever required. The Mission also seeks to improve service delivery by putting in place enabling

Tabl 1: J&K Public Health Facilities Infrastructure-2014

S.No	District	PD/NPD	Population	SC	PHC	CHC	DH
1	Anantnag	NPD	1069749	123	41	6	2
2	Badgam	NPD	755331	118	47	9	1
3	Bandipora	NPD	385099	45	11	3	1
4	Baramula	NPD	1015503	138	53	12	1
5	Doda	PD	409576	108	33	3	1
6	Ganderbal	NPD	297003	42	20	1	1
7	Jammu	NPD	1526406	180	37	16	3
8	Kargil	NPD	143388	95	16	4	1
9	Kathua	NPD	615711	151	35	6	2
10	Kishtwar	PD	231037	60	17	1	1
11	Kulgam	NPD	423181	91	28	3	1
12	Kupwara	NPD	875564	194	39	7	1
13	Leh Ladakh	PD	147104	121	16	3	1
14	Poonch	PD	476820	109	32	3	1
15	Pulwama	NPD	570060	88	37	5	1
16	Rajouri	PD	619266	143	37	8	1
17	Ramban	PD	283313	56	19	3	1
18	Reasi	NPD	314714	75	22	2	1
19	Samba	NPD	318611	75	16	1	1
20	Shopian	NPD	265960	47	10	2	1
21	Srinagar	NPD	1250173	76	32	15	5
22	Udhampur	NPD	555357	114	35	6	1

systems at all levels. This involves simultaneous corrections in manpower planning as well as infrastructure strengthening. A general observation from infrastructure table is that all the facilities are mostly available in Kashmir region rather than Jammu region. Moreover, First Referral Units i.e. CHC/SDH is quite less in number which put indirectly burden on District Hospitals or Tertiary hospitals like MCH. The most populous District i.e. Jammu [6] lacks the most in terms of District Hospitals which already cater the most of the referral patients of all of the Jammu Region. Other Districts like Anantnag, Baramula also faces the same infrastructural problems. To obtain the clear picture, we have carried out various exploratory analysis of the facilities available in different districts and the number of OPD and IPD patients visits across districts.

3. DATA COLLECTION

This paper is mainly based on secondary data collected from NRHM-HMIS portal. The exploratory data analysis carried out in this paper is based on the HMIS data of public health infrastructure [5] of Jammu & Kashmir (April 2013- March- 2014). HMIS data is widely used by the Central/State Government officials for monitoring and supervision purposes. Along with HMIS data, the census data of 2011 of Jammu & Kashmir across districts is also used. To carry out exploratory data analysis we have used SPSS Modeler [6], a data mining tool. This tool provide numerous plotting graphs which gives which provide a realistic glimpses of distribution of public healthcare facilities and patient distribution.

4. DATA ANALYSIS

Using SPSS modeler, data analysis is carried out on HMIS data of Jammu & Kashmir State. The data available is in excel format and these are subjected to dashboard graphical tool to obtain desired graphs. Various types of scatter plot and line graph are used to carry out exploratory data analysis. The facility level, patient services, population data are used to carry out analysis.

4.1 Distribution of OPD/IPD patients

Observing the distribution patterns of OPD and IPD patients given in Fig.1.1, we concluded that the number of outpatient and inpatients are mostly concentrated in Jammu district. More than 25 lakh OPD patients and 1.5 lakh IPD patients are handled by Jammu District health institutions which show it is catering not only the Jammu district patients but also the other districts of Jammu region. Next in line is Baramula which caters around 20 lakh OPD patients and around 0.80 lakh IPD patients. Despite having District hospitals in each district, the patients move towards Jammu, Baramula and Srinagar. It shows the hospitals of other districts lacks infrastructure facilities even for OPD patients. The handling of IPD patients is quite low in districts Doda, Ramban, Leh-Ladakh, Reasi, Poonch, Kishtwar, Kargil, Shopia, Bandipora. This shows the maximum patient of Jammu region districts are referred to Jammu Hospitals. Though, each district has its own district hospital.
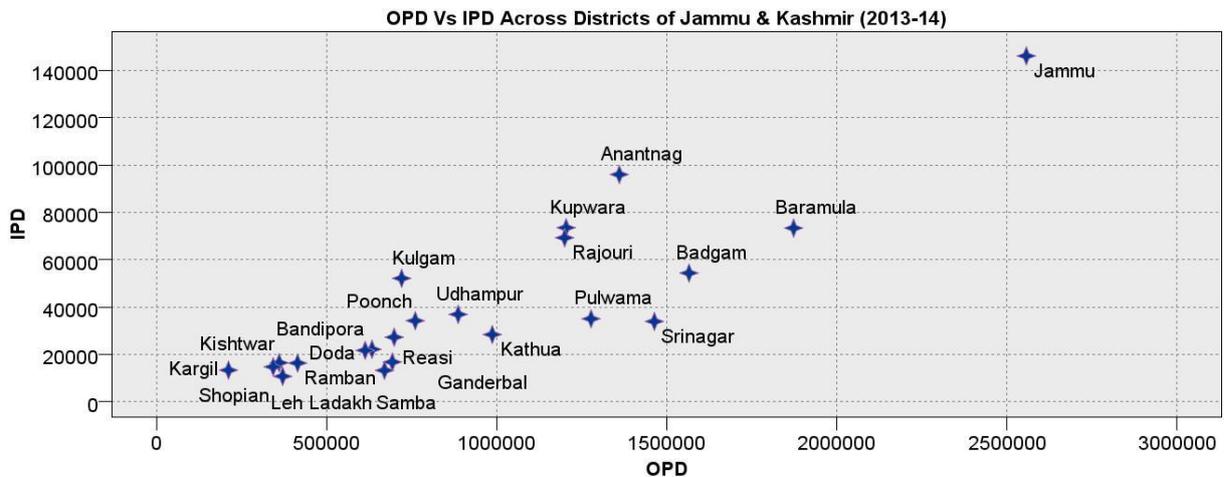

Figure 1: OPD/IPD patients across districts of J&K

4.2 Distribution pattern of public healthcare institutions

Public health care delivery in India has been envisaged at three levels namely primary, econdary and tertiary. At the primary level includes SCs and PHCs. At the secondary level includes CHCs or SDH and District Hospitals. In Jammu & Kashmir, there is wide variation in distribution of healthcare institutions as explained below:

4.2.1   Community Health Centres:

Community Health Centres (CHCs) is the First Referral Units (FRUs) in secondary level of public health care. The CHCs were designed to provide referral health care for cases from the Primary Health Centres level and for cases in need of specialist care approaching the centre directly [19]. 4 PHCs are included under each CHC. In J&K, the CHC has been increased since 2011. In 2011, the numbers of CHCs were 83 and were increased to 119 as on 31st March, 2014. Although there is significant increase since 2005 when CHC were just 70. The Community Health Centres in entire Jammu & Kashmir State has not been rationally distributed with the most of them concentrated in Kashmir region which includes districts Baramula, Badgam, Srinagar, Kupwara as shown in Fig. 1.2. Though Jammu is biggest District in Jammu region, it still lacks behind the Kashmir Zone in terms of CHC institutions. Out of 22 districts' in entire J& K state only, nearly half of them have only 2-4 CHC in each district. The worst districts in terms of not having much CHC are Kargil, Kishtwar, Samba, Ganderbal, and Bandipora.
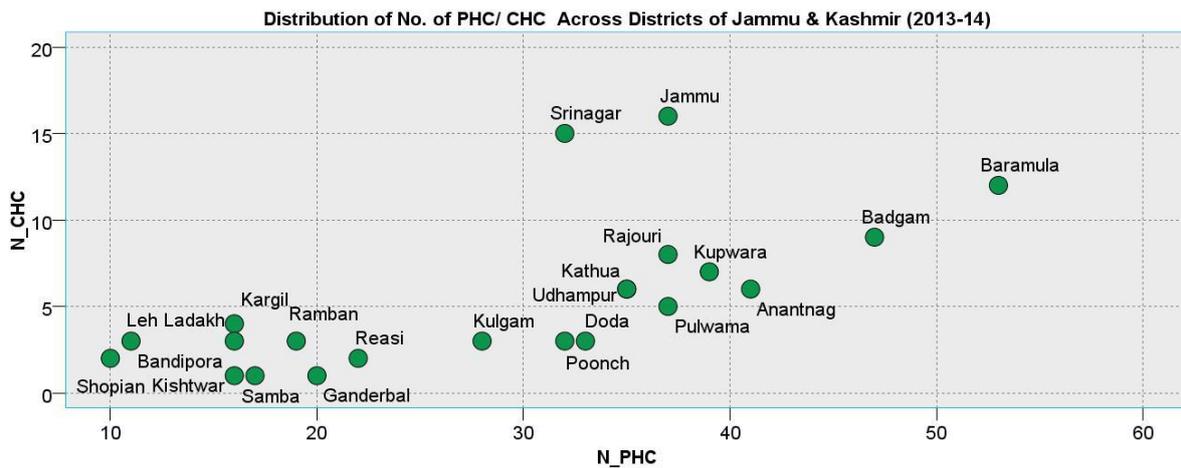
Figure 2: Distribution of PHC/CHC Across Districts

4.2.2   Primary Health Centres:

Primary Health Centre is the cornerstone of rural health services- a first port of call to a qualified doctor of the public sector in rural areas for the sick and those who directly report or referred from Sub-Centres for curative, preventive and promotive health care [18]. It acts as a referral unit for 6 Sub-Centres and refer out cases to Community Health Centres CHCs-30 bedded hospital) and higher order public hospitals at sub-district and district hospitals. In J&K, the numbers of PHCs have been increased quite significantly from
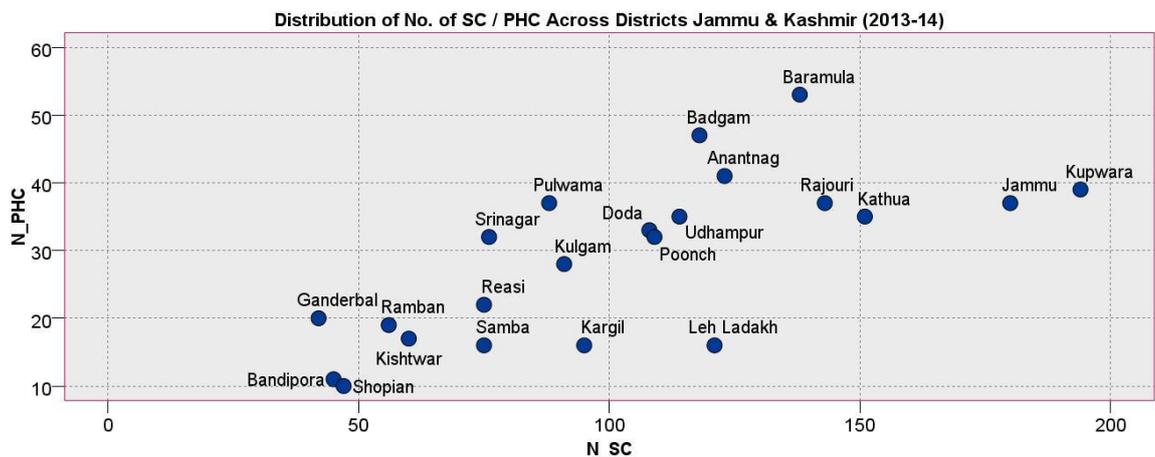
Figure 3: Distriibution of SC/PHC Across Districts

397 in 2011 to 633 in 2014. The PHCs have maximum concentrations in Baramula, Badgam, Anantnag, Jammu, Kupwara, Rajouri which are around 40 or more. The districts which have least PHCs include Shopian, Bandipora, Kargil, Kishtwar, Samba, Leh- Ladakh, Ramban, Ganderbal, Reasi as shown in Fig. 1.3.

4.2.3   Sub-centres:

In the public healthcare, a Sub-centre provides interface with the community at the grass-root level, providing all the primary health care services [17]. It is the foremost of a referral pyramid of health facilities consisting of the SCS, PHCs, CHCs, SDHs and District Hospitals. In J&K, the number of Sub-centres increased from 1907 in 2011 to 2249 in 2014. The maximum concentration of Sub centres are mainly in two districts – Kupwara and Jammu as seen in Fig. 1.3. Sub Centres which are in the range of 100-150 are in districts Doda, Poonch, Udhampur, Leh-Ladakh, Anantnag, Badgam, Baramula, Rajouri , Kathua. The least number of SCs are in districts Ganderbal, Bandipora, Kargil, Shopian, Kishtwar, Ramban.
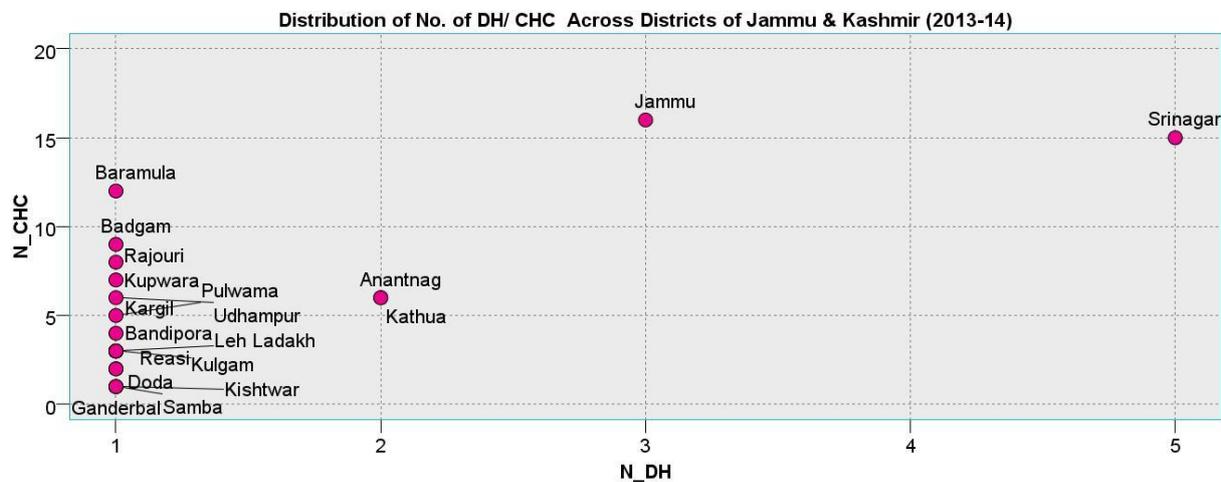

Figure 4: Distriibution of DH/CHC Across Districts

4.2.4   Districts Hospitals:

District hospital is an essential component of the district health system and functions as a secondary level of health care which provides curative, preventive and promotive healthcare services to the people in the district [20]. Every district is expected to have a district hospital linked with the public hospitals/health centres down below the district such as SDHs, CHCs, PHCs and SCs. In J&K, the numbers of District hospitals have increased from 22 in 2011 to 30 in 2014. There is wide disparity as far as distribution of districts hospitals is concerned as shown in Fig. 1.4. The maximum number of hospitals is in Srinagar i.e. 5. The next in the list is Jammu having 3 District Hospitals despite being the largest district in terms of area and population wise. Kathua comes third having two district hospitals despite having less population as compare to Ananatnag, Badgam, Baramula, Kupwara. Out of 22 districts, 19 districts have only 1 District hospital in each district.

4.2 Distribution of Population as per Census -2011

According to 2011 Census, Jammu and Kashmir had a population of 1, 25, 48,926, accounting roughly for 1.04 percent of the total population of the country. The decadal growth rate during 2001-2011 was about 23.70 percent which was higher than the decadal growth rate 17.64 percent at the national level. The population distribution line graph shows the Jammu District is most populous one with Srinagar district as next highest as shown in Fig. 1.5. Anantnag, Baramula, Kupwara are also populous districts. Depending upon population distribution, only Srinagar have good healthcare facilities rest of the districts lacks a lot as far as healthcare facilities concerned.
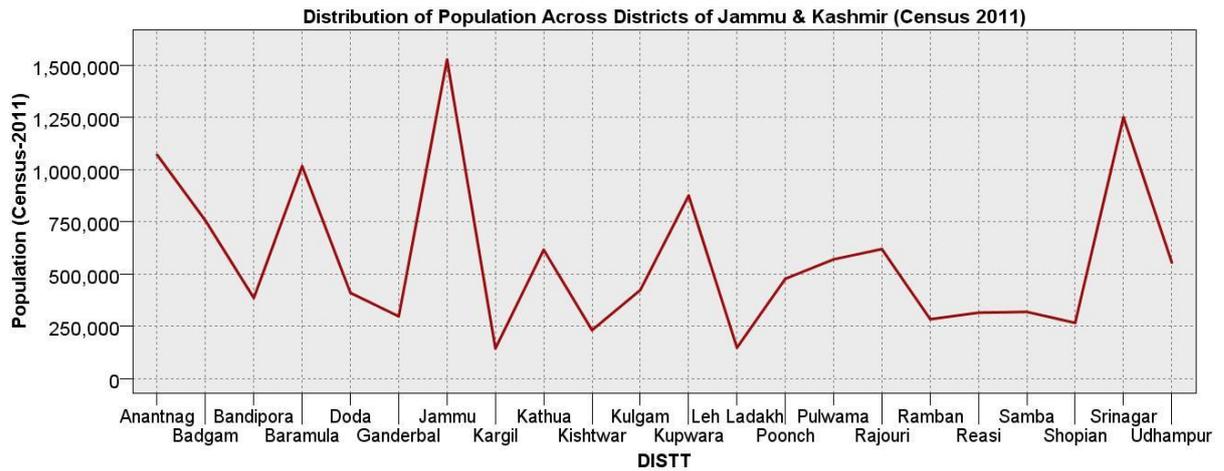
Figure 5: Population Distribution across Districts

4.4 Distribution of OPD Patients w.r.t Population

Comparing with the population distribution, the number of OPD patients is quite high as shown in Fig. 6. Next is Baramula, which is third highest populous district. Although Srinagar is second highest populous district still it has less number of OPD patients as Kashmir region it has more public health institutions as compared to Jammu. Although Jammu district has fair number of public healthcare facilities but it caters roughly whole of Jammu region, this increase the patient load on Jammu hospitals
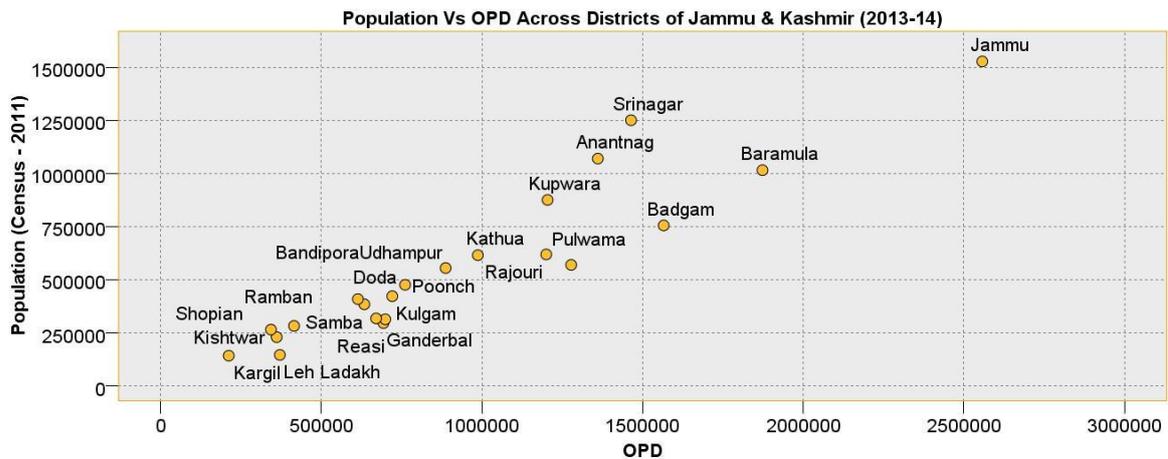
Figure 6: Population vs OPD patients' distribution across Districts

4.5 Distribution of IPD Patients w.r.t Population

The maximum number of IPD patients is in Jammu district as seen in Fig. 7. Roughly about 1.5 lakh patients are handled by the Jammu district healthcare institutions. This is quite eye opening. There is dearth of public healthcare institutions in Jammu region which have been verified even in facility survey carried out by various agencies [A]. Moreover, the population of Jammu District is also quite highest. This is also a reason to establish more institutions in Jammu and other districts of Jammu region.
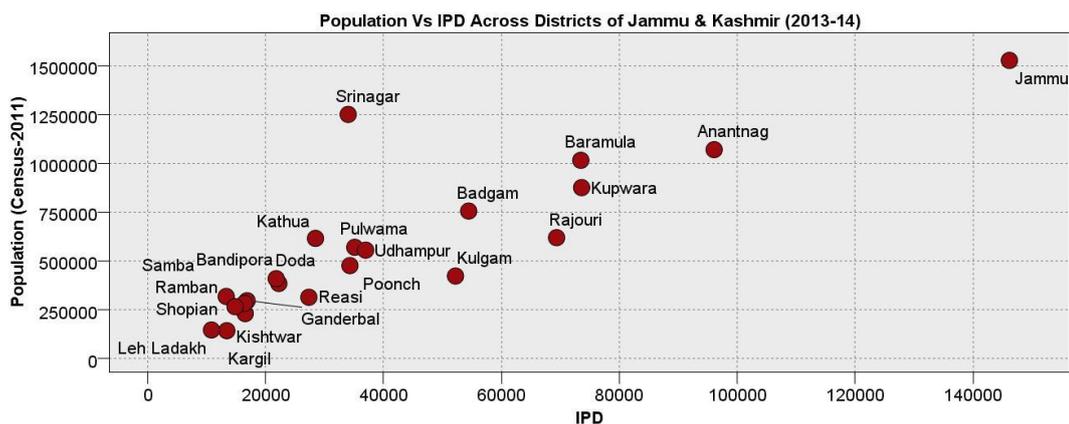
Figure 6- Population vs IPD patients' distribution across Districts

4.6 High Priority Districts:

With the above analysis, we found that Jammu region districts lacks most as far as health infrastructure is concerned. Taking into account the districts which are underperforming and ranked lower in the ranking (the bottom 25% of the districts in every State according to composite health index), six districts of Jammu & Kashmir have been identified by Govt. of India in its report. These include Rajouri, Poonch, Doda, Kishtwar, Ramban and Leh-Ladakh [7]. Although NRHM have been implemented in these districts since 2005, their performance remains the lowest. This is because of the healthcare facilities infrastructure has not built rationally. The analysis carried out clearly reflects the shortcomings within and to assist these districts in bringing them at par with the non priority districts. The exploratory analysis of healthcare data can be great help to the healthcare planners in policy formulation in this regard.

5   CONCLUSION

After going through data available, it is clear that the distribution of public healthcare institutions is not rational with the maximum concentration around summer capital of the state, Srinagar. As the secondary and tertiary levels of public healthcare institutions are mostly available in Srinagar, the patients approach to them easily. The Jammu District is covering the patients especially of the entire Jammu division. This put pressure on already limited infrastructures of Jammu District hospitals. The worst performing districts in terms of public healthcare institutions are Leh-Ladakh, Kargil, Ramban, Doda, Rajouri, Reasi. Moreover, recent study carried out by the GOI, indicates that six districts are under High Priority Districts (HPD) due to extreme lack of infrastructure facilities available there. This prompt us to think that the public healthcare data can provides the realistic picture of irrational healthcare facilities distribution in some districts. This study would help the govt. authorities and healthcare providers to take fresh initiative to provide uniform public healthcare infrastructure facilities. Even though the perception about HMIS data is that it is irrelevant, poor in quality and not timely provided yet it provide a lot of information which could be used by the planning and management team to formulate policies based on data rather on superficial basis.

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