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# Impact of Morphometric Attributes and Road Networks in Maternal Health Care Services of Birbhum District, West Bengal

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***Abstract***

*Equitable provision of health care services and the degree of accessibility are major challenges for developing countries. The study regarding with accessibility to health care has long been of interest to medical geographers and other social scientists. There are numerous factors that contribute to the status of maternal health care services.*

*This investigation, in Birbhum District of West Bengal, focuses on those that affect the interval between the onset of obstetric complication and its outcome, going through the medium of accessing maternal health care services (MHCS). The use of MHCS depends as much on both the availability and accessibility of services along with the socio-economic characteristics of the users. In spite of having adequate education and satisfactory nourishment, women die during obstetric labour in different parts of the world. Geographical location and allocation of health service centres along with the terrain pattern, road condition, status of connectivity and accessibility can be the governing factors over here. Through the study, it has tried to find out the interrelationship between physiography, accessibility and connectivity with the prevailing maternal health care service and maternal health outcome status of the study area. The study has revealed the fact that the area with rugged terrain exhibiting lower accessibility, connectivity and inadequate provision of MHCS. This has raised a question on the strategic allocation of health care services and provision of service facilities to the downtrodden population.*

***Key Words: MHCS, Physiography, Accessibility, Connectivity.***

**1. Introduction:** Proximity and protecting health are the key concern of the health care service issue; it is to correct the "health impairments" ( Akhtar & Izhar, 2010). Health care facilities or services at any region can be divided into two broad types, which are- primary health centers and hospitals. The former provides basic health care services and later provides services for specialist health treatment (Murad, 2007). In the study the roles of both factors have been taken into account. The availability of maternal health services in rural areas of developing countries are remains poor because of low availability of human resources (Iyengar et al., 2009). According to Mansourian (Akhtar & Izhar, 2010), this structural component of health services depending upon the "efficacy" and efficiency of the services which are going to provide. The geographical location and allocation of health service centres along with the terrain pattern, road condition, status of connectivity and accessibility are the key component in the utilization of maternal health care services (Akhtar &

Izhar, 2010; Thaddeus & Maine, 1994; Gage & Calixthe, 2006; Kara & Egresi, 2012-2013). The study of accessibility to health care has long been of interest to medical geographers and other social scientist (Quah, 1977; Joseph and Phillips, 1984; cited in Kara & Egressi, 2013). Accessibility to the health care is concerned with ability of a population to obtain a certain set of health care services, which according to Penchansky & Thomas (1981) and Oliver & Mossialos (2004) can be grouped into three categories- (a) availability, (b) affordability and (c) geography (Black et al. n d.). The 3-delays model has been used by Thaddeus & Maine (1994) to establish the importance of underlying major factors in the utilization of MHCS.

> Phase –I-"delay in deciding to seek care on the part of the individual, the family, or both"; phase-II-"delay in reaching an adequate health care facility"; phase-III-"delay in receiving adequate care at the facility" (Thaddeus & Maine, 1994).

Regarding the development of medical infrastructure, it was started after World War II and World Health Organisation (WHO) advised to initiate first five year national health development plan in the 1961 (Akhtar & Izhar, 2010).The use of MHCS depends as much on both the availability and accessibility of services along with the socio-economic characteristics of users (Gage & Calixte, 2006). A woman from Birbhum district told in a maddening tone that- "*amader Dai bhalo, garib manusher haspatale bhorti hoa maron, Bed, osud sab kena, tar upar daktar-nurseder kato katha*"- We poor people are better off with the village Dai. Going to hospital is very expensive and burdensome; we have to pay for the bed and medicines. In addition, the doctors and nurses treat [us] in a harsh manner (Rana et al., 2005). Geographic accessibility often considered as the physical accessibility governing by the terrain, topography and road network and travel time (Black et al. n d.; Williams, 1987). There are several issues and challenges that make the health policy and infrastructural allocation difficult to implement, as these are directly related to the distance to health service and need to health care (Murad, 2007). The study of Thaddeus & Maine (1994) found that in spite of having adequate education and satisfactory nourishment women die during obstetric labour in different parts of the world. The accessibility to medical and health services is the area to which infrastructure is directly related and seems to influence the 1$^{st}$ and 2$^{nd}$ delays to health care services (Airey, 1989). The nature of terrain, roads condition, location, aspect and distance are having greater influence to measure the degree and status of MHCS of a given area (Thaddeus & Maine, 1994). There are some literatures which have emphasised road quality as an indispensible factor along with terrain, accessibility and connectivity in the provision, allocation and utilization of maternal health care services (Airey, 1989; Thaddeus & Maine, 1994; Akhtar & Izhar, 2010; Satia et al., 2014). Spatial inequalities in the distribution of health facilities are another important factor in the present context (Akhtar & Izhar, 2010). People from rural farming community in Mexico have to travel 30km to reach to the facility. The misery is that by the time the patient reaches to the facility it encounter "en route" death (Thaddeus & Maine, 1994). It was found that around 60% pregnant women had to travel between one to five hours to reach to the Essential Obstetric Care (EOC). Deteriorating roads coupled with unaffordable transportation cost , makes it difficult for the poor, especially for women to access health care, as these women are deprived with money, time, incentives to access the facility and less concern from the family members (Masuma & Bangser, 2004). Straight-line distances, driving distances and driving time are strongly linked with each other. Straight-line distances can be used to assess physical access to health services (Taiar et al., 2010). Geographical barriers such as mountainous terrain or poor road conditions also delay access to maternal health care (Guttmacher Institute, 2007; cited in Masuma & Bangser, 2004). Study of Sourav Neogi (Satia et al., 2014) has reported that because of difficult terrain, broken chain of

transportation, especially in the least accessible island; force the women to deliver at home. Rumsey (2002) noted that lack of access to health care facilities refers not only to economic and socio-cultural distance as well as physical distance (Akhtar & Izhar, 2010). The lack of transport facilities was reported to be a major problem hindering childbirth at hospitals. Many residents of Birbhum villages are suffering from this problem (Rana et al., 2005).

**2. Objectives:** To assess the significance of physiographic features and road accessibility in the utilization of maternal health care services, followings are taken as the main objectives of the study.

1. Identification of morphometric attributes of different parts in the study area.
2. Quantification of prevailing road network accessibility and connectivity status.
3. Analysing the maternal health care services and the status of maternal health.
4. Establishing the interrelationship between physiography, accessibility, connectivity and population pressure with the prevailing maternal health care service and maternal health outcome status of the study area.

**3. Methods and Materials:** The work involves three principal stages - surveillance, collection of materials and data assessment for interpretation. Firstly, the objectives have been guided by different literary sources enforcing the prime domain of the study and field observation. The study is based on information accrued from the topographical sheets from Survey of India (SOI), like- (a) Topographical maps of series 72P and 73M (1:50,000) published by Government of India, which are-72P/8, 72P/11, 72P/12, 72P/14, 72P/15, 72P/16 and 73M/1, 73M/2, 73M/5, 73M/6, 73M/9, 73M/10, 73M/11, 73M/13, 73M/14, 73M/15, (b) Block map, and (c) statistical accounts regarding the issue from- District Statistical Handbook, Birbhum (2012), reports from Block Medical Officer of Health (BMOH), Birbhum, Population Census ( Govt. of India, 2011). To identify the relief features the entire district has been divided into 33 grids, each of 250 $km^2$. To accomplish the study different morphometric and road network indices have been calculated with the help of following methods.

**Table-1:** Adopted Techniques

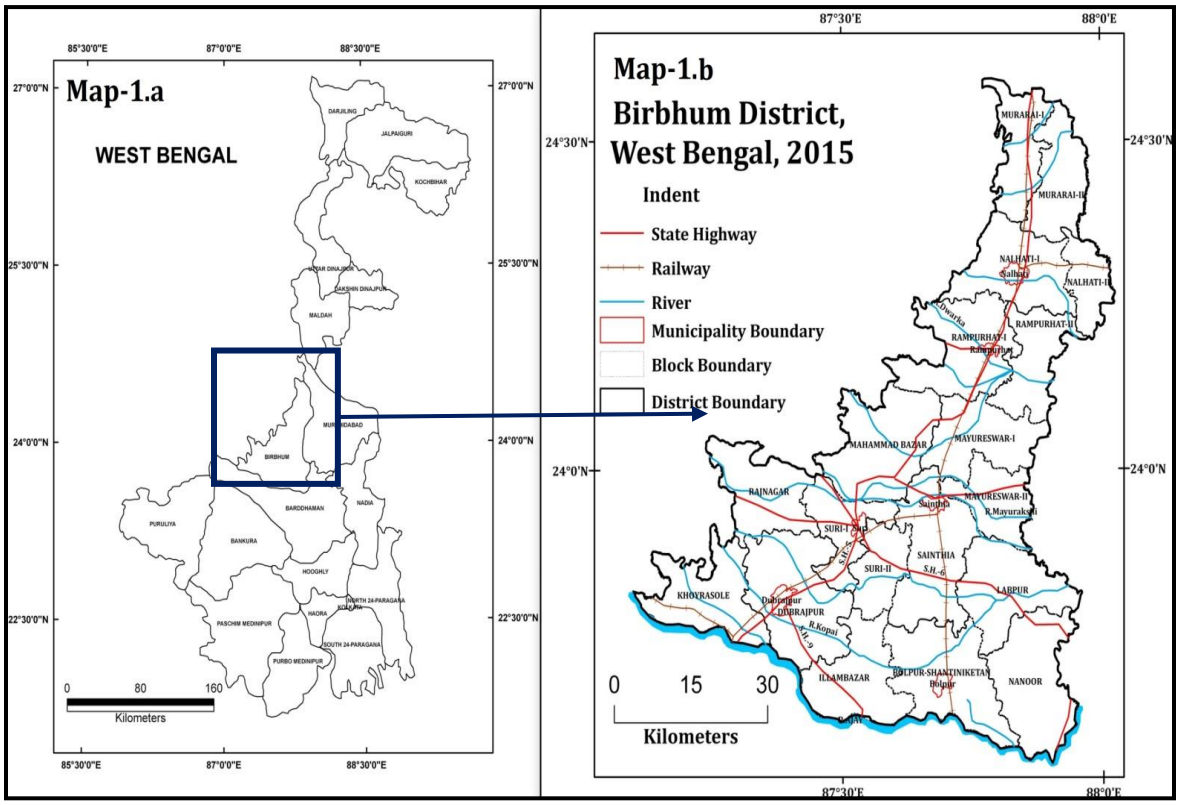
| Indexes | Parameters | Methods Proposed By | Methods |
|---|---|---|---|
| **1. Morphometric Index** | Ruggedness Index | R.J.Chorley (1965) | RN.I.= [(Amplitude of Relief × Drainage Density)/1000] |
| | Dissection Index | Dov Nir (1957) | D.I.=(Amplitude of Relief/Maximum Altitude) |
| | Relative Relief | G.H.Smith | R.R.=(Maximum Elevaton-Minimum Elevation) |
| **2. Road Network Index** | Accessibility Index | Hanson (1959) & Kanksy (1963) | 1. Cyclomatic Number (μ)= e-v+p |
| | | | 2. Alpha Index (α) = (μ/2v-5) |
| | | | 3. Beta Index (β) =(e/v) |
| | | | 4. Gamma Index (γ) = [e/{3(v-2)}] |

Source: Sen, 1993; Saxena, 2012

Use of Microsoft Excel-2003-2007 and SPSS-15.0 (SPSS Inc., Chicago, Illinois, USA,2009) software to quantify the data; have reduced the time of large and complex calculations and data

analysis. The spatial distributions have been mapped through ArcGIS, Version 9.3 (Esri Developers Summit, 2008).

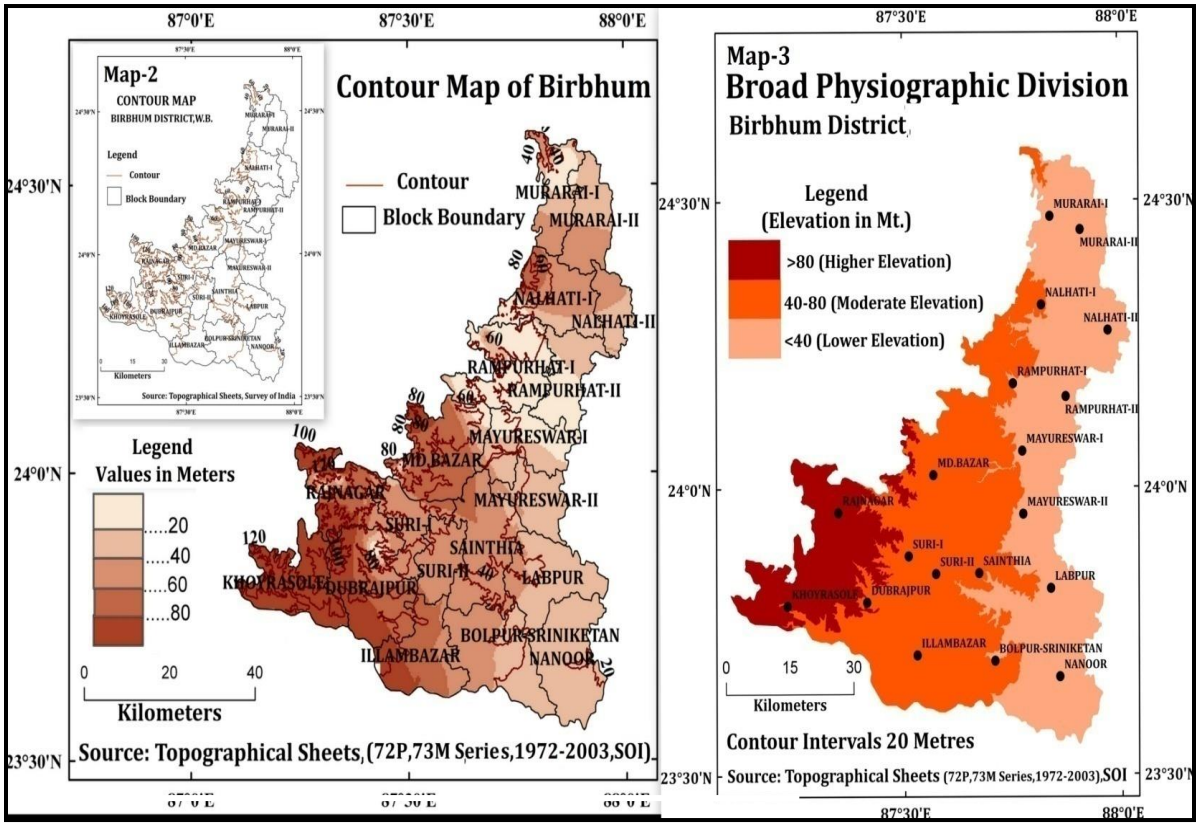
**4. Study Area:** Birbhum district is located in the western part of West Bengal with an extension from $23^0$ 32'30" N to $24^0$ 35' N and $87^0$ 05'25" E to $88^0$1'40" E. The area of the district is 4550 $km^2$, sharing 5.12% of land area and 3.83 % of total population of the state, indicating relatively lower density of population (771/$km^2$) of the district than the average, that is 1029/ $km^2$ (Population Census, 2011).The district is characterised by an undulating topography, part of the Chhotanagpur plateau that projects through the western borders of the district. In shape it looks like- an "isosceles triangle" (District Gazetteer, 1975). The apex is situated at the northern extremity, very close to the point where the Ganges and hills of Santhal Paraganas begin to diverge, while river Ajay forms the base of the triangle. The district is bounded by the states of Jharkhand and Bihar on the west, and lies at the eastern end of the Chhotanagpur plateau, on the east it is bounded by the district of Murshidabad and on the south by Bardhaman from which it is separated by natural boundary, i.e. Ajay River. The soil and landscape is very much akin to the Rarh. The eastern portion, comparatively fertile to the west, constituting the north eastern Rarh Region, merges with the Gangetic plain. The district is comprised with 19 blocks and Suri is the district head quarter (Map-1).




**Map-1:** Location Map

**5. Results and Discussions**

**5.1. Morphometric Characteristic of the Study Area:** The entire region has some distinctive as well as exclusive physical features with respect to Chhotonagpur Plateau projecting through the western boarder of the district. The district is well drained by a number of rivers and plateau streams running in nearly every case from west to east with a slightly south-easterly inclination towards the Suri sub-division and north-easterly inclination towards half of Rampurhat sub-division. To the north in Murarai-I and II, the land slopes north to north-east as it is evident from the flow of the Pagla Nadi. From the Broad Physiographic Division map it could be seen that the eastern part of the district lies in the comparatively lower elevated zone (<40 Mt.), which comprises with the blocks like- entire part of Murari—II, Nalhati-II, Rampurhat-II, Mayureswar-I and II, Labpur and eastern part of Murari-I and Bolpur-Sriniketan (Map-3). Ajay is flowing through the south and is entering the district at about $87^0$08' E and $23^0$ 46' N. Its floods sometimes destroy the villages and crops on its left bank affecting a larger part of Bolpur and Nanoor.

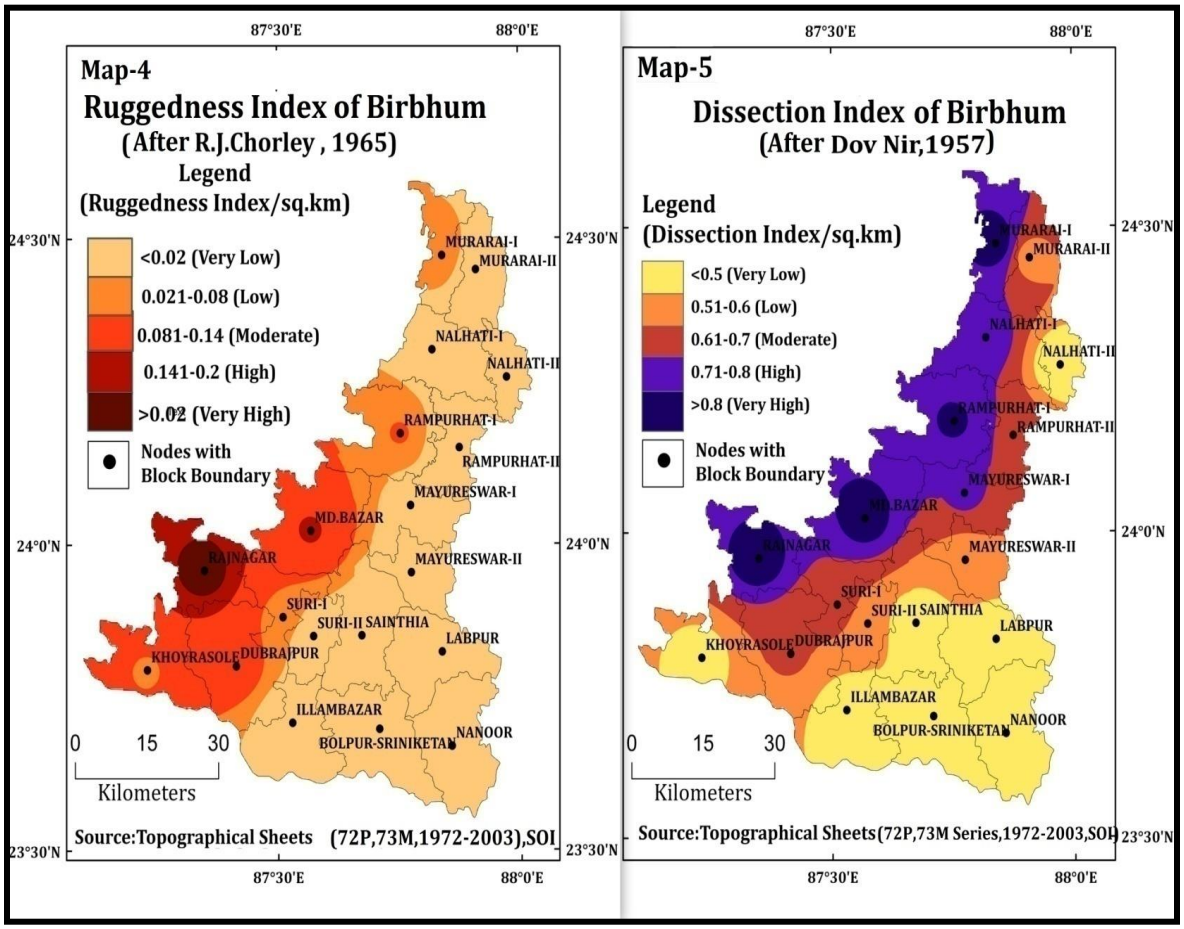



The rolling upland topography in between Mayurakshi and Ajay is known for its picturesque variety, which comprises with the blocks like- eastern part of Mahammad Bazar, Suri-I, Dubrajpur and entire Suri-II and Illambazar. Kopai river displays severe scare of gully erosion which has been resulted in the formation of badland topography to north of Binuria, Sriniketan and Santiniketan (Map-3). The western part of the district is bounded by 80 and 120 meter contours, comparatively high rugged and dissected part of the district, comprising with the blocks like-Rajnagar, Mahammad Bazar, Dubrajpur, western part of Khoyrasole, are displaying ruggedness values like- 0.25, 0.15, 0.11 and dissection values like- 0.08 and 0.92, 0.90, 0.62 and 0.43 respectively, ensuring the evidence of high undulating and dissected topography.

**Table-2:** Specific Morphometric Characteristics of the study Area

| Category | Parameters | Maximum Values | Minimum Values | Average Values |
|---|---|---|---|---|
| **Morphometric Features** | Ruggedness Index | 0.25 | 0.013 | 0.06 |
| | Dissection Index | 0.9 | 0.33 | 0.6 |
| | Relative Relief (in Mt.) | 115 | 10 | 40 |

(Source: Toposheets (SOI), Computed by the Authors)




**5.2. Prevailing Road Network Accessibility and Connectivity Status:** Accessibility to the facility is the highly indispensible factor to control the utilization of MHCS, as in most cases pregnant women, belonging to resource poor region, often suffered from delivery related complications due to inadequacy in the timely access of transport to reach the facility.

**Table-3**: Connectivity and Network Structure of the Study Area

| Alpha Index (α) | Beta Index (β) | Gamma Index (γ) | Cyclomatic Number (μ) |
|---|---|---|---|
| 0.09 | 1.11 | 0.41 | 3 |

(Source: Computed by the Authors)

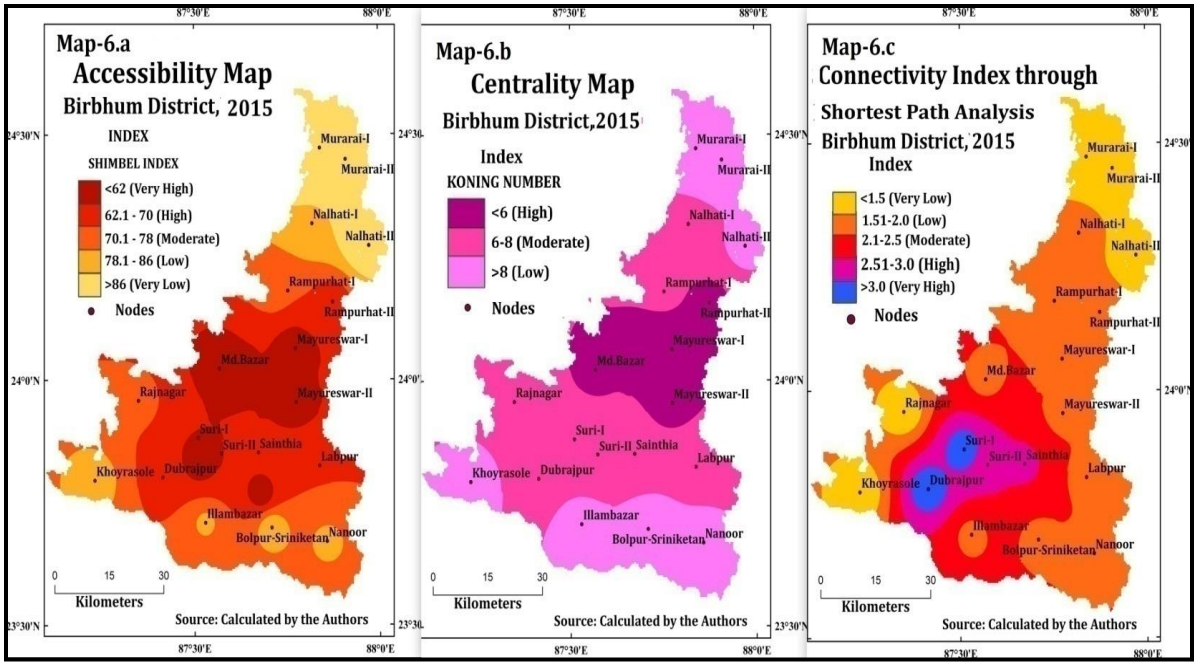
One of the most important measures of connectivity of a network is the *Alpha Index* (α), ranges between 0 to 1. Higher the index, greater is the degree of connectivity in the network. Here α index value 0.09 is portraying very low degree of connectivity. *Beta Index* (β) at the same time is representing a complicated network structure and the value is 1.11. The connectivity has calculated by *Gamma Index* (γ) varies from a set of nodes having no interconnection (γ=0) to the one in which every node has an edge connected to other nodes in the graph (γ=1). The numerical range of the index is 0 to 1. Here the γ value is 0.41 indicating lower connectivity, where the number of non-interconnected set of nodes are greater than which have an edge connected to other node in the circuit. The Cyclomatic number (μ) is a different way of measuring connectivity. In a disconnected tree type network the index is to be '0'. The area is indicating low to moderate connectivity status as μ=3.

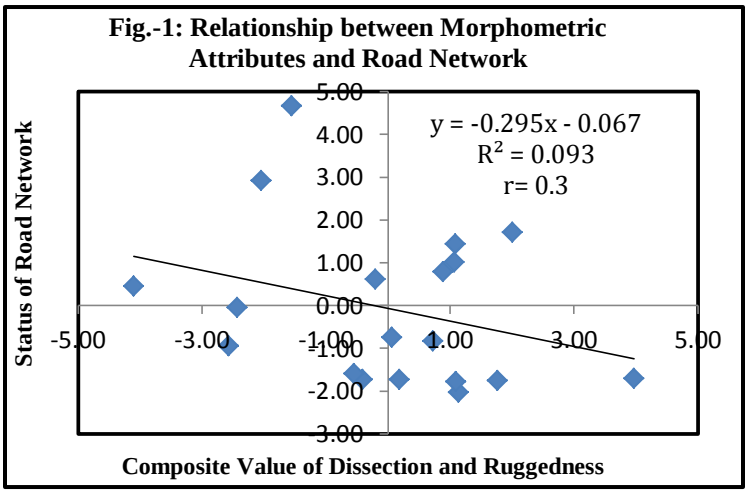
**Table-4:** Accessibility and Connectivity Characteristic of the Study Area

| Category | Parameters | Maximum Values | Minimum Values | Average Values |
|---|---|---|---|---|
| **Connectivity and Accessibility** | Shimbel Index (SI) | 113 | 56 | 75 |
| | Koning Number(KN) | 10 | 5 | 8 |
| | Direct Connectivity Index (DCI) | 4 | 1 | 2 |

(Source: Computed by the Authors)

While the Shimbel Index (SI) can be derived from the shortest path matrix- the total of each row gives the SI value. In the Map-6.a, Md. Bazar, Mayureswar- I and II, and Suri-I and II are having SI value less than 62, on the other hand Murarai-I & II, Nalhati-II and Illambazar are falling in the category of very low SI value (>86). Since, the previously mentioned blocks are having lowest SI value of all blocks; these are comparatively the most accessible area as per the SI value. In response to the shortest path matrix, Murarai-I & II, Nalhati-I &II, Khoyrasole, Illambazar and Nanoor are the distant node from point of centrality with higher *Koning Number* (>8) , as *Koning Number* has been developed to describe the degree of centrality of any node on a network. It is calculated by adding up the numbers of arcs from each other node using shortest path available. Thus Md. Bazar, Mayureswar-I & II and Rampurhat-II are having the lowest number (<6) and are, therefore, the most central node in the network (Map-6.b). According to measures discussed above, the accessibility can be obtained directly from the connectivity matrix, which is scoring high (>3) in Suri-I, followed by Suri-II, Sainthia, Dubrajpur (Map-6.c).

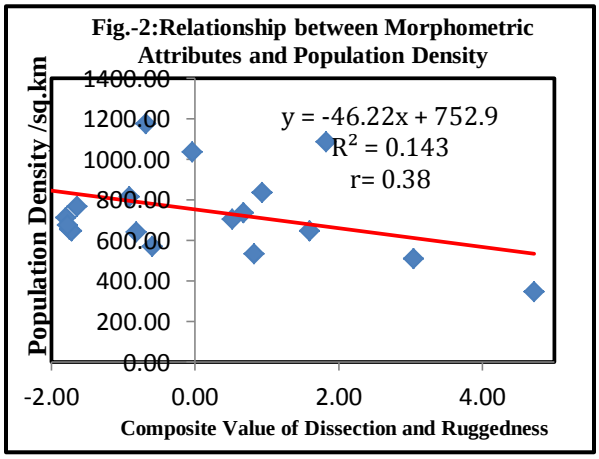


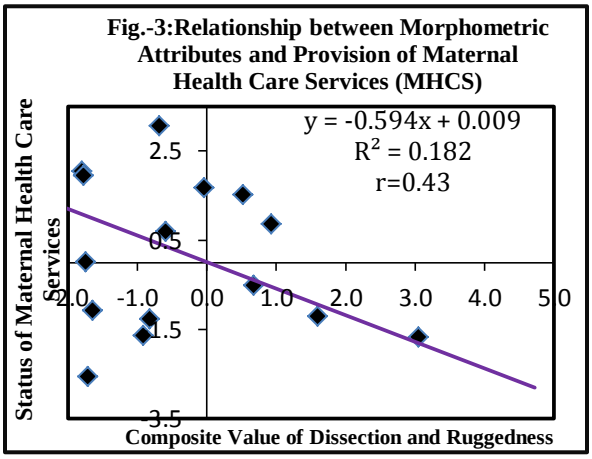



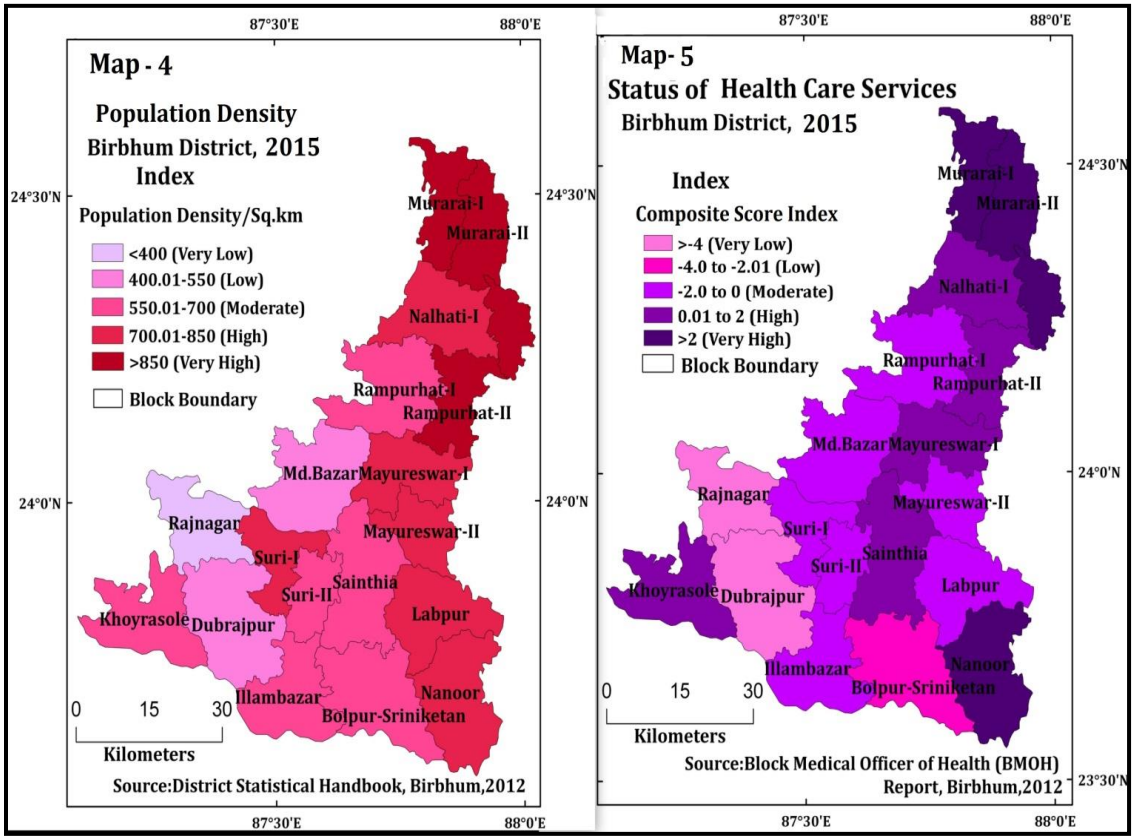

It is seen that there is a negative correlation between the status of morphometric indices with the prevailing road network (Fig.-1).Though, it is signifying in a lower level (-0.3) because of the centrality of some blocks which are falling in the moderate to high elevated zone in broad physiographic division (Map-3), like- Suri-I, Mahammad Bazar and Dubrajpur. These are the area where the Shimbel Index, Konning Number and Direct Connectivity index are fairly feasible which lowering down the significance level of the respective correlation (Map-6.a, 6.b & 6.c and Fig.-1).

But if the health infrastructure can be considered along with the prevailing morphometric indices, it could be seen that lower elevated areas like- Murari-I, II, Nalhati-II, Rampurhat-II, Mayureswar – II and Nanoor have scored higher composite value in the health infrastructural index, these are- 4.16, 3.07, 1.68, 1.52 and 2.05 respectively. On the other hand Rajnagar (-5.56), Mahammad Bazar (-1.67) and Dubrajpur (-4.22) are in the deprived section of the health infrastructural index. Here it can be said that the provision and strategic allocation of maternal health infrastructure is getting affected by the location of the respective blocks.

**5.3. Population Density and Status of Maternal Heath Care Infrastructures:** The blocks, which are to be found in the north-eastern part of the district dominated by lower undulating surface (Map-4 and 5), like- Murarai-I and II, Nalati-II, Rampurhat –II are showing high population density (>850/sq.km), whereas blocks situated on western part of the district, characterised by rugged topography (Map-4 and 5), like- Rajnagar, Md.Bazar and Dubrajpur are persistent with lower population density (<400/sq.km). Thus areas with higher elevation mostly comprise with sparse and lower population density in a very convincing way Map-7 and Fig.-1.



It is often difficult to understand the difference between the hindrance and actual obstacle. The effect of distance in the utilization of MHCS is function of time and cost of travel along with undulating topography, poor, unpaved road, inadequate connectivity and accessibility. Figure-3 is portraying a negative correlation between the prevailing maternal health care services and ruggedness and dissection status, as with the increase in the value of ruggedness and dissection status correspondingly leading to lowering score in the provision of maternal health care services (Map-8, Fig.-2).

**6. Interrelationship between Morphometric Attributes, Road Networks and Maternal Health Care Services:** In this part of analysis the major objective is to determine the interrelationship between morphomatric indices and network connectivity characteristic with provision of maternal health care services and finding out the principal influencing factor for the system. Preparation of correlation matrix and principal component analysis are the standard device in this investigation. The correlation matrix is exhibiting a bi-variate relationship between the variables. It is evident, though none of the variables are highly correlated; Shimbel Index is playing a dominant role in the matrix table, showing positive relationships with health infrastructure and Koning number and on the other hand, negatively correlated with Ruggedness Index (Table-5).

**Table-5:** Interrelationship between Morphomatric Indices and Network Connectivity Characteristic with Provision of Maternal Health Care Services (Pearsonian product moment correlation matrix) in Birbhum

| Correlation Matrix | MMR | SE | ANC | VUL | HI | RD | SI | KI | DCI | RN | DI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **MMR** | 1.00 | -0.18 | -0.76 | 0.57 | -0.10 | -0.34 | -0.31 | -0.45 | -0.25 | 0.13 | 0.16 |
| **SE** | | 1.00 | 0.46 | 0.07 | 0.32 | -0.35 | 0.58 | 0.33 | -0.45 | 0.25 | 0.33 |
| **ANC** | | | 1.00 | -0.48 | 0.36 | 0.12 | 0.42 | 0.29 | 0.01 | -0.19 | 0.11 |
| **VUL** | | | | 1.00 | 0.13 | -0.34 | -0.16 | -0.18 | -0.22 | 0.07 | -0.08 |
| **HI** | | | | | 1.00 | -0.26 | **0.55** | 0.23 | -0.39 | **-0.58** | -0.22 |
| **RD** | | | | | | 1.00 | -0.16 | 0.02 | 0.18 | -0.14 | -0.16 |
| **SI** | | | | | | | 1.00 | **0.82** | -0.66 | -0.11 | -0.10 |
| **KI** | | | | | | | | 1.00 | -0.34 | -0.13 | -0.36 |
| **DCI** | | | | | | | | | 1.00 | -0.12 | -0.05 |
| **RN** | | | | | | | | | | 1.00 | **0.70** |
| **DI** | | | | | | | | | | | 1.00 |

**MMR=** Maternal Mortality Ratio, **SE=** Socio-economic Status**, ANC=** Antenatal Care**, VUL=** Vulnerable Pregnancy Outcome, **HI=** Health Infrastructure**, RD=** Road Density, **SI=**Shimbel Index, **KI=**Koning Number, **DCI=**Direct Connectivity Index, **RN=**Ruggedness Index, **DI=**Dissection Index

**Table-6:** Interrelationship between Morphomatric Indices and Network Connectivity Characteristic with Provision of Maternal Health Care Services (Extraction of principal components with cumulative percentages of variance) in Birbhum

| PCA | MMR | SE | ANC | VUL | HI | RD | SI | KI | DCI | RN | DI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 (31.29%)** | -0.59 | 0.60 | 0.71 | -0.29 | **0.64** | -0.06 | **0.91** | **0.76** | -0.46 | -0.30 | -0.20 |
| **2 (53.77%)** | 0.64 | 0.51 | -0.33 | 0.62 | 0.21 | -0.67 | 0.27 | -0.03 | -0.65 | 0.42 | 0.38 |
| **3 (72.08%)** | -0.32 | 0.39 | 0.37 | -0.43 | -0.46 | 0.07 | -0.02 | -0.09 | 0.11 | **0.76** | **0.79** |

With 31.29% explanation in the first PCA Shimbel Index became the prime factor (0.91) to determine the MHCS system. Whereas Koning Number and Health Infrastructure are having moderate influences on the system. In 3rd stage of the analysis with cumulative 72.08% explanation, Ruggedness Index and Dissection Index become dominant factors.

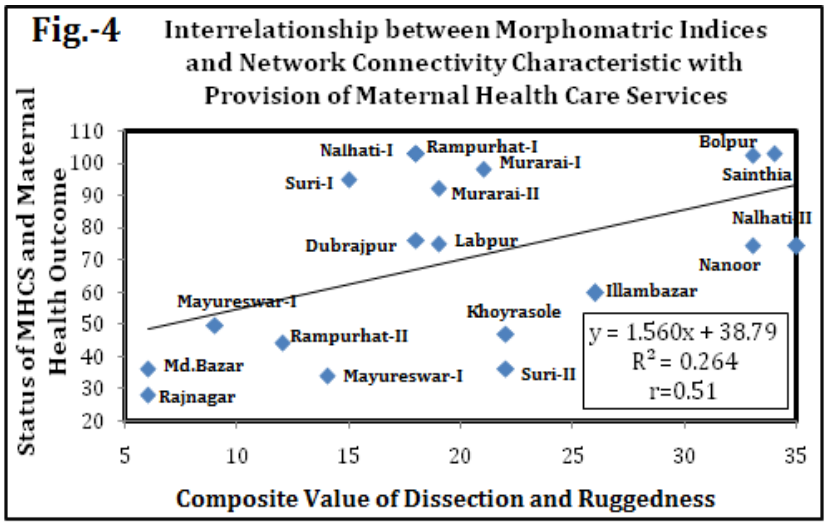
**7. Relevance of Morphometric Attributes and Road Networks on Maternal Health Care Services:** Under the null hypothesis, where the population correlation is zero, the expression of the student't' distribution with (n-2) degree of freedom is the following equation.

$$\mathbf{T = [r \times \{\sqrt{(n-2)/ (1-r^2)}\}]}$$

As in the component matrix, Shimbel Index became the prime factor for the system, it is considered as an independent variable and the rest factors are as dependent variables. Since the calculated 't' of Shimbel Index in relation to Health Infrastructure (2.72), Koning Number (5.91) and with Direct Connectivity Network (3.62) are more than the tabulated value 2.57 ( at 0.01% significance level), the null hypothesis is rejected and difference sample means is significant over a larger number of observation.

**Table-6:** Computation and Comparison of 't' based on Correlation Coefficient of Different Variables

| (X) | (Y) | R | Computed t | Tabulated t at (n-2) or 17 Degrees of Freedom 0.01 Significance Level |
|---|---|---|---|---|
| **SI** | **MMR** | -0.31 | 1.34 | **2.57** |
| | **SE** | 0.58 | **2.93** | |
| | **ANC** | 0.42 | 1.91 | |
| | **VUL** | -0.16 | 0.67 | |
| | **HI** | 0.55 | **2.72** | |
| | **RD** | -0.16 | 0.67 | |
| | **KI** | 0.82 | **5.91** | |
| | **DCI** | -0.66 | **3.62** | |




Considering all the parameters in to account, correlation co-efficient value is found out as 0.51 when the entire status of Ruggedness Index and Dissection Index are lying in the independent axis. Here the't' value (2.44) is greater than tabulated value at 0.05 level of significance (1.74) and on the other hand it is falling in the zone of acceptance in 0.01 level of significance (2.57). Thus, it could be said that the null hypothesis that is Ruggedness Index and Dissection Index are important factor behind the provision and utilization of maternal health care services can be rejected at 5% significance level where as the correlation co-efficient is said to be significant but it can be accepted in 1% significance level, means over a large number of observation this two sets of variables will be independent.

**8. Conclusion:** Although morphometric indices have controlling influence in the allocation and provision of maternal health care services but this study has found that the major problems of the concerned health services are related with accessibility and connectivity. Shimbel Index (SI) has become the prime factor in the first stage of analysis, though Ruggedness Index and Dissection Index have got importance in 3rd stage of analysis, which implies that the maternal health care services are directly correlated with Shimbel Index and later to morphometric characteristics of the study area. The blocks, mainly situated in the eastern, north-eastern and south-eastern part of the district, show higher level of ANC services and health infrastructural status, like- Murarai-I and II, Suri-I, Bolpur-Sriniketan. On the other hand, blocks like- Rajnagar, Md.Bazar, Khoyrasole, Dubrajpur are exhibiting high ruggedness and dissection indices, conversely, lower accessibility and connectivity index, population density and inadequate provision of health infrastructure. This is raising a serious question on the distribution and provision of health care services in the district; as the utilization of health care services can be governed by many factors like terrain, accessibility and connectivity and socio-economic condition but the allocation and distribution of health care facilities should be guided by the standard norms, population strength and grass root level aspiration and demand. But here in the district, the provisions of health care services seem to be affected mostly by the connectivity and accessibility of the health care services along with the prevailing physiographic attributes. This can be witnessed from the blocks like- Rajnagar, Mahammad Bazar and Dubrajpur as these are standing in the last row of the maternal health care infrastructure index. It is worth mentioning here that the UNDP's Millennium Development Goal (MDG-5) status is very low in the blocks, like-Rajnagar (-4.69), Md.Bazar (-2.71), Mayureswar-I (-4.63), Rampurhat-II (-5.55) and Suri-II (-7.40). These can be considered as overall reasons behind the lower utilization of ANC service, disappointing status of institutional delivery and inadequate provision of maternal health infrastructure. As the utilization of ANC service is often getting influenced by the socio-

economic backwardness, mostly in cases of the blocks lying in the adjacent part of Jharkhand; like-Rajnagar, Md.Bazar, Khoyrasole and Dubrajpur. These areas are characterised by comparatively low population density, low health care services, low ANC, higher socio-economic backwardness, higher MMR, higher maternal death and have occupied first row in the vulnerable maternal health outcome index. Thus to uplift the position of these blocks in the maternal health care status index, the developmental institutions should construct more roads for enabling people to utilize more ANC services. It can also be a contributory factor in increasing the percentage of institutional delivery. On the other hand, the cases like-lower utilization of contraceptives and ANC services which directly affecting the MDG-5 status can be controlled through suitable ground level supervision and accountability of the prevailing services which indeed increase people's awareness towards the system of maternal healthcare services and its outcome.

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