A BLOCK-LEVEL STUDY ON SPATIAL DISTRIBUTION PATTERN OF PRIMARY HEALTH CARE CENTRES AND SUB-CENTRES IN UTTAR DINAJPUR DISTRICT, WEST BENGAL

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ABSTRACT *Any country, any state or district or blocks have some sort of integrated health services for the welfare of people. It is expected that the health regulators has envisaged an idea regarding the integration of lower order health services to its higher order. Any kind kind of health initiatives are carried out through organized way. Subcentres and the Primary health care centres not only cater the preliminary first aid health services to its vicinity but also have the responsibility to make aware the people about the initiatives and health benefits taken by the government. The study emphasizes on the nature of spatial point pattern of distribution of Health Subcentres and Primary Health Care centres in each block of Uttar Dinajpur district. Various quantitative analyses have been carried out in order to reveal the pattern of distribution of such health centres in Uttar Dinajpur district. Global Position Coordinate system has been integrated with ARC GIS 10.00 version analysis tool. Precautions have been taken to select the perfect methodology to narrate the distribution pattern. The study emphasizes on the distribution pattern through nearest neighbor analysis tool and to support it standard normal distribution/ Z score, thematic mapping technique and probability test has been carried out. The entire study has given insight on the centres of dynamic in characters owing to its effort to upgrade the basic health services to its people.*

Keywords: *Health, Distribution, Nearest Neighbour, Pattern, Spatial, GIS*

Introduction: The District Health System is the fundamental basis for implementing various health policies, delivery of healthcare and management of health services for defined geographic area. It is an integrated service which is allotted to each district and subsequently devoted for the inhabitants of the said district. Every district is expected to have a district hospital linked with the public hospitals/health centres down below the district such as Sub-district/Sub-divisional hospitals, Community Health Centres, Primary Health Centres and Sub-centres. Though District hospital is an essential apex component part of the district health system and it caters function as a secondary level of health care as well as provides curative, preventive and promotive healthcare services to the people in the district but the another component parts of lower order hierarchy in district health care system remain as Primary Health Centres and subcentres. The excellence of services in different lower component part would ultimately reduce the stresses to the district hospital. As the Primary Health Centre and subcentres are the cornerstones of rural health services. The basic essence of the said study is to give the priority about nature of dispersal of Primary Health Care system & health subcentres in Uttar Dinajpur district situated in different tehsils & grampanchayets. It is the point where 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. A typical Primary Health Centre covers a population of 20,000 in hilly, tribal, or difficult areas and 30,000 populations in plain areas with 6 indoor/observation beds. Every Primary Health care services acts as a referral unit for 6 Sub-Centres and refer out cases to Community Health Care (30 bedded hospital) and higher order public hospitals located at sub-district and district level. However, as the population density in the district is not uniform, the number of PHCs would depend upon the case load. PHCs should become a 24 hour facility with nursing facilities. Select PHCs, especially in large blocks where the higher order centre is over one hour of journey time away, may be upgraded to provide 24 hour emergency hospital care for a number of conditions by increasing number of medical officers. Standards are the main driver for continuous improvements in quality. The performance of Primary Health Centres can be assessed against the set standards. Setting standards is a dynamic process. Prior such types of centres was used for treating the patients only for communicable diseases but recent trends has been chaged in terms of protocols, programmes and initiatives taken by Govt. for treatment of non-communicable diseases.

Service Delivery: The Department of Health and Family Welfare (DoHFW) of the Government of West Bengal (GoWB) has emphasized on a process of improving the health systems and services within the State, through a strategic planning process. The Health Sector Strategy (HSS) lays down the framework for the strategic planning process in the state. The concept of Primary Health Centre (PHC) is not new to India. The

Bhore Committee in 1946 gave the concept of a PHC as a basic health unit to provide as close to the people as possible, an integrated curative and preventive health care to the rural masses with an emphasis on preventive and promotive aspects of health care. Usually, Primary Health Care Services in a district cater two types of services. In this regard the said services are categorized as A and B. PHCs in type A category would provide routine outpatient services, preventive, promotive, first aid emergency care and implementation of all the National Health Programmes, primarily through nursing staff. The doctor will mainly conduct OPD services. Whether, Primary Health Care Services of Type B would provide all kind of services of type A in addition equipped with maternal delivery care. People inhabiting in the rural area are getting assurance of minimum necessary services from the Primary Health Care centres. So in other words such kind of health centres assures minimum routine services to its inhabitants.

Study Area:

Uttar Dinajpur district have an extension of latitude and longitude within the coordinate of 25°11' N to 26°49' N and 87°49'E to 90°00'E occupying an area of 3142 km^2 enclosed by Panchagarh, Thakurgaon and Dinajpur district of Bangladesh in the east, Kishanganj, Purnia and Katihar districts of Bihar on the west, Darjeeling district and Jalpaiguri districts are on the north and Malda district and Dakshin Dinajpur districts are on the south. There are 4 Municipalities, 9 Blocks and 97 Panchayats covering 3263 inhabited villages. The district comprises 1505 mouzas and four municipality viz. Raiganj, Kaliyaganj, Dalkhola and Islampur. The district is bestowed with 160 primary health care service centres and subcentres but the dispersal of this institution is not uniform in nature. As the district is rural in character and most of the people are rural inhabitants, peoples are dependent on these service centres for routine outpatient services, preventive, promotive, first aid emergency care. Simultaneously, these centres are the points of implementation of all the National Health Programmes, primarily through nursing staff and doctor will mainly conduct OPD services. The first aid appropriate management of injuries and accident, stabilization of the condition of the patient before referral, dog bite/snake bite/scorpion bite cases, and other emergency conditions are carefully managed in such type of institutions.

Objective:

The study examines the distribution patterns, hierarchy and the magnitude of dispersal of primary health care services and subcentres and its significance of existing nature of distribution in the study area. The entire focus of the study is given on the pattern of distribution of PHCs and health subcentres keeping view to improve the spatial distribution and its equitable access to the masses.

Literature Review: Indian Public Health Standard documents have been revised in order to get a changing protocols of the existing programmes and incorporating new needs, protocols and programmes, especially for providing due emphasis to the Non- Communicable Diseases. Flexibility is allowed to suit the diverse needs of the states and regions. The document has taught about country's large number of public health institutions in rural areas from Sub-Centres at the most peripheral level to the district hospital at the district level. In addition the document gives the idea about importance and highly desirable functional and deliver quality care in a safe manner. IPHS guidelines will act as the main driver for continuous improvement in quality and serve as benchmarks for assessing the functional status of health facilities. The literature is however replete with a wide range of concepts and principles which can provide the framework for the analysis and planning of health facilities in a developing country such as theory which was articulated by Walter Christaller (Christaller, 1936) to show the relationship between the presence of a service and the population needed to support it, the size of the hinterland within which such a population was contained and the size and the central place itself. In an elegant and rigorous statement, Christaller (Christaller, 1936) demonstrated how, under specified conditions nested hierarchy of central places would result and these would be distributed in a hexagonal pattern of service areas.

Hypothesis:

In order to fulfill the objectives the following null and alternative hypothesizes are framed.

Ho: There is a clustering and uniform of distribution of Primary health care services and health subcentres in the district.

Ha: The distribution of Primary Health Care services and health subcentres are dispersed.

Data Source and Methodology: Primary and secondary data sources have been utilized in this study. The primary data comprises with the geographic coordinates of all the primary healthcare centres and health subcentres in the district, while the secondary data is procured from the census, district statistical handbook, Indian Public Health Standard Report, department of health and family welfare government of West Bengal and Directorate General of Health services Ministry of Health and family welfare. After getting point coordinate about each primary health centres and health subcentres the coordinate is added to Arc GIS 10 version's environment. The overlaying operation of district administrative map and the point

coordinate facilitate the individual block-wise distribution pattern of primary health care centres and health subcentres in Uttar Dinajpur District. Every quantitative technique has been applied carefully to brief the study precisely. Block-wise distributional spatial pattern the data are analyzed by Nearest Neighbour Ratio technique. Chi-square test is done to assess the divergence of observe distribution of PHCs and health subcentres from expected distribution in each block individually. The various cartographic thematic mapping techniques have been performed in order give visual outlook of distribution. Most of the data are analyzed using percentage and Geographical Information System (GIS) analysis tools such as nearest neigbour ratio (NNR), Chi Square test, Z score and probability test. The study has identified 160 primary and subcentre healthcare facilities with 26 Primary Health Care Centres and 134 subcentres as follows. Block-wise quantitative analysis of distribution reveals the fact that there were inequalities in the spatial distribution of primary health care centres and health subcentres in the study area. During framing the hypothesis the hypothesis is framed for three extreme values of Rn scale i.e. clustering (0), random (1) and regular (2.14). For accepting or rejecting the framed hypotheses results are tested through significance test.

Population and Primary Health Centres and Subcentres in Uttar Dinajpur District: According to 2011 census Uttar Dinajpur District comprises of 9 Community Development Blocks and 4 Statutory Towns. There are total 1494 villages and 5 Census Towns in the district. Uttar Dinajpur district occupies 15th position in terms of population and 11th position in terms of 0-6 year's population in the state. Uttar Dinajpur district has maximum proportion of child population (0-6 years) among all the districts in the State i.e. 16.1% of total population are children and hence the primary health care centres give its services especially on the maternal and child care. However the block level study reveals that some blocks are sparse in number of primary health care centres and health subcentres in respect of existing population number. The below table-1 proof the fact that usually the pressure happens to occur in the Kaliyaganj block where total 3 PHCs and health subcentres exist to cater the services to 74714 population though most of the people are dependent for their preliminary treatment in Kaliyaganj hospital. On the other hand apart from the existence of the district hospital in Raiganj block it enjoys the lesser population pressure as the block have 46 primary health care centres and health subcentres and each centre would like to cater the services to 9353 population.

Table-1: Block-wise Population and Primary Health Care Centres and SubCentres

C.d Blocks	Population	Primary Health Centres and Subcentres	Population/Health Centres
1. Chopra	284,403	29	9807
2. Islampur	308,518	17	18148
3. Goalpokhar-1	326,120	11	29647
4. Goalpokhar-2	291,258	05	58250
5. Karandighi	368,332	27	13642
6. Raiganj	430,221	46	9353
7. Hemtabad	142,056	10	14206
8. Kaliyaganj	224,142	03	74714
9. Itahar	303,678	12	25306

Source: Census, 2011 and Computed by author

Distributional Pattern of Health Care Centres in Uttar Dinajpur District: As the NNR (Nearest Neighbour Ratio) result indicates some apparent distribution pattern about the primary health care centre and health subcentres in Uttar Dinajpur District the overall analysis is inclined towards the uniform distribution. As the chi square test values (X^2) of individual blocks indicate that the every block has a tendency to be uniform distribution pattern in terms of PHCs and health subcentres distribution as the calculated values of X^2 is much smaller than the critical/tabled values at 0.01 significance level and hence the null hypothesis is liable to be accepted for individual blocks in the district. In order to more precise analysis about the distribution of the said health centres the standard normal distribution is assessed through Z score and p values for every block. The nearest neighbour ratio shows the clustering and dispersion of the health care services within the district and further the chi square test exhibits block-wise dispersion of the observed distribution of services from the expected distribution. The maximum Rn values are recognized in the blocks such as 1.87 for Kaliyaganj, 1.45 for Hemtabad, 1.37 for Chopra, and 1.34 for Raiganj indicates the tendency of distribution towards regular. Only random distribution of centres exist at Goalpokhar-I, Islampur, Itahar and Karandighi blocks having Rn values 0.89, 0.96, 1.10 and 1.05 as follows. The z-scores and p-values returned by the pattern analysis tools tell us whether we can reject that null

hypothesis or not. Often, we would like to run one of the pattern analysis tools, hoping that the z-score and p-value will indicate that we can reject the null hypothesis, because it would indicate that rather than a random pattern. The said entities viz. primary health care centres and health subcentres or the values associated with the point features exhibit statistically significant clustering or dispersion. GIS analyst tool has made possible to proof whether the distribution of observable phenomena i.e PHCs and subcentre's are significant statistically or not. As the P value indicates the probability the result gives the appearance of the higher the Z score value lesser the p value in some blocks. Speculation arises that whether the nearest neighbour ratio (Rn) results of Chopra, Hemtabad, Kaliyaganj and Raiganj are toward uniform pattern or we ought to be inclined towards the null hypothesis. GIS analyst tools have solved the problem. Nearest Neighbour Ratio Z score results in Chopra, Hemtabad, Kaliaganj and Raiganj are 3.84, 2.75, 2.89 and 4.55 as follows in association with very small p values i.e.0.00012, 0.006, 0.003 and 0.000005, yields the fact that it is unlikely that the observed spatial pattern reflects the theoretical uniform and cluster pattern as framed by null hypothesis rather it is better to make comment that the PHCs and health subcentres are in a dispersed manner in the said blocks. On the Other hand Goalpokhar I, Karandighi and Ithar blocks has a chance of uniform distribution or it accords with the null hypothesis as the nearest neighbor z score values exhibit -0.58 and 0.52 and 0.70 as it lies within the normal distribution first category i.e. -1.65 to +1.65 in association with the p values i.e.0.56 and 0.6. The other two blocks such as Goalpokhar II, Islampur accord with the hypothesis or it can be argued that said blocks have a chance of tendency to be uniform pattern in terms of distribution.

HYPOTHETICAL STANDARD NORMAL DISTRIBUTION GRAPH

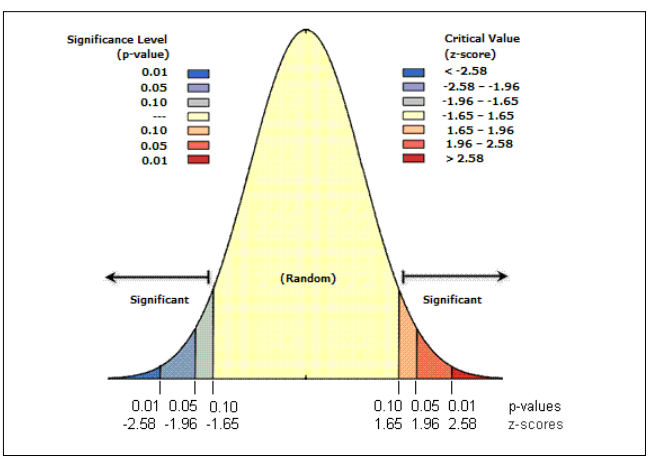
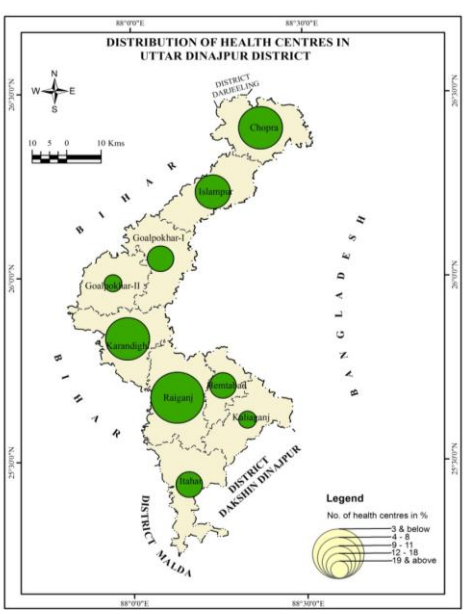


Figure 1



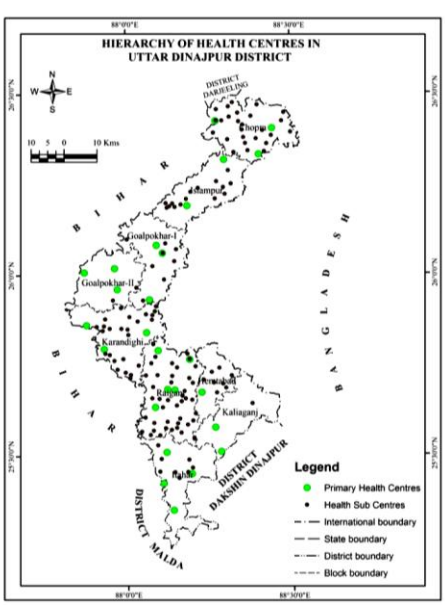
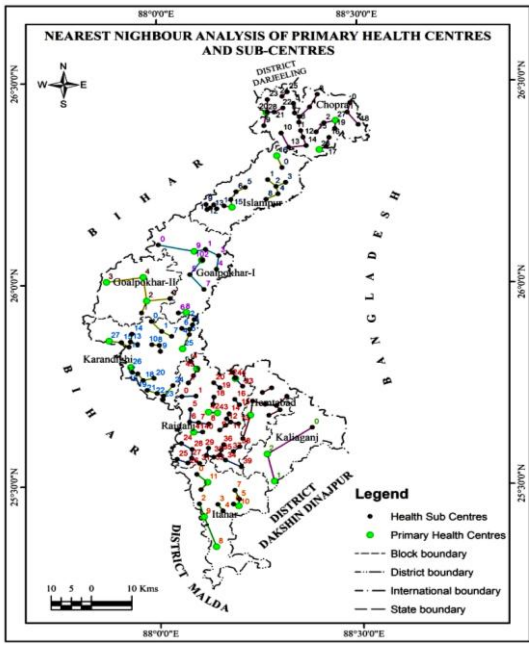


Figure 2 & 3



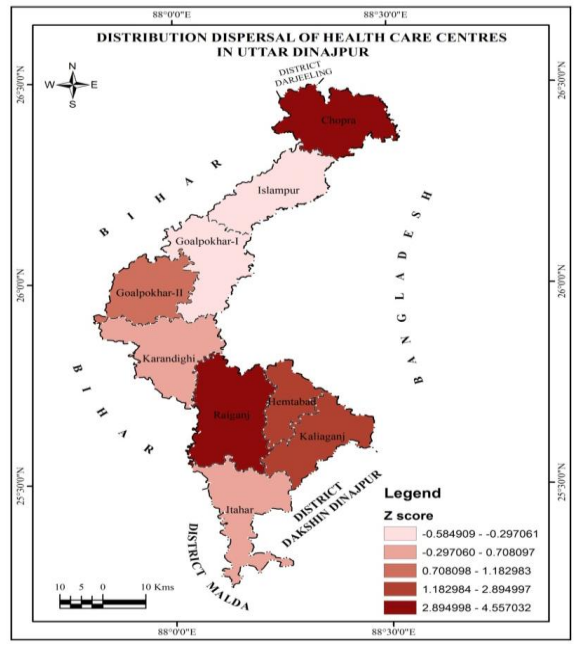


Figure 4 & 5

Table-2 Block-Wise expected and observed distribution Health care Services

Sl No.	Blocks	Area in sq.Km	Observed points	Expected	(O-E)^2	{(O-E)^2}/E	Remarks
1	Chopra	378.478224	29	20	81	4.05	Accords with hypothesis as the computed values of chi square in each block is less than the tabled values@ 0.01 significance level
2	Goalpokhar-I	357.324627	11	20	81	4.05	
3	Islampur	343.675561	17	20	9	0.45	
4	Goalpokhar-II	304.815979	5	20	225	11.25	
5	Karandighi	391.468684	27	20	49	2.45	
6	Raiganj	482.453927	46	20	676	33.8	
7	Itahar	363.385396	12	20	64	3.2	
8	Hemtabad	190.99827	10	20	100	5	
9	Kaliaganj	311.759199	3	20	289	14.45	

Sources: Computed by Author
Source: Computed by author

Table-3, Nearest Neighbour Ratio, Standard Normal Distribution and Probability of distrinution

Sl NO.	Blocks	Area(Sq Km)	NN Expected	NN Observed	NNR Ratio	NN Z Score	P Value
1	Chopra	378.478224	1806.306538	2480.670549	1.373339	3.846208	0.00012
2	Goalpokhar-I	357.324627	3341.615568	2980.397908	0.891903	-0.584909	0.558609
3	Goalpokhar-II	304.815979	4364.744971	5714.25575	1.309184	1.182983	0.236816
4	Hemtabad	190.99827	2185.167444	3177.551494	1.454146	2.747426	0.006007
5	Islampur	343.675561	2248.121963	2163.455676	0.962339	-0.297061	0.76642
6	Itahar	363.385396	2751.459447	3045.450663	1.106849	0.708097	0.478885
7	Kaliaganj	311.759199	5097.051426	9550.285773	1.873688	2.894997	0.003792
8	Karandighi	391.468684	1903.867128	2005.308658	1.053282	0.529654	0.596352
9	Raiganj	482.453927	1585.175344	2130.189627	1.34382	4.557032	0.000005

Summary: Health is one of the important parameter for well being of individual. Uttar Dinajpur district is one of the region where people do depend on the health subcentres and primary health care centres for preliminary, promotive, first aid and antenatal and post natal care visit, immunization of child different health benefit. In addition any kind of untoward disaster might happen to the people. The distance situation of district hospital and subdivisional hospitals has made it possible to visit to the PHCs and health subcentres. Primary Health care centres exist to support the sub center's referral patient. The study highlighted the nature of block-wise distribution pattern of the said services. The study has proofed that some blocks exhibit the dispersed pattern of distribution. In this regard the future review of situation for uniform services is the basic essences of the study. Apparent analysis reveals that the inhabitants of the block are not getting uniform services because of more distance from the expected distribution of the said services. It is the need of hour to give insight on the issue of distribution at the desired level for the sake of people's welfare. In addition the said centres should have some integrated services with its higher and lower order health centers and equipped better to give the utmost services to its people.

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When you change the way you look at things, the things you look at change.

~ Dr. Wayne Dyer