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What Socioeconomic Factors are Associated with Different Levels of Antenatal Care Visits
in Bangladesh? - A Behavioral Model

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Authors' contributions

SS and MM designed the study, SS and JJ carried out analysis and interpretation of data; SS,
MM and JJ wrote the manuscript and critically revised the manuscript for intellectual content.
All authors read and approved the final version.

What Socioeconomic Factors are Associated with Recommended Antenatal Care Visits in Bangladesh? – A Behavioural Model

Abstract

We identify the socioeconomic determinants of three levels of antenatal care (ANC) visits (no, intermediate (1-3), and recommended (≥ 4)) in Bangladesh using a behavior model framework for healthcare utilization. Using multinomial logistic regression, we found that different levels of visits had different determinants, e.g. media exposure increased the likelihood of intermediate compared to no visits while desire for pregnancy increased the likelihood of recommended compared to intermediate visits. We therefore highlight that ANC policies or interventions should be target-group specific as determinants differ depending on level of ANC visits.

Keywords: Antenatal care, Bangladesh, pregnancy care, demography and health survey.

The World Health Organization (WHO) recommends a minimum of four antenatal care (ANC) visits for uncomplicated pregnancies (routine ANC) (Organization, 1994). Although the determinants of ANC visits are much researched, the focus has been on adequate vs. inadequate visits (Simkhada, Teijlingen, Porter, & Simkhada, 2008). Researchers have generally failed to consider the variation within inadequate visits. Arguably, even if not reaching four visits, some (intermediate) visits are better than none. The factors that influence the help seeking behavior, and especially those that are against reaching recommended number of visits, might be different among those without any ANC visits compared to those with intermediate number of visits. Therefore, it is important to know which socioeconomic determinants influence which groups, and to what extent, in order to design effective policies and interventions. This is of particular importance as it could potentially be easier to increase intermediate visits to recommended visits although more beneficial in terms of health to increase no visits to intermediate visits. These findings can have a beneficial role for policy making not only in Bangladesh but also in other resource poor settings of Asia and Africa where a great underutilization of ANC prevails (Zanconto, Msolomba, Guarenti, & Franchi, 2006).

Antenatal care (ANC) is a specialized pattern of care organized for pregnant women that enable them to attain and maintain good health throughout the pregnancy period (WHO, 1994). It includes providing health information about pregnancy complications and danger signs, symptoms, and risks of labor and delivery, importance of seeking medical care, and delivery with the assistance of skilled health care personnel (WHO, 1994). Many health problems related to pregnancy are preventable, detectable, or treatable by trained health workers (Carroli, Rooney, & Villar, 2001; WHO, 1994). In addition, researchers showed that

ANC visits during pregnancy have positive impact on postnatal utilization of health services which have a positive impact on the health status of the child (Dhakal et al., 2007; Oyerinde, 2013) including a reduction in neonatal deaths (Fottrell et al., 2013).

Bangladesh was on track but failed to achieve Millennium Development Goal (MDG) 4 (reducing under-five child mortality by two-thirds) and 5 (reducing maternal mortality by three quarters) (United Nations, 2015). The Sustainable Development Goals (SDG) 3.1-2 are even more challenging (reduce the global maternal mortality ratio to less than 70 per 100,000 live births and end preventable deaths of newborns and under-five children by 2030). For example, the current neonatal mortality rate is 24 per 1,000 live births (2014) (United Nations, 2014) and the maternal mortality rate is 176 per 100,000 live births (2015) (World Bank, 2015) in Bangladesh. A potential contributing factor for failing to reach the MDGs could be low utilization of ANC as only 25.5% of mothers achieve recommended visits (National Institute of Population Research and Training [NIPORT], 2013). Although the Bangladeshi government, non-governmental organizations (NGOs), and different international organizations are working together to ensure improved use of ANC visits, the achievement is still not satisfactory. Therefore, attention is warranted to investigate what might influence the use of ANC visits to implement specific interventions, which in turn, might be helpful towards reaching the SDG 3.1-2 not only in Bangladesh but also other resource poor settings.

Previously researchers have tried to identify the factors associated with ANC visits in Bangladesh (Abedin, Islam, & Hossain, 2008; Shameem Ahmed, Sobhan, Islam, & Barkat-e-Khuda, 2001; Amin, Shah, & Becker, 2010; Haque, Rahman, Mostofa, & Zahan, 2012; Islam, Odland, & Islam, 2011; Kishowar Hossain, 2010; M. Rahman, Islam, & Islam, 2008) with little agreement on important predictors. In those studies, researchers use either older

data from previous Demography and Health Surveys (Haque et al., 2012; Kishowar Hossain, 2010; M. Rahman et al., 2008) or samples unrepresentative of the population (Abedin et al., 2008; Amin et al., 2010; Islam et al., 2011). Moreover, the focus has been on adequate vs. inadequate visits and has not differentiated between inadequate visits.

The purpose is therefore to examine the socioeconomic factors associated with recommended, intermediate, and no ANC visits in Bangladesh using a conceptual behavioral model for healthcare services utilization for developing countries.

METHODS

Data source

We used Bangladesh Demographic Health Survey' (BDHS)'2011 data. The survey was conducted by the National Institute for Population Research and Training (NIPORT) and funded by U.S. Agency for International Development (USAID) (NIPORT, 2013). It is a nationally representative survey with stratified, multistage cluster sample of 600 enumeration areas (EAs) from urban and rural areas. From 17,964 selected households in EAs, 17,511 were occupied and from these, 17,842 ever married women aged 15-49 years were interviewed with a response rate of 98%. The sampling technique, survey design, data collection, quality control, ethical approval and participants' consent for the BDHS'2011 has been described elsewhere (NIPORT, 2013). For this study, women who had at least one child in the previous three years preceding were included in order to reduce potential recall bias. Therefore, the sample for this study is 4,672 women.

Conceptual framework

We adapted the behavioral model framework of Andersen (Andersen, 1995) for ANC utilization, which has been used previously in developing countries (Amin et al., 2010; Thind, Mohani, Banerjee, & Hagigi, 2008; Titaley, Dibley, & Roberts, 2010). In the model

several variables are outlined under four factors that affect healthcare utilization: external environment, predisposing-, enabling-, and need factors. External environment factors cover the state of physical environment. The predisposing factors reflect the individuals' propensity and ability to cope with health deterioration, including timely healthcare seeking behavior. Enabling factors represents the actual ability of the individual to obtain healthcare services, such as knowledge of where to seek care and ability to pay. Finally, need factors cover the individual's actual healthcare needs. The need for healthcare can be judged by the women or family members (perceived need) or by healthcare professionals (evaluated need), for example based on the symptoms experienced in prior pregnancies or the severity of illness in the current pregnancy. The four factors of the model are outlined in Figure 1 together with the associated variables used in the current study.

Variable specification

Dependent variable

We considered women who visited any ANC providers (medically or non-medically trained) during pregnancy to have received ANC. Women with 1–3 visits, although not reaching recommended level (≥ 4), are assumed to obtain some benefit. The dependent variable used in the current study is therefore categorized into three groups: no (0), intermediate (1–3), and recommended (≥ 4) visits.

Independent variables

We included region and place of residence (rural/urban) as external environment factors. Rural residents have less access to healthcare centers compared to urban residents and are also differently affected by health risks (Hajizadeh, Alam, & Nandi, 2014).

Bangladesh's seven administrative divisions or regions; Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, and Sylhet have in-between geographical variation, for example flood prone areas, (Barisal and Dhaka), hilly regions (Chittagong and Sylhet), cyclone prone

(Khulna, Barisal) and “monga” (seasonal food scarcity) areas (Rajshahi and Rangpur). These variations can be expected to have impact on healthcare need and use (NIPORT, 2013).

We included education of the parents, birth order, and religion of the household as predisposing factors. Parents’ education has been found to be positively related to health seeking behavior for their children in general and also during pregnancy (Tey & Lai, 2013). Education was categorized into no-, incomplete primary-, complete primary-, incomplete secondary-, and secondary/higher education, in line with the BDHS’2011 report (NIPORT, 2013). Completion of primary education indicates 5 years of schooling while completion of secondary education corresponds to 10 years of schooling. Birth order is considered a predisposing factor as women are more likely to seek healthcare services for first order than higher birth order as the perceived risk is higher for first pregnancy (Chakraborty, Islam, Chowdhury, Bari, & Akhter, 2003). Thus the variable was dichotomized as first born vs. second or higher born. Researchers have shown that the Muslim women are more likely to visit ANC services compared to other religions in developing countries (Simkhada et al., 2008). It is therefore hypothesized that religion might capture beliefs and attitudes toward ANC visits and thus the individuals’ predisposition of utilizing ANC. The variable was dichotomized into Muslim vs. non-Muslim, as Islam is the predominant religion in Bangladesh.

Enabling factors, i.e. the ability to seek help when needed, are captured in the model by wealth status, husband’s occupation, media exposure and attachment to any NGO. The ability to pay for healthcare is an important enabling factor. This is captured in the current study through household wealth status and husband’s occupation, the latter being a proxy for income. Wealth was assessed in the BDHS in terms of an (interviewer-observed) assets-based wealth index. The variable was categorized into five quintiles of relative wealth: poorest, poorer, middle, richer, and richest and is kept as same for this study (NIPORT, 2013).

Husband occupation is categorized into three broad groups where the low-income group includes agricultural workers and day laborers; the middle-income group includes factory workers; while the high-income group constitutes of businessmen and mid- or high-level workers. Belonging to a NGO such as Grameen bank, Bangladesh Rural Advancement Committee (BRAC), *Bangladesh Rural Development Board* (BRDB), ASHA or other microcredit institutions is also connected to the ability to pay for healthcare as it enables women to either pay for ANC visits through microloans from these organizations or through access to the medically trained professionals employed by these organizations. Finally, knowledge about ANC services and where to get the services is considered to be an important enabling factor. Therefore, the frequency the respondent reads newspapers, listens to the radio, and watches the television are included in the model as information campaigns on family planning, maternal-, and child health are broadcasted in media regularly. The variable was dichotomized as yes/no if the respondent was exposed to (any) media.

The health status of the woman and the fetus during pregnancy are prerequisite to be captured by the need factor. However, this information is lacking in the data and we instead utilize if the mothers' have any terminated pregnancy, which includes miscarriage, abortion and stillbirth, dichotomized as yes/no. The hypothesis is that having complications in previous pregnancy creates a more cautious pregnancy and thereby increase the number of ANC visits (Thind et al., 2008). A variable for whether or not the pregnancy was intended was also included to capture the need for ANC. Previously, researchers have shown that willingness to visit healthcare professionals are higher for desired pregnancies (Dibaba, Fantahun, & Hindin, 2013).

Data analysis

We performed the analyses in STATA 14 (Stata-Corp, College Station, TX, USA) with the "svy" command to account for the cluster sampling design used in the survey.

We used multinomial logistic regression model as the dependent variable has three categorical outcomes (Long & Freese, 2006). The results are presented as relative risk (RR) ratios, which is obtained by exponentiating the estimated coefficients and can generally be interpreted as odds ratios. When presenting the results for all three choice sets the sum of the coefficients of no vs. intermediate visits and intermediate vs. recommended visits are equal to the coefficients of the no vs. recommended visits choice set. This fact allows the determinants to differ between levels of ANC visits. In order to facilitate interpretation of the results the marginal effects at the mean of the independent variables were also estimated, which shows the probability of being in a specific outcome category. Estimating marginal effects at the mean assumes that the sample is representative of the population at the mean; a less strict assumption than the alternative average marginal effects, which assumes that the sample's distribution, is representative of the population. Multicollinearity and interaction effects were evaluated for the model by checking correlation and variance inflation factors (VIF) and tolerance values. Univariate analyses using chi square tests were also performed.

RESULTS

The majority of the respondents had intermediate visits (41%) followed by no visit (31%), and recommended visits (28%). We present the characteristics of the respondents in Table 1. All variables are significantly related to ANC visits in univariate analyses. Education was, for example, positively associated with number of visits while high birth order and living in a rural setting was associated with fewer visits. There is also a significant pro-rich association between wealth and ANC visits.

We present the RR ratios of the fully adjusted model in table 2. The highest estimated risk was found in the choice set of no vs. recommended visits where mothers with no education had 8.94 (95% CI, 5.2-15.3) times higher risk of no visits compared to secondary and higher educated women. Wealth index was also a strong predictor where the poorest

mothers, compared to the richest, had 7.16 (95% CI, 4.5-11.3) times higher risk of no compared to recommended visits.

The marginal effects at the mean (Table 3) are easier to interpret than the RR ratios. For mothers with no education, the probabilities of having no visits were 31% ($p<0.001$) higher compared to mother with secondary or higher education, all other variables taken at the mean. The same group had 26% ($p<0.001$) lower probability of having recommended visits. A similar effect is found for wealth status where the poorest, compared to the richest, had 27% ($p<0.001$) higher probability of having no visits and 24% ($p<0.001$) lower probability of having recommended visits. Several other variables are significant with expected sign. For example, mothers with unwanted pregnancy had 6% ($p<0.05$) lower chance of having recommended visits and mothers with a previously terminated pregnancy had 4% ($p<0.05$) higher chance of achieving recommended visits, comparing to the counterparts. The VIF values did not show any multicollinearity among the variables as all of those had values lower than 10 (Bruin, 2006).

DISCUSSION

In this study, we estimated the determinants related to recommend ANC visits in Bangladesh and also compared with two groups, no and intermediate ANC visits. Beside many other determinants, we found that maternal education and household wealth status were the strongest determinants of ANC visit.

We described four groups of factors in the conceptual model that affecting number of ANC visits; the external environment, predisposing-, enabling-, and need factors. We found that enabling and predisposing factors were the most important determinants of number of ANC visits, followed by external environment and need factors. Within factors, we found that economic status and mother's education were the most important determinants followed by region, residence and birth order in all the choice sets. Husband's education, husband's

occupation, media exposure, desire for pregnancy and previously terminated pregnancy were found to only affect certain levels of visits¹ (Table 2). Religion and belonging to an NGO were found not to influence level of ANC visits in the adjusted model.

In terms of predisposing factors, several studies from other countries (e.g. (Guliani, Sepehri, & Serieux, 2014; Saad–Haddad et al., 2016; Simkhada et al., 2008) and also from Bangladesh (Kishowar Hossain, 2010; M. Rahman et al., 2008) have found that women’s education was one of the best predictors for ANC visit, which is in line with our finding. Several pathways had been suggested through which mother’s education might affect ANC visits, including greater knowledge about the importance of health services and increased ability to select the most appropriate service for their needs (Kishowar Hossain, 2010; M. Rahman et al., 2008). We also found that husband’s education had some effect on the probability of having intermediate visits compared to no visits, although much smaller than the effect of women’s education. This has important policy implications as providing education to the fathers can reduce the proportion of no visits. It will however not affect the proportion of recommended visits.

We also found that higher birth order, another predisposing factor, was associated with all levels of ANC visits. The reason might be that women rely on previous pregnancy experience and thus feel reduced need for ANC visits compared to the first birth. Another reason might be that they need to stay at home to take care of elder siblings (Titaley et al., 2010). The final predisposing factor, religion, was found not to be a significant predictor for ANC visits. This is in accordance with some prior studies (Abedin et al., 2008) and in opposition to others (Haque et al., 2012; M. Rahman et al., 2008).

Regarding the external environment, we found that Sylhet division had the highest probability of no visits, as shown previously (Kishowar Hossain, 2010). Inhabitants in Sylhet

¹ This was not due to the variables husband’s education and occupation capturing the same effect as excluding one only had a small effect on the practical and statistical significance of the other.

division have the lowest access rate to healthcare centers (Baqui et al., 2008), which might explain the negative association to ANC visits. However, Dhaka and Chittagong divisions have the highest density of physician compared to the other divisions (Syed Ahmed, Hossain, Raja Chowdhury, & Bhuiya, 2011) and still the association was negative compared to Rangpur. The reason might be there are diversities within Dhaka and Chittagong divisions with many slums and high inequality. Researchers have suggested a negative relationship between rural residence and ANC visits, due to the longer distance to the healthcare centers (Haque et al., 2012; M. Rahman et al., 2008). We found the same effect although the negative effect might be stronger for recommended than intermediate visits.

The second strongest predictor, wealth index or the household economic status, was an enabling factor. This is in line with a systematic review suggesting that household economic status had a high impact on ANC visits (Guliani et al., 2014; Saad-Haddad et al., 2016; Simkhada et al., 2008). The reason might be that the richest women can afford health services and associated costs. The same line of reasoning can be applied to husband's occupation, which was considered a proxy for income. Compared to being a professional, being in the lower income group reduced the probability of having recommended visits compared to intermediate, but did not influence the probability of intermediate visits compared to low.

We found different results for two other variables for enabling factor. Exposure to media, i.e. if the respondent reads newspapers, watches the TV or listens to the radio, had significant positive effect on the ANC visits as previously shown among some indigenous population in Bangladesh (Islam et al., 2011). Media is an important source for information and can therefore increase knowledge about the existence of ANC services and its benefits and have a positive effect on health seeking behavior (Amin et al., 2010). We found that media exposure does reduce the likelihood of no visits but mainly by increasing intermediate

and not recommended visits. Belonging to an NGO and thereby having easy access to a healthcare professionals and microloans was not associated with number of ANC visits which is contrary to the findings of two previous studies from Bangladesh (Quayyum et al., 2013; K. M. Rahman, 2009). This raises the question if NGO membership does not reach the ones in most need alternatively why microloans are not used to pay for ANC (Arvidson, 2008).

Regarding need factor, we found that desired pregnancy was positively associated with recommended compared to intermediate visits, while no association could be found for intermediate compared to no visits. Researchers have previously reported that unwanted pregnancies are associated with fewer ANC visits (Gabrysch & Campbell, 2009; M. M. Rahman, Rahman, Tareque, Ferdos, & Jesmin, 2016; Titaley et al., 2010), which is in line with our study findings. Having previously been exposed to a terminated pregnancy was associated with an increased probability of having recommended compared to intermediate visits, but not with intermediate compared to no visits. Although the significant relationship is in line with expectations, both the size of the RR ratio and the statistical significance might be underestimated as the variable was composed of both voluntary and involuntary termination of pregnancy where only the latter is expected to influence ANC utilization behavior.

From a policymaking perspective, the enabling factors have high degree of mutability as suggested by Andersen (Andersen, 1995) followed by health belief, which was captured in the parents' education and religion in this study. From Table 3 it is clear that, for example, increased wealth status was associated with increased chance of having recommended number of visits, but also a decreased risk of having no visits. Based on the results of the current study, an intervention to improve enabling factors such as an information campaign can be expected to increase the number of mother's having intermediate visits while an intervention compensating costs related to ANC visits can be expected to increase both

intermediate and recommended visits. In both cases the proportion of no visit is expected to fall. These differences in effect should not be overlooked when designing an intervention to increase ANC visits.

One of the strengths of this study is that it is based on a representative national survey with large sample size, as well as differentiating the group of non-recommended number of visits into no and intermediate visits. The cross sectional nature of the survey however only allows estimation of associations and not causality. Therefore, the results need to be interpreted with caution, especially when designing interventions. The study is also subject to potential recall bias, as the data was generally not collected in connection with the pregnancy. However, in order to reduce this potential bias, the sample was restricted to mothers with delivery within the last three years. Moreover, some information such as household wealth index, husband's occupation, media exposure, or belonging to NGO was collected at the time of survey and not during the pregnancy. If large, systematic changes in these variables had occurred between pregnancy and the survey time, the results might have been biased. However, we are not aware of any events during the study period that might cause such bias. A final limitation is that the variables used to capture the external environmental factor were geographical region of residence and rural/urban residence. Unfortunately, less crude variables such as distance to the ANC centers and available transportation were not available in the BHDS survey (NIPORT, 2013). This is therefore only indirectly captured in the existing variables. However, Anwar et al. showed that the number of ANC visits were unaffected by distance (Anwar et al., 2008) in Bangladesh. We were not able to test the independence of irrelevant alternatives (IIA) assumption for the multinomial logistic regressions model due to the complex survey design. However, it is unlikely that the IIA assumption has been violated due to the dissimilar outcome alternatives (Cheng & Long, 2007).

A number of aspects are left for future research, especially how the pregnancy outcomes are affected by different levels of ANC visits, controlling other potential sociodemographic factors, in these resource poor settings. The outcomes could be the complications at the time of delivery, postpartum health of the mothers as well as birthweight and health of the babies. By estimating the potential health benefits, the next step would be to estimate the economic benefits, i.e whether moving from no visits to intermediate visits is cost-effective compared to moving from intermediate visits to recommended visits.

CONCLUSION

We conclude that the external environment, predisposing- and enabling factors were associated with underutilization of ANC services. In addition, these associations tend to differ between levels of ANC visits. This has potential far-reaching implications for design of interventions to increase ANC visits not only in Bangladesh but also other resource poor settings in the world. For example, (assuming a causal relationship) an increase in the proportion of intended pregnancies (e.g. by increasing the use of contraceptives) could increase the proportion of mothers reaching recommended visits, although it may not increase the proportion of mothers seeking ANC. Thus, such an intervention should therefore hypothetically only be chosen if the purpose is to increase the proportion with recommended visits but not if the goal is to reduce the proportion without any ANC.

Recently, a voucher program (enabling factor) has been introduced in Bangladesh to encourage the use of maternal health service. The program shows promising results (Nguyen et al., 2012) which would be expected based on the results of the current study. However, the coverage of the program is low and ensuring higher access of the program to women might be one pathway for increased ANC visits and hopefully reduced maternal mortality.

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REFERENCES

- Abedin, S., Islam, R., & Hossain, T. (2008). Antenatal Care During Pregnancy: A Study on Naogaon District in Bangladesh. *Medwell Journals*, 3(8), 537-541.
- Ahmed, S., Hossain, M. A., RajaChowdhury, A., & Bhuiya, A. (2011). The health workforce crisis in Bangladesh: shortage, inappropriate skill-mix and inequitable distribution. *Human Resources for Health*, 9(1), 3.
- Ahmed, S., Sobhan, F., Islam, A., & Barkat-e-Khuda. (2001). Neonatal Morbidity and Care-seeking Behaviour in Rural Bangladesh. *Journal of Tropical Pediatrics*, 47(2), 98-105. doi:10.1093/tropej/47.2.98
- Amin, R., Shah, N., & Becker, S. (2010). Socioeconomic factors differentiating maternal and child health-seeking behavior in rural Bangladesh: A cross-sectional analysis. *International Journal for Equity in Health*, 9(1), 9.
- Andersen, R. M. (1995). Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav*, 1-10.
- Anwar, I., Sami, M., Akhtar, N., Chowdhury, M., Salma, U., Rahman, M., & Koblinsky, M. (2008). Inequity in maternal health-care services: evidence from home-based skilled-birth-attendant programmes in Bangladesh. *Bulletin Of The World Health Organization*, 86, 252-259.
- Arvidson, M. (2008). Contradictions and Confusions in Development Work: Exploring the Realities of Bangladeshi NGOs. *Journal of South Asian Development*, 3(1), 109-134. doi:10.1177/097317410700300105
- Baqui, A. H., El-Arifeen, S., Darmstadt, G. L., Ahmed, S., Williams, E. K., Seraji, H. R., . . . Black, R. E. (2008). Effect of community-based newborn-care intervention package implemented through two service-delivery strategies in Sylhet district, Bangladesh: a

cluster-randomised controlled trial. *The Lancet*, 371(9628), 1936-1944.

doi:[http://dx.doi.org/10.1016/S0140-6736\(08\)60835-1](http://dx.doi.org/10.1016/S0140-6736(08)60835-1)

Bruin, J. (2006). Newtest: command to compute new test. UCLA: Statistical Consulting Group.

Carroli, G., Rooney, C., & Villar, J. (2001). How effective is antenatal care in preventing maternal mortality and serious morbidity? An overview of the evidence. *Paediatric and Perinatal Epidemiology*, 15, 1-42. doi:10.1046/j.1365-3016.2001.0150s1001.x

Chakraborty, N., Islam, M. A., Chowdhury, R. I., Bari, W., & Akhter, H. H. (2003). Determinants of the use of maternal health services in rural Bangladesh. *Health Promotion International*, 18(4), 327-337. doi:10.1093/heapro/dag414

Cheng, S., & Long, J. S. (2007). Testing for IIA in the multinomial logit model. *Sociological Methods & Research*, 35(4), 583-600.

Dhakal, S., Chapman, G., Simkhada, P., van Teijlingen, E., Stephens, J., & Raja, A. (2007). Utilisation of postnatal care among rural women in Nepal. *BMC Pregnancy and Childbirth*, 7(1), 19.

Dibaba, Y., Fantahun, M., & Hindin, M. (2013). The effects of pregnancy intention on the use of antenatal care services: systematic review and meta-analysis. *Reproductive Health*, 10(1), 50.

Fottrell, E., Azad, K., Kuddus, A., & et al. (2013). The effect of increased coverage of participatory women's groups on neonatal mortality in bangladesh: A cluster randomized trial. *JAMA Pediatrics*, 167(9), 816-825.

doi:10.1001/jamapediatrics.2013.2534

Gabrysch, S., & Campbell, O. (2009). Still too far to walk: Literature review of the determinants of delivery service use. *BMC Pregnancy and Childbirth*, 9(1), 34.

- Guliani, H., Sepehri, A., & Serieux, J. (2014). Determinants of prenatal care use: evidence from 32 low-income countries across Asia, Sub-Saharan Africa and Latin America. *Health Policy and Planning*, 29(5), 589-602. doi:10.1093/heapol/czt045
- Hajizadeh, M., Alam, N., & Nandi, A. (2014). Social inequalities in the utilization of maternal care in Bangladesh: Have they widened or narrowed in recent years?
- Haque, S. E., Rahman, M., Mostofa, M. G., & Zahan, M. S. (2012). Reproductive health care utilization among young mothers in Bangladesh: does autonomy matter? *Womens Health Issues*, 22(2), e171-180. doi:10.1016/j.whi.2011.08.004
- Islam, M., Odland, J., & Islam, M. (2011). Determinants of antenatal and postnatal care visits among Indigenous people in Bangladesh: a study of the Mru Community. *Rural and remote health*, 11(2), 1672.
- Kishowar Hossain, A. H. M. (2010). Utilization of Antenatal Care Services in Bangladesh: An Analysis of Levels, Patterns, and Trends From 1993 to 2007. *Asia-Pacific Journal of Public Health*, 22(4), 395-406. doi:10.1177/1010539510366177
- Long, J. S., & Freese, J. (2006). *Regression models for categorical dependent variables using Stata*: Stata press.
- National Institute of Population Research and Training (NIPORT), Mitra Associates, and ICF International. (2013). Bangladesh Demographic and Health Survey 2011. Dhaka, Bangladesh and Calverton, Maryland, USA: NIPORT, Mitra and Associates, and ICF International.
- Nguyen, H. T. H., Hatt, L., Islam, M., Sloan, N. L., Chowdhury, J., Schmidt, J.-O., . . . Wang, H. (2012). Encouraging maternal health service utilization: An evaluation of the Bangladesh voucher program. *Soc Sci Med*, 74(7), 989-996.
doi:http://dx.doi.org/10.1016/j.socscimed.2011.11.030

- Oyerinde, K. (2013). Can antenatal care result in significant maternal mortality reduction in developing countries. *J Community Med Health Educ* 3: e116. doi.
- Quayyum, Z., Khan, M. N. U., Quayyum, T., Nasreen, H., Chowdhury, M., & Ensor, T. (2013). "Can community level interventions have an impact on equity and utilization of maternal health care" - Evidence from rural Bangladesh. *International Journal for Equity in Health*, 12(1), 22.
- Rahman, K. M. (2009). Determinants of maternal health care utilization in Bangladesh. *Research Journal of Applied Sciences*, 4(3), 113-119.
- Rahman, M., Islam, I., & Islam, A. Z. (2008). Rural–urban differentials of utilization of antenatal health-care services in Bangladesh. *Health Policy and Development*, 6(3), 117-125.
- Rahman, M. M., Rahman, M. M., Tareque, M. I., Ferdos, J., & Jesmin, S. S. (2016). Maternal Pregnancy Intention and Professional Antenatal Care Utilization in Bangladesh: A Nationwide Population-Based Survey. *PLoS ONE*, 11(6), e0157760. doi:10.1371/journal.pone.0157760
- Saad–Haddad, G., DeJong, J., Terreri, N., Restrepo–Méndez, M. C., Perin, J., Vaz, L., . . . Bryce, J. (2016). Patterns and determinants of antenatal care utilization: analysis of national survey data in seven countdown countries. *Journal of Global Health*, 6(1), 010404. doi:10.7189/jogh.06.010404
- Simkhada, B., Teijlingen, E. R. v., Porter, M., & Simkhada, P. (2008). Factors affecting the utilization of antenatal care in developing countries: systematic review of the literature. *Journal of Advanced Nursing*, 61(3), 244-260. doi:10.1111/j.1365-2648.2007.04532.x

- Tey, N.-P., & Lai, S.-l. (2013). Correlates of and Barriers to the Utilization of Health Services for Delivery in South Asia and Sub-Saharan Africa. *The Scientific World Journal*, 2013, 11. doi:10.1155/2013/423403
- The World Bank. (2015). Maternal mortality ratio. Retrived from <http://data.worldbank.org/indicator/SH.STA.MMRT>
- Thind, A., Mohani, A., Banerjee, K., & Hagigi, F. (2008). Where to deliver? Analysis of choice of delivery location from a national survey in India. *BMC Public Health*, 8(1), 29.
- Titaley, C., Dibley, M., & Roberts, C. (2010). Factors associated with underutilization of antenatal care services in Indonesia: results of Indonesia Demographic and Health Survey 2002/2003 and 2007. *BMC Public Health*, 10(1), 485.
- United Nations (2015). The Millennium Development Goals Report 2015. Retrieved from [http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG 2015 rev \(July 1\).pdf](http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf)
- United Nations (2014). Levels & Trends in Child Mortality Report 2014. Retrieved from http://www.unicef.org/media/files/Levels_and_Trends_in_Child_Mortality_2014.pdf
- WHO (1994). Antenatal care report of a technical working group. Geneva: World Health Organization. Retrived from <http://www.popline.org/node/312905>.
- Zanconato, G., Msolomba, R., Guarenti, L., & Franchi, M. (2006). Antenatal care in developing countries: the need for a tailored model. *Semin Fetal Neonatal Med*, 11(1), 15-20. doi:10.1016/j.siny.2005.10.002

Table 1: Antenatal care visits according to background characteristics (n=4672)

	ANC visits		
	No visit (n=1442)	Intermediate visits (n=1925)	Recommended visits (n=1326)
External Environment			
Region***			
Dhaka	238 (32%)	310 (41%)	207 (27%)
Khulna	113 (20%)	231 (42%)	208 (38%)
Rajshahi	149 (25%)	290 (49%)	154 (26%)
Barisal	156 (30%)	213 (40%)	157 (30%)
Chittagong	329 (35%)	394 (42%)	219 (23%)
Sylhet	313(44%)	260 (37%)	138 (19%)
Rangpur	123 (21%)	227 (38%)	243 (41%)
Residence***			
Rural	1168 (37%)	1365 (43%)	658 (21%)
Urban	253 (17%)	560 (38%)	668 (45%)
Predisposing Factors			
Mother's education***			
No education	457 (59%)	237 (31%)	80 (10%)
Incomplete Primary	344 (43%)	335 (41%)	128 (16%)
Complete Primary	205 (36%)	241 (43%)	116 (21%)
Incomplete secondary	375 (20%)	887 (48%)	589 (32%)
Secondary and higher	40 (6%)	225 (33%)	413(61%)
Husband's education***			
No education	590 (49%)	444 (37%)	166 (14%)
Incomplete Primary	293 (37%)	335 (43%)	159 (20%)
Complete Primary	194 (32%)	273 (46%)	132 (22%)
Incomplete secondary	244 (22%)	493 (44%)	374 (34%)
Secondary and higher	100 (10%)	380 (39%)	495 (51%)
Birth order***			
Second born or more	1065 (36%)	1187 (40%)	699 (24%)
First born	356 (21%)	738 (43%)	627 (36%)
Religion***			
Muslim	1313 (31%)	1730 (41%)	1154 (28%)
Hindu and others	108 (23%)	195 (41%)	172 (36%)
Enabling Factors			
Wealth Index***			
Poorest	516 (52%)	361 (36%)	124 (12%)
Poorer	368 (42%)	363 (41%)	146 (17%)
Middle	270 (30%)	417 (47%)	206 (23%)
Richer	199 (21%)	438 (46%)	311 (33%)
Richest	68 (7%)	346 (36%)	539 (57%)
Husband Occupation***			
Lower income	713 (42%)	701 (41%)	281 (17%)
Blue color	237 (34%)	300 (42%)	170 (24%)
Professional	471 (21%)	924 (41%)	875 (38%)
Media Exposure***			
No	765 (47%)	620 (38%)	229 (14%)
Yes	656 (21%)	1305 (43%)	1097 (36%)
Belongs to NGO*			
No	925 (29%)	1318 (42%)	926 (29%)
Yes	496 (33%)	607 (40%)	400 (27%)
Need Factors			
Desire for pregnancy***			
Not wanted	258 (45%)	228 (39%)	91 (16%)
Wanted	1163 (28%)	1697 (41%)	1235 (30%)
Terminated pregnancy			
No	1179 (30%)	1621 (42%)	1085 (28%)
Yes	242 (31%)	304 (39%)	241 (31%)

*p<0.05 ; **p<0.01; ***p<0.001

Table 2: Multinomial logistic regression analysis of the odds of ANC visits (adjusted)

	ANC visits		
	No visit vs. Recommended visits	No visit vs. Intermediate visits	Intermediate visits vs. Recommended visits
External Environment			
Region			
Dhaka	2.37* (2.8-7.2)	1.89*(1.3-2.7)	2.37* (1.6-3.4)
Khulna	2.42* (1.5-3.9)	1.44 (1.0-2.1)	1.69* (1.2-2.5)
Rajshahi	2.83* (1.7-4.7)	1.15 (0.8-1.7)	2.47* (1.7-3.6)
Barisal	3.10* (1.9-5.0)	1.75* (1.2-2.5)	1.76* (1.2-2.7)
Chittagong	6.27* (3.9-10.1)	2.35* (1.7-3.3)	2.67* (1.8-3.9)
Sylhet	7.78* (4.7-12.8)	2.70* (1.9-3.9)	2.89* (1.9-4.3)
Rangpur ®	-	-	-
Residence			
Rural	1.91* (1.5-2.5)	1.20* (1.0-1.5)	1.59* (1.3-2.0)
Urban ®	-	-	-
Predisposing Factors			
Mother's education			
No education	8.94* (5.2-15.3)	3.86* (2.4-6.1)	2.32* (1.6-3.5)
Incomplete Primary	5.26* (3.2-8.5)	2.41* (1.5-3.8)	2.18* (1.6-3.0)
Complete Primary	4.38* (2.7-7.1)	2.23* (1.4-3.5)	1.97* (1.4-2.7)
Incomplete secondary	2.51* (1.6-3.8)	1.45 (1.0-2.2)	1.73* (1.4-2.2)
Secondary and higher ®	-	-	-
Husband's education			
No education	1.71* (1.2-2.5)	1.42* (1.0-2.0)	1.20 (0.9-1.6)
Incomplete Primary	1.61* (1.1-2.3)	1.42* (1.0-2.0)	1.14 (0.8-1.5)
Complete Primary	1.60* (1.1-2.3)	1.21 (0.9-1.7)	1.33 (1.0-1.8)
Incomplete secondary	1.23 (0.9-1.7)	1.22 (0.9-1.7)	1.00 (0.8-1.3)
Secondary and higher ®	-	-	-
Birth Order			
Second born or more	1.62* (1.3-2.0)	1.35* (1.1-1.6)	1.20* (1.0-1.4)
First born ®	-	-	-
Religion			
Muslim	1.23 (0.8-1.8)	1.13 (0.8-1.6)	1.09 (0.8-1.5)
Hindu and others ®	-	-	-
Enabling Factors			
Wealth Index			
Poorest	7.16* (4.5-11.3)	3.18* (2.2-4.6)	2.25* (1.6-3.3)
Poorer	7.45* (4.9-11.4)	3.10* (2.1-4.5)	2.41* (1.8-3.3)
Middle	4.91* (3.6-7.2)	2.34* (1.7-3.3)	2.10* (1.6-2.7)
Richer	3.28* (2.3-4.7)	1.84* (1.3-2.6)	1.78* (1.4-2.2)
Richest ®	-	-	-
Husband Occupation			
Lower income	1.58* (1.2-2.0)	1.12 (0.9-1.4)	1.40* (1.1-1.7)
Blue color	1.09 (0.8-1.5)	0.94 (0.7-1.2)	1.15 (0.9-1.5)
Professional ®	-	-	-
Media Exposure			
No	1.45* (1.2-1.8)	1.26* (1.1-1.5)	1.15 (0.9-1.4)
Yes ®	-	-	-
Belongs to NGO			
No	1.21 (1.0-1.5)	1.04 (0.9-1.2)	1.16 (1.0-1.4)
Yes ®	-	-	-
Need Factors			
Desire for pregnancy			
Not wanted	1.40* (1.0-1.9)	1.01 (0.8-1.3)	1.38* (1.0-1.9)
Wanted ®	-	-	-
Terminated pregnancy			
Yes	0.80 (0.6-1.0)	0.98 (0.8-1.2)	0.81* (0.7-1.0)
No ®	-	-	-

® Reference category * p<0.05

Table 3: Estimated prediction probabilities of each variable category at the three levels of ANC visits

	ANC visits		
	No visit	Intermediate visits	Recommended visits
External Environment			
Region			
Dhaka	0.16***	0.07	-0.23***
Khulna	0.08**	0.06	-0.14**
Rajshahi	0.07*	0.14**	-0.21***
Barisal	0.12***	0.05	-0.17***
Chittagong	0.21***	0.05	-0.26***
Sylhet	0.25***	0.03	-0.28***
Rangpur ®	-	-	-
Residence			
Rural	0.07**	0.04	-0.10***
Urban ®	-	-	-
Predisposing Factors			
Mother's education			
No education	0.31***	-0.06	-0.26***
Incomplete Primary	0.20***	0.02	-0.22***
Complete Primary	0.17***	0.02	-0.20***
Incomplete secondary	0.08**	0.06*	-0.14***
Secondary and higher ®	-	-	-
Husband's education			
No education	0.08**	-0.02	-0.06*
Incomplete Primary	0.07**	-0.03	-0.05
Complete Primary	0.05	0.01	-0.06*
Incomplete secondary	0.04	-0.02	-0.01
Secondary and higher ®	-	-	-
Birth order			
Second born or more	0.07**	-0.01	-0.05**
First ®	-	-	-
Religion			
Muslim	0.03	-0.00	-0.02
Hindu and others ®	-	-	-
Enabling Factors			
Wealth Index			
Poorest	0.27***	-0.01	-0.24***
Poorer	0.24***	0.00	-0.25***
Middle	0.18***	0.03	-0.21***
Richer	0.12***	0.04	-0.16***
Richest ®	-	-	-
Husband Occupation			
Lower income	0.05*	0.02	-0.07***
Blue color	0.00	0.03	-0.02
Professional ®	-	-	-
Media Exposure			
No	0.06**	-0.01	-0.04*
Yes ®	-	-	-
Belongs to NGO			
No	0.02	0.01	-0.03
Yes ®	-	-	-
Need Factors			
Desire for pregnancy			
Not wanted	0.02	0.04	-0.06*
Wanted ®	-	-	-
Terminated Pregnancy			
Yes	-0.02	-0.02	0.04*
No ®	-	-	-

® Reference category *p<0.05 ; **p<0.01; ***p<0.001

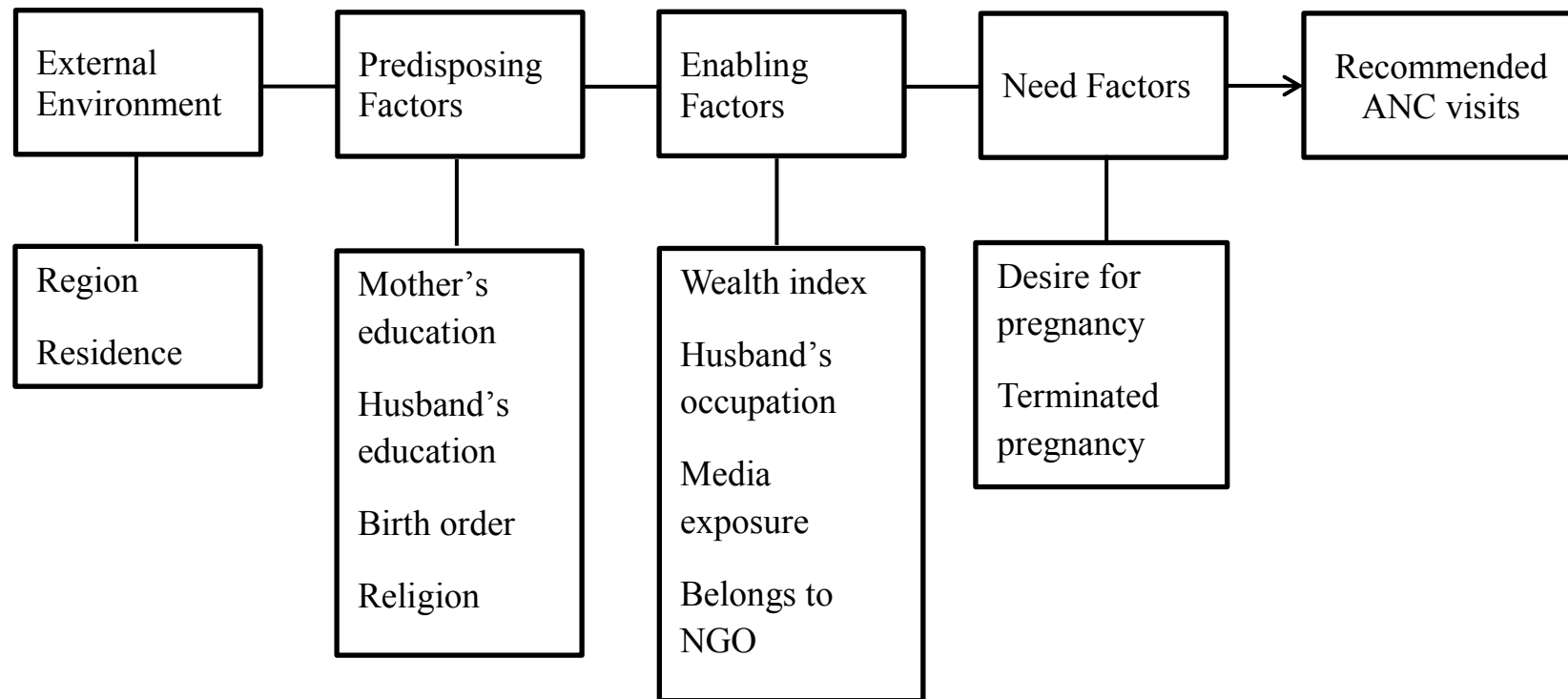


Figure 1: Theoretical framework of factors associated with recommended ANC visits in Bangladesh. Adapted from Andersen behavioral model