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Spatial Dichotomy in Maternal Health Status of Birbhum District, West Bengal

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Abstract

Pregnancy and child birth related complications are the leading cause of disability and death among women belonging to Reproductive Age (15-49) in developing countries. In this study an attempt has been made to examine the factors associated with prevailing Maternal Health Care Services (MHCSs) and vulnerable pregnancy and maternal health outcome status. The results from the multivariate analysis has confirmed that, Millennium Development Goal-5 (MDG-5) status is governing the system in a positive way (0.88) which is getting reflected by the cumulative impact of four major parameters: Maternal Mortality Ratio (MMR), % of Institutional Delivery, Contraceptive Prevalence Rate (CPR), and Antenatal Care (ANC) service utilization. This MDG-5 status is negatively correlated with the prevalence of maternal death and status of vulnerable pregnancy outcome as the correlation status is -0.73 and -0.63 respectively. The system is getting the trivial effect mainly from MMR (-0.79) and vulnerable maternal outcome status (-0.74). Utilization of ANC service is often getting influenced by the socio-economic backwardness factors, 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 service, low ANC, higher socio-economic backwardness, higher MMR, higher maternal death and have occupied first row in the vulnerable maternal health outcome index .

Introduction

India had been witnessing a rapid economic growth in recent years but the growth was not seen to be reflected in the nutritional status of mothers, children and adults (Taneja, 2015; p.21). There had been a continuous decline in the proportion of underweight children in the country between two National Family Health Surveys (NFHS) in 1998-'99 and 2005-'06 (Taneja, 2015). World Health Organization (WHO) had introduced the "Health for All (HFA) by the Year 2000" which was again catalyzed by the concept of Primary Health Care (PHC), established in 1978 with the pronouncement of Alma Ata (Leisch; cited in Akhtar & Izhar, 2010). It was a conference where all governments and world leaders were invited to protect and promote health by adopting Primary Health Care approach. Afterward, during the Millennium Summit in 2000, 189 countries around all over the world settled on a set of actions and goals related to health and development enclosed in the form of Millennium Declaration.This Millennium Development Goals (MDGs) are a combination of eight goals, serving every part of public health, to be achieved by 2015 (Taneja, 2015; Lule, et al., 2005). The MDGs are to —

Goal-1: Eradicate extreme poverty and hunger;
Goal-2: Achieve universal primary education;
Goal-3: Promote gender equality and empower women;
Goal-4: Reduce child mortality;
Goal-5: Improve maternal health;
Goal-6: Combat HIV / AIDS, malaria and other diseases;
Goal-7: Ensure environmental sustainability;
Goal-8: Develop a global partnership for development (Taneja, 2015; Lule, et al., 2005; Boopathy et al, 2014, Jeyalakshmi et al.2011).

India is committed to achieve the MDGs to control maternal mortality (MDG-5) (Triveni,et al., 2012). This commitment was being concretised through the launching of National Rural Health Mission (NRHM, 2005-2012) by the Government of India in 2005-06 to provide effective health care to rural population in the country with special focus on those states which have poor health outcomes and inadequate public health infrastructure as well as manpower and in most cases deprived from the health facilities (Shekhar, et al., 2010). Out of eight MDGs three goals (MDG 4, 5 and 6) are directly related to health while the rest have links with health. "This global approach has galvanised unprecedented efforts to meet the needs of the world's poorest" (Taneja, 2015; p. 28). Amongst all sectors of public health the most vulnerable and deprived sections is the maternal and child health (Akhtar & Izhar, 2010; Lule, et al.,2005; Boopathy et al,2014, Taneja, 2015 ; Jeyalakshmi et al.2011; Shekhar, et al., 2010; Mondal, 2003).

The structure of the maternal health care services is more like a pyramid where community level village health workers and Trained Birth Attendants (TBA) form the base of the pyramid along with Auxiliary Nurse Midwife (ANM) and Accredited Social Health Activist (ASHA) (Taneja, 2015; Park,2013). It is the first level of contact of individuals, family and community with the facility. The eight essential elements of PHC have been sub-divided into three main parts. First part comprising education, supply of food and drinking water, second part included elements of preventive medicines for maternal and child health including family planning services and third part emphasized on the curative medicinal aspects (Akhtar & Izhar, 2010; Taneja, 2015). Equitable provision of health care service is the major challenge of the developing countries (Kara & Egresi, 2013). The Twelfth Five Year Plan (2012-'17) has given special focus on pregnant women and lactating mothers by restructuring and strengthening the Integrated Child Development Scheme (ICDS) (Taneja, 2015).

(I) Socio-economic-cultural Factors and its Impact on Utilization of Maternal Health Care Services (MHCS)

(I.a) Reflection of Socio-economic and Occupational Status

Socio-economic status can be evaluated by a collective functional expression of educational level, income and occupational status, housing conditions, where the ultimate cumulative result is often used as a " surrogate measure for poverty", as poverty is a "discrete entity" (Nagahawatte & Goldenberg, 2008,p.81) and is not easy to measure and express into numerical calculation (Nagahawatte & Goldenberg, 2008). Literatures are replete with the fact of direct association of poverty with adverse pregnancy outcome (Mondal, 2003; Neeraja, 2014; Nagahawatte & Goldenberg, 2008; Thaddeus & Maine, 1994; Bhagat & Praharaj, 2005). Higher lifetime morbidity could be seen amongst the black or American Indian, Alaska natives (Nagahawatte & Goldenberg, 2008), Tanzanian poor (Masuma & Bangser, 2004), within Nigerians (Thaddeus & Maine, 1994).

"…..the poor must be brought from the margins into mainstream. The process must be inclusive. The weakest economies and communities need special and differentiated help" (President Benjamin W. Mkapa, cited in Masuma & Bangser, 2004).

The basic reason behind the poorer sharing the maximum percentage of Maternal Near Miss Cases (MNMC) (Jabir, et al., 2013) is that they receive less Pre-natal Care (PNC) or Ante-natal Care (ANC) (Bhagat & Praharaj, 2005; Mondal,2003; Satia et.al. 2014). Obstacle in receiving ANC for the poorer section of the society may include inability to pay (Thaddeus & Maine, 1994; Masuma & Bangser, 2004 and Gage & Calixte, 2006), less willingness to accrue services because of past negative experiences, or may be due to misconception, traditional rigidity and needless restriction (Nagahawatte & Goldenberg, 2008). Morbidity and mortality rates are common among groups of low socio-economic condition (Kloos et al., 1987; Murphy, 1981; Kwast et al, 1984; cited in Thaddeus & Maine, 1994; Marmot. et al, 1998; Kandel et al, 2004; cited in Gage & Calixte, 2006). According to Mead and Newton (1967) every society has different viewpoints regarding pregnancy, labour, post partum, and they are prescribed with different health care seeking behaviour from their tradition and culture and they practice the thing likewise.

In rural setting sometimes pregnant women are unable to ignore or refuse to take services of village *Dai*, otherwise her and her family may be banned from the society (Mondal, 2003). This is one of the main reasons behind increasing percentage of home delivery in rural India that is around 96% whereas in urban settings it is 68%. Only 8% birth in rural India is attended by trained health personnel (Neeraja, 2014). Inefficient use of MHCSs is a common scenario in rural India. It is evident from different studies that late ANC registration, less consumption of Tetanus Toxide (TT) & Iron Folic Acid (IFA) and preferences on home delivery are the common scenario amongst the pregnant women of developing countries. Various studies on maternal and reproductive health conducted in Andra Pradesh, Delhi, Madhya Pradesh, Pune and Varanasi respectively have revealed diverse response in the said context.

It has been reported that in the last four years 26% of births were delivered in the health facility and 74 % in home, within which 34% only have been attended by Trained Birth Attendants (TBA). The records of home delivery in other states of India like- in Karnataka (28%), Maharastra (20%), Tamilnadu (11%) (Hema Nalini, B.E., 1989; Ratna Dhar, 1989; Talwar et al., 1990; Usha et al., 1990; Satish Kumar et al.1990; cited in Neeraja, 2014). In Calcutta the pregnant women, who have failed

to avail proper ANC, have delivered Low Birth Weight (LBW) babies as compared to those, who have attended ANC at proper time. During gestation women prefer to visit the natal home for delivery but in many cases due to adverse economic situation they cannot afford to enjoy the natal home's affection and services. For example, women from Mahabunagar District of Andra Pradesh mostly suffer from this disadvantageous position because of inadequate economic subsistence (Shah and Shah, 1992, cited in Neeraja, 2014). Out-of-Pocket (OOP) expenditure on health care is a burden to the poorer section of the society, and show the way to an "impoverishment and is a regressive system of financing" (Nareja, 2015; p.57).

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 comfortable with the village Dai. Going to hospital is very costly and troublesome; we have to expend for the bed and medicines. In addition, the doctors and nurses treat [us] in an unsympathetic manner (Rana et al., 2005).

(I.b) Imprint of Education

Uneducated women are more likely to be employed than the educated ones and in rural areas women are more likely to be engaged in wage earning than women in urban area. This may be due to positive association between no education and poverty (NFHS, 2006). Studies illustrated the fact that illiterate women from rural low socio-economic status most of the time ignore maternal health care services. Here the opportunity cost of time plays a vital role as they could not afford to waste the time in seeking health care services and would rather prefer to indulge in some wage earning activities (Mondal, 2003). During the launch of National Family Planning Programme in 1952, the main objective was to stabilize the increasing population. Thus in the third five year plan the programme strategy was changed from clinic based approach to extension education approach. Family Planning 2020 (FP, 2020) is a global approach which gives women the freedom to decide for themselves "whether, when and how many children they want to have" (Taneja, 2015; p.116).

According to investigation done in coolie family of Andhra Pradesh regarding utilization of MHCS, Neeraja (2014) has came out with the information that women working as coolies do not have any time to access the MHCS and most of the time they adopt self treated delivery in home. More or less similar findings can be seen in Tamilnadu (Kavita and Audinarayana, 1997; Sivakami and Kulkarni, 1998; cited in Neeraja, 2014). There is ample evidence of works illustrating the fact that education has a positive co-linearity with the utilization of MHCs (Thaddeus & Maine, 1994; Elo, 1992). The positive association is repeatedly documented between women's education and maternal health seeking behavior and child health services (Cleland, 1979; Cleland and Ginneken, 1988; Kwast et al., 1981; Abbas and Walker, 1986; cited in Thaddeus & Maine, 1994; Barrera, 1990; Caldwell, 1979 and 1990; cited in Elo, 1992). Some studies explained that with the increase in level of education, utilization of health care services decreases as people then mostly start self-care and self-treatment (Orubuloye and Caldwell, 1975; Thaddeus & Maine, 1994). This contradictory evidence could be seen in Tanzania, where increasing literacy did not have any impact on the maternal mortality rate (Thaddeus & Maine, 1994). Educated mothers take more advantages of modern medicine than less educated one (Barrera, 1990) and Caldwell, 1979 & 1990; cited in Elo, 1992). Nepal Family Health Survey (1996) has associated maternal schooling with "medicalized pregnancy" (Rowe et al., 2005).

According to Rowe et al (2005) women (Chitwan) living in *Terai* lowland of Nepal have better access to education and other health services than in comparison to *Khasi* in hilly region. In case of health knowledge the Chitwan performed better than the Khasi. On the other hand they did not find any effect of literacy on the higher caste (Brahmin/Chetri). This may be because these castes have their own cultural practices for maintaining purity and avoiding pollution. For these women, "cultural practices will persist regardless of their literacy" (Rowe et al., 2005, p.531) and among the women of lower caste the increasing educational level contribute to better health practice. Surprising increase in female education has contributed to the spectacular decline in fertility among Muslims in Iran and Bangladesh (Bhagat & Praharaj, 2005). Different national level studies have confirmed inverse relationship between education and fertility and positive association between education and utilization of MHCSs (Kishor & Gupta, 2009; Kavita and Audinarayana, 1997; Rajeswari and Hasalkar, 1994; cited in Neeraja, 2014; Rowe et al., 2005; Bhagat & Praharaj, 2005). According to NFHS (1993), mothers in lower age groups with higher birth orders and higher educational status utilize the MHCs more than those of higher age group with higher birth order and lower educational status (cited in Neeraja, 2014).

Age at marriage, both for women and men increases with increasing education and wealth. However, age at marriage increase more with education for the women than compared to men (Kishor & Gupta, 2009). Researchers concluded that education is more important factor than religious elements to determine fertility (Rele and Kanitkar, 1976; cited in Bhagat & Praharaj, 2005). Studies are there to illustrate the reason behind significantly higher fertility rate among Scheduled Caste (SCs) and Scheduled Tribe (STs). Education and religion operate in the system in an interactive way (Bhagat & Praharaj, 2005). Castro (1995) found that educated women have smaller family size while the rural illiterates opt for bigger ones. The

study is relevant here as it has come out from the study that around 37% pregnant women in Andra Pradesh have adopted family planning services and the figure increases to 45% for the pregnant women with secondary level of education (Sundari 1996; cited in Neeraja, 2014).

(I.c) Association with Women's Position, Age of Marriage, Family Type and Family Planning Services (FPS)

The utilization of MHCS is more than those who are in a consanguineous relationship. At the same time there could be seen higher use of ANC for the younger couple. The pregnant women from Mahabubnagar, Andhra Pradesh, shows differentiate utilization status regarding MHCS with the varying age of marriage (Neeraja, 2014). Study has revealed the fact that those who get married at the age of 11 years or earlier shows lower utilization status than those who have get married after 18. Women's status in the family or in the society generally underlines the shape and women's access to MHCS (Thaddeus & Maine, 1994; Mondal, 2003). In countries like- Nigeria, Ethiopia, Tunisia, Korea and India, studies reported that the decision belongs to spouse or adult senior member of the household to decide whether to seek care or not (Stock, 1983; Thaddeus & Maine, 1994).

Sex discrimination has a large contribution in increasing maternal morbidity and mortality. In many part of the world women finds child bearing as a means to upgrade their position within family as well as in society. Thus find the women in a "paradoxical" situation (Thaddeus & Maine, 1994). In a patriarchal society men's views are more dominant than women's regarding family planning services. Most of the time, because of son preference women has to bear child though out her fecundity. Women's position in the family upgraded with early delivery and motherhood which maintain the "family lineage" in a positive way. Positive relationship between husband and wife influence the use family planning services in desired way (Mahadevan, 1979; Shivaraja, 1987; cited in Neeraja, 2014).

In India the most well known method of spacing is pill (66%) along with Intra Uterine Device (IUD) (61%) and condom (58%). The highest use of contraceptives have been reported for Kerala, Himachal Pradesh, Maharashtra, Punjab, Mizoram and New Delhi, whereas states like- Bihar, Uttar Pradesh as well as Assam including other north-east states have recorded minimum adaptation of contraceptives(25%) .In many cases people avoid the contraceptives by saying the fertility and child bearing as "god's willingness" (Neeraja, 2014; p.33). The ANC utilization index (Kotelchuck, 1994; cited in Mondal, 2003) has came out with the result that women in vertical joint family receive better care than women live in a horizontal family or in nuclear family.

(I.d) Impact on Severe Obstetric Outcomes

According to WHO (1990) half a million women die each year from pregnancy related complications among which 88-98% "obstetric" (Webster's, 2008) death can be avoided though timely action. Timely and adequate ANC can reduce pregnancy related risk (Bhagat & Praharaj, 2005; Mondal, 2003). For example, access to ANC and delivery care can reduce the adverse outcomes associated with preeclampsia. Poor women are most affected by this. Depression, stress, Intensive Partner Violence (IPV), short pregnancy interval are main reasons behind the maternal depletion among poor pregnant women.75% maternal death results from direct obstetric causes like- Postpartum Haemorrhage (PPH), obstructed labour, infection, toxaemia, unsafe abortion etc (Thaddeus & Maine, 1994). "Women who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy" are considered to be Maternal Near Miss Cases (MNMC) (Jabir, et al., 2013). Pre-clampsia or hypertensive disorder affects 5% of all pregnancies usually after 20 weeks of gestation.

In 1997 around 42% death in India were caused by anaemia. In India among the top 10 killer of females of reproductive age group, anaemia is playing vital role. In Maharashtra (74%), UP (52%) and in Bihar (89%) a large number of deaths, much more than the national average of around 13%, are caused by hypertensive disorder or convulsion (Misra, 2007). Anaemia is considered to be a major killer (64.4%) in rural Andhra Pradesh (Bhatt, 1997). Type -1 health problems, like- nausea, morning sickness, vomiting, dizziness, swelling, weakness, sleeplessness are most common during 1st trimester of pregnancy. Some have reported that Nausea and Vomiting during Pregnancy (NVP) increases the length of gestation and decreases the risk of pre-term birth (Klebanoff et al., 1985; Tierson et al. 1986; cited in Mondal, 2003). Toxaemia during pregnancy is a specific syndrome of late pregnancy, and occurs normally after 20 weeks of gestation.

Objectives

The following objectives have been taken into consideration to investigate the issue on maternal health status:

(i) Block wise identification of Maternal Mortality Ratio (MMR), Maternal Moratlity Rate (MMRate), Maternal Near Miss Ratio (MNMR).

(ii) Positional classification of different blocks in the health care service index, vulnerable maternal health outcome index, Bed Turnover Rate (BTR), Average Length of Stay (ALST)

(iii) Identifying the dominant factor to govern the system of maternal health status in the district Birbhum.

Methods and Materials

This study is based on the data, which have been

collected from (i) Population Census (Govt. of India, 2011), (ii) District Level Family and Health Survey (DLHS- 3, 2007-'08) report, (iii) District Statistical Handbooks (Birbhum, 2011), (iv) data provided from Chief Medical Officer of Health (CMOH), Birbhum (v) Different health reports published by Govt. of India and Govt. of West Bengal like- reports from National Rural Health Mission (NRHM), Ministry of Health and Family Welfare (MHFW), Reproductive and Child Health (RCH), Sample Registration System (SRS) and other institutions. The statistical analyses have been performed using Microsoft Office Excel, 2007 and SPSS, Version 15 (SPSS Inc., Chicago, Illinois, USA, 2009) and spatial distributions have been mapped through ArcGIS, Version 9.3 (Esri Developers Summit, 2008) (Fig. 1).

Study Area

Geographic Entity

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 bounded by Jharkhand and Bihar on the west, lies at the eastern end of the Chhotanagpur plateau, and on the east it is bounded by Murshidabad District and on the south by Bardhaman District from which it is separated by a natural boundary, i.e. Ajay River (Fig. 2).

Results and Discussions

MMR[1] and MMRate[2]

Maternal Mortality Ratio (MMR) is considered to be one of the best indicators of women's health and the quality and accessibility of health services. For the district Birbhum, the MMR is 122.31; the Maternal Mortality Rate (MMRate) is 0.132. Regarding MMR, the blocks which have scored far high ratio than the district are- Mayureswar-II (532.62), Mayureswar-I (417.25), Suri-II (372.44), Rajnagar (369) and Rampurhat-II (272.73), which have ranked 1st, 2nd, 3rd, 4th and 5th position respectively, have kept the state well behind (145) (Fig. 3). Apart from Mayureswar-I, II and Rampurhat-II, rest of the blocks of Rampurhat sub-division are into the range of 70 to 180, while Suri subdivision is in the safest position, along with

Bolpur-Sriniketan block (40) of Bolpur sub-division. The scenario of MMRate is to some extent the same as MMR of the district. Rampurhat-I and Suri-I, turn out to be 1st and 2nd rank holder in case of MMRate. These two are treated as a tertiary health care unit [District Hospital (DH)] for the district, where the patient load is always very much high (Map-3). Here the specialized consultative care is provided usually on referral from primary Sub Centers (SCs) and Primary Health Centers (PHCs)] and secondary medical care [Block Primary Health Centers (BPHCs)] units. Considering obstetric health, most of the Perinatological (High Risk Pregnancy Cases) cases are being tackled in these district hospitals on an emergency basis, which is the main reason behind the high MMRate.

5.2. Population Density and Status of Health Care Service:

From Fig. 4 it is evident that areas with high population density are characterised with higher provision of health care services. The identification of rural health care service status has been calculated considering six parameters - (i) Population per Doctor, (ii) Population per Antenatal Midwives (ANM), (iii) Population per Accredited Social Health Activist (ASHA), (iv) Population per Bed in the Hospital, (v) Population per Sub- Centre (SC) and (vi) Population per Primary Healthcare Centre (PHC).

The 1st, 2nd and 3rd position of health care service index have been occupied by Murarai-I, Nalhati-II and Murarai-II respectively. Conversely, Rajnagar, Dubrajpur, Bolpur-Sriniketan, Md. Bazar and Mayureswar-II are the most deprived block in this regard occupying the last row (19th, 18th, 17th, 16th and 15th position) of health care service index respectively.

Bed Turnover Rate (BTR[3]) and Average Length of Stay (ALST[4]):

These two seem to have a direct negative relation, as it is evident from the map that, the blocks with high to very high bed turnover rate (>200), like- Murarai-II, Nanoor, Nalhati-I, Labpur and Illambazar, picturise low to very low average length of stay (Fig. 5). Because of high patient load (occupying 1st, 2nd, 3rd, 5th and 11th position respectively, regarding total population of the block) the number of discharge is high in the blocks, mentioned above. This can be one of the main reasons behind the high bed turnover rate in the respective blocks along with low average length of stay. On the other hand, people of Murarai-I & II and Nalhati-I are likely to move towards the higher level referral unit after getting referred form the Murarai Rural Hospital and Nalhati Hospital. Like- People from Murarai-II mostly opt for treatment at Jangipur Hospital situated in the adjacent district Murshidabad, and people of Murarai-I and Nalhati-I are mostly moving towards Rampurhat Hospital. This is another reason behind the low average length of stay and high bed turnover rate of the respective blocks.

Maternal Death Scenario:

It can be observed that maximum number of home deliveries are being conducted in the blocks of Rampurhat Sub-division, except Rampurhat-I (having its own District Hospital). Maximum share of transit death could be seen in Murarai-I & II and Nalhati-II (Fig. 6). It is because of the low accessibility of these blocks;

like the Shimbel Index values of these blocks are- 113, 99 and 101; standing at the 19th, 18th and 17th position in the rank index of accessibility. The most obvious positive correlation (0.56) can be seen between the occurrence of home delivery and maternal death (Fig.-7). It is because of less accessibility and connectivity and lower socio-economic status of the respective blocks.

Status of Antenatal Care Coverage (ANC):

Prevailing ANC have been identified through the following parameters, with respect to percentage of total number of pregnant women registered for ANC; like- (i) At least three ANC checkups, (ii) TT-1, (iii) TT-2, (iv) IFA-100. Here Rajnagar (5.06), Murarai-II (4.78), Rampurhat-I (2.15), Nalhati-II (1.17) and Nanoor (0.70) are holding the 1st to 5th position respectively. Regarding at least three antenatal checkups, those blocks have high number of ANC coverage, which are having their own BPHCs and RHs and DH, like- Murarai-II, Dubrajpur, Sainthia, Labpur, Bolpur-Sriniketan, Rampurhat-I and Suri-I (Fig. 8).

Socio-economic Condition

This has been expressed in terms of degree of backwardness taking the parameters like- (i) percentage of Illiterate to total Population, (ii) percentage of Non- Workers to total Population, (iii) Work Participation Rate (WPR). The concentrations of backward blocks regarding the socio-economic condition are mostly gathering in the western and north-western part of the district (Fig. 8). Higher deprivation regarding SES could be seen in Murarai-I & II, followed by Md. Bazar, Rajnagar, Khoyrasole and Dubrajpur.

Vulnerable Maternal Health Outcome Index

The vulnerable maternal health outcome index has been calculated taking the parameters like- (i) no. of Institutional Delivery, (ii) percentage of Maternal Death to total Institutional Delivery, (iii) percentage of Spontaneous Abortion to total Registered Pregnancy, (iv) percentage of Still Birth to total Institutional Delivery, (v) percentage of Birth Weight <2.5 kg to total Institutional Live Birth, (vi) percentage of Birth Weight <1.8 kg to total Institutional Live Birth, (vii) percentage of Infant Death within 24 hrs of Birth to total Institutional Live Birth, (viii) percentage of Pregnant Women with Hb level <7 to total no. of Pregnant Women registered for ANC. Md. Bazar (1st), Illambazar (2nd), Suri-II (3rd), Nanoor (4th) and Khoyrasole (5th) followed by Rajnagar, Mayureswar-I and Rampurhat-II are lying in the most alarming zone of the vulnerability index of pregnancy and maternal health outcome; as these areas do not have any District Hospital (DH) of their own or nearby and again these blocks are characterised by lower utilization of ANC coupled with lower position in the health infrastructural index (Fig. 8). Whereas blocks like- Suri-I, Bolpur-Sriniketan and Rampurhat-I are lying in good position in the respective index, as because these areas have their own DH and occupying higher rank in health infrastructural index along with higher utilization of ANC services (Fig. 9).

6. Interrelationship between the Factors of Maternal Health Care Services and Maternal Health Status

From the correlation matrix, it is clear that the Millennium Development Goal (MDG-5) status (MMR, percentage of Institutional Delivery, CPR, and ANC service utilization) is negatively correlated with the prevalence of maternal death and status of vulnerable outcome of pregnancy as the correlation status is -0.73 and -0.63 respectively (Table-4). In spite of the said occurrence the factors have highly correlated with each other. In the first Principal Component Analysis (PCA), where 34.23% has got explained, MDG-5 status seem to be the governing factor for the whole system in a positive way (0.88), conversely, the system is getting the trivial effect mainly from MMR (-0.79) and vulnerable pregnancy outcome status (-0.74) (Table-5).

From the second PCA with 60% of explanation, socio-economic status (0.62), population density (0.67) and mainly health infrastructure (0.73) are starting to dominate the system (Table-5). Here, it ought to be mentioned that health infrastructure is highly getting influenced by the population density in a positive way (0.80) (Table- 4). It can be dragged out from the response of multi-variate analysis that the dominant absolute variables for the maternal health system are MMR, vulnerable maternal health outcome index and MDG-5 status. That's why these factors are having a universal apple for the whole region. Where, health infrastructure, population density and socio-economic status are the relative factors which are guiding the system from their regional distribution and dominancy status. These are quite residual factors which have their own regional entity and accountability, which can take system dominancy in absence of the absolute dominant factors of first PCA.

Spatial Distribution of the Factors of Maternal Health Care Services and Maternal Health Status (Quadrant Positional Analysis)

Murarai-I & II, Nalhati-II and Nanoor have taken position in the "+, +" co-ordinate, which implies that the dominant factors of first PCA are performing well in these areas; like in respect to MDG-5 status Murarai- I & II and Nanoor have obtained the 4th, 1st and 7th position respectively. On the other hand the "-, -" co-ordinate is getting occupied by Rajnagar and Mayureswar-II, which implies that the performance of the dominant factors in the 1st PCA are discontent for the system in the said blocks. Like- in respect to MDG-5 status index Mayureswar-II and Rajnagar are standing in the 16th and 17th position consecutively. This factor (MDG-5 status) is in a good stage in some of the blocks; like- Bolpur, Rampurhat-I and Suri-I. That's why these blocks are in

the 2nd, 3rd and 5th position in the MDG-5 status index and conversely for the next level influential factors; like- health infrastructural status and socio-economic status; these blocks could be seen in the last row of the respective rank indices. Blocks, those are sharing the section of " -, +" co-ordinate; like- Md. Bazar and Suri-II are getting negative influence of the 1st PCA's dominant factor; like for MDG-5 status ,they are holding 14th and 19th rank and for MMR (8th and 3rd rank) and vulnerable maternal health outcome index (1st and 3rd rank) these two blocks are in quite an alarming position. The "+,-" co-ordinate is basically getting shared by the Bolpur-Sriniketan, Rampurhat-I and Suri-I, here the vulnerable effect of pregnancy outcome is remarkably less (Map-11). The concentrations of several private and public-private medical institutions along with the district government hospitals have lowered the level of vulnerability here regarding pregnancy outcome. From the analysis this can be concluded that these areas are mainly getting influenced by the prevailing population density and their socio-economic dominancy along with the provision of health infrastructure which can further strengthen their position in the system of maternal health care services and maternal health status (Fig.10).

Conclusion

From the above discussion it is evident that the dominant factor for the maternal health status in Birbhum district is MDG-5 status, which is getting reflected by the cumulative impact of four major parameters mentioned earlier. Areas with high population density, like- Murarai-I & II, Nalhati-I, Suri-I, Nanoor etc are suffering from low average length of stay and high bed turn over rate; in spite of having good position in the health care service index. Utilization of ANC service is often getting influenced by the socio-economic backwardness, mostly in cases of the blocks, which are 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. Low mean age at marriage (57.2 %) is one of the many factors contributing adverse maternal and child health outcomes since babies born to the young mothers are more likely to be premature, have low birth weights, and suffer from complications at the time of delivery. Thus pre-mature marriage is one the main responsible factors which enhances gynaecological and obstetric morbidity, even chances of maternal death.

As per the District Level Health Survey, Reproductive and Child Health (DLHS-RCH, 2003-04), the mean age of marriage of the district among girls is 17.6, which is lower than the state average of 18.6. The percentage of girls married below the legal age at marriage is about 60 percent, which is significantly higher than the state average (45.4 %). The percentage of mothers who had at least three ANC checkups is 59.1 for the district where the state average is 66.9% according to the last DLHS-3 (2010). Within the total maternal death, the percentage share of institutional delivery is 64.47, home delivery is 27.05 and around 9.2 % deaths are occurring in the transit and it is most prone in the northern part of the district, like in Murarai-I and II, Nalhati-II, Mayureswar-I. Within the institutional delivery around 60% deliveries are being conducted in the two district hospitals (Rampurhat and Suri) and in Bolpur sub-divisional hospital.

As far as institutional delivery is concerned there is no significant difference with state level average, as the state average is 49.1% and the district average is 48.7% (DLHS-3). Infant mortality has been recognized as an important summary indicator of the quality of health care, as infant death within 24 hrs of birth become the guiding factor for the system of vulnerable pregnancy outcome and at the same time it seems to have a moderate positive co-linearity with the still birth (0.62). Though the data availability on still birth is often unreliable, yet from the accrued data, it can be observed that the occurrence of still birth is remarkably high in the blocks like-Murarai-I and II, Nalhati-II, Mayureswar-I, Md.Bazar, Khoyrasole and Labhpur. The unfortunate events of infant death within 24 hrs of birth is highest in the blocks of Rampurhat sub-division (44.68 % to total), followed by Bolpur sub-division (28.72%) and Suri sub-division (26.59%). Regarding maternal death, again, Rampurhat subdivision is in the most threat zone with 57.89% of total maternal death, followed by Suri sub-division (25 %) and Bolpur sub-division (17.10%).

In order to monitor and improve the health status of pregnant women and mother in a more effective way, steps and initiatives should be taken by the Community Health Care Management authority to bring about effective coordination between the different sectors of maternal health care system, which could further enhance the guiding factors of Janani Suraksha Yojona (JSY). But apart from all these, initiatives should be taken from the grass root level to bring the indigenous cohort population in the system. Providing ASHA from the village members can not be the way out to monitor the system comprehensively. Here, the most dominant factor of maternal health care system of the district which are- vulnerable pregnancy outcome, still birth and infant death - ought to be minimised which can be started by averting the cohort from pre-mature marriage and through deployment of an external decisive monitoring system to bring accountability within the system. Thus improvement in health indicators in the coming years needs further increase in financial support, improved management, and active public participation in management of public health facilities along with sustained political commitment and

accountability of the health system to the people at large.

End Note

Maternal Mortality Ratio (MMR)
*= [No. of Residents' Maternal Death/ No. of Residents' Live Births]*100,000 (Park, 2013).*
Maternal Mortality Rate (MMRate)
*= [No. of Maternal Deaths /No .of Women belonging to Reproductive Age Group (15-49)]*1000 (Park, 2013)*
Bed Turnover Rate (BTR)
= [Total No. of Death and Discharge/No. of Beds during that Time Period] (Segen, 1992)
Average Length of Stay (ALST)
= [Total Patient Days/ Total No. of Death and Discharge during that Time Period] (Segen, 1992)

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Table - 1: Administrative Composition of Birbhum District, West Bengal

Sub-division	Rampurhat	Sadar (Suri)	Bolpur
Area in sq.km	1574.23	1782.72	1186.66
Population in Lakh	12.7	9.86	7.6
Population density	807	553	640
No. of Blocks	8	7	4
Total no. of Panchayets	65	62	40
No. of Municipality	2	3	1
Name of the Municipality	Nalhati, Rampurhat	Sainthia, Dubrajpur, Suri	Bolpur

Source: District Statistical Handbook, Birbhum (2012)

Table - 2: Demographic Aspects

Total Population (2011)	Population Density (2011)	% of SC (Schedule Caste)	% of ST (Schedule Tribe)	% of Muslim Population
3502404	769.76	29.5	6.92	35.08%

Source: District Statistical Handbook, Birbhum (2012)

Table - 3: Position in West Bengal in respect to Maternal Health Status

	% of Girls Marrying before 18 years of Age	% of Mothers who had at least Three ANC Visit during Last Pregnancy	% of Institutional Births	% of Public Health Centres Functioning for 24 hrs
West Bengal	41.3	66.9	49.1	25.9
Birbhum	57.2	59.1	48.7	44.4

Source: District Level Family and Health Survey-3 (DLHS-3, 2010)

Table - 4: Interrelationship between the Factors of Maternal Health Care Services and Maternal Health Status Birbhum, 2014

Correlation Matrix	MMR	S-E	ANC	VMHOI	PD	HCS	MDG-5	% of MD to Total RP
MMR	1	-0.18	0.33	0.57	-0.14	-0.10	-0.73	0.02
S-E		1	0.30	0.07	0.40	0.32	0.38	-0.08
ANC			1	0.52	0.03	0.04	-0.17	-0.06
VMHOI				1	-0.18	0.13	-0.63	-0.28
PD					1	0.80	0.27	-0.01
HCS						1	0.21	0.03
MDG-5							1	0.24
% of MD to Total RP								1

MMR= Maternal Mortality Ratio, SE= Socio-economic Status, ANC= Antenatal Care, VUL= Vulnerable Maternal Health Outcome Index, PD= Population Density, HCS= Health Infrastructure, MDG-5=Millennium Development Goal-5, MD= Maternal Death, RP= Registered Pregnancy

Table - 5: Interrelationship between the Factors of Maternal Health Care Services and Maternal Health Status (Extraction of principal components with cumulative percentages of variance) in Birbhum, (2014)

PCA	MMRatio	SE	ANC	VMHOI	PD	HCS	MDG-5	% of MD to Total RP
1 (34.23%)	-0.79	0.37	-0.38	-0.74	0.55	0.41	0.88	0.22
2 (25.71%)	0.23	0.62	0.57	0.52	0.67	0.73	-0.07	-0.21
3 (13.45%)	0.34	-0.47	-0.35	-0.08	0.35	0.42	-0.25	0.50

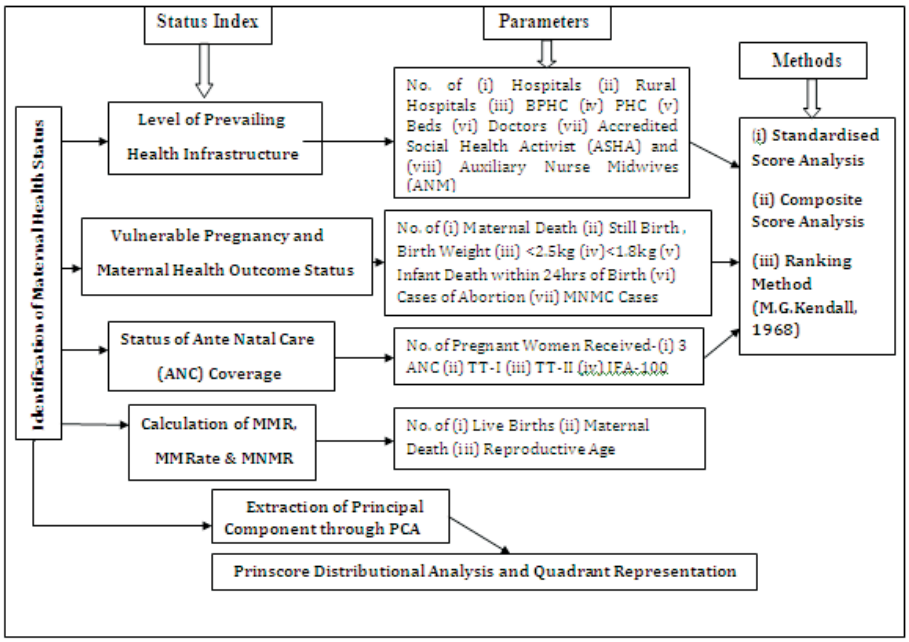

Fig. 1:Flowchart of the Study

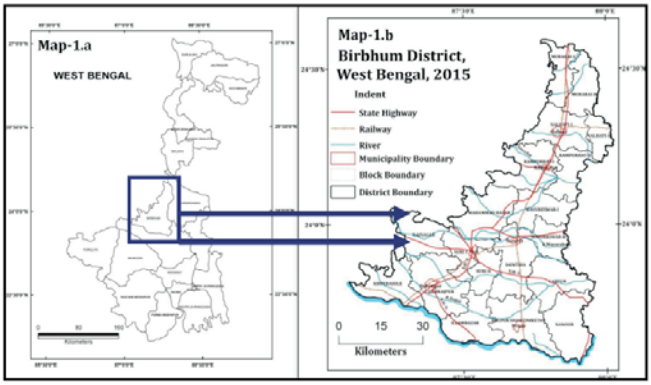

Fig. 2: Location of the Study Area

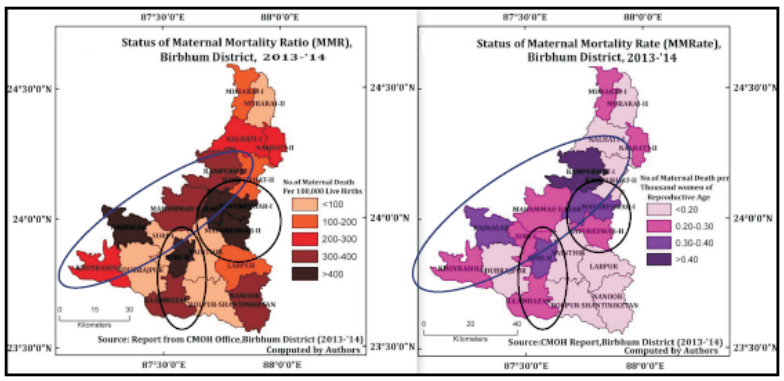

Fig. 3: Status of Maternal Mortality Rato and Rate, Birbhum, West Bengal

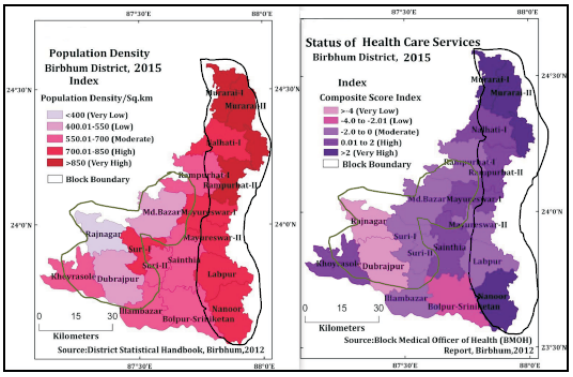

Fig. 4: Population Density and Status of Health Care Services, Birbhum, West Bengal

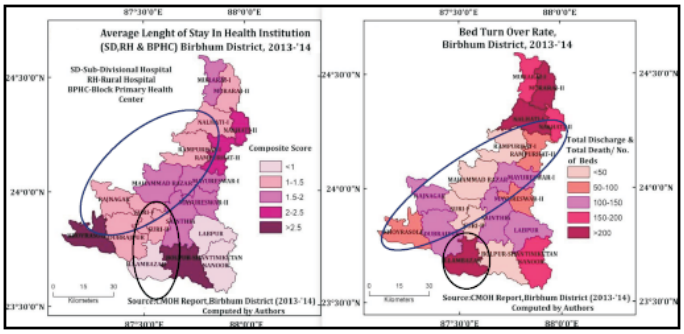

Fig. 5: Average Length of Hospital Stay and Bed Turn Over Rate, Birbhum, West Bengal

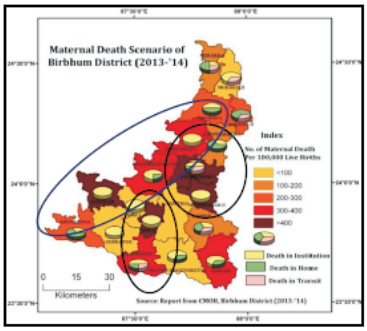

Fig. 6: Maternal Death Scenario, Birbhum, West Bengal

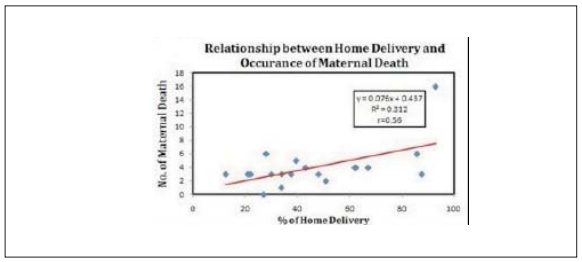

Fig. 7: Relation between Delivery at Home and Maternal Death, Birbhum, West Bengal

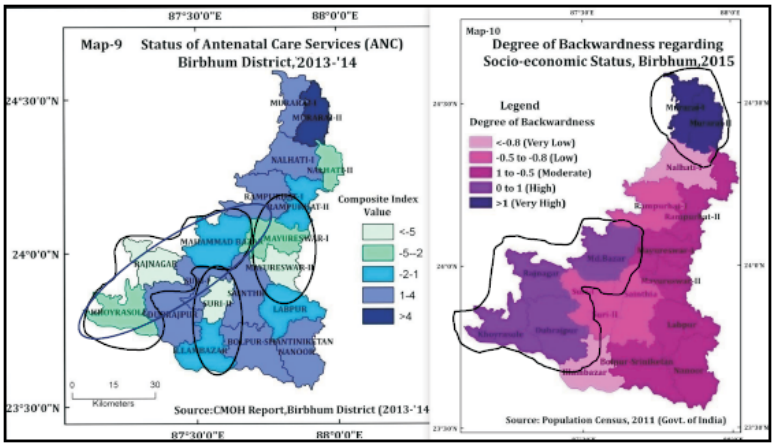

Fig. 8: Status of Antenatal Care Services and Degree of Socio-Economic Backwardness, Birbhum, West Bengal

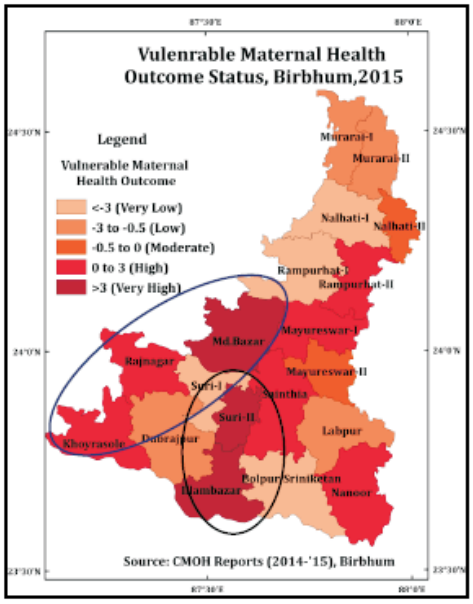

Fig. 9:Vulnerability of Maternal Health, Birbhum, West Bengal

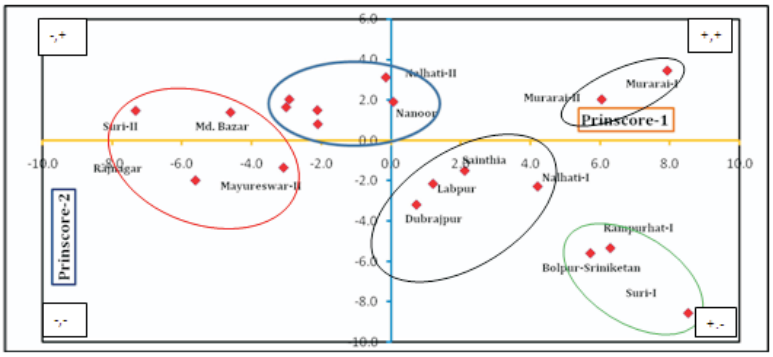

Fig. 10:Spatial Distribution of the Factors of MHCS and Maternal Health Status (Quadrant Distribution), 2014

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