DETERMINANTS OF MATERNAL HEALTHCARE UTILIZATION IN BANGLADESH, 1993-2007

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1 Introduction

Recent data from the Bangladesh Maternal Mortality and Health Care Survey (BMMS) 2010 estimate the maternal mortality ratio (MMR) in Bangladesh to be 194 deaths per 100,000 live births in the 2007-2010 period, an impressive 40% reduction over the past decade (NIPORT et al. 2011). While maternal mortality has substantially improved, maternal causes still account for 14% of deaths among Bangladeshi women of reproductive age. BMMS 2010 indicates that hemorrhage (heavy bleeding) and eclampsia (pregnancy-induced hypertension) account for more than half of all maternal deaths, both of which in most cases can be prevented or treated. Most effective strategies to prevent pregnancy-related deaths and improve the health of mothers and children include antenatal care (ANC) and delivery care (World Bank 2010b). Timing and frequency of ANC visits have been shown to affect the survival and health of mother and child by providing the opportunity for preventive measures, early detection of disease or complication and timely care (AbouZahr and Wardlaw 2003). Appropriate delivery care includes delivery in a health facility or by a skilled attendant. Despite progress on MMR in Bangladesh, delivery and antenatal care utilization remain low according to BMMS II estimates with only 23% of births taking place in a health facility, 27% of births attended by a skilled professional and 38% of births preceded by the recommended four ANC visits (NIPORT et al. 2011).

Bangladesh's progress on improving maternal health can be assessed through Millennium Development Goal 5 (MDG 5). One of the indicators for MDG 5 is the reduction of MMR by 75% between 1990 and 2015, which means reaching an MMR of 143 by 2015. Given the recent BMMS II estimate, Bangladesh is on track to meet this (Chowdhury et al. 2011; NIPORT et al. 2011). However, it appears unlikely that Bangladesh will meet other indicators included in MDG 5 such as achieving 50% skilled birth attendance and universal ANC coverage of four or more ANC visits (Chowdhury et al. 2011). While the use of maternal healthcare services has increased in the past decade from exceptionally low levels, utilization still remains low and the maternal health situation in Bangladesh continues to be an area of major concern.

In order to design, adopt and implement appropriate policies that will increase maternal health service utilization, policymakers need to know which factors have the greatest impact on maternal healthcare use. The aims of this chapter are to identify the determinants of maternal healthcare utilization among women of reproductive age in Bangladesh between 1993 and 2007, ascertain which determinants are primarily responsible for the increases in utilization over this period and offer recommendations on how to further improve levels of service use. The analysis focuses on three types of maternal health services: skilled attendance at birth, delivery in a health facility and four or more antenatal care visits.

2 Background: Maternal Health Service Utilization

The majority of maternal deaths and disabilities in Bangladesh are caused by direct obstetric causes (i.e. hemorrhage, eclampsia, and obstructed or prolonged labor) or indirect causes (e.g. infection, anemia), most of which can potentially be prevented and/or treated. However, in resource-constrained settings, health services may not be available or may be of poor quality that is ineffective in preventing or treating the conditions described above. Furthermore, even when services are available, utilization is not universal. Many factors influence maternal healthcare utilization including but not limited to individual characteristics, social norms, economic conditions and the health system (including financing, payments to providers, human resources, physical availability and accessibility of facilities[1] and cost of services).

Many of the factors that influence maternal healthcare utilization have been explored both quantitatively and qualitatively in the literature. Maternal age has been identified as a significant predictor of healthcare utilization during pregnancy and childbirth (Reynolds et al. 2006; Thind et al. 2008; Bell et al. 2003; Sagna and Sunil 2012; Ochako et al. 2011; Neupane and Doku 2011; Islam and Odland 2011; Agha and

[1] In this paper, physical availability refers to whether or not facilities exist; physical accessibility includes factors such as distance to the facility and the presence and condition of roads and transport to reach the facility.

Carton 2011). Most studies have shown that older mothers use services more than younger mothers – likely due to greater decision-making power within the household, confidence and experience with the health system (Gabrysch and Campbell 2009). Older age is associated with parity, another factor that has been shown to be a significant factor influencing maternal health care use. However, some studies have found that lower parity is associated with maternal health service utilization (Bell et al. 2003; Sagna and Sunil 2012; Ochako et al. 2011; Neupane and Doku 2011; Agha and Carton 2011). Bell and colleagues (2003) show that first births are likely to take place in health facilities in Bangladesh, Bolivia, Ghana, Indonesia, Malawi and Philippines compared to subsequent births. Furthermore, Thind and colleagues (2008) have shown that higher birth order is predictive of deliveries taking place in the home.

The strong and positive relationship between mother's education and maternal healthcare utilization is well-established (Babalola and Fatusi 2009; Thind et al. 2008; Singh et al. 2012; Bell et al. 2003; Chakraborty et al. 2003; Sagna and Sunil 2012; Zere et al. 2011; Ochako et al. 2011; Neupane and Doku 2011; Islam and Odland 2011; Agha and Carton 2011). Education operates through a number of pathways to influence the use of services. Education increases knowledge and access to information about risks of pregnancy as well as about available services. Education is also associated with higher wages, control over resources and better communication with family members and providers (Gabrysch and Campbell 2009). Women's education is related to autonomy, another factor that has been explored in the literature to explain maternal healthcare use. Agha and Carton (2011) identified women's autonomy as an important factor in deliveries taking place in health facilities in a district in Pakistan. While some studies have found autonomy to increase skilled attendance at birth, others have found no effect – and the effect of autonomy is likely to be modified by factors such as age, wealth and parity (Gabrysch and Campbell 2009). Husband's education also has an impact, though Gabrysch and Cambell's literature review (2009) found the impact of husband's education to be less than that of mother's education. In addition, Chakraborty and colleagues (2003) found that women in Bangladesh who have husbands in the business or service sectors are more likely to use modern health center services.

Other individual-level characteristics that have been considered in the use of maternal health services include religion/caste/ethnicity, exposure to mass media, severity of the pregnancy condition, and counseling about pregnancy complications. The potential influence of religion, caste or ethnicity is based on the idea that certain cultural backgrounds, norms and beliefs may decrease the decision to seek care. The results in the literature on this category of factors are mixed with a few studies showing large differences while others show none (Gabrysch and Campbell 2009). Thind and colleagues (2008) found caste to be a significant predictor of deliveries taking place in health facilities in the private sector in the Indian state of Maharashtra. In Ghana, while no ethnic differences have been found to affect use of delivery services, religious differences surface with Muslims less likely than Christians to use services (Gyimah et al. 2006; Addai 2000). Exposure to mass media at the individual and community levels have been shown to positively influence maternal healthcare use (Thind et al. 2008; Sagna and Sunil 2012; Islam and Odland 2011; Agha and Carton 2011; Babalola and Fatusi 2009). While knowledge about and experience with pregnancy complications have been cited in qualitative studies as a predictor of maternal health service use, few quantitative studies have explored this, and the results are mixed from those that have (Gabrysch and Campbell 2009).

At the household and community levels, a number of factors have been found to be significant determinants of utilization of maternal health services. The strongest of these is socioeconomic status with wealthier women using services far more than poor women; this relationship is well-documented and holds true for both public and private sector service utilization (Zere et al. 2010; Kesterton et al. 2010; Babalola and Fatusi 2009; Jayaraman et al. 2008; Anwar et al. 2008; Collin et al. 2007; Singh et al. 2012; Bell et al. 2003; Sagna and Sunil 2012; Zere et al. 2011; Ochako et al. 2011; Neupane and Doku 2011; Agha and Carton 2011).

Physical accessibility has been assessed at the community and regional levels. Women living in urban areas are likely to have better access to services, infrastructure (including better human resources) and better access to information. Numerous studies in Asia and Africa have shown a positive effect of urban residence on maternal health service utilization (Babalola and Fatusi 2009; Zere et al. 2010; Thind et al. 2008; Jayaraman et al. 2008; Stephenson et al. 2006; Ochako et al. 2011; Islam and Odland 2011; Bell et al. 2003). Thind and colleagues (2008) found that rural residence was predictive of deliveries taking place at home in India. Regional factors can also be a reflection of cultural, social, and ethnic differences in service utilization. Singh and colleagues (2012) show that regional differences exist in the use of ANC services and safe deliveries among married adolescents in India, indicating that unobserved characteristics in the regions drive service utilization. Jat and colleagues (2011) highlight the importance of community-level and district-level interventions in increasing the use of maternal health services in the state of Madhya Pradesh in India.

Physical accessibility has numerous aspects, but distance to facilities and roads and transportation to travel that distance are some of the most important ones for maternal health (Thaddeus and Maine 1994). In a mixed-methods study, Islam and Odland (2011) found traveling distance and transport issues to be important in not accessing antenatal and postnatal care in Bangladesh. In a study in Pakistan, Agha and Carton (2011) show that proximity to a health facility is an important predictor of delivery in a health facility. While travel distance, time and cost to reach health services are important factors, they are difficult to measure and only a relatively small number of quantitative studies have included physical accessibility in the analyses.

Finally, health system factors also have a role to play in the utilization of maternal healthcare services. Kruk and colleagues (2007) show that total health expenditure (irrespective of the sources of financing) as well as government health expenditure as a percentage of total health expenditure are positively associated with skilled birth attendance and caesarean sections. Furthermore, a recent macro-level study by Muldoon

and colleagues (2011) found access to water and sanitation, a less corrupt government and higher total expenditures on health per capita to be negatively associated with maternal health outcomes. Difficulties exist in finding good variables to measure health system factors. The term "health system" is itself broad and includes many different aspects. While the framework developed by Roberts and colleagues (2008) describes many factors involved in a health system[2], it neither proposes the relative importance of any of the factors, nor does it suggest methods of quantifying them. Thus, this review found few quantitative studies that examine health system effect on maternal healthcare utilization.

3 Theoretical Framework for Health Service Utilization

Health service utilization can be analyzed using a health-seeking behavior model. A number of such models have been developed, each with the goal of explaining or predicting health-seeking behaviors. These models have come from various fields including social psychology, medical sociology and medical anthropology. Social psychology has given rise to the health belief model (HBM), the theory of reasoned action and the theory of planned behavior (TPB). Medical anthropology has contributed the decision making model, and medical sociology has developed the socio-behavioral health care utilization model.

The HBM was first developed in the 1950s. Sheeran and Abraham have a more recent adaption guided by the notions of perceived susceptibility and severity of the health problem, health motivation, perceived

[2] Roberts and colleagues developed a framework of five health sector reform "control knobs" to improve performance of a health system: financing, payment, organization, regulation and behavior. Financing is defined as the mechanisms that help raise funds to pay for health-sector activities, and allocation of those funds. Payment is the collection of methods for transferring money to health care providers in hopes of creating incentives that appropriately influence their behavior. Organization is the overall structure of the health care system and the individual institutions that provide health care services. Regulation refers methods used by the state to alter the behavior of actors in the health system (e.g. licenscing). Behavior refers to the ability of private sector and government to influence people's beliefs, expectations, lifestyles and preferences through advertising, education, and information dissemination.

benefits and barriers and socio-demographic factors (Sheeran and Abraham 1995).[3] The theory of reasoned action developed into the TPB, which has been used commonly in HIV/AIDS work (Ajzen and Fishbein 1980; Ajzen 1985, 1988, 1991). Within this model, behavioral intention is thought to be determined by a certain set of factors. Conner and Sparks (1995) developed this further by claiming that attitudes toward behaviors (i.e. the belief that a behavior will have a particular consequence), subject norms, perceived control (driven by beliefs about access to resources and success of resources) and socio-demographic variables determine behaviors. The central role of social network support is unique to TPB, and its greatest weakness is perhaps an overemphasis on psychological factors and not enough emphasis of structural factors (e.g. access, availability).

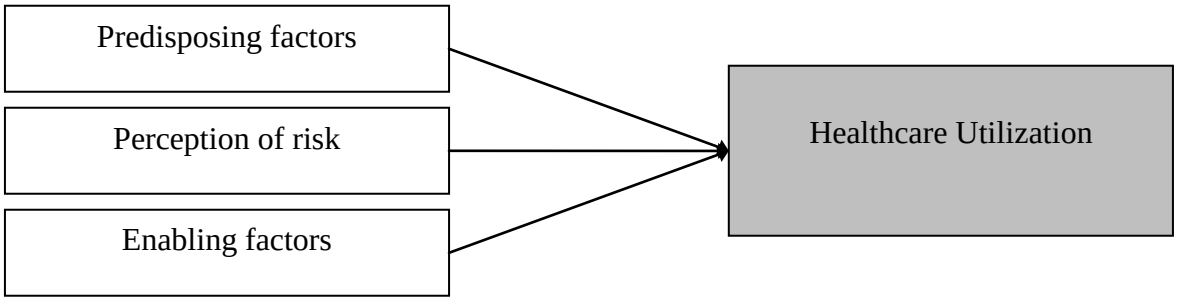
The ethnographic decision making model attempts to predict health-seeking by first conducting an ethnographic assessment in the community, followed by creating hypothetical scenarios (vignettes) (Hausmann-Muela et al. 2003). Then interviewees are presented with these vignettes and provide their answers for health-seeking, after which data are compared with actual cases.

The socio-behavioral healthcare utilization model introduces a logical sequence of three categories of factors that lead to health service use: predisposing, need and enabling factors (Andersen and Newman 1973). The socio-behavioral healthcare utilization model was initially developed by Andersen based on the U.S. healthcare system, and it was later modified by Kroeger (1983) for application in developing countries and includes the same three categories of factors in determining the choice and level of health care use (Figure 1). As proposed by Kroeger, *predisposing factors* are characteristics of the subject (e.g. age, sex, household size and status, interaction with the social network, ethnicity, religion, education, socioeconomic status). *Characteristics and perceptions of the disorder* reflect an individual's categorization of whether a condition is chronic or acute, severe or trivial, the type of disease pattern and the expected benefits and consumer satisfaction. In this analysis, this category will be referred to as

[3] Please refer to Figure A1 in the appendix for an illustration of the different types of theoretical models discussed.

perceptions of risk. In the case of pregnancy, an individual may perceive higher risk for a number of reasons which include but are not limited to whether she has complications during the current or a previous pregnancy, it is her first pregnancy, she is age 35 or older at the time of her pregnancy, she is aware of the risks associated with pregnancy and she thinks the care would be beneficial and quality of care will be worth the cost. Finally, *enabling factors* are those that facilitate the use of particular services. These can include geographical accessibility of the service, the appeal (opinions/attitudes) and acceptability of the service, the quality of care provided and the costs and fees associated with it; many of the enabling factors are related to the community and the health system.

Figure 1. The Socio-Behavioral Healthcare Utilization Framework



For this analysis, we use the Kroeger healthcare model to analyze the utilization of maternal healthcare services in Bangladesh. We adapt the framework to accommodate the specific type of service (maternal healthcare), the location (Bangladesh), the cultural context and the available data in the Demographic and Health Surveys (DHS) to explore the role of both individual and community factors. Education, household assets, religion, household size and age come directly from the Kroeger model and are typical predisposing factors used in most healthcare utilization analyses, irrespective of the type of healthcare service. Furthermore, these factors have been found to be significant determinants of maternal healthcare utilization specifically as discussed in the previous section. Perception of risk is quantified through four factors. Women for whom it is the first birth may perceive the pregnancy to be more risky since it is their first such experience. Older women may perceive higher risk because they have been through the experience before and are more aware of potential complications – and they may also have more

experience with the health sector and perceive the benefits to be greater. A woman who has had a child die soon after birth may associate health of the child with the pregnancy and thus may perceive risks more acutely to prevent another neonatal death. Finally, previous experience of a pregnancy that terminated could make a woman more aware of pregnancy risks and therefore seek care for a subsequent pregnancy. With respect to enabling factors, urban residence, a community's wealth, differences between regions and exposure to mass media are commonly assessed in the literature on maternal healthcare utilization as discussed in the previous section. This analysis includes two factors – treatment at a hospital or by a doctor of a sick child in the community – in an effort to measure physical availability of medical services in the community. And furthermore, exposure to media messages about family planning can also signal health sector efforts at IEC (Information, Education, Communication) and BCC (Behavior Change Communication)[4] with respect to reproductive health in general.

While this analysis will be able to estimate the effects of predisposing and perception of risk factors, it will be limited in its ability to estimate the effects of health system factors within the enabling factors category. Due to data limitations, the health system factors will be limited to the media messages received and the treatment of children variables. While ideally information on facilities, equipment, supplies and human resources would be useful, since the data do not include information on access to health services and cost of health services, the analysis will be limited in its scope to explore the effects of health system enabling factors on women's utilization of maternal health services. The data sources are discussed below, but data availability limits the structure of the analysis and the factors that are included.

[4] According to UNESCO's definition, IEC is a process of working with individuals, communities and societies to develop communication strategies to promote positive behaviors which are appropriate to their settings. BCC is a process of working with individuals, communities and societies to develop communication strategies to promote positive behaviors which are appropriate to their settings and provide a supportive environment which will enable people to initiate and sustain positive behaviors.

4 Empirical Strategy

To identify the determinants and estimate the effect of each of these factors on maternal health care utilization, we use the following multilevel random effects logistic model for each dependent variable:

$$(1) \qquad Log_e\left[\frac{p(USE_{i,j,t}=1)}{p(USE_{i,j,t}=0)}\right] = \alpha + \boldsymbol{P}_{i,j,t}\beta + \boldsymbol{PR}_{i,j,t}\gamma + \boldsymbol{E}_{i,j,t}\delta + \boldsymbol{\theta}_t + u_{j,t} + \varepsilon_{i,j,t}$$

where $USE_{i,j,t}$ is a binary indicator variable which equals 1 if the mother reports having utilized the healthcare service of interest for birth *i* in cluster *j* and survey *t* and is 0 otherwise. The maternal healthcare services of interest are skilled attendance at birth, delivery in a health facility and four or more antenatal care visits during that pregnancy. Following the conceptual framework, three sets of regressors are included: $\boldsymbol{P}_{i,j,t}$ represents a vector of predisposing factors, $\boldsymbol{PR}_{j,t}$ represents perception of risk factors, and $\boldsymbol{E}_{i,j,t}$ represents enabling factors (Table 1). In addition, we include survey fixed effects ($\boldsymbol{\theta}_t$) and cluster random effects to control for other unobservable factors. While $u_{j,t}$ captures the difference between the average service utilization in cluster *j* and the average service utilization in the entire country, $\varepsilon_{i,j,t}$ measures the deviation in service utilization associated with birth *i* and the average service utilization for the *j*-th cluster. The regression models are estimated in Stata/MP 12.0 using the xtlogit command. We pool the data for all years and run the regressions specific to utilization of each healthcare service of interest. The results of the pooled data analysis are expected to yield average effects for each type of service over the entire period.

Table 1. Predisposing, Perception of Risk and Enabling Factors Included in Model

$P_{i,j,t}$: predisposing factors	$PR_{i,j,t}$: perception of risk factors	$E_{i,j,t}$: enabling factors
• Mother's level of education • Household assets • Mother's religion • Household size • Mother's age	• First birth • Mother of older age at time of birth • Mother's prior experience with a neonatal death • Mother's prior experience with a pregnancy that terminated	• Urban residence • Community's assets • Division • Treatment at a hospital of a child in the community Treatment by a doctor of a child in the community a doctor • Exposure to media messages about family planning • Exposure to mass media

5 Data

5.1 Data Source

Maternal health service utilization trends were analyzed to assess their determinants over time using microdata from the Demographic and Health Surveys (DHS) for Bangladesh. The DHS has administered over 240 surveys from 1984 to the present covering over 80 countries. The DHS are nationally-representative household surveys that provide data built around a core of a full birth history for a wide range of indicators in the areas of health, population and nutrition. They are also generally representative at the residence level (urban-rural) and region level (states/divisions). Standard DHS surveys have relatively large sample sizes (about 5,000 to 30,000 households per survey) and are conducted approximately every five years, enabling comparisons over time. In Bangladesh, only ever-married women age 10-49 are interviewed.

A total of five DHS were used in this analysis, covering a period of 14 years from 1993 to 2007. The sample is first restricted to the 51,143 women who are of reproductive ages 15-49. Then, the sample is restricted to births occurring in the three years prior to the survey to maintain consistency across surveys

and to get estimates for the most recent time period for each survey. Thus, the final sample consists of 16,830 births in the three years prior to the survey for 16,766 women age 15-49. After applying the restrictions for age and three-year window for birth and dropping observations with missing values, the resulting sub-sample is no longer representative of the original sample of women; therefore, sample weights are not applied in the regression analyses.

5.2 Coding of Variables

5.2.1 Dependent Variables

The dependent variables of interest are skilled attendance at birth, birth in a health facility and more or more ANC visits during the pregnancy. Skilled attendance at birth is a dichotomous variable coded with a value of 1 to indicate there was skilled attendance at the birth and 0 otherwise. Skilled attendance is defined as a birth that was attended by a doctor, nurse/midwife, family welfare visitor or community skilled birth attendant. Birth in a health facility is a dichotomous variable with a value of 1 to indicate that the birth occurred in a health facility and 0 otherwise. The facilities included in this definition are government or private hospital, government health center, government health post, maternal and child welfare center, NGO static clinic or sub-district health complex. Finally, a dichotomous variable is coded as 1 to indicate that a birth was preceded by four or more ANC visits during the pregnancy and 0 otherwise.

5.2.2 Independent Variables

5.2.2.1 Predisposing factors

The variable for level of education completed by each mother is divided into four categories: no education, primary education, secondary education and higher education (>12 years). The reference category in the regressions is no education. Data on household assets is used to create an asset index that is a composite of asset information available consistently for all of the DHS surveys. The asset index, a

continuous variable, incorporates information on source of drinking water; type of toilet facility; floor, wall and roof materials; presence of electricity in the home; and possession of a television. Each of the assets is assigned a score based on the quality and/or prevalence within the household. These scores are then summed to produce the final asset index. Source of drinking water is categorized as surface (0), open/well (1) or surface (2). Type of toilet is categorized as no facility (0), pit/latrine (1) or flush (2). Floor, wall and roof materials are categorized as natural (0), rudimentary (1) or finished (3). The maximum possible value for the final asset index is 12. Three dummy variables are created to capture the main religion groups: Muslim, Hindu and other. In the regressions, the reference group is "other" and includes Christians and Buddhists. Household size, a continuous variable, is used directly from the DHS and reflects the number of members in the household.

5.2.2.2 Perception of risk factors

Several variables are used to assess the effect of perception of risk on maternal healthcare utilization. A dichotomous variable is created to indicate whether the birth is the mother's first. Another dichotomous variable is created to indicate whether a mother is of older age at the time of a birth – the variable is coded with a value of 1 if the mother is between the ages of 35 and 49 at the time of birth and 0 otherwise. Prior experience with neonatal death is a dichotomous variable that indicates whether the mother had lost a previous child soon after delivery. Neonatal death[5] is coded with a value of 1 if any previous children died before the age of one month and 0 otherwise. Finally, a variable is included to reflect a mother's previous experience with a poor pregnancy outcome. The variable labeled pregnancy loss is coded with a value of 1 if the mother had a previous pregnancy that miscarried, was aborted or ended in a stillbirth and 0 otherwise. Since this variable includes both spontaneous abortion and menstrual regulation[6], it may be an overestimate of poor pregnancy outcome as menstrual regulation is not necessarily a poor outcome.

[5] Neonatal deaths are defined as those that occur within 28 days of birth.

[6] Menstrual regulation (MR) is the re-establishment of non-pregnancy for women at risk of pregnancy. The difference between MR and abortion is that MR has neither a pregnancy test before the procedure nor an

5.2.2.3 Enabling factors

A dichotomous variable is created to indicate the type of residence of the mother and is coded with a value of 1 if in an urban area and 0 if in a rural area. To assess the effect of a community's socioeconomic status on an individual's use of maternal healthcare services, we create a continuous variable that measures the self-excluded mean household asset index in the cluster (i.e. the average household asset index in the cluster was calculated excluding the individual woman's own household asset index – thus it was the average asset index of those around her). A set of division fixed effects are included to assess the impact of geographical variation. The regions are recoded from the original DHS datasets to ensure geographical consistency across surveys, and five fixed effects are included to represent the divisions (Barisal, Dhaka, Chittagong & Sylhet, Khulna and Rajshahi). A community-level dichotomous variable indicates whether any sick child in the cluster had been taken to a hospital for treatment of diarrhea, cough or fever in the two weeks prior to the survey. This variable is a proxy for the physical availability of higher-level health services in the area and is assigned a value of 1 if any sick child was taken to a hospital and 0 otherwise. Similarly, a community-level dichotomous variable is created to indicate whether any sick child in the cluster had been taken to a doctor for treatment of diarrhea, cough or fever. To measure whether the mother had been exposed to reproductive health messages through various channels of mass media, a dichotomous variable is created and assigned a value of 1 if the mother had heard any messages and 0 otherwise. Sources of media message include radio, television, newspaper, posters and brochures. For the ANC model, the media sources are restricted to radio, television and newspaper to reduce the potential correlation with media sources that could be found where ANC services are provided (i.e. posters, brochures). Because the surveys ask only about family planning messages, this variable does not capture messages about broader reproductive health information. A dichotomous variable was also included to control for exposure to mass media in general (i.e. watching television, listening to the radio or

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examination of uterine contents afterward (Piet-Pelon 1997). Thus, pregnancy is not confirmed before the procedure.

reading a newspaper). Finally, we included a fixed effect for each survey to capture survey-specific differences.

6 Results

6.1 Descriptive Analysis

Figure 2 illustrates the trends in maternal healthcare use between 1993 and 2007 in the dataset. Skilled attendance at birth increased from 11% in 1993 to 24% in 2007. The proportion of births taking place in a health facility steadily increased from only 4% to 19%. Four or more ANC visits during pregnancy also increased from a very low 6% to 23%. Of these outcomes, delivery in a facility increased the greatest as a percentage of the initial level of service use.

Figure 2. Trends in Maternal Healthcare Utilization, 1993-2007 (*n*=16,830 births)

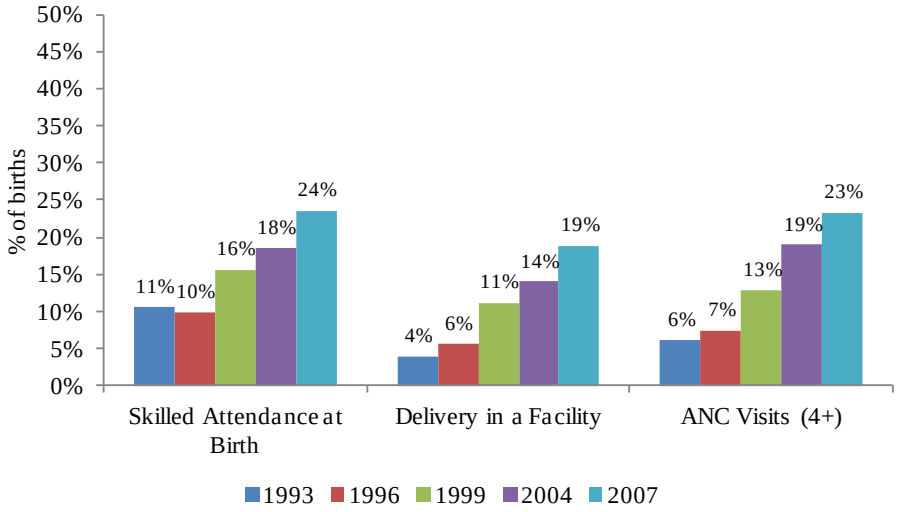


Table 2 presents the general profile of women in the sample in the first and last surveys. The proportion of women with no education decreased from 56% in 1993 to 25% in 2007. While the proportion of women completing increased from 27% to 31%, the increase in completion of secondary school was greater – 14% to 36%. The proportion of women with higher education was 8% in 2007, an increase from 2% in 1993. The household asset index increased from 3.41 to 5.64. The proportions of women who are Muslim and Hindu stayed relatively stable, with the overwhelming majority being Muslim. The average size of the household became smaller by about one member, and the average age of women in the sample remained at 25 years.

A higher proportion of births reported in the three years before the 2007 survey were first births than in the corresponding period before the 1993 survey, and the proportion of mothers between the ages of 35 and 49 remained stable. While experience with previous neonatal deaths decreased between 1993 and 2007, previous pregnancy termination increased marginally.

With respect to enabling factors, urban residence more than doubled from 14% to 36%, and the average asset index for other households in the cluster also increased substantially. Treatment of

Table 2. Descriptive Summary of Variables, 1993 and 2007

	1993 (*n*=3409)		2007 (*n*=2924)	
	Mean	Std. Dev.	Mean	Std. Dev.
Predisposing Factors				
Education				
No education	0.56	0.50	0.25	0.43
Primary school	0.27	0.45	0.31	0.46
Secondary school	0.14	0.35	0.36	0.48
Higher education	0.02	0.14	0.08	0.28
Household asset index	3.41	2.54	5.64	2.94
Religion				
Muslim	0.89	0.32	0.90	0.29
Hindu	0.11	0.31	0.09	0.29
Household size	6.81	3.51	6.20	3.08
Perception of Risk Factors				
First birth	0.25	0.44	0.32	0.46
Older age at birth	0.06	0.24	0.06	0.24
Previous neonatal death experience	0.15	0.36	0.10	0.30
Previous pregnancy terminated	0.13	0.34	0.15	0.36
Enabling Factors				
Urban	0.14	0.35	0.36	0.48
Household asset index (cluster)	3.48	1.87	5.75	2.28
Treatment at hospital of a child (cluster)	0.34	0.47	0.22	0.41
Treatment by doctor of a child (cluster)	0.46	0.50	0.59	0.49
Exposure to FP messages in media	0.47	0.50	0.36	0.48
Exposure to mass media	0.44	0.50	0.54	0.50

a sick child in the community for diarrhea, cough or fever decreased – in 1993, 34% of clusters had at least one sick child treated at hospital but in 2007 that percentage dropped to 22%. In contrast, treatment of a sick child by a doctor increased at a cluster level – in 1993, 46% of clusters had at least one sick child treated by a doctor for the illnesses mentioned, and it increased to 59% of clusters in 2007. Exposure to family planning messages decreased from 47% of women in 1993 to 36% of women in 2007 seeing, reading or hearing the messages in the media. General exposure to mass media, however, increased from 44% to 54% of women being exposed to various channels of mass media.

6.2 Regression Analysis

6.2.1 Predisposing Factors

Table 3 presents the odds ratios (OR) for maternal healthcare utilization estimated using the model in Equation (4.1). Mother's education is a strong and significant predictor of utilization of all three services. Compared to women with no education, women who completed primary school have 1.4 times the odds of skilled attendance at birth, 1.7 times the odds of delivering in a health facility and 1.6 times the odds of the recommended number of ANC visits. The effects increase with level of education completed with higher education having the greatest effect. Women with higher education have 9.8 times the odds of skilled attendance at birth, 11.2 times the odds of delivery in a facility and 12.4 times the odds of four or more ANC visits.

Household wealth is also a significant predictor of service utilization. For every one unit increase in the household asset index, there are 1.2 times the odds of using any of these maternal health services. The results for religious affiliation are mixed. While there is no significant association between religion and delivery in a facility or ANC visits, Muslim women have lower odds of having skilled attendance at birth. The size of the household does not appear to matter for use of any of these maternal health services.

6.2.2 Perception of Risk Factors

Women for whom it is the first birth have significantly higher odds of service utilization. Compared with those for whom it is not the first birth, these women have 1.8 times the odds of skilled attendance at delivery, 1.9 times the odds of delivery in a facility and 1.3 times the odds of four or more ANC visits. Perceptions of risk for women age 35 and older at birth is a

Table 3. Multilevel Random Effects Logistic Modeling of Maternal Healthcare Utilization for Births in the Three Years Prior to Survey to Ever-Married Women Age 15-49

	Skilled Attendance at Birth		**Delivery in a Facility**		**ANC Visits (4+)**	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Survey Fixed Effects (ref=1993)						
Survey 2	0.789**	(0.649 - 0.958)	1.339**	(1.015 - 1.765)	1.187	(0.938 - 1.504)
Survey 3	0.825**	(0.685 - 0.994)	1.946***	(1.507 - 2.513)	1.506***	(1.202 - 1.888)
Survey 4	0.756***	(0.631 - 0.905)	1.901***	(1.487 - 2.430)	1.978***	(1.603 - 2.441)
Survey 5	0.899	(0.743 - 1.090)	2.376***	(1.840 - 3.068)	2.169***	(1.732 - 2.714)
Predisposing Factors						
Education (ref=no education)						
Primary school	1.397***	(1.198 - 1.630)	1.709***	(1.388 - 2.104)	1.592***	(1.335 - 1.898)
Secondary school	2.993***	(2.561 - 3.497)	3.639***	(2.967 - 4.464)	3.783***	(3.175 - 4.507)
Higher education	9.762***	(7.755 - 12.29)	11.21***	(8.627 - 14.56)	12.40***	(9.718 - 15.82)
Household asset index	1.205***	(1.174 - 1.237)	1.217***	(1.180 - 1.256)	1.189***	(1.156 - 1.223)
Religion (ref=other religion)						
Muslim	0.471**	(0.249 - 0.891)	0.875	(0.374 - 2.050)	1.015	(0.455 - 2.263)
Hindu	0.941	(0.491 - 1.804)	1.928	(0.812 - 4.574)	1.422	(0.628 - 3.217)
Household size	1.000	(0.985 - 1.015)	1.002	(0.984 - 1.020)	1.01	(0.994 - 1.027)
Perception of Risk Factors						
First birth	1.842***	(1.644 - 2.063)	1.911***	(1.671 - 2.185)	1.309***	(1.159 - 1.480)
Older age at birth	1.415***	(1.111 - 1.802)	1.661***	(1.237 - 2.231)	0.704**	(0.518 - 0.955)
Previous neonatal death	1.226**	(1.020 - 1.474)	1.263*	(0.996 - 1.600)	1.119	(0.908 - 1.378)
Previous stillbirth/miscarriage	1.233***	(1.070 - 1.421)	1.386***	(1.173 - 1.637)	1.590***	(1.370 - 1.845)

Table 3 continued

	Skilled Attendance at Birth		Delivery in a Facility		ANC Visits (4+)	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Enabling Factors						
Urban (ref=rural)	1.505***	(1.282 - 1.767)	1.409***	(1.165 - 1.704)	1.584***	(1.326 - 1.891)
Cluster's household asset index	1.141***	(1.097 - 1.188)	1.178***	(1.124 - 1.234)	1.141***	(1.092 - 1.191)
Division (ref=Barisal)						
Chittagong & Sylhet	0.878	(0.717 - 1.075)	1.114	(0.859 - 1.445)	0.89	(0.706 - 1.122)
Dhaka	0.925	(0.750 - 1.141)	1.421***	(1.089 - 1.854)	1.066	(0.840 - 1.354)
Khulna	1.668***	(1.332 - 2.089)	2.558***	(1.935 - 3.383)	1.372**	(1.060 - 1.776)
Rajshahi	1.221*	(0.983 - 1.516)	2.143***	(1.633 - 2.813)	1.724***	(1.358 - 2.188)
Treatment at a hospital of a child in cluster	1.259***	(1.113 - 1.425)	1.168**	(1.006 - 1.355)	1.157**	(1.006 - 1.331)
Treatment by a doctor of a child in cluster	1.129**	(1.001 - 1.273)	1.099	(0.948 - 1.274)	1.011	(0.883 - 1.156)
Exposure to FP messages in media[†]	1.173**	(1.031 - 1.335)	1.111	(0.951 - 1.297)	1.351***	(1.176 - 1.553)
Exposure to mass media	1.175**	(1.017 - 1.357)	1.152	(0.961 - 1.381)	1.220**	(1.040 - 1.430)
Constant	0.017***	(0.009 - 0.035)	0.001***	(0.000 - 0.003)	0.003***	(0.001 - 0.007)
Observations	16830		16830		16830	
Number of cluster	580		580		580	

*** p<0.01, ** p<0.05, * p<0.1. [†] For the skilled attendance at birth and delivery in a health facility models, the media sources include radio, television, newspaper, posters and brochures. For the ANC model, the media sources are restricted to radio, television and newspaper.

significant predictor for skilled attendance at birth (OR=1.4) and delivery in a facility (OR=1.7). However, older mothers have lower odds of having the recommended number of ANC visits. While women who had experienced a previous neonatal death have higher odds of skilled attendance at birth (OR=1.2) and delivery in a facility (OR=1.3), there is no significant association for ANC visits. Experience with a previous pregnancy termination (from miscarriage, stillbirth or abortion) resulted in higher odds of utilization for all three services. Women who had an earlier pregnancy terminated had 1.2 times the odds of skilled attendance at birth, 1.4 times the odds for delivery in a facility and 1.6 times the odds of completing four or more ANC visits compared to women who had never experienced a pregnancy termination.

6.2.3 Enabling Factors

As evident in Table 3, the type of neighborhood has a significant effect on maternal health service utilization. Women living in an urban area have 1.4-1.6 times the odds of using any of these services compared to women living in a rural area. Furthermore, there is a higher likelihood that services are utilized by women in wealthier neighborhoods. A one-unit increase in the average household asset index of other women around her is associated with 14% higher odds of skilled attendance at birth and recommended ANC visits and 18% higher odds of delivering in a health facility.

The results for the divisions are mixed, but women residing in Khulna and Rajshahi have significantly higher odds of using all of the maternal health services. Women in Khulna have the highest likelihood of skilled attendance at birth and delivery in a facility, while women in Rajshahi are most likely to have four or more ANC visits. The relatively large effects of division reflect unobserved factors that are unaccounted by the model. One example is religiosity. In

divisions of Barisal, Sylhet and Chittagong, religiosity tends to be higher compared to Rajshahi, Khulna and Dhaka which are known to be religiously more progressive. Another example is structural differences related to the availability or accessibility of facilities between divisions, which reflects one of the limitations of the DHS data (i.e. lack of health systems and other structural data).

Treatment at a hospital of a sick child is associated with higher odds for service utilization for all three outcomes – women in these clusters have 1.3 times the odds of skilled attendance at birth and 1.2 times the odds of delivering in a facility and using ANC services compared to women in whose cluster no sick child was reported as having received treatment at a hospital. The results are not as strong for treatment of a child by a doctor. While treatment of a sick child by a doctor is associated with 13% higher odds of skilled attendance at birth, there is no significant association with use of the other services.

Exposure to media messages about family planning is associated with higher odds of skilled attendance at birth and ANC visits. A woman who is exposed to family planning messages has 17% higher odds of skilled attendance at birth compared to a woman who has not been exposed to these messages. Similarly, a woman who is exposed to the messages has 35% higher odds of completing four or more ANC visits during pregnancy. Exposure to mass media in general is also associated with higher likelihood of using these two services – women with exposure to mass media have 1.2 times the odds of skilled attendance at birth and ANC visits compared to women with no exposure.

Finally, after including all of the explanatory variables in the model, the survey fixed effects indicate a secular increase in utilization over the 1993-2007 period for delivery in a facility and

for ANC visits. However, results also indicate that this is not the case for skilled attendance at birth. This is in contrast to the overall increase in all services as illustrated in Figure 2, but the decomposition analysis below provides a better understanding of the estimates.

6.3 Decomposition Analysis

The effects of the various predisposing, perception of risk and enabling factors over the study period can best be understood through a decomposition analysis for each healthcare service. The purpose of the decomposition analysis is to identify the portion of increase in service utilization over the sample period that was accounted for by changes in each independent variable. There are three components to this decomposition: (1) the effect of each independent variable as estimated by the regression parameter, (2) the change in the independent variable over the course of the study period, and (3) the change in the dependent variable over the study period. The calculation for the percent explained by each independent variable, *x*, is presented in Equation (4.2).

$$(2) \qquad \%\ explained\ by\ x = \frac{\hat{\beta}_x \ * \ \Delta\bar{x}}{\Delta\bar{y}} * 100$$

where Δx is the change in independent variable *x* between the first and last surveys, $\hat{\beta}_x$ is the estimated parameter for *x* and $\Delta\bar{y}$ is the change in the dependent variable (probability of service utilization) between the first and last surveys.[7] According to Equation (4.3), 95% upper and

[7] This is not a full-fledged regression decomposition as delineated by Oaxaca (1973) and Blinder (1973), which uses a combination of (a) a weighted average of coefficients and (b) coefficients from separate regression models for each "group" to explain differences.

lower bounds for the percent explained were also calculated to get a sense of the accuracy of the estimate.

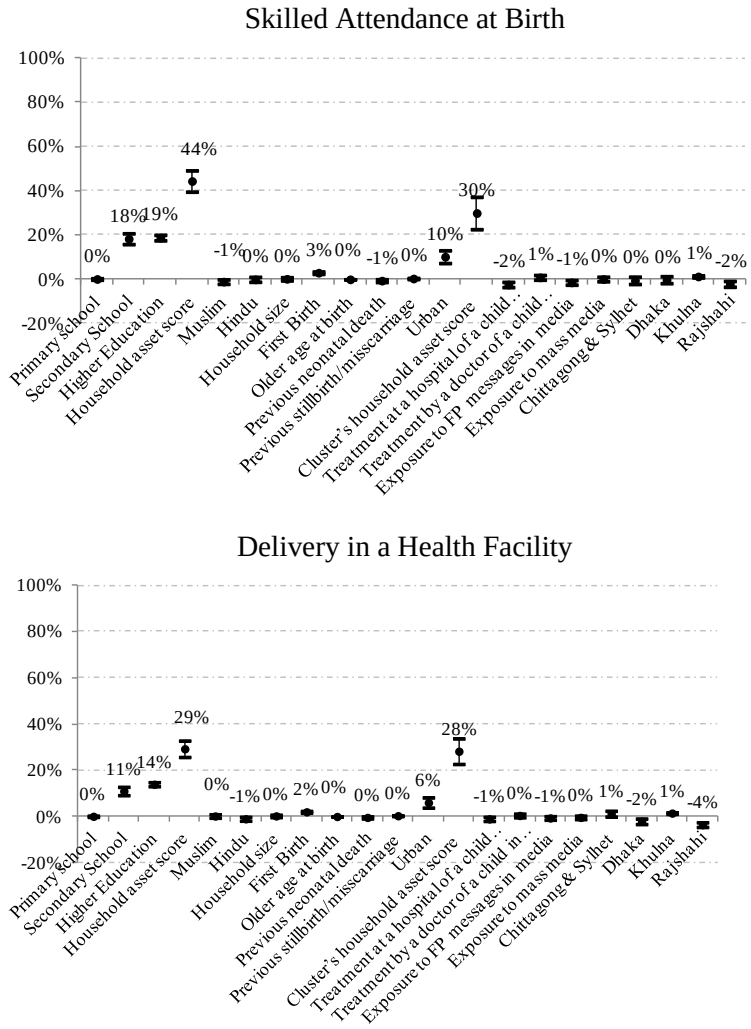
$$(3) \qquad \%\ explained\ by\ x = \frac{[\hat{\beta}_x \pm (1.96 * se_x)] \ * \ \Delta\bar{x}}{\Delta\bar{y}} * 100$$

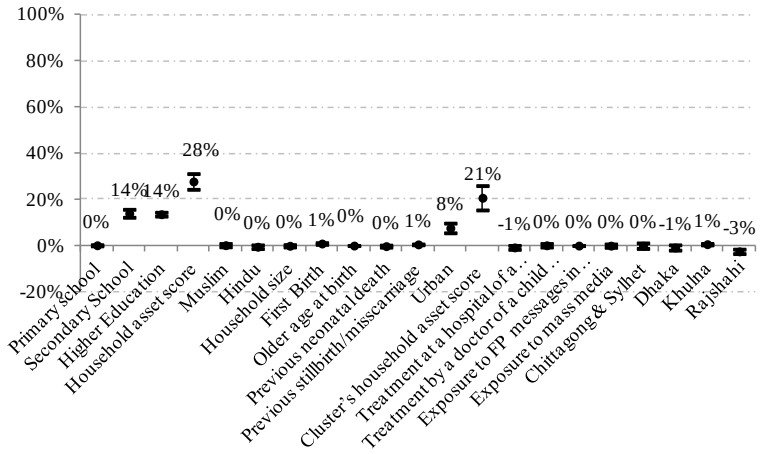
Decomposition analyses are more easily carried out within a linear regression framework. Thus, we re-estimate the models shown in Table 3 using multilevel linear regressions. As shown in Figure 3, the changes in the explanatory factors included in the model are able to explain much of the increases in maternal healthcare service utilization between 1993 and 2007. (See Tables A1-A3 in the appendix for calculations.) For skilled birth attendance, the model over-predicts the increase in utilization – that is, a larger increase in service utilization is predicted than actually occurred. For delivery in a health facility and the recommended number of antenatal care visits, 85% and 81%, respectively, of the increase in utilization is explained.

Skilled birth attendance in the three years prior to the survey increased from 11% in 1993 to 24% in 2007. A substantial portion of the increase (44%) is explained by improvements in the individual's household asset index, which increased by two units over the study period. Other predisposing factors that contribute to the explanation are secondary school and higher education, together accounting for 37% of the observed change. The only perception of risk factor that explained any of the increase in skilled birth attendance is first birth (3%). Improvements in the average asset index of women around her explain an additional 30% of the increase in utilization and urban residence contributes 10%. As reported in Table A1, the changes in the independent variables explain in total 119% of the increase in skilled birth attendance over the time period. This result suggests that given the changes in the independent variables, there should have been

more of an increase in skilled birth attendance than is evident. The implication of this is the presence of forces countering the positive effects of factors such as education, household wealth,

Figure 3. Decomposition Analysis by Type of Maternal Healthcare Service: Percent of Increase in Service Utilization between 1993 and 2007 Explained by Explanatory Variables





neighborhood wealth and first birth on service utilization. Another explanation might be a measurement or reporting issue with the 1993 survey.

The percentage of deliveries taking place in health facilities increased from 4% to 19% over the study period, and changes in the explanatory factors account for 87% of this increase in utilization (Table A2). (The coefficients for the survey fixed effects in Table 4 are a simple reflection of the percentage of change not explained by the explanatory variables included in the model.) As in the case of skilled birth attendance, education, household wealth and neighborhood wealth explain the majority of the increase in delivery in a facility. While improvements in education explain approximately 25% of the increase, increases in household wealth explain an additional 29%. Improvements in the average wealth index of other households in the cluster contribute similarly (28%). Urban residence explains about 6% of the increase in utilization, and again, first birth is the only predisposing factor that accounts for any of the increase in utilization (only 2%).

Finally, four or more ANC visits during pregnancy increased from 6% to 23% between 1993 and 2007, and changes in the independent variables explain 80% of the increase. The same set of

factors – education, household and neighborhood wealth, urban residence and first birth – accounts for the bulk of the increase in ANC utilization. (Table A3)

7 Conclusions and Discussion

The findings of this chapter demonstrate that a combination of predisposing, perception of risk and enabling factors have influenced the utilization of maternal healthcare services in Bangladesh between 1993 and 2007. Education and household assets predispose mothers to use all three types of maternal healthcare services. These results are consistent with earlier studies that have found educated women more likely to use services than less educated women in Bangladesh (Chakraborty et al. 2003; Bell et al. 2003; Islam and Odland 2011). The findings on household assets support previous evidence from Bangladesh that has shown wealthier women using maternal health services more than poorer women (Anwar et al. 2008; Collin et al. 2007; Bell et al. 2003). While belonging to the Muslim faith is associated with lower odds of skilled attendance at birth, there is no significant association of any faith with the other services.

With respect to perception of risk, women for whom it is a first birth are found to have higher odds of utilization of all services. Compared to younger women, mothers who are age 35 or older at the time of birth have increased odds of skilled attendance and delivery in a facility but lower odds of ANC visits. The findings on first birth and older age are generally consistent with the literature on the relationship between age and maternal healthcare use in Bangladesh (Bell et al. 2003; Islam and Odland 2011). While a previous neonatal death results in higher odds of skilled attendance at birth and delivery in a facility, there is no significant association with ANC. On the other hand, a previous pregnancy termination is associated with higher odds of using all three services. A previous pregnancy termination includes those that ended in stillbirth or miscarriage,

suggesting that women who have experienced pregnancy complications or poor pregnancy outcomes in the past have a greater perception of risk and thus are more likely to use services. However, given the available data, this also includes induced abortion and menstrual regulation which are not necessarily poor pregnancy outcomes but rather women exercising their choice in using medical services to terminate a pregnancy. Thus, the effect of this factor is likely an underestimate.

This analysis finds enabling factors to be very influential in the use of maternal health services. Residing in an urban and more well-to-do neighborhood increases the odds of women using maternal health services, results that are consistent with other studies conducted in Bangladesh (Islam and Odland 2011; Bell et al. 2003). Regional differences also appear with women residing in Khulna and Rajshahi having higher odds of utilizing services compared to those in the other divisions. Availability and accessibility may explain some of these community-level differences in maternal health care use, including factors like the presence of facilities that are staffed and equipped to provide quality health services. The distances to facilities in Khulna and Rajshahi may also be less than in other divisions – or the roads and available transport may be better or less costly. In addition, there may be unobserved cultural and social differences between the regions that make women more or less likely to seek care. Exposure to media messages about family planning increases the odds of utilization of skilled birth attendance and ANC but there is no association for delivery in a facility. Exposure to mass media in general follows a similar pattern. The results on exposure to mass media is consistent with the findings of Islam and Odland's (2011) study on the use of antenatal and postnatal care services. With respect to specific health system factors, treatment at a hospital of a sick child in the community is found to be a significant determinant of all three maternal health services while treatment of a sick child by a doctor is predictive of only skilled attendance at birth. Since treatment at a hospital is a proxy

for availability and accessibility of health facilities, it is not surprising that this variable is significantly associated with delivery in a facility. The results of both of the child treatment variables suggest that perhaps if facilities and medical professionals are available and accessible, then there may be a higher likelihood of services being used. However, these factors are limited in their ability to adequately capture a health system effect and highlight a need for better health system variables in the DHS. Data on factors such as availability of facilities and services, quality of services, human resources for health and cost of services are often lacking in household surveys. Given the potential role of health system factors on maternal health service use, there is a need to collect this type of information in household and women's questionnaires to adequately identify the determinants of utilization to enable design of policies and programs appropriately to improve utilization and maternal health outcomes.

While recognizing that the analysis does not adequately capture health system effects, the decomposition analysis indicates that over the 14-year time period, the increases in all three maternal health services are explained primarily by increases in schooling (especially secondary school and higher education), improvements in household and neighborhood wealth and increases in urbanization. Thus, a strong socioeconomic gradient emerges in the utilization of maternal healthcare services. As educational improvements and economic progress have had a substantial impact on the increased utilization of maternal health services, Bangladesh should continue its efforts in girls' education in order to have a larger proportion of women having completed secondary school before becoming mothers. Since the 1990s, the Government of Bangladesh has enacted measures to improve girls' schooling such as a Female Stipend Program that provides financial support for enrolment and retention of girls in secondary school as well as a Food for Education program to increase primary school enrolment in rural areas. The results from this study reinforce the need to continue investing in girls' education in order to improve maternal

healthcare utilization. While assets at the household level have improved markedly between 1993 and 2007 on average, the majority of the women in the surveys reported having only a few assets even in 2007. Thus, policies to improve the economic situation of a large share of Bangladeshis would help increase maternal health care utilization.

However, such changes in education and household wealth are not likely to happen immediately, and the government should also focus on other efforts in the short-term. The regression results indicate that exposure to family planning messages has a positive impact on skilled attendance at delivery and ANC visits. However, the proportion of women reporting exposure to these messages decreased over the study period. These results suggest that better and more communication about family planning – and perhaps broader aspects of reproductive health – have the potential to improve the use of maternal healthcare services further. Combined with the results on education and household wealth, the implication is to focus on women who are disadvantaged with respect to education, wealth and residence (i.e. living in rural areas). Women with less education and from poorer households can be focused on for IEC/BCC to improve awareness of (i) risks of pregnancy and childbirth, (ii) benefits of healthcare to address the risks, and (iii) availability of services. A report written by Saha (2002) on Bangladesh indicated that basic delivery care was available in 52% and comprehensive emergency obstetric care in only 3% of all facilities (public and private), and specific components of ANC were lacking in a substantial percentage of facilities. Service quality is perceived to be poor in the public sector in Bangladesh, and long wait times result in patients seeking care in the private sector (Abbasi 1999). Thus, there is not only a need on the demand side to highlight to the communities the importance of antenatal and delivery care but also on the supply side to better staff, equip and stock existing facilities in order to provide the necessary services at an acceptable level of quality.

Bangladesh can also learn from neighboring countries about reducing soecioeconomic gradients for maternal healthcare utilization. To address a socioeconomic gradient in maternal health care use and improve maternal mortality, India has implemented a scheme targeted at poor women to encourage deliveries in facilities. The Janani Suraksha Yojna (JSY) program was launched in 2005 and is a conditional cash transfer scheme that provides financial incentives to mothers living below the poverty line (as well as community health workers who accompany them) to deliver in health facilities. Results have been varied across different states in India but are encouraging as a way to reduce socioeconomic gradients in maternal healthcare use (Lim et al. 2010). Similarly, the Government of Bangladesh recently piloted and has been expanding a demand-side financing scheme to encourage the utilization of maternal health services, particularly among the poor. The voucher program, financed by government and pooled donor funds, provides women with reimbursement for ANC, delivery and postnatal care services, transportation costs and a cash incentive, and has been shown to be very effective in increasing antenatal, delivery and postnatal care in pilot areas (Nguyen et al. 2012). This study's findings on the strong socioeconomic gradient in maternal healthcare use suggests that the government and donors ought to consider targeting more resources to the lower socioeconomic groups and expanding the voucher program to cover all economically disadvantaged households.

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8.1 Appendix

Figure A1: Health Belief Model as Developed by Sheeran and Abraham (1995)

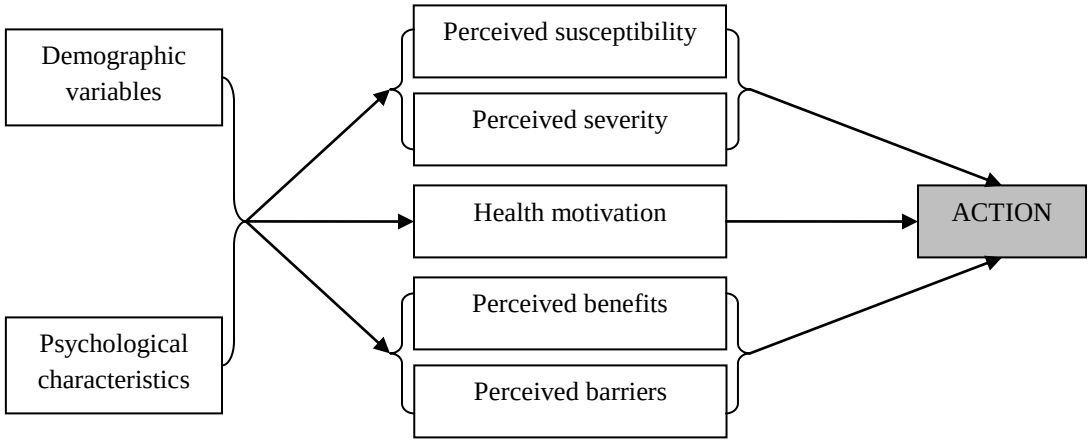

Figure A2: Theory of Planned Behavior as Developed by Conner and Sparks (1995)

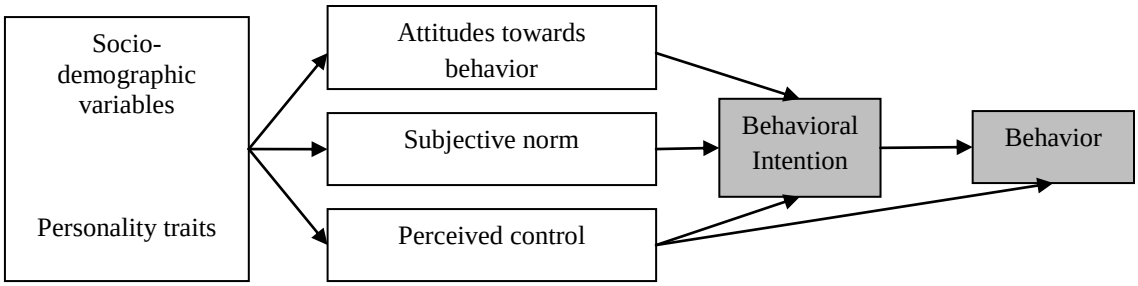

Figure A3: Socio-Behavioral Healthcare Utilization Model as Developed by Andersen and Newman (1973)

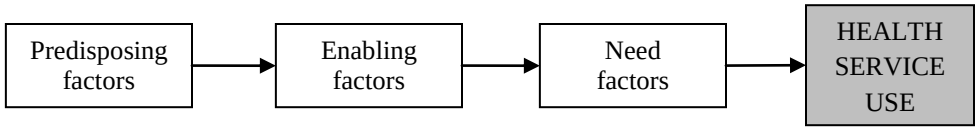

Figure A4: Socio-Behavioral Healthcare Utilization Model as Developed by Kroeger (1983)

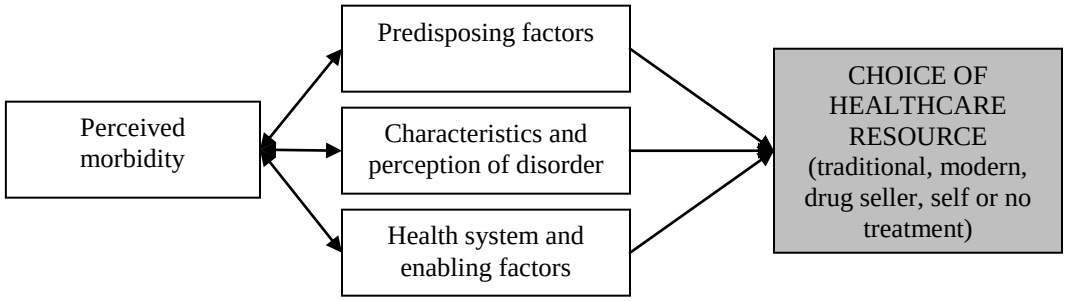

Table A1 Decomposition Analysis for Skilled Birth Attendance: Percent of Increased Utilization Explained by Independent Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1993	2007	1993-2007 Change	Coefficient	S.E.	% explained in decline in births	Lower bound	Upper bound
Skilled Attendance at Birth	0.11	0.24	0.13					
Primary school	0.27	0.31	0.04	0.00	-0.01	0%	0%	0%
Secondary School	0.14	0.36	0.21	0.11	-0.01	18%	16%	21%
Higher Education	0.02	0.08	0.06	0.40	-0.01	19%	18%	20%
Household asset score	3.41	5.64	2.22	0.03	0.00	44%	40%	49%
Muslim	0.89	0.90	0.02	-0.07	-0.03	-1%	-2%	0%
Hindu	0.11	0.09	-0.02	0.00	-0.03	0%	-1%	1%
Household size	6.81	6.20	-0.61	0.00	0.00	0%	-1%	1%
First Birth	0.25	0.32	0.06	0.06	-0.01	3%	2%	4%
Older age at birth	0.06	0.06	0.00	0.03	-0.01	0%	0%	0%
Previous neonatal death	0.15	0.10	-0.06	0.01	-0.01	-1%	-1%	0%
Previous stillbirth/miscarriage	0.13	0.15	0.02	0.02	-0.01	0%	0%	1%
Urban	0.14	0.36	0.22	0.06	-0.01	10%	7%	13%
Cluster's household asset score	3.48	5.75	2.27	0.02	0.00	30%	23%	37%
Treatment at a hospital of a child in cluster	0.34	0.22	-0.12	0.03	-0.01	-2%	-4%	-1%
Treatment by a doctor of a child in cluster	0.46	0.59	0.12	0.01	-0.01	1%	0%	2%
Exposure to FP messages in media	0.47	0.36	-0.11	0.02	-0.01	-1%	-2%	0%
Exposure to mass media	0.44	0.54	0.10	0.00	-0.01	0%	-1%	1%
Chittagong & Sylhet	0.27	0.38	0.11	-0.01	-0.01	0%	-2%	1%
Dhaka	0.32	0.22	-0.10	0.00	-0.01	0%	-2%	1%
Khulna	0.08	0.11	0.03	0.07	-0.01	1%	1%	2%
Rajshahi	0.25	0.17	-0.08	0.03	-0.01	-2%	-3%	-1%
Total						119%	87%	152%

The first two columns show the mean of the respective variables in the first and last survey years. The variables in bold indicate the variables of interest. The third column shows the difference of the means in the first and last survey periods. The fourth column contains the estimated regression coefficients. The fifth column indicates the components as a percentage of the total decline in births.

The calculation for the fifth column is as follows: $Column\ 5 = \frac{(Column\ 3 * Column\ 4)}{(Change\ in\ \text{Birth})} * 100$

Table A2 Decomposition Analysis for Delivery in a Health Facility: Percent of Increased Utilization Explained by Independent Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1993	2007	1993-2007 Change	Coefficient	S.E.	% explained in decline in births	Lower bound	Upper bound
Delivery in a health facility	0.04	0.19	0.15					
Primary school	0.27	0.31	0.04	0.00	-0.01	0%	0%	0%
Secondary School	0.14	0.35	0.21	0.08	-0.01	11%	9%	13%
Higher Education	0.02	0.08	0.06	0.36	-0.01	14%	13%	15%
Household asset score	3.41	5.64	2.22	0.02	0.00	29%	26%	33%
Muslim	0.89	0.90	0.02	0.01	-0.03	0%	-1%	1%
Hindu	0.11	0.09	-0.02	0.07	-0.03	-1%	-2%	0%
Household size	6.81	6.20	-0.61	0.00	0.00	0%	0%	1%
First Birth	0.25	0.32	0.06	0.05	0.00	2%	2%	2%
Older age at birth	0.06	0.06	0.00	0.03	-0.01	0%	0%	0%
Previous neonatal death	0.15	0.10	-0.06	0.01	-0.01	0%	-1%	0%
Previous stillbirth/miscarriage	0.13	0.15	0.02	0.02	-0.01	0%	0%	0%
Urban	0.14	0.36	0.22	0.04	-0.01	6%	4%	8%
Cluster's household asset score	3.48	5.75	2.27	0.02	0.00	28%	23%	34%
Treatment at a hospital of a child in cluster	0.34	0.22	-0.12	0.01	-0.01	-1%	-2%	0%
Treatment by a doctor of a child in cluster	0.46	0.59	0.12	0.01	0.00	0%	0%	1%
Exposure to FP messages in media	0.47	0.36	-0.11	0.01	-0.01	-1%	-1%	0%
Exposure to mass media	0.44	0.54	0.10	-0.01	-0.01	0%	-1%	0%
Chittagong & Sylhet	0.27	0.38	0.11	0.02	-0.01	1%	0%	2%
Dhaka	0.32	0.22	-0.10	0.03	-0.01	-2%	-3%	-1%
Khulna	0.08	0.11	0.03	0.09	-0.01	1%	1%	2%
Rajshahi	0.25	0.17	-0.08	0.06	-0.01	-4%	-5%	-3%
Total						85%	61%	109%

Table A3 Decomposition Analysis for Four or More ANC Visits: Percent of Increased Utilization Explained by Independent Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1993	2007	1993-2007 Change	Coefficient	S.E.	% explained in decline in births	Lower bound	Upper bound
ANC Visits (4+)	0.06	0.23	0.17					
Primary school	0.27	0.31	0.04	0.01	-0.01	0%	0%	0%
Secondary School	0.14	0.35	0.21	0.11	-0.01	14%	12%	16%
Higher Education	0.02	0.08	0.06	0.41	-0.01	14%	13%	14%
Household asset score	3.41	5.64	2.22	0.02	0.00	28%	24%	31%
Muslim	0.89	0.90	0.02	0.02	-0.03	0%	-1%	1%
Hindu	0.11	0.09	-0.02	0.04	-0.03	0%	-1%	0%
Household size	6.81	6.20	-0.61	0.00	0.00	0%	-1%	0%
First Birth	0.25	0.32	0.06	0.03	-0.01	1%	1%	1%
Older age at birth	0.06	0.06	0.00	-0.01	-0.01	0%	0%	0%
Previous neonatal death	0.15	0.10	-0.06	0.01	-0.01	0%	-1%	0%
Previous stillbirth/miscarriage	0.13	0.15	0.02	0.04	-0.01	1%	0%	1%
Urban	0.14	0.36	0.22	0.06	-0.01	8%	6%	10%
Cluster's household asset score	3.48	5.75	2.27	0.02	0.00	21%	15%	26%
Treatment at a hospital of a child in cluster	0.34	0.22	-0.12	0.01	-0.01	-1%	-2%	0%
Treatment by a doctor of a child in cluster	0.46	0.59	0.12	0.00	-0.01	0%	-1%	1%
Exposure to FP messages in media*	0.46	0.36	-0.10	0.00	0.00	0%	0%	0%
Exposure to mass media	0.44	0.54	0.10	0.00	-0.01	0%	-1%	1%
Chittagong & Sylhet	0.27	0.38	0.11	0.00	-0.01	0%	-1%	1%
Dhaka	0.32	0.22	-0.10	0.01	-0.01	-1%	-2%	0%
Khulna	0.08	0.11	0.03	0.04	-0.01	1%	0%	1%
Rajshahi	0.25	0.17	-0.08	0.05	-0.01	-3%	-3%	-2%
Total						81%	59%	104%