Extended Abstract

Household Socioeconomic Status, Neighbour Socio-economic Disadvantage, Community Level Poverty and Its Association with Maternal-Child Health Services Utilization in Bangladesh- Looking beyond Individual and Household Factors.

Samarul Islam, Ph. D Research Scholar, International Institute for Population Sciences, Mumbai, India

Email:- samar_demo@outlook.com

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The Context:

Timeline to meet the goals of Millennium development is finished in 2015; it was adopted in 15 years back Millennium Summit year 2000. In this MDG, there have been two maternal and one child health related goals incorporated for the achievement. After, come under limelight these significant issues, institutional delivery care has been identified as a single most significant intervention for safe motherhood (Mehari, 2013). Empirical evidences also show that institutional delivery is a significant factor to reduce the maternal as well as neo-natal mortality. Therefore, Government of Bangladesh and other developmental aid organization is making efforts to all deliveries should take place in health facility with skilled birth attendant. Although, in Bangladesh like other South Asian countries, women are preferred to deliver at home without skilled birth attendant (SBA), consequently Bangladesh has experiencing a high maternal mortality (MMR) and neonatal mortality (NNMR). Resultant this situation becomes a major hindrance to achieve MDG 4 and 5 goals by 2015. Bangladesh is ranked 49 out of 183 countries in MMR, although; MMR is declining gradually from 800 per 100 000 live birth in 1990 to 240 in 2010. In Bangladesh, the maternal mortality ratio was 240 per 100000 live births (2010) which declined continuously and stood to 170 in 2014 (WHO, UNICEF 2014). Bangladesh is one of the countries that experience more than 60 percent decrease in maternal mortality ratio (MMR, deaths per 1 00 000 live births) between 1990 and 2008. Though Bangladesh lags behind to reach MDG goal 5 of 143 maternal deaths per 1 00 000 live births by 2015. Bangladesh has reduced the mortality rate for children below the age of five by 71%, exceeding the Millennium Development Goal 4 (MDG)-2015 target of 66% reduction. Compared to figures in 1990 when the under-five child mortality was 144 per 1,000 live births, the number has dropped to 41 per 1,000 live births in 2012. One of the important indicators of MDG-4 was ensuring universal health coverage of measles vaccination among one-year-old children by 2015. Bangladesh still away to achieve the universal full immunization of children, around 15% of children not fully immunized in 2011. Bangladesh didn't achieve the infant mortality rate of 31 (per 1000 live births) by 2015. The current infant mortality rate in Bangladesh is 37(2011) (Health Bulletin-2013, MIS, and DGHS).Therefore the appropriate delivery care, timely interventions are essential to prevent women from experiencing pregnancy complications and reducing maternal and child mortality. Improvement of maternal health and reduction in maternal mortality is one of the prime agenda of Bangladesh's Population Policy (2012) and Health Policy (2011). In this direction, Government of Bangladesh launched a number of programs and initiatives. Bangladesh Government has launched Health and Population Sector Program (HPSP) in 1998 after Cairo Conference (1994) in consultation with the development partners and the stakeholders to reform the health and population sector to provide a package of essential health care services to the people and to lower the rate of population growth, to improve the health condition of people. In 2001, Bangladesh launched its flagship health program as Bangladesh National Strategy for Maternal Health, under Ministry of Health and Family Welfare (MoHFW).

Review of Literature*:*

Various studies show that ensuring deliveries at quality healthcare facilities can bring significant improvements in maternal and child health indicators (Sugathan, et.al.2001; Collier, et.al, 2002; Borghi et.al.2006; Agha,et.al.2011; Mehari, 2013; Akter, et.al. 2014;).Various interventions were launched and proved successful in increasing

institutional deliveries though a number of underlying factors blocked further progress in ensuring universal access and reducing mortality rates associated with childbirth (UNICEF, 2011). There are three types of delay in seeking care from health facility cited in the three delay model, delay in seeking care, delay in reaching health centers and delay in receiving care at health institutions (Thaddeus and Maine, 1994).

Socio-economic and demographic factors:

Empirical studies found that utilization of health services is a complex phenomenon, a range of factors like social, cultural, demographic, health system, health belief, availability, accessibility, services cost, personal characteristics associated with health services utilization (Anderson and Newman, 1973; Kroeger, 1983; Becker, et al. 1993; Sarin, 1997;). Many previous studies found that socioeconomic and demographic factors have a profound effect or influence on demand for utilization of maternal and child health services. Maternal and child health care utilization also determined by demographic factors like birth order, parity and age of mother at birth, marital status (Magadi, Madise and Rodrigues, 2000; Magadi et al., 2000; Mekonnen and Mekonnen, 2002 Stekelenburg,et al., 2004). Education, exposure to mass media and household status seems to be a strongest determinant of maternal and child health services utilization. (Ray et al. 1984; Khan and Gupta 1985; Kanitkar and Sinha 1989; Jain et al. 1992; Elo 1992; Swenson et al. 1993; Abdalla 1993; Govindasamy 1994; Khan, Soomro, and Soomro 1994; Barlow and Diop 1995; Govindasamy and Ramesh 1997; Ahmed and Mosley 1997; Regmi and Manandhar 1997; Vallieres et. al,.2013).

Community access and health care services utilization.

Various studies showed that there is strong relationship between community level factors and utilization of maternal health services (Sepehri et al. 2008; Babalola and Fatusi, 2009; Janevic et al. 2012; Ononokpono et.al. 2014 ;). Rahman's (2000) study demonstrates that women decision to seek care and attend a health facility influence by personal need, social factors and location of services. The study by Ononokpono et.al. (2014) found that region of residence, community education level, community health facility delivery strongly associated with postnatal care in Nigeria. Study findings by Ononokpono and Odimegwu (2014) demonstrate that a strong association between community level factors and place of delivery, community education level significant and have a profound impact in determining health facility delivery. Another study by Janevic et al. (2012) found that community-level socioeconomic status had the greatest influence on contraception use among poor women from Central Asia. In a study in Nigeria, by Aremu et al. (2011) found that women living in highly socioeconomic disadvantage neighborhood are associated with facility delivery and more chance of giving birth in the home.

Need for the study:

The present study is confined to Bangladesh. Bangladesh exhibit poor maternity services utilization and health infrastructure and lack of trained health personnel. A substantial proportion of women delivered at home without skilled birth attendant, therefore, low percent of institutional delivery (29%) (BDHS- VI) lead to high maternal mortality ratio (170/100 000 in 2013) and neo-natal mortality rate (24/1000 in 2013) (World Bank, 2013).Bangladesh is ranked 49 out of 183 countries in MMR, although; MMR is declining gradually from 800 per 100 000 live birth in 1990 to 240 in 2010. In Bangladesh, the maternal mortality ratio was 240 per 100000 live births (2010) which declined continuously and stood to 170 in 2013 (WHO, UNICEF 2014). Bangladesh is one of the countries that experience more than 60 percent decrease in maternal mortality ratio (MMR, deaths per 1 00 000 live births) between 1990 and 2008. Though Bangladesh lags behind to reach MDG goal 5 of 143 maternal deaths per 1 00 000 live births by 2015. Bangladesh exhibits highest MMR in South Asian region due to several socio-economic reasons along unavailability of transport, accessible adequate health care facility and unaffordable treatment cost. In Bangladesh, a large proportion of rural people and marginalized still faces difficulties to access quality of maternal health services. Rural population is particularly disadvantaged in terms of lack of reliable means of transportation and poor road networks.

Therefore, a sizeable proportion of maternal deaths in developing countries occur on the way to the hospital (Ronsans and Graham, 2006). Distance from the adequate health facility is also significant factor for safe delivery. Matthews et al. (2005) stated that distance and safe delivery is inversely associated. Moreover, the delivery cost is reflected as a major hindrance for availing distance health facility or institutional delivery services. Therefore, there is a primary need for physical infrastructure for availing health services at an affordable cost. In light of above background studies, the study tries to assess the role of community access along with physical as well as economic barrier in receiving maternal and child health services care or its effect on maternal and child health care in line with individual and household level characteristics. This study will also provide the necessary knowledge on the issues related to transportation, distance, neighbor socio-economic disadvantage and community access in Bangladesh, rural areas and regional differential across the states. This study will also be useful to policymakers for making specific policies according to the condition and need of different states to deliver better maternal health care services, to increase maternal and child services utilization and reduce maternal and infant mortality.

Research Questions: The research question of this study is-

Does household socioeconomic status, neighbor socio-economic disadvantage, community level poverty and physical accessibility matters for utilization of maternal and child health services?

Research Hypothesis: The hypothesis of this study is:

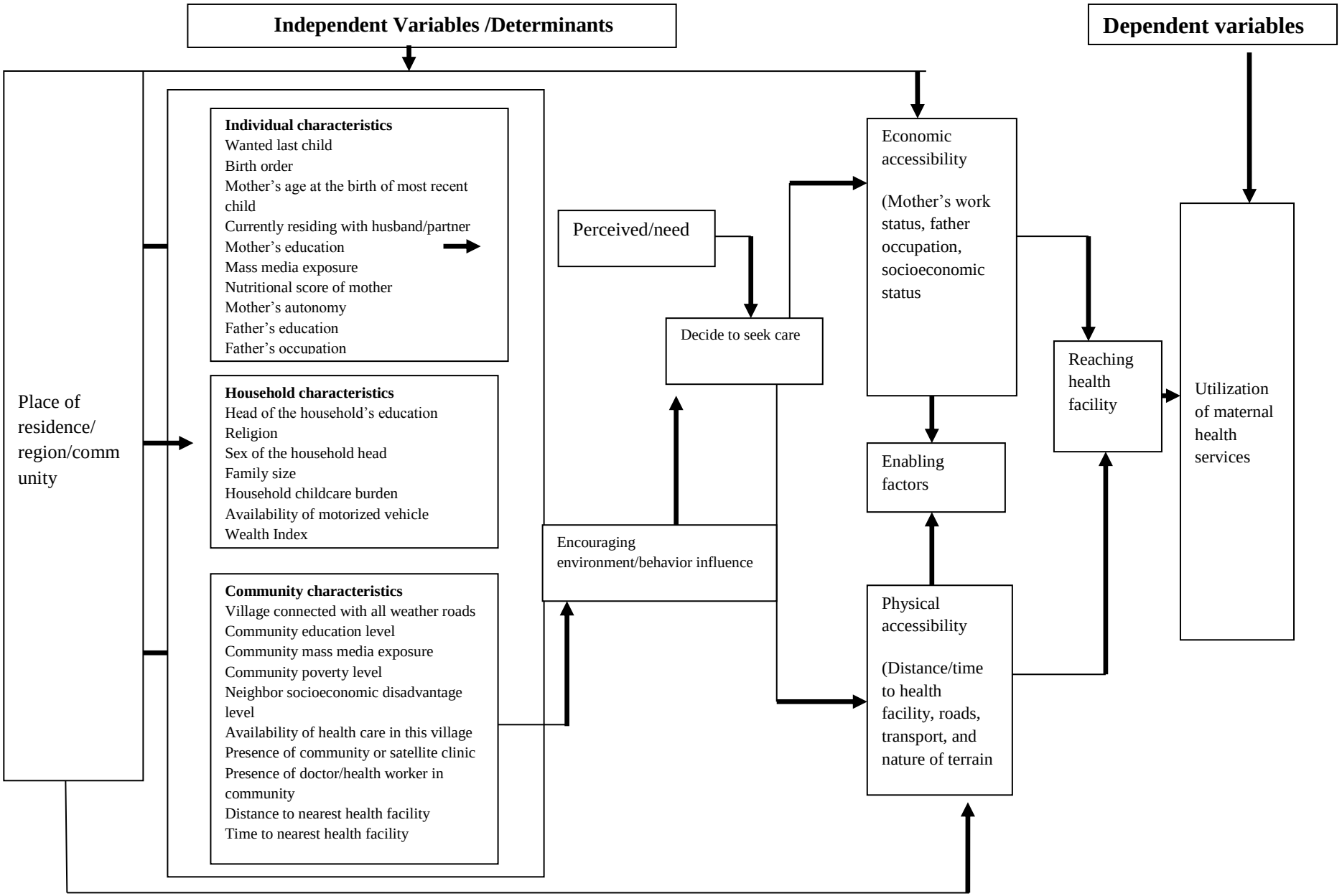
H2: Neighbor socio-economic disadvantage and poverty level at community does not affect health care services utilization in Bangladesh

Research objectives:

The specific objectives of this study are-

The objectives of this paper are to understand the effect of household socioeconomic status, neighbor socio-economic disadvantage, community level poverty on maternal and child health services utilization.

Figure: Conceptual framework of determinants of maternal health care services utilization



Data Source and Methods:

The present study has used data of the sixth and fifth round of Bangladesh Demographic and Health Survey (BDHS-VI, 2011 and BDHS-V, 2007) (nationally representative- 5-year retrospective collection of statistical records). These BDHS survey has conducted by National Institute of Population Research and Training (NIPORT), Dhaka, Bangladesh on behalf of the Ministry of Health and Family Welfare (MoHFW), Government of Bangladesh and implemented by Mitra and Associates of Dhaka. ICF International provided financial and technical assistance for the survey through USAID/Bangladesh. The BDHS is a part of worldwide Demographic and Health Surveys Program, which is design to collect data on fertility, family planning, maternal and child health. The 2011 BDHS is a nationwide sample survey of ever-married men (15 to 54) and women (12 to 49) of reproductive age. The BDHS-VI (2011) (5-year retrospective collection of statistical records) designed to provide information on basic national indicators of social progress, including fertility, childhood mortality and causes of death, fertility preferences and fertility regulation, maternal and child health practices and outcomes, nutritional status of mothers and children, awareness and attitudes towards HIV/AIDS and prevalence of non-communicable diseases along with demographic and socio-economic information on both individual mothers and their respective household. In addition, the survey also provides information on breastfeeding practices, nutritional levels including the presence of anemia and iodine deficiency, community level data on accessibility and availability of health and family planning services.

The sample for the 2011 BDHS is nationally representative and covers the entire population residing in the country. The survey used a sampling frame the list of enumeration areas (EAs) prepared for the 2011 Population and Housing Census, provided by the Bangladesh Bureau of Statistics (BBS). The primary sampling unit (PSU) for the survey is an EA that was created to have an average of about 120 households. The survey is based on two-stage stratified sample of households. In first stage, 600 EAs were selected with probability proportional to the EA size, with 207 clusters in urban areas and 393 in rural areas. A complete household listing operation was carried out in all selected EAs, to provide a sampling frame for the second stage selection of household. In the second stage of sampling, a systematic sample of 30 households on average was selected per EAs. In 2011 BDHS, sample size for households, ever-married women (12-49) and ever married men (15-54) is 17141, 17842 and 3997 respectively. Eligible women response rate in BDHS- VI is 97.9 percent.

The 2011 BDHS used five types of questionnaires: Household, Women's, Men, Community (at the cluster or PSU level) and Verbal Autopsy questionnaire. The content of the questionnaires based on the MEASURE DHS model questionnaires.

The household questionnaire was used to list all the usual members and visitors in the selected households. Some basic information was collected on the characteristics of each person listed, including age, sex, education and relationship to the head of the household. The main purpose of the household questionnaire was to identify women and men who are eligible for an individual interview, also used for height and weight measurements, anemia test, and measurements of blood pressure and blood glucose. In addition information collected on dwelling unit, source of water, type of toilet facilities, and ownership of various consumer goods etc.

The woman's questionnaire was used to collect information from ever-married women age (12-49), information collected in women questionnaire: background characteristics (e.g. age, education, religion, and mass media exposure), reproductive history, use and sources of family planning methods, antenatal, delivery, postnatal and newborn care, breastfeeding and infant feeding practices, child immunization and childhood illness, marriage,

fertility preferences, husband's background and respondent' work , awareness of AIDS and other STI, food security etc.

The man's questionnaire was used to collect information from ever-married men age (15-54), information collected in man's questionnaire; background characteristics, marriage, fertility preferences, participation in reproductive health care, awareness of AIDS and other STI.

The community questionnaire was administered in each selected cluster; data were collected from a group of four to six community leaders who were knowledgeable about socioeconomic conditions and availability and accessibility of health and family planning services/ facilities. Community leader included such as government officials, teachers, social workers, religious leaders, and health care providers.

The verbal autopsy questionnaire administered by the mother who reported death of a child under the age of five.

For this study, Children's data- children's recode (KR) file used. This dataset has one recode for every child of interviewed, born in five years preceding the survey. It contains the information related to the child's pregnancy and postnatal care, immunization, and health. This file was used to look at child health indicators such as immunization coverage, Vitamin A supplementation, occurrences of diarrhea, fever, and cough and childhood illness treatment. The unit of analysis in this file is the children of women born in the last five years. The focus of this study on the most recent birth of the respondent in preceding five years before the survey. The total sample size of most recent birth to ever-married women in Bangladesh is 7325 (2011) and 4926 (2007). The present study focuses on Bangladesh as whole country and rural Bangladesh.

Definition and Description of variables:

Definition of outcome variables:

The outcome variables were antenatal care coverage, place of delivery and postnatal care (Maternal health indicator). The outcome variables prenatal care and place of delivery, which are recognized as key determinants of maternal health and indicators of progress towards MDG 5 goal. The child health indicator outcome variables are full immunization of children, Vitamin A supplement, Baby postnatal check-up, diarrhea treatment and fever treatment. The outcome variable immunization is a key determinant of child health and indicator of progress towards MDG 4 goal. All the outcome or dependent variables are dichotomous in nature. All information comes from BDHS women's questionnaire, which records all events related to maternal health for preceding the five years before the survey.

***Maternal health care indicator*:**

Tetanus injection - mother received one or more tetanus toxoid injections during pregnancy (received/not received)

Antenatal care coverage - measured in counts or numbers like 0, 1, 2….9 or more and finally recoded into a binary variable, where zero '0' denotes less than four visits and one '1' denotes four or more visits.

Facility delivery -The outcome variable which is place of delivery, measured in different categories where the births taking place, finally recoded into a binary variable, where zero '0' denotes Non-institutional and one '1' denotes an institutional delivery. Facility delivery includes delivery took place in hospital, Maternal and Child Welfare Centre (MCWC), Upazilla/Thana Health Centre (UHC/THC), Family Welfare centre (FWC), NGO clinic and other.

Postnatal care - which is also a binary variable, where zero '0' indicates no receive of check-up after delivery and one '1' denotes received check-up after childbirth.

***Child health care indicators*:**

Full immunization coverage-children age 12-23 months and 0-59 months (objective -5) received BCG (tuberculosis), measles, three doses of each DPT (diphtheria, pertussis, tetanus), three doses of each polio vaccines, excluding polio 0 and three doses of hepatitis B (where '0' denotes No and '1' denotes Yes).

Vitamin A- Vitamin A supplement to child age 6-59 months and 0-59 months (objective -4) – received at least one dose of vitamin A (received/not received).

Baby postnatal check-up - within two months after the birth of the baby (Yes/No).

Diarrhea treatment- children age 0-59 months who suffered from diarrhea during two weeks before the survey seek medical treatment from health provider/facility (Yes/No)

Fever treatment- children age 0-59 months that suffered from fever during two weeks before the survey; seek medical treatment from health provider/facility (Yes/No).

All outcome or dependent variables are dichotomous in nature. All information comes from BDHS women's questionnaire, which records all events related to maternal and child health for preceding the five years before the survey.

Definition of predictor's variables:

The independent predictor's of maternal and child health care services utilization include individual, household and community and area level factors.

Individual level characteristics:

Antenatal care, which is one of the four pillars of safe motherhood, initiated by WHO, 1994. The variable prenatal care recoded into binary form, where '0' denotes less than four visits and '1' denotes four or more visits.

Birth order of the most recent child is an important determinant of maternal health care utilization. Birth order has been categorized into four categorized, where the values '0', '1', '2', and '3' denote '1', '2', '3', and '4+', respectively.

Wanted last child also taken into one of the predictor variable, to know the impact of unwanted children and its association with health services, the categories for this variable are 'wanted then', 'wanted later', and 'wanted no more' which are denoted by the values '0', '1', and '2' respectively.

From a long time, the importance of mother age at birth of the child has been recognized and in many studies, it was found that younger women tend to use health care services more frequently than the older women. Age of women is also associated with education, knowledge, and experience. As a result, all these things have influence in seeking health care. Here, mother age at birth of most recent child categorized into four, namely '<18', '18-23', '24-29', & '30+', given values of '0', '1', '2',& '3' respectively.

Mother's education is a very important factor and plays a significant role in seeking health care, to perceive their health condition. Like mother' education, father or husband education can also play a significant role. Both education variables categories into 'no education', 'primary education', 'secondary education', and higher, which given values of '0', '1', '2',& '3' respectively.

Exposure to any kind of mass media, this variable compute from three different variables namely frequency of reading newspaper or magazine, frequency of listening to radio and frequency of watching television, all these three variables having three category of '0'- not at all, '1'- less than once a week, '2'- at least once a week. The compute variable 'Exposure to any kind of mass media' is whether the respondent exposes to any of these (newspaper or magazine, radio, and television). Finally the Exposure to any type of mass media also categorized into three of 0'- not at all, '1'- less than once a week, '2'- at least once a week.

Nutritional status of mother, this variable derived from individual data file, categorized into '0'- low, '1'-medium and '2' high.

Ever had terminated pregnancy is also important determinant of maternal health care services utilization, Studies found that those women who are having miscarriage, abortion or stillbirth, they are more likely to use maternal health services more frequently than those not experience. Ever had terminated pregnancy is a binary variable given a value of '0'-No and '1'- Yes.

Mother empowerment or autonomy or decision-making power of women, this variable computed from five different variables namely person who usually decides on respondent's health care, final say on child health care, decision maker for using contraception, person who usually decides on visits to family or relatives, and person who usually decides on large household purchases, all these five variables having four to five categories – '0'- respondent, '1'- husband and respondent, '2'-husband, '3' –someone else, '4'- other. All variables recode in binary form, given a value of '0'- husband and other and '1'- with respondent, husband and respondent. Then we use principal component analysis and divide the score into three categories of low, medium and high, denoted by '0', '1' and '2'.

Father's occupation is one of the significant predictor and has a positive influence on treatment seeking behavior. Husband occupation categorized into three where '0' denotes primary occupation, '1' denotes secondary occupation, and '2' denotes the tertiary occupation.

Household level characteristics:

The household level variables include religion, the perception of health seeking behavior different among religions. This so because traditional beliefs, norms, and ideologies vary from religion to religion, for example, Muslim women are more restricted in terms of movement than women from other religion. Here, religion recoded into two categories of '0'- Muslim and '1'other'. The category of other includes Hindu, Buddhism and Christian.

It was perceived that the household head being a female, the chances of maternal health services utilization more than those household had a male head. Sex of the household head is in binary form, denoted by '0' Male and '1' Female.

The size of the family and maternal health utilization has a positive relationship; studies found that small family more likely to visits health centers more frequently than the large family. Here, household size recode into less than

four and more than four family members, denoted by '0' and '1'. Similarly, the family children burden mean number of children in-house recoded into 0-1 and 2+, denoted by '0' and '1'.

Access to transportation plays a significant role in accessibility of health care utilization. It was assumed that if the house possessed any type of motorized vehicle and they more likely to use that vehicle to reach the health centers. Availability of motorized vehicle is a binary variable, denoted by '0'- No and '1'- yes.

To know the relative socioeconomic status of the mother, we use wealth index, which determines the financial well-being of the mother. The wealth index categorized into five categories of '0'- poorest, '1'-poorer, '2'-middle, '3'-richer and '4' richest.

Community and area level variable:

Village connected with all-weather road, in access to the health facility, physical accessibility play a significant role, even if the respondent taken decision to seek care. Village connected with all-weather road is a binary variable, denoted by '0'- No and '1'- yes.

Distance to any nearest health facility (in km) is a major determinant and physical barrier in access to maternal health care utilization particularly in rural areas. The distance to nearest health facility is computed from community file, distance given in mile converted into kilometer. Here, any health facility included hospital, thana/upazila health centers, family welfare centers, maternal and child welfare centers, private hospital and clinic, and NGO clinic. Distance to any nearest health facility categorical variable, categorized into four denoted by '0-5', '6-15', '16-30', and '30+', given value of '0', '1', '2', and '3' respectively. Similarly, the time taken to reach nearest health facility (in minutes) is categorical in nature and categorized into four. Where values '0', '1', '2', and '3' denoted by '0-30', '31-60', '61-90', and '91+'. The time is taken to reach the health facility based on most common means of transportation.

Community education level is categorical in nature, this variable computed by taking percentage of the female population aged 16 years and older in the cluster or enumeration areas with secondary and higher education, divide the percentage into three category low, medium and high, given level of '0', '1' and '2'.

Community mass media exposure level- the percentage of mother expose to any kind of mass media in cluster or PSU. The percentage divided into two quintiles and categorized into '0'- Low and '1' High.

Availability health care in village, this variable dichotomous in nature, computed using three variables namely any pharmacies in the community, any skilled birth attendant working in this village/mohalla and presence of allopathic/MBBS doctors in this village. We use principal component analysis and divide the score into two categories of low and high, denoted by '0' and'1'.

Community antenatal care level- is measured as the percentage of mother who visits four or more for prenatal checkup in the enumeration areas and this measure divided into two quintiles and categorized into '0'- Low and '1' High.

Community facility delivery level- is measured as the percentage of mother who delivered in a health facility in the enumeration areas and this measure divided into two quintiles and categorized into '0'- Low and '1' High.

Community poverty level – is measured as the percentage of mother poorest and poorer (lowest 40% quintiles) of household wealth index in the enumeration areas and this measure divided into three quintiles and categorized into '0'- Low and '1' Medium and '2' High.

Neighbor socio-economic disadvantage index, this index composed of percentage of mother poorest (lowest 20% quintiles) of household wealth index, percentage of mother having no education or uneducated and percentage of mother unemployed in the enumeration areas and this measure divided into three quintiles and categorized into '0'- Low and '1' Medium and '2' High.

Place of residence- we used place of residence as a proxy to control for the different levels of services access seen between urban and rural areas. This is a dichotomous variable where '0' denotes rural and '1' denotes urban.

Statistical analysis:

The analysis was carried out for Bangladesh and Rural Bangladesh. In the present study, we used children data file (information comes from women questionnaire), community data file, women data file. First to fulfill our objective, we merge kids file and community file using cluster or PSU as an identifier variable and then we create community-level variables in the individual file and merge with kid-community file again. The analysis has been carried out by using software Stata/MP 13.0

The utilization of maternal and child health services is a complex phenomenon, affected by a number of factors-factor from individual, household and community level. For this objective, we used Bivariate and Multivariate logistic regression to analyze the importance of factors affecting utilization of maternal and child health services at each level individual, household and community separately, after that considering all level with selected predictor variables, adjusted effects are estimated by logistic regression. When calculating adjusted percentage for categories of a given predictor variable, other variables are held constant at their mean values; finally mean values are multiply with 100 to calculate adjusted percent

To know the influence of household status, neighbor socioeconomic disadvantage, community poverty level and physical accessibility (distance and time to nearest health facility, availability of motorized vehicle and village connected with all-weather road) in utilization of maternal-child health services, we performed Multivariate logistic regression with five different models. Other community level variables are adjusted in model 5. In addition to this descriptive statistics and binary logistic regression also performed.

Here, we are interested to know the influence of distance and time to the nearest health facility on maternal health care indicators by socioeconomic status, education and availability of motorized vehicle.

To know whether distance does really influence institutional delivery, it is assume that there is a casual relationship between distance to nearest health facility (DIST.) and institutional delivery. It is also assumed that DIST. is an endogenous variable and to examine the endogeneity of DIST. We attempt Instrumental Variable (IV) estimation to estimate the causal impact of DIST. on institutional delivery. Instrumental variables are variables which are correlated with endogenous variable (distance to the nearest health facility) and are not related with the error term in the outcome equation. If these two conditions are satisfied, then one can identify and estimate a consistent estimate of causal effect of distance on facility delivery. The IV-Probit model applied and use distance to non – health infrastructures of development as instrument using Principal Component Analysis (PCA) (Kumar et al.2013). Here, distance to any health facility is a categorical variable. The utilization antenatal care is measure by two ways- one, the use of antenatal care which takes the value of one if an individual seeks prenatal care during pregnancy and zero if an individual does not. Two, the amount of prenatal care received, which is proxied by the number of visits

(Sepehri et al. 2008). The utilization of antenatal care modeled using hurdle or two-part model, the first part specifying decision to seek care and the second part, the extent of utilization. Generally, in two part model (TPM) for admit and visits data (count model), we use Poisson and Negative Binomial models (extention – for excess zeros (zero-inflated)). First, for our TPM we check all the assumptions fulfill or not, then, the mean of our dependent that is variable number of antenatal care visits (m14) is not equal to variance; therefore we rejected Poisson model and moved to negative binomial, (here variance more than mean). Here, we used logit in our first part and negative binomial in the second part, coefficient converted into odd ratio. We use multilevel two-level logistic regression for the likelihood of giving birth in the medical institution and received postnatal care after childbirth. Multilevel models take into account of hierarchical structure of the data (7325 births nested within 600 EAs (primary sampling units)) and clustering at different levels. In addition, multilevel models enable simultaneous analysis of how area (community) and individual levels factors associated with health outcomes and the extent to which between area and individual variability in the outcome is explained by variables defined at multiple levels (Gage.A.J 2007). Four models were developed for facility delivery and postnatal care. Model 1 include constant only, model 2 include community and model 3 individual and finally model 4 both community and individual factors.

Result:

Factors affecting utilization of maternal health care services- at community level:

The results show that, in Bangladesh as a whole and rural area, each of the community level variables has a small positive and statistically significant effect on the proportion of mothers receiving tetanus injection but in receiving antenatal checkup community level variables has a large positive and statistically significant effect. The utilization of all three maternal health care indicators decreases by distance and time to the health facility and level of poverty in the community. The influence of distance and time to health facility centers in ANC check-up more profound in Bangladesh as a whole than rural, as distance and time increases from village centers to health facility the percent of utilization of ANC decreases. Poverty at community level also significantly determining the use of ANC, with the low level of poverty at community having ANC check of 39 percent and it decrease to 12 percent in high poverty level community. Mother who lived in communities with a high percent of educated mother and expose to any kind of mass media were more likely to receive ANC check-up and facility delivery compared with mother who resided in low percent of educated as well as exposure to mass media.

For facility delivery- Bangladesh as a whole each of the community and area level variables has a large positive effect on giving birth in a health institution though not all the variables are statistically significant. there are significant differences by all the variables but significant and large differences by distance and time to nearest health facility, village connected with all-weather road, education at community level, exposure to any kind of mass media at community level and poverty level at community. Like in ANC and facility delivery, The results show that for indicator of postnatal care, there are significant differences by all the variables but significant and large differences by antenatal care at community level, health facility delivery at community level, community education level, community mass media exposure and community poverty level in both areas, place of delivery also statistically significant for country as a whole. (Note- household and individual factors affecting utilization of maternal health care services not discussed here).

Antenatal check-up:

The association between antenatal care checkup and wealth index, community poverty level, neighbor socioeconomic disadvantage, and physical accessibility assessed in *Table 1* with different models. Model 1 and Model 2 indicate that a strong association between socio-economic status, poverty level and physical accessibility are apparent. The results suggest that the influence of household wealth is stronger than that of geographical access. Though the distance to nearest health facility is significantly associated with ANC in model 2 but in model 5 with wealth quintile and other variables, the association between antenatal care and distance to nearest health facility

became insignificant. From model 5, we can observed that wealth quintile, village connected with road, availability of motorized vehicle, community education and mass media level, and place of residence significantly associated with antenatal care services utilization. From model 5 indicates that the mother from richest wealth quintile 5.6 times more likely to received ANC check-up than mother from poorest category. The association between wealth status, poverty level and accessibility became weak (odd ratio) in model 5. There strongest predictors of antenatal check-up are wealth status, village connected with road, availability of motorized vehicle, community education level and community mass media exposure – all these variables statistically significantly associated with ANC check-up in Bangladesh.

Facility delivery:

The association between institutional delivery and wealth index, community poverty level, neighbor socioeconomic disadvantage and physical accessibility assessed in ***Table 2*** with different models. In Model 1 and Model 2 indicates that a strong association between household socioeconomic status, poverty level at community and physical accessibility are apparent. The adjusted odd ratios suggest that the influence of household wealth is stronger than that of geographical access. Though the distance to nearest health facility significantly associated with facility delivery in model 2 but in other models with wealth quintile, the association between institutional delivery and distance became insignificant. In model 3, we assess the relationship between wealth quintile, poverty level at community and physical accessibility but in model 4, we drop poverty level at community and include neighbor socioeconomic disadvantage at the community level, to know both variables effect on choice of delivery place. From model 5, we can observe that wealth quintile, availability of motorized vehicle, availability of health care in this village, education and mass media at community level and place of residence significantly associated with institutional delivery. From model 5 indicates that the mother from richest wealth quintile 6.8 times more likely to give birth in health institution than mother from poorest category. The variable village connected with all-weather road significantly associated with delivery at medical institution but became insignificant in model 3 when consider wealth status and community poverty level.

Postnatal care:

In Table 3 shown that the relationship between household statuses, poverty level in the community and accessibility with postnatal care after childbirth, like ANC and facility delivery. In Bangladesh as a whole country, all the variables like wealth quintile, poverty at community level, accessibility (distance, time, road and vehicle) are strongly associated with care after birth of the child in model 1 and model 2. The neighbor socioeconomic disadvantage statistically significantly associated with postnatal care in model 4 but became in significant in model 5, when other community level variables are adjusted in model 5. The distance to nearest health facility which is significant in model 2 but it is insignificant in model 3 and model 4. The women who in a community with high institutional delivery 2.2 times more likely to give birth in medical institution than women living in low facility delivery community. In model 5 household socioeconomic statuses, availability of motorized vehicle, antenatal care at the community level, level of health facility delivery at community, community education level all are significantly associated with postnatal care.

Child immunization:

Association between wealth status, neighbor socioeconomic disadvantage, accessibility, health care in village level and on the likelihood that a child age 12-23 months received full immunization in Bangladesh assessed in Table 4. All the variables used for ANC, facility delivery and PNC include here, in addition of these variables we also include health care in the village and locality and its effect on the likelihood of a children (12-23 months) received full vaccination in Bangladesh. The result of this table shows that wealth status except poorer category significantly associated with child immunization in model 1. Village connected with all-weather road (yes), availability of motorized vehicle in the household (yes), time to taken to reach nearest health facility (0-30 & 91+) are significantly

associated with the outcome variable. Both health care factors in village are not statistically related with the response variable. From model 5, we can see that children from richest wealth quintile 2.7 times more likely to receive vaccination than children from poorest category. Similarly, the children from the states of Khulna, Rajshahi and Rangpur are more chances of getting vaccination than children from state of Barisal.

Discussion and findings:

The result of this showed that all three statuses or position of mother variables (wealth status, neighbor socioeconomic disadvantage and community poverty level) are positive associated with both maternal and child health care services utilization in Bangladesh as whole country. The associations of household socioeconomic status with health services are consistent with previous studies, but the result of neighbor socioeconomic disadvantage and community poverty level are new in Bangladesh and hope that none of the study conducted regarding this. The result from our study especially for neighbor socioeconomic disadvantage and community poverty level with health care are expected. Our analysis revealed that living in a disadvantage community and high poverty level area also effect health services utilization.

Conclusion:

The study documented that the importance of individual household status as well as neighbor status also matter in health care. The study also found that status/economic position is more important than accessibility, status play greater role than accessibility in Bangladesh. Therefore efforts should be made to consider the level of economic development at community level when formulating policies and programs of health care.

Table 1 Association between wealth status , community poverty level and accessibility with ANC services utilization (odd ratio) in Bangladesh, BDHS-VI,2011

Background Characteristics	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Wealth Index					
Poorest®					
Poorer	**1.40***		**1.39***	**1.37***	**1.39***
Middle	**1.96***		**1.83***	**1.80***	**1.75***
Richer	**2.68***		**2.54***	**2.55***	**2.30***
Richest	**7.41***		**6.59***	**6.66***	**5.69***
Community poverty level					
Low®					
Medium	**0.70***		**0.81***		
High	**0.61***		0.83		
Neighbor socio-economic disadvantage level					
Low®					
Medium				**0.56***	**0.71***
High				**0.77***	1.24
Village connected with all weather road					
No®					
Yes		**1.59***	**1.32***	**1.36***	**1.24***
Availability of motorized vehicle					
No®					
Yes		**2.73***	**1.31***	**1.28***	**1.34***
Distance to nearest health facility (km)					
0-5®					
6-15		**0.59***	0.90	0.90	1.04
16-30		**0.40***	**0.72***	**0.74***	0.85
31+		**0.35***	**0.65***	**0.65***	0.76
Time to nearest heath facility (minute)					
0-30®					
31-60		1.03	1.03	1.05	1.01
61-90		**0.73***	**0.76***	0.82	0.79
91+		**0.64***	0.79	0.82	0.83
Availability of health care in this village					
Low®					
High					0.91
Community education level					
Low®					
Medium					**1.60***
High					**1.64***
Community mass media exposure level					
Low®					**1.54***
Medium					**1.47***
High					
Type of place of residence					
Urban®					
Rural					**0.63***

Note- significance level $p<0.05$

Model 5 - Adjusted with other community level variables

Table 2 Association between wealth status , community poverty level and accessibility with facility delivery (odd ratio) in Bangladesh, BDHS-VI,2011

Background Characteristics	Model 1	Model 2	Model 3	Model 4	Model 5
Wealth Index					
Poorest®					
Poorer	1.35*		1.31*	1.26	1.25
Middle	2.01*		1.92*	2.00*	1.89*
Richer	3.27*		3.04*	3.40*	2.94*
Richest	8.05*		7.34*	8.65*	6.89*
Community poverty level					
Low®					
Medium	0.66*		0.70*		
High	0.44*		0.50*		
Neighbor socio-economic disadvantage level					
Low®					
Medium				0.66*	0.84*
High				0.58*	0.93
Village connected with all-weather road					
No®					
Yes		1.40*	1.07	1.12	1.05
Availability of motorized vehicle					
No®					
Yes		2.95*	1.30*	1.22	1.29*
Distance to nearest health facility (km)					
0-5®					
6-15		0.53*	0.88	0.84	0.97
16-30		0.45*	0.91	0.88	1.04
31+		0.44*	0.97	0.94	1.12
Time to nearest heath facility (minutes)					
0-30®					
31-60		0.83	0.85	0.84	0.84
61-90		0.72*	0.79	0.81	0.82
91+		0.47*	0.66*	0.64*	0.71*
Availability of health care in this village					
Low®					
High					0.82*
Community education level					
Low®					
Medium					1.32*
High					1.81*
Community mass media exposure level					
Low®					
Medium					1.45*
High					1.74*
Type of place of residence					
Urban®					
Rural					0.67*

Note- significance level *p<0.05

Model 5 - Adjusted with other community level variables

Table 3 Association between wealth status , community poverty level and accessibility with postnatal care (odd ratio) in Bangladesh , BDHS-VI,2011

Background Characteristics	***Model 1***	***Model 2***	***Model 3***	***Model 4***	***Model 5***
Wealth Index					
Poorest®					
Poorer	**1.28***		**1.28***	**1.23***	**1.25***
Middle	**1.64***		**1.65***	**1.66***	**1.59***
Richer	**2.75***		**2.64***	**2.77***	**2.42***
Richest	**6.15***		**5.68***	**6.17***	**4.65***
Community poverty concentration					
Low®					
Medium	**0.80***		**0.82***		
High	**0.61***		**0.64***		
Neighbor socio-economic disadvantage level					
Low®					
Medium				**0.78***	1.08
High				**0.67***	1.05
Village connected with all weather road					
No®					
Yes		**1.35***	1.10	**1.12***	1.02
Availability of motorized vehicle					
No®					
Yes		**3.20***	**1.51***	**1.45***	**1.60***
Distance to nearest health facility (km)					
0-5®					
6-15		**0.64***	1.02	0.99	1.23
16-30		**0.54***	0.99	0.96	1.20
31+		**0.57***	1.10	1.09	**1.39***
Time to nearest heath facility (minute)					
0-30®					
31-60		**0.75***	**0.77***	**0.76***	**0.78***
61-90		**0.66***	**0.72***	**0.73***	**0.77***
91+		**0.56***	**0.75***	**0.74***	0.81
Availability of health care in this village					
Low®					
High					1.00
Community antenatal care level					
Low®					
High					**1.62***
Community Health facility delivery level					
Low®					
High					**2.20***
Community education level					
Low®					
Medium					**1.50***
High					**1.57***
Community mass media exposure level					
Low®					
Medium					**1.37***
High					1.21
Type of place of residence					
Urban®					
Rural					0.94

Note- significance level p<0.05

Model 5 - Adjusted with other community level variables

Table 4: Association between wealth status, Neighbor socioeconomic disadvantage, accessibility and health care in village level on the likelihood that a child age 12-23 months received full immunization in Bangladesh, BDHS-VI, 2011

Background Characteristics	Model 1	Model 2	Model 3	Model 4	Model 5
Wealth Index					
Poorest					
Poorer	1.49			**1.56***	1.54
Middle	**1.73***			**1.67***	**1.76***
Richer	**1.67***			1.30	1.54
Richest	**2.86***			**2.12***	**2.79***
Neighbor socioeconomic disadvantage level					
Low					
Medium	0.71			0.76	0.76
High	**0.51***			**0.59***	0.62
Village connected with all weather road					
No					
Yes		**1.83***		**1.67***	**1.89***
Availability of motorized vehicle					
No					
Yes		**6.18***		**4.69***	3.60
Distance to nearest health facility (km)					
0 - 5					
6-15'		0.99		1.17	0.99
16-30		1.11		1.36	1.12
31+		1.09		1.42	1.25
Time to nearest heath facility (minute)					
0-30					
31-60		**0.46***		**0.48***	0.56
61-90		0.60		0.69	0.69
91+		**0.40***		0.54	0.71
Presence of community or satellite clinic in this village					
No					
Yes			1.17		1.30
Presence of MBBS doctor or health worker in this village					
No					
Yes			1.29		1.18
Community education level					
Low					
Medium					1.16
High					1.36
Community mass media exposure level					
Low					
Medium					1.45
High					1.45
Type of place of residence					
Urban					
Rural					**1.96***
Region					
Barisal					
Chittagong					0.86
Dhaka					1.46
Khulna					**2.56***

Rajshahi	**2.11***
Rangpur	**3.12***
Seylhet	1.17

Note- significance level p<0.05
Model 5 - Adjusted with other community level variables