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Master Thesis

Effects of Child Marriages in Bangladesh

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Abstract

Marrying off daughters at a young age is a strong social norm in many countries of the developing world. By parents it is considered a means to secure their daughters' future financially and socially. However, these child marriages are often associated with poor social and physical outcomes – as these women tend to bear children at very young ages and quit their education.

Bangladesh is a country with one of the highest rates of child marriages in the developing world. This thesis examined the determinants of child marriages and their effects on poor child health outcomes (stunting and child mortality) in infants and children under the age of five in Bangladesh. Hence it utilized the nationally representative 2011 Demographic and Health Survey. The studied sample comprised of ever-married women aged 12 to 49, and children born in the five years preceding the survey. A multinomial logistic regression was used to study the determinants of child marriages, while for studying the effects on child health, binary logistic regressions were used. As for studying the socioeconomic inequality in child health, a decomposition method was applied.

The findings suggest that both our outcomes are improving. In other words, the age at marriage has been increasing and the prevalence of stunting and child mortality has been declining over the past two decades. The results of the analyses showed that socioeconomic status (wealth status, education, place of residence) and religion are important predictors of age at marriage. Further, the predictors of poor child health outcomes were found to be socioeconomic status, as well, and the woman's age at birth and access to maternal care.

Results also showed that there is no socioeconomic inequality present in the age at marriage, which therefore cannot explain the socioeconomic inequality that is present in the child health outcome of stunting.

1. Introduction

It is widely recognized that every individual has a right to health, despite their socio-economic status. Yet, in many developing countries considerable inequalities prevail, often at the expense of the poor. There are various causes that can affect health outcomes, from the lack of access to health care services to harmful behavior. One such behavior is marrying off daughters at a very young age.

In many developing countries, child marriages are a strong social norm. For parents it is desired to marry off daughters early, as they believe it is a means of securing them both a financial and social future. Still, these early marriages are often associated with poor social and physical outcomes. Evidence shows that girls who marry at a young age attain lower levels of education, have less reproductive control and encounter higher rates of mortality. Such outcomes suggest a high impact on society at large, including high population growth, a more rapid spread of disease, and higher numbers of uneducated women (Field et al. 2008; UNICEF, 2005).

With early female marriage having direct impact on the health of young mothers and their offspring, it should be viewed critically from a social and policy perspective. Health is one of the most important conditions of human life and is the essential part of a person's opportunity to develop talents and capabilities. Both child marriage and health are a matter of social justice and demand protection; while health requires a fair distribution as well as access to it (Sen, 2002; UNICEF, 2005). Furthermore, insight into socioeconomic inequalities that might be present can help policymakers construct policies and make distributional decisions regarding family planning programs, in terms of the scale that should be covered, which segments of the population should be targeted and which interventions should be improved and how (Adams et al. 2013).

In Bangladesh, a South Asian low income country, nearly 68 percent of young women are already married at the age of 18, and among them 59 percent have already delivered their first child by the age of 18. As a result, Bangladesh is a country with one of the highest rates of child marriages in the developing world (Bates et al. 2007; UNICEF, 2005).

Studies show that the prevalence of child marriage tends to be higher in rural areas (UNICEF, 2005). Other studies indicate there is a relationship present between adolescent pregnancies and poor child health outcomes such as infant mortality, stunting, underweight, diarrhea and anemia. Scholars have concluded that delaying age at first birth reduces infant mortality and

improves child health (Finlay et al. 2011; Rahman et al. 1989; Abdullah et al. 2006). Furthermore, research shows that women bearing children in developing countries are at higher risk of facing severe complications like obstructed labor, obstetric fistula and other kinds of delivery related injuries or infections (Cook et al. 2004; Abdullah et al. 2006; ICRW 2003). Research has also indicated that other social factors such as education is a strong determinant of variation of age at marriage (Bates et al. 2007; Field et al. 2008).

Most studies in the field have concentrated on either just the phenomenon of child marriage or just the consequences of early childbearing. However, not many of these studies have directly articulated that there is a relationship present between the socioeconomic motivations to child marriage and poor child health outcomes. Whereas, it seems that this phenomenon precedes poor child health outcomes. This report attempts to extend previous research by estimating the prevalence of child marriage and early childbearing – by identifying and understanding the socioeconomic factors associated to it.

Furthermore, this study aims to denote an understanding to which extent socioeconomic factors influence early marriage and childbearing, and focuses on young women in Bangladesh. The leading questions this research intends to answer state as follows:

1. What are the determinants of child marriages in Bangladesh?
    a. How unequally distributed is this phenomenon across socioeconomic status and an urban or rural place of residence?
    b. Which determinants correlate to child marriage?
2. What are the effects of child marriage on child health – stunting and child mortality?
    a. What are the pathways of impact of these factors on a child's health or survival?
3. What contributes to socioeconomic inequality in child health?
    a. To what extent does socioeconomic inequality in child marriage explain socioeconomic inequality in child health?

The answers to the research questions are obtained using logistic regressions, and a decomposition analysis of inequalities for the third research question. Chapter 2 of the paper provides background information of Bangladesh, an overview of the effects of child marriages and adolescent pregnancies, and the conceptual model of this paper. Chapter 3 describes the data sources and the variables used in the research; while chapter 4 describes the methods. Chapter 5 discusses the results of the research. The research is concluded with a discussion and conclusion, presented in chapter 6.

2. Background

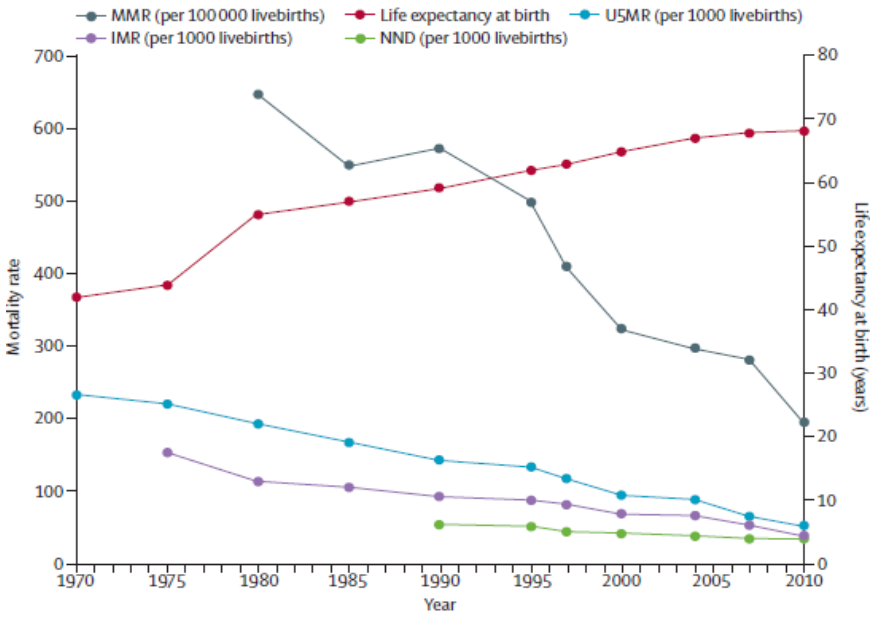
2.1.Bangladesh

Bangladesh is a country located in south Asia, surrounded by India on three sides, along with a narrow border with Burma in the southeast of the country and with the Bay of Bengal in the south. In 2011 Bangladesh had a total population of 150,494,000 people, making it the eighth most densely populated country in the world. As a rapidly urbanizing country, nearly a third lives in urban areas (World Health Organization, 2013). The country consists of 7 administrative divisions and 64 districts. Dhaka is the capital and largest city in Bangladesh in addition to being the most densely populated. Most of the population is Muslim, accounting for 90 percent, followed by Hindus at 9 percent, and 1 percent other religions (NIPORT, 2013). Bangladesh is a fairly young country that gained independence in 1971 after the country suffered a nine-month War of Liberation. The national language is Bangla, spoken and understood by all (Chowdhury et al. 2013).

Bangladesh is considered a low income country by the World Health Organization (WHO). Nevertheless, the country has experienced economic growth and significant progress in reducing poverty over the past decade. The proportion of people living under the $1 poverty line has declined – the poverty headcount rate fell from 48.9 percent in 2000 to 31.5 percent in 2010 (World Bank, 2013).

The average life expectancy at birth in 2011 was 69 years of age for men and 70 years for women (WHO, 2013). The total fertility rate per woman was 2.2, compared to the global and regional average of 2.4. This average has declined substantially since the 1970s when it was 6.9 children per woman. Furthermore, the probability of children dying before the age of five is 41 children per 1,000 live births – which is lower than the regional average of 55 and the global average of 51 per 1,000 live births. This average has also declined substantially since 1990, from an average of 144 children dying per 1,000 live births. The infant mortality ratio is 33 per 1,000 live births, which is just below the global average of 35 children dying per 1,000 live births. The maternal mortality ratio is 240 per 100,000 live births, which is higher than the regional average of 200 and the global average of 210. Although these statistics are still high, infant, child and maternal mortality have declined substantially and steadily over the past four decades (see Figure 1). In 2010, the United Nations applauded Bangladesh's progress towards achieving the Millenium Development Goals (MDGs) 4 and 5, in reducing child and maternal mortality (Chowdhury et al. 2013).

Figure 1: Mortality rates and life expectancy in Bangladesh (1970-2010)



Source: Chowdhury et al. 2013

Bangladesh has a pluralistic health system, consisting of many stakeholders in the health production – the Government, the private sector (formal and informal), non-governmental organizations (NGO) and donors. Nearly 4 percent of the country's GDP is spent on health, a third of which comes from public resources. The remaining two thirds are private out-of-pocket payments, partially supported by non-profit NGOs. Moreover, foreign donations are steered through governmental and NGO routes. The per capita health expenditure is lower than its neighbouring countries (WHO, 2013; Ahmed et al. 2013).

2.2.Child marriage

According to UNICEF, child marriage is a marriage contracted before the age of 18. Bangladesh is a country with one of the highest rates of child marriages in the developing world (Bates et al. 2007; UNICEF, 2005). Early marriages are strongly motivated by social and economic norms within the context of the country. In a country that still remains largely patriarchal and poor, marrying off daughters is one of the most common incentives to relieve a financial burden of the family. A direct consequence, in addition to inherent health related problems, is that due to early marriage, girls often remain uneducated, thereby precipitating intergenerational issues of a wide spectrum. Also, child marriage is considered a violation of human rights. Though Bangladesh has laws that prohibit marriage at an age younger than 18, enforcement still remains a challenge (ICRW, 2003; UNICEF, 2005).

The harmful tradition remains, as such laws conflict religious laws and customs. An example of such a custom is that a woman is considered competent to enter marriage as soon as she attains puberty i.e. when she has menstruated. Thus, the timing of a young girl's menstruation is related with the first steps towards marriage, as she is considered ready to bear children (Huda, 1997; ICRW, 2003).

Furthermore, a large body of evidence exists on the additional consequences of child marriages. Field and his colleagues investigated what effects early marriage has on education. They found that child marriages in developing countries are inversely correlated to education among girls. They used age of first menstruation as an instrumental variable to track preparedness for marriage. In situations when young girls in rural Bangladesh were forced by biology to delay marriage (i.e. the onset of menstruation was delayed) research shows that they attained more schooling and were more likely to be literate. Further in their paper, they proposed that the Government enforces consent laws between the ages of 15 and 17, as these would be more efficient and feasible to enforce (Field et al. 2008). In like manner, other research shows that programmes like the Government's Female Stipend Programme secondary school scholarships had immediate effects in delaying marriage and childbearing. The main conditions of this programme were that the girls should attend school for most of the year, pass the final examinations, and the girls should remain unmarried until they have completed secondary schooling (Adams et al. 2013; ICRW, 2003). In such programs, both the girls and their parents received a stipend that was conditional on the girl remaining unmarried until she completed secondary schooling. A similar programme introduced by the NGO sector aimed at increasing school attendance – a Food for Education programme which provided a monthly cereal ration to poor families if their children attended primary school. Between 1990 and 2010, the proportion of girls that were registered in secondary education increased from 34 percent to 54, closing the gap between enrolled boys and girls. This had been achieved by the positive discriminatory approaches. Although it is a significant improvement, school attendance and completion among girls from the poorest families still much lower than those from wealthier families. Inequities still exist among the hard-to-reach, poorer areas of the country. Resultantly, dwelling slum populations still have limited access to such programs (Adams et al. 2013).

Lastly, empirical research has shown that when economic opportunities in forms of jobs are provided, both the parents and the daughters become interested in delaying marriage. An example for this would be the garment industry, which at the moment employs around 2.8

million poor women in Bangladesh. This industry has contributed to a rapid increase in the female labour force, rising from 8 percent in 1983 to almost 33 percent in 2010. However, while it provides the means to earn a living for themselves and their family, there are many violations of worker safety and rights present that may compromise the actual potential of helping these young women (Adams et al. 2013).

2.3.Adolescent pregnancy

In the developing world, disadvantages like poverty, and a motivation to protect girls and assure economic stability often drive girls to marriage at a young age. These young women are most often married to men much older than them and find themselves in marriages with little decision-making power, especially in areas like reproductive rights. Evidence shows that outcomes of infant and child health are strongly correlated to the childbearing age of the mother (UNICEF, 2005; ICRW, 2003). Pregnancy in the period of adolescence is often a cause for higher chance of maternal mortality due to complications during childbirth. Complications that often occur are obstructed labour, often causing obstetric fistula, or gestational complications like anaemia and toxaemia. Such complications arise due to their physical immaturity in stature, low body weight or small pelvic size. Evidence shows that the most important reason for this physical immaturity is malnutrition. Chronic malnutrition can delay physical maturation and prolong the growth period even beyond the age of 20 years old. Studies have shown that adolescent girls in rural Bangladesh have a high prevalence of being stunted and very thin, which can be explained by low socioeconomic status and poor diet (Rah et al. 2008).

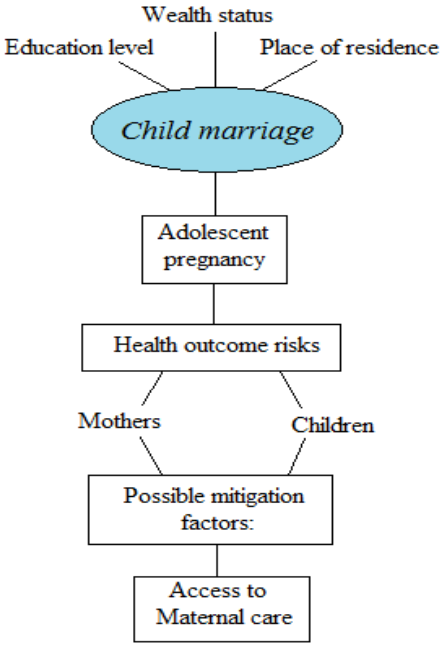
In addition to their physical state, a danger for complications during pregnancy and childbirth remains high, because of the lack of access to prenatal and obstetric care, due to poverty or living in remote or rural areas (Abdullah et al. 2006; Cook et al. 2004).

Research into the health outcomes of children born to young mothers has shown strong evidence of premature birth, infant mortality and low birth weight. In addition, if the child were to survive, it would still live a life in malnutrition with increased sensitivity to infectious diseases and illnesses. The age to which a young woman delays her first birth has a significant effect on diminishing these risks of poor health outcomes. Based on research conducted in low to middle income countries, giving birth above the age of 17 was found to be correlated with better health outcomes for both the children and their mothers (Abdullah et al. 2006; Finlay et al. 2011). Even though several family planning programs are present, the poorest of

the population often have little to no access to these reproductive health information and services; either before or after they are married, leaving them largely uninformed about the dangers of early pregnancy. Such family planning programmes often consist of interventions that focus on delaying pregnancy and/or stimulating healthcare seeking behaviour during pregnancy. Workshops and discussion groups would be led by peer educators and influential people from the community. Evidence shows that such programmes lead to better knowledge about contraceptive methods, pregnancy and, most importantly, they increase the awareness of the risks of early pregnancy (Christiansen et al. 2013).

2.4.Conceptual model

Figure 2: Conceptual model of the effects of child marriage



The conceptual model for this thesis is shown above in Figure 2. The figure shows the effects of child marriage, which is based on the theoretical background. Child marriages are directly related to adolescent pregnancies – which are likely to induce poor health outcomes for both the mothers and their children. Furthermore, access to maternal care (antenatal care and skilled attendance at delivery) is believed to be a possible mitigation factor to the issue of infant and child stunting and mortality. This study aims to investigate all these aspects, and is especially concentrated at analyzing whether there are inequalities present between the rich and the poor of the population, the lower or better educated, ones living in urban or rural areas – and, in what proportions these inequalities are present. In sum, the study examines how the socioeconomic status, level of education and the area of residence, that is urban or rural, affect the probability of early marriage and childbearing.

3. Data

3.1.Data sources

This thesis is an empirical study that utilizes data from the Demographic and Health Surveys (DHS) of Bangladesh, taking six time periods into account – 1993/1994, 1996/1997, 1999/2000, 2004, 2007 and 2011. The main analysis in this paper is done using the 2011 data, whereas all the six time periods are used in order to study the descriptive trends in the key outcomes. The DHS is a nationwide sample survey collected at household level and consists of five types of questionnaires – a Household Questionnaire, Woman's Questionnaire, Men's Questionnaire, Community Questionnaire, and of two Verbal Autopsy Questionnaires used to collect information on the causes of death of children dying under the age of five. It is designed to provide information on national indicators of health, like mortality levels of women and children, fertility levels, maternal and child health, nutritional status; and to provide information on the availability and accessibility of health and family planning services. The survey is designed in a way to provide representative results for both urban and rural areas, for the seven administrative divisions of the country and, most importantly, to provide representative results for the country as a whole (NIPORT, 2013).

Women who were eligible for partaking in this survey were all ever-married women aged 12 to 49 who are members of the selected household, and women who spent the night preceding the survey in the selected household. These women were interviewed using the Woman's Questionnaire that provides detailed information on her demographic and health characteristics (NIPORT, 2013). In each year of observation approximately 10,000 women were interviewed, whereas in 2011 17,842 ever-married women took part in the survey.

Furthermore, as this study is interested in studying the health of infants and children under the age of five, it uses a sample that comprises of children born in the five years preceding the survey in 2011. In order to avoid biased results, one child per mother is observed – creating a sample of 7,325 children.

Further, in this study inequality analyses will be performed in order to decompose underlying socioeconomic inequalities present in our variables of interest. This analysis is based on wealth quintiles, sorting the population from the poorest to the richest. In order to do this, a wealth index is calculated – that includes conditions of the household the respondents live in, from wall, roof and floor material, to the sources of drinking water, sanitation facility, to the

durable goods they possess, whether they have electricity and whether the household owns any land (O'Donnell et al. 2008; NIPORT, 2013).

3.2.Variables

In this study three dependent variables are chosen – *age at marriage, child stunting* and *child mortality.*

Firstly, the age at first marriage is observed by creating specific age groups, making the variable 'age at marriage' a categorical one. Three age groups are created in order to delineate the immaturity to enter marriage. The first age group considers women who were married before the age of 13 ('child'), the second age group considers those married from 14 to 18 ('adolescent') and lastly, the age group with women married at an age older than 18 ('woman').

Secondly, this research examines the prevalence of stunting among infants and children under the age of five. By definition, stunting is an indicator of malnutrition that is expressed when a child suffers from a reduced height for its age (height-for-age z-score; HAZ). This health outcome is under the direct effect of a child's poor nutritional status, affected by food shortages and chronic or recurring diseases. It is a long run measure, less sensitive to temporary illnesses that affect outcomes such as underweight (weight-for-age z-score; WAZ) or wasting (weight-for-height z-score; WHZ). Also, this measure is better explained by socioeconomic indicators as these are also long run in nature. Furthermore, children who are considered stunted have a height that is two standard deviations below the median height for children of the same sex and age of an international standard index (Giroux, 2008).

Thirdly, this research examines an extreme health outcome – child mortality, which accounts for whether an infant or child has died before its fifth birthday. The Mosley-Chen framework is used as a foundation of analyzing the determinants of child mortality. This framework accompanies both social and medical science approaches, as they believe both biological and social determinants are important factors to influencing a child's survival. Moreover, they state that child mortality should be viewed as a chronic disease influenced by many different factors as opposed to being an acute, single-cause outcome (Mosley and Chen, 1984).

Therefore, the variables chosen for the research are presented and explained in Table 1 below. Each variable is described how it is created. For example, age at marriage is made by creating specific age groups in order to delineate the immaturity to enter marriage. In similar manner the age at birth is observed. Further, the respondent's wealth status, highest obtained level of

education, place of residence, access to maternal care and child health outcomes are presented, together with a few control variables (household size, religion and division of residence).

Table 1: Variables of interest

Variable	***Description***
Age at marriage	Takes value '0' if married at an age younger than 13 (*child*); value '1' if married at 14-18 (*adolescent*); value '2' if married at an age older than 18 (*woman*).
Age at birth	Takes value '0' if gave birth at an age younger than 18 (*adolescent*); value '1' if gave birth at an age older than 18 (*woman*).
Education level	Takes value '0' if respondent has '*no education'*; value '1' if respondent has obtained at least a '*primary'* level of education; value '2' if respondent has obtained a '*secondary or higher'* level of education.
Husband's education level	Takes value '0' if husband has '*no education'*; value '1' if husband has obtained at least a '*primary'* level of education; value '2' if husband has obtained a '*secondary or higher'* level of education.
Wealth group	Takes value '1' if respondent is a member of a '*poorest'* household; value '2' if respondent is a member of a '*poorer'* household; value '0' if respondent is a member of a '*middle'* household; value '4' if respondent is a member of a '*richer'* household; value '5' if respondent is a member of a '*richest'* household.
Place of residence	Takes value '1' if respondent lives in an *urban area* and '0' otherwise.
HAZ, stunting	Takes value '1' if infant or child was found to be *stunted* and '0' otherwise.
Child mortality	Takes value '1' if infant or child was found to have *died* and '0' otherwise.
Antenatal care	Takes value '1' if child's mother had used *antenatal care* (at least once) from a health professional (qualified doctor, nurse/midwife/paramedic, family welfare visitor, medical assistant/sub-assistant community medical officer, health assistant or family welfare health assistant) during pregnancy and '0' otherwise.
Skilled attendance at delivery	Takes value '1' if a *skilled attendant* (qualified doctor, nurse/midwife/paramedic, family welfare visitor, community skilled birth attendant, medical assistant/sub assistant community medical officer, health assistant or family welfare health assistant) was present during delivery and '0' otherwise.
Household size	Takes value '0' if respondent is a member of a '*very large'* household (>15); value '1' if respondent is a member of a '*large'* household (10-15); value '2' if respondent is a member of a '*medium'* household (5-10); value '3' if respondent is a member of a '*small'* household (<5).
Religion	Takes value '1' if respondent's faith is '*Islam'*; value '2' if respondent's faith is '*Hinduism'*; value '3' if respondent's faith is '*Buddhism'*; value '4' if respondent's faith is '*Christianity'*.
Division	Takes value '1' if respondent lives in the division of '*Barishal'*; value '2' if in the division of '*Chittagong'*; value '3' if in the division of '*Dhaka'*; value '4' if in the division of '*Khulna'*; value '5' if in the division of '*Rajshahi'*; value '6' if in the division of '*Sylhet'*; value '7' if respondent lives in the division of '*Rangpur'*.

4. Methods

In order to answer the research questions, analyses will be performed using the software Stata (version 12). The outcomes of interest are age at marriage and child health outcomes (stunting and child mortality).

Furthermore, the primary interest of this study is in researching the determinants that influence child marriages. For this analysis a Multinomial logistic model is chosen because it generalizes logistic regressions to problems with more than two possible outcomes and allows the dependent variable to be a categorical one. This model is preferred because the specification includes a dependent categorical variable, with three categories – 'child', 'adolescent' and 'woman'. Additionally, the model allows for the prediction of the probability of being in one of the three categories using several independent variables – binary, categorical and continuous. The assumption that underlies this model is that being a member of a specific category is not dependent on being a member of another one (Starkweather and Moske, 2011). The multinomial logistic regression is performed using probabilities shown in the below equations; and interpreted using marginal effects.

$$P\hat{}(y = 0|x) = \frac{exp(\beta_{0,0} + \beta_{0,1}x_{0,1} + \cdots + \beta_{0,7}x_{0,7})}{1 + exp(\beta_{0,0} + \beta_{0,1}x_{0,1} + \cdots + \beta_{0,7}x_{0,7}) + exp(\beta_{2,0} + \beta_{2,1}x_{2,1} + \cdots + \beta_{2,7}x_{2,7})}$$

$$G(z) = \frac{exp(z)}{[1 + exp(z)]} = \Lambda(z)$$

$$P\hat{}(y = 1|x) = \frac{1}{1 + exp(\beta_{0,0} + \beta_{0,1}x_{0,1} + \cdots + \beta_{0,7}x_{0,7}) + exp(\beta_{2,0} + \beta_{2,1}x_{2,1} + \cdots + \beta_{2,7}x_{2,7})}$$

$$G(z) = \frac{exp(z)}{[1 + exp(z)]} = \Lambda(z)$$

$$P\hat{}(y = 2|x) = \frac{exp(\beta_{2,0} + \beta_{2,1}x_{2,1} + \cdots + \beta_{2,7}x_{2,7})}{1 + exp(\beta_{0,0} + \beta_{0,1}x_{0,1} + \cdots + \beta_{0,7}x_{0,7}) + exp(\beta_{2,0} + \beta_{2,1}x_{2,1} + \cdots + \beta_{2,7}x_{2,7})}$$

$$G(z) = \frac{exp(z)}{[1 + exp(z)]} = \Lambda(z)$$

Where y = 0 if age at marriage is as '*child*'
Where y = 1 if age at marriage is as '*adolescent*'
Where y = 2 if age at marriage is as '*woman*'
X_1 = wealth quintile
X_2 = highest obtained educational level
X_3 = husband's education
X_4 = place of residence (urban)
X_5 = division
X_6 = household size
X_7 = religion

Next, the effects of child marriage on child health outcomes are observed in this research through a Binary logistic model. This model is chosen due to the fact that the outcome variables of interest, which depict the status of child health in Bangladesh, are binary variables stunting and child mortality. This model is favourable as it is an application of a multiple regression to a binary dependent variable (Wooldridge, 2009). The dependent variables in question are structured in a way that whether an infant or child under the age of five was found to be either 'stunted' or have 'died', the indicators take value one and zero otherwise. The dependent variables are explained by various characteristics like wealth status, education level of the mother, place of residence and access to maternal care that are believed to affect the probability of a poor health outcome in infants and children. Therefore, the binary logistic regressions are performed using probabilities shown in the below equations for the outcomes of stunting and child mortality. These are then interpreted using marginal effects.

$$P(y = 1|x) = G(\beta_0 + \beta_1 x_1 + \cdots + \beta_7 x_7) = G(z)$$
$$G(z) = \frac{exp(z)}{[1 + exp(z)]} = \Lambda(z)$$

Where y = 1 if infant or child under the age of five is '*stunted*'
Where y = 0 if infant or child under the age of five is '*normal*'

$$P(y = 1|x) = G(\beta_0 + \beta_1 x_1 + \cdots + \beta_7 x_7) = G(z)$$
$$G(z) = \frac{exp(z)}{[1 + exp(z)]} = \Lambda(z)$$

Where y = 1 if infant or child under the age of five is '*dead'*
Where y = 0 if infant or child under the age of five is '*alive'*

X_1 = age at birth
X_2 = wealth quintile
X_3 = highest obtained educational level
X_4 = place of residence (urban)
X_5 = division
X_6 = antenatal care
X_7 = skilled attendance at delivery

Moreover, this study is interested in observing whether socioeconomic inequalities are present in the health variables of stunting and child mortality. In order to quantify the degree of these inequalities a concentration index must be calculated, using:

$$C_y = \frac{2cov(y_i, R_i)}{\mu_y}$$

Where y = infant or child under the age of five is *'stunted'*

Such a concentration index is bounded between the values -1 and 1.

However, due to drawbacks of the generalized concentration index, this study uses Erreygers' corrected concentration index. This method takes into account key requirements of transfer, level independence, cardinal invariance and mirror for bounded variables – like the dependent variables of interest (child stunting and mortality) (O'Donnell et al. 2008; Erreygers, 2009).

Isolating what contributes to socioeconomic inequality in child health, this study uses a decomposition method (O'Donnell et al. 2008). In order to apply a decomposition method, the above mentioned concentration indices and contributions need to firstly be calculated, using Erreygers corrected concentration index (Erreygers, 2009):

$$CC_y = 8cov(y_i, R_i)$$

Then, after the concentration index in stunting and child mortality has been measured, it can further be decomposed to explain the inequality that is present. This is done in order to isolate which determinant(s) drive the inequalities present in the child health outcomes, i.e. by how much it contributes to the inequality. Firstly, to decompose the CC_y of the poor child health outcome, a linear regression is used:

$$y_i = \alpha^P + \sum_{j=1}^{J} \beta_j^P x_{ji} + \varepsilon_i$$

Where y is infant or child under the age of five is *'stunted'* or *'dead'*, β_j is a coefficient, x_j are the determinants of poor child health and ε is an error term. Then the Erreygers' corrected concentration index CC_y can be expressed by:

$$CC_y = 4\left[\sum_{j=1}^{J} \beta_j^P \bar{x}_j C_{xj} + GC_\varepsilon\right]$$

Where x is the mean of the determinants of poor child health and where GC_ε is the generalized concentration index for the error term. Furthermore, $4\beta_j^P \bar{x}_j C_{xj}$ expresses the contribution of each of the determinants of stunting and child mortality (Erreygers, 2009). A contribution is derived from a combination of both the strength of the association between the determinant and the outcomes of stunting and child mortality, *and* the inequality in the determinant (O'Donnell et al. 2008). Ultimately, such an analysis provides insight and a better understanding of the possible causes of inequality, which is crucial for policymaking.

Furthermore, this inequality will be presented graphically using the concentration curve, computed with the software Adept (version 5.5). The concentration curve is directly correlated to the concentration index. A concentration curve is used in order to delineate in

which group of the population an outcome is more concentrated, whether among the rich or the poor of the population. Further, this figure shows on the x-axis the cumulative percentage of the population ranked from the poorest to the richest; while the y-axis shows the cumulative percentage of the outcomes stunting and child mortality in infants and children under five. The 45-degree diagonal stands for the 'Line of Equality', representing a proportionate distribution of the outcome between the rich and the poor of a population. The concentration curve lies above the Line if the outcome is concentrated more among the poor; while below represents a concentration among the rich.

5. Results

An analysis of the variables of interest will be made in this chapter of the research. This will firstly be done by providing insight into the descriptive statistics of the outcome variables, determinants and control variables. Bar charts and line graphs visualize these differences and trends. The effects determined to be most pertinent to this research are the ones of the respondents' wealth status, her obtained level of education, whether she lives in an urban or rural area and whether she has received any maternal care during pregnancy or at delivery. Furthermore in this chapter, predictors of child marriage and poor child health outcomes will be studied using the chosen models.

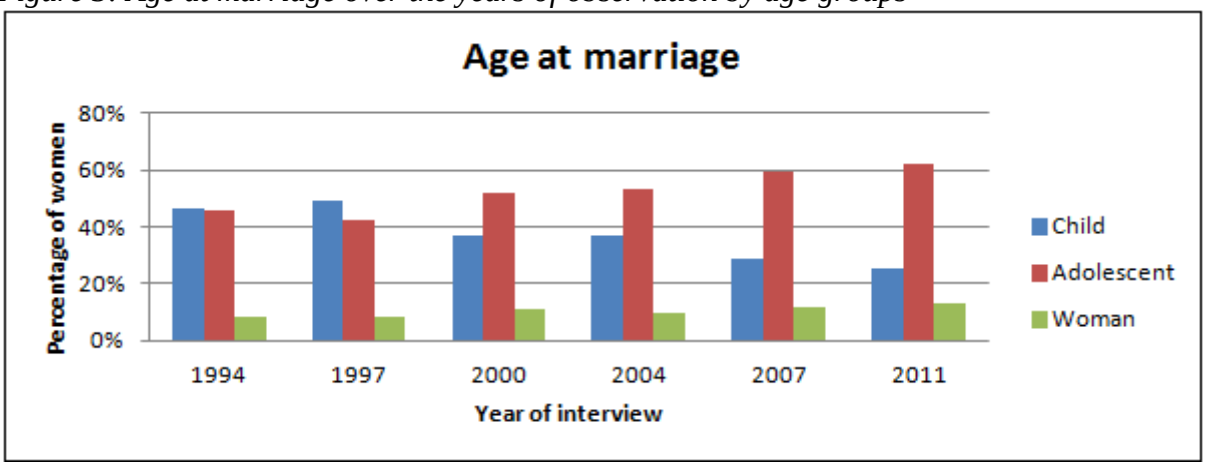
5.1.Summary statistics

5.1.1. Age at marriage

Table 6 (see: Appendix) shows the trends in the age at marriage from 1994 to 2011. In 1994, 46.3% of women in the sample married as a 'child'. While in 2011 this group counted 25.3%. Furthermore, for the age group 'adolescents' this percentage of women marrying then increased from 45.6% in 1994 to 61.9% in 2011. Next, for the age group 'woman' the proportion increased from 8.1% in 1994 to 12.8% in 2011.

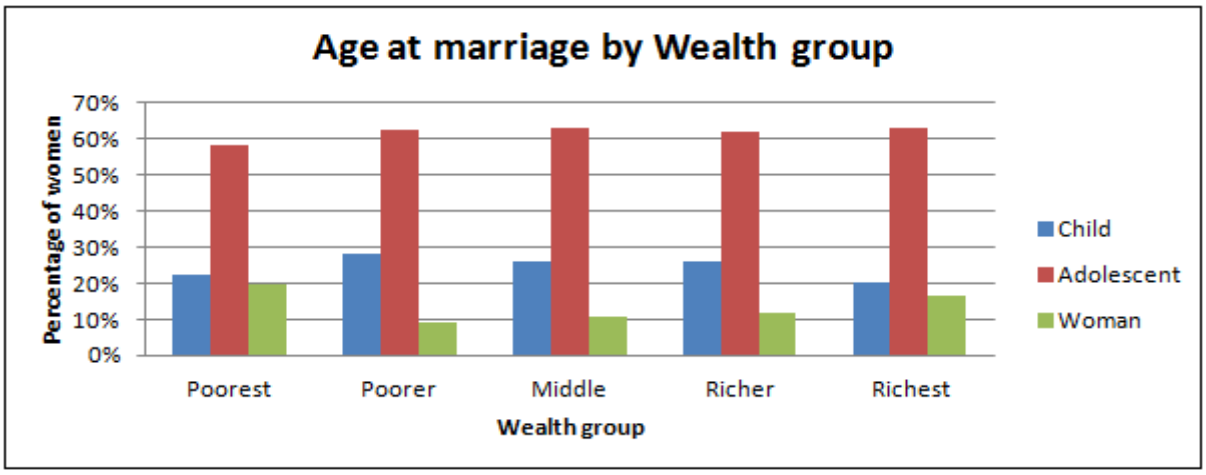
In order to observe these changes more easily, the results are shown graphically in Figure 3. The trends of age at marriage for all the years of observation are illustrated. It should be noted that the number of girls being married off as 'children' has declined over the years, while the number of women marrying as 'adolescents' has increased. The age group 'woman' also encountered a slight increase over the years. Based on what has been tracked thus far, one can conclude that over the years of observation the age at marriage has increased. In other words, more and more Bangladeshi women get married as 'adolescents'.

Figure 3: Age at marriage over the years of observation by age groups



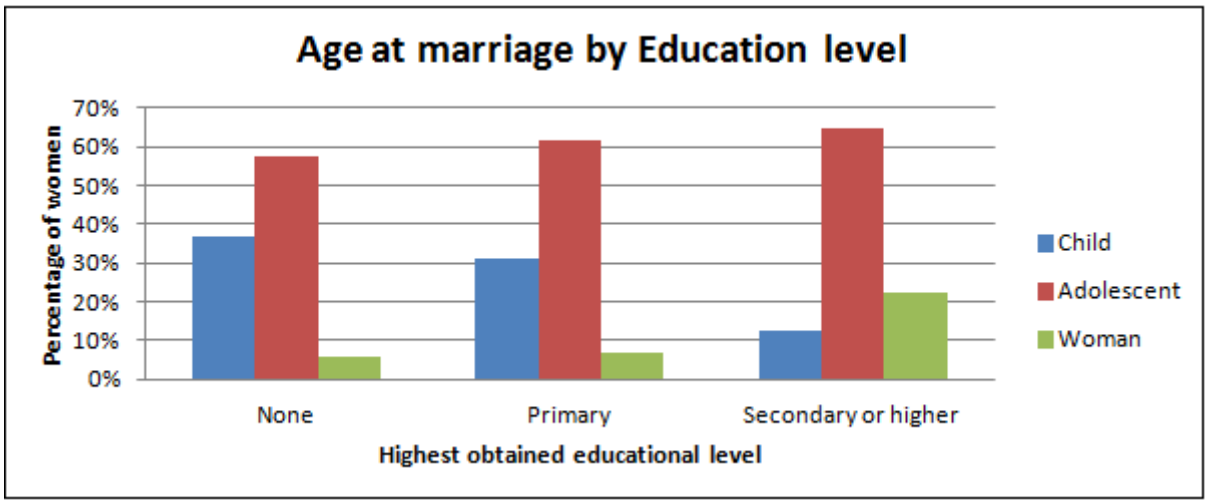
Next, the age at marriage over wealth quintiles was observed. As illustrated in Figure 4, there is no specific trend visible for either the higher or the lower wealth groups. Instead, it can be inferred that marrying as an 'adolescent' leads to an increase of around 5% when moving towards the wealth quintile 'richest'. As for the age groups 'child' and 'woman', there is no apparent trend of either increase or decrease. Therefore, one can conclude on a descriptive level that an almost equal proportion in the age at marriage among the different wealth quintiles is present.

Figure 4: Age at marriage by Wealth group



Proportions of age at marriage were also observed for the woman's highest obtained level of education. Figure 5 shows the overall impact of education and when a young woman would marry. On a descriptive level, one can observe that when a young woman has no education at all, she will most likely be married off as a 'child'. At the same time this proportion will drop significantly as we observe women with either secondary or higher education. Next, one can observe an increase in age at marriage when moving towards higher levels of education. In other words, women with a higher level of obtained education marry at a more mature age, either as an 'adolescent' or 'woman'. Therefore, from a descriptive perspective one might conclude that education affects at what age young women will enter marriage.

Figure 5: Age at marriage by woman's highest attained level of education



A similar pattern can be observed for the influence of a husband's education – a downward sloping trend for being married off as a 'child' and upward for 'adolescents' and 'women'. Furthermore, the interest is in comparing the proportions at which age girls get married based on their place of residence. Both in urban and rural areas most women get married as 'adolescents'. The percentage of girls marrying as 'children' is lower in urban areas and the percentage of women marrying as a 'woman' is higher in urban areas, which was expected. Therefore, it can be concluded on a descriptive level that there are differences present between urban and rural areas on when women marry.

When looking at the household size, one can observe (see: Table 6 in Appendix) that the proportion of people living in small households (0-5 members) has increased over the years. In 2011 most households in the sample (62%) are small ones.

Also, one of the control variables accounted for is the religion of the respondents. So far it is apparent that in Bangladesh most women enter marriage as 'adolescents'. This is the case for all religions. In Table 6 (see: Appendix) one can observe in what proportions each religious group is represented among the respondents. Women of the Islam faith are in the largest proportion married off as 'children', while women of the Buddhist tend to marry at an age older than 18.

Furthermore, the division of residence of the respondents is observed and several things can be noted. Being married off as a 'child' is most common in the division Rangpur, located in the Northwest of Bangladesh – also known as one of the poorest areas. Next, when looking at being married off as an 'adolescent' – this is most common in the divisions Barishal and

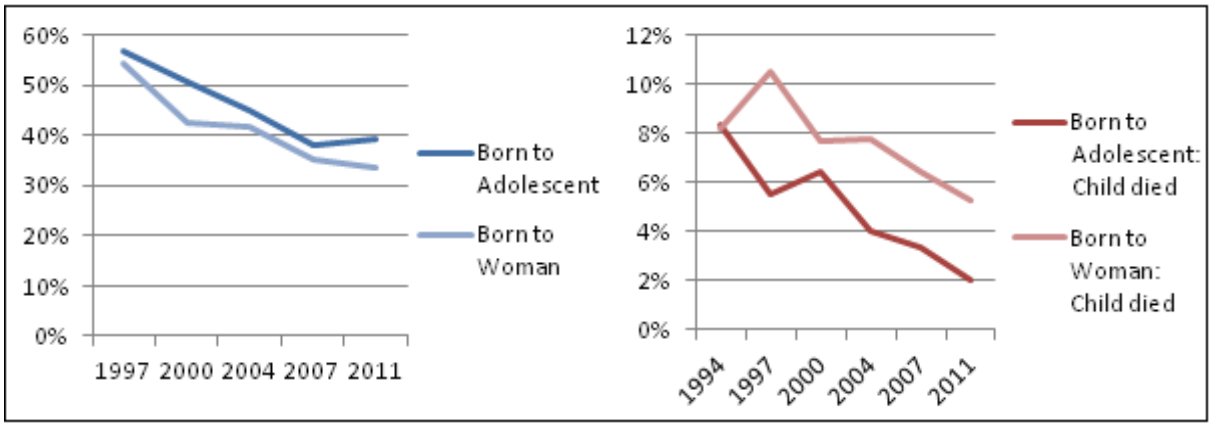
Chittagong. While marrying as a ‘woman’ is most common in Sylhet, located in the Northeast of Bangladesh – known as one of the richest areas.

5.1.2. Child health

When observing the prevalence of child stunting and mortality it is of interest to see whether a woman's age at birth has any influence on the occurence of these outcomes. Based on Figure 6, one might conclude on a descriptive level that for both the categories 'adolescent' and 'woman' there are downward sloping trends present in both outcomes of interest. This means that the occurrence of both infant and child stunting and mortality have been declining over the years of observation. Next, what might be observed is that stunting seems to be higher for children born to 'adolescents'; whereas, child mortality seems to be higher for children born to women at an age older than 18.

In more detail, in 1994 56.8% of the infants and children in our sample, born to adolescent mothers, were found to be stunted; while those born to mothers aged older than 18 this proportion was 54.2%. In 2011 these values declined to 39.2% and 33.6%, respectively. As for child mortality, in 1994 8.4% of children born to 'adolescents' have died; while, 8.2% children died who were born to 'women'. These values declined to 2% and 5.3%, respectively, in 2011. Therefore, one might conclude on a descriptive level that the age at childbearing has an effect on child health.

Figure 6: HAZ Stunting (left) and Child mortality (right) by Age at birth

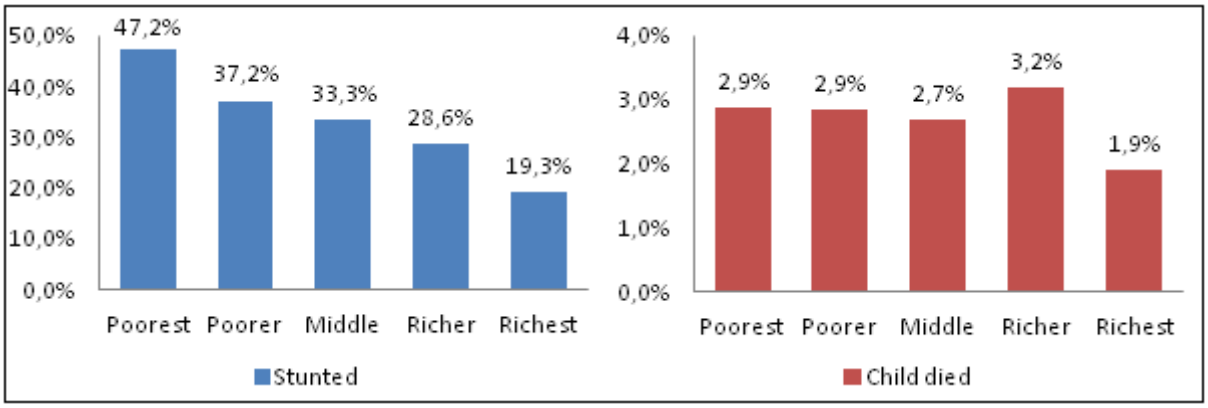


Next, wealth groups were studied by looking into what proportions stunted children or children who have died belonged to either of the wealth groups: 'poorest', 'poorer', 'middle', 'richer' or 'richest'. First, one can infer from Figure 7 that there is a downward sloping trend present, in both our outcomes, when moving towards better standing households. In more detail, it is clear that from all the ‘poorest’ infants and children under the age of 5 in the

sample, 47.2% were found to be stunted. This proportion decreases gradually to 19.3% of infants and children stunted, who are part of the 'richest' households. While for child mortality we see that from all the ‘poorest’ infants and children under the age of five in the sample, 2.9% of them have died. Further, this proportion decreases gradually to 1.9% of children who have died belonging to the 'richest' households.

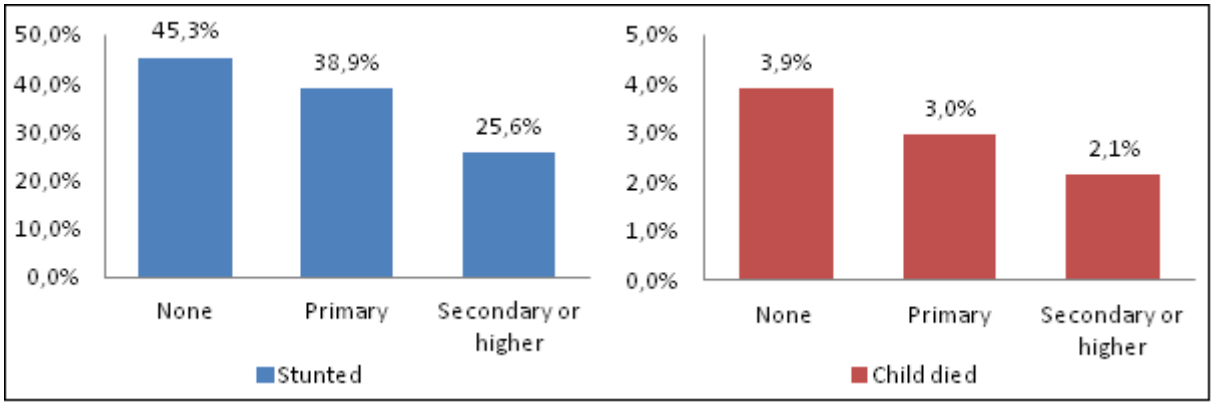
Therefore, one might conclude on a descriptive level that children from ‘richest’ households are less likely to be stunted and will less likely die, than ones born in the ‘poorest’ households.

Figure 7: HAZ Stunting (left) and Child mortality (right) by Wealth group



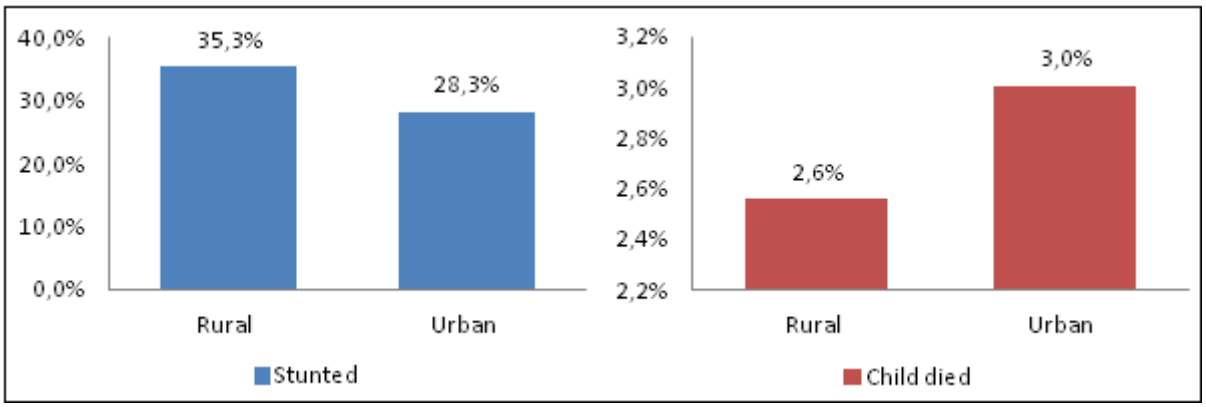
Furthermore, when looking at the effects of obtained education (Figure 8), there is a downward sloping trend – when moving towards higher levels of education. This is understood to mean that highest proportion of infants and children who are stunted were ones born to mothers with no education. Likewise, the highest percentages of children who have died were born to mothers with no education at all. In detail, one can observe a decline from 45.3% to 38.9% and, finally, to 25.6% of infants and children stunted to mothers with a secondary or higher level of education. For child mortality, there is a decline from 3.9% to 3% and, finally, to 2.1% of infants and children dying when moving towards higher levels of education. Therefore, it can be explained on a descriptive level, that education has an effect in lowering the occurrence of child stunting and mortality.

Figure 8: HAZ Stunting (left) and Child mortality (right) by Mother's Educational level



Next the place of residence is observed (Figure 9). Firstly, among the infants and children under the age of five in the sample who were found to be stunted 35.3% of them live in rural areas and 28.3% in urban areas. When looking at infant and child mortality, we see proportions of 2.6% of children have died in rural areas and 3% in urban areas. Thus, on a descriptive level it can be concluded, that more children are stunted in the rural areas of Bangladesh; while overall more die in urban areas.

Figure 9: HAZ Stunting (left) and Child mortality (right) by Place of residence

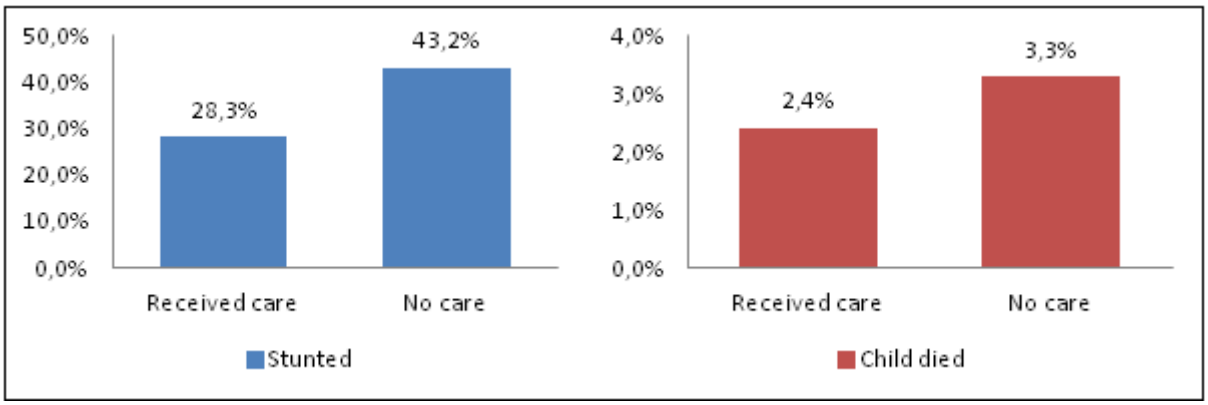


Lastly, the effects of access to maternal care during pregnancy and at delivery are illustrated in the following figure. The care that is observed includes antenatal care during pregnancy and skilled attendance at delivery. First, what can be seen in Figure 10 is that the proportions of infants and children that are stunted are higher among children whose mothers haven't received any maternal care; which counts 43.2% of the women in the sample. The proportion of children who are stunted is lower in children whose mothers did receive this care, but still high, counting 28.3%. Alongside stunting, the numbers for mortality demonstrate similar effects. The proportion of infants and children who have died is higher for those whose mothers haven't received any maternal care; counting 3.3% of the child population; while the

proportion of children who have died and whose mothers did receive maternal care counts 2.4% of the children in the sample.

Therefore, based on these results one might conclude on a descriptive level that access to maternal care has an effect on lowering the occurrence of stunting and mortality in infants and children under the age of five.

Figure 10: HAZ Stunting (left) and Child mortality (right) by Maternal care



5.2.Predictors of child marriage

This section of the paper analyzes the marginal effects of socioeconomic status considering a woman's wealth status, highest obtained educational level, living standards and the place of residence on under aged marriages.

Firstly, marrying at an age below 14 (as a 'child') was observed, compared to marrying as an 'adolescent' (aged 14-18). When all variables are included in the model, one can make a thorough interpretation of the effects (Table 2). The probability of marrying as a 'child' compared to marrying as an 'adolescent' seems to increase if the woman comes from a 'richer' household, by 3 percentage points. The woman's obtained level of education influences this matter as well. Having obtained at least a primary level of education decreases the probability a young woman would have been married off as a 'child', compared to 'adolescent', by 5.1 percentage points. Having obtained a secondary or higher level of education will further decrease this probability to 22.3 percentage points, ceteris paribus. Also, Table 2 indicates that in addition to education, the place of residence also influences the age at marriage. Living in an urban area furthermore increases the probability a woman will marry as a 'child' compared to as an 'adolescent' by 1.5 percentage points. Also, living in certain divisions of Bangladesh has an effect. Living in either the divisions Khulna, Rajshahi or Rangpur – seems to increase the probabilities to be married off as a 'child' by 6.1, 2.7 and 9.4 percentage points, respectively. This result is not surprising since these divisions are among the poorest ones in Bangladesh. At the same time one can observe a converse trend for the divisions of Chittagong and Sylhet where this probability of a woman to be married off as a 'child' decreases by 6.6 and 12.6 percentage points. Also reasonable since these are the wealthier areas. Next, a woman's religion also influences whether or not she will enter marriage as a 'child'. Being of Hindu faith, Buddhist or Christian faith all decrease the probability a young woman will be married off at such a young age – by 10.6, 16.8 and 18.8 percentage points, respectively. Finally, results show that whether a woman comes from a 'poorest', 'poorer' or 'richest' standing background, or any household size, does not affect the probability of being married off as a 'child', compared to as an 'adolescent'.

Table 2: Marginal effects on Age at marriage[1]

Outcome variable	*Child*		*Woman*	
Wealth Quintiles				
Poorest	-0.016	(0.010)	0.024***	(0.007)
Poorer	0.008	(0.010)	-0.004	(0.007)
Middle *(reference cat.)*				
Richer	0.030***	(0.010)	-0.002	(0.007)
Richest	-0.003	(0.010)	0.018**	(0.007)
Education				
None *(reference cat.)*				
Primary	-0.051***	(0.010)	0.009*	(0.005)
Secondary or higher	-0.223***	(0.010)	0.112***	(0.007)
Education of partner				
None *(reference cat.)*				
Primary	-0.033***	(0.009)	-0.003	(0.006)
Secondary or higher	-0.050***	(0.009)	0.068***	(0.007)
Place of residence	0.015*	(0.007)	0.042***	(0.005)
Division				
Barishal *(reference cat.)*				
Chittagong	-0.066***	(0.012)	0.039***	(0.008)
Dhaka	0.007	(0.012)	0.036***	(0.008)
Khulna	0.061***	(0.013)	-0.006	(0.007)
Rajshahi	0.027**	(0.013)	0.016**	(0.008)
Sylhet	-0.126***	(0.012)	0.153***	(0.012)
Rangpur	0.094***	(0.014)	-0.010	(0.007)
Household size[2]				
Very large (*reference cat.)*				
Large	-0.049	(0.045)	0.041**	(0.022)
Medium	-0.036	(0.042)	0.014	(0.019)
Small	-0.035	(0.042)	0.008	(0.020)
Religion				
Islam *(reference cat.)*				
Hinduism	-0.106***	(0.009)	0.072***	(0.009)
Buddhism	-0.168***	(0.049)	0.211***	(0.080)
Christianity	-0.188***	(0.029)	0.089	(0.056)

[1]Base outcome: *Adolescent* (age at marriage from 14-18)
[2]Number of household members: XL = >15 members; L = 10>15 members; M = 5>10 members; S = 0>5 members
The figure shows marginal effects and standard errors for each category
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Secondly, entering marriage at an age older than 18 (i.e. as a 'woman') is observed. These effects were compared to marrying as an 'adolescent'. For the respondents in our sample, who married as 'women', we can also observe that her socioeconomic background, education levels of both her and her husband, where she lives, and her religion affect whether or not she will marry at an older age. Belonging to either the 'poorest' or 'richest' wealth quintile increases the probability she married as a 'woman', compared to 'adolescent' – by 2.4 and 1.8 percentage points. Furthermore, the probability of marrying as a 'woman' increases if the woman obtains a primary level of education – by 0.9 percentage points; while having obtained a secondary or higher level of education increases this probability by 11.2 percentage points. Living in an urban area increases the probability by 4.2 percentage points. While, at the same time, one can observe such an increase for the divisions Chittagong, Dhaka, Rajshahi and Sylhet in 3.9, 3.6, 1.6 and 15.3 percentage points, respectively. This is reasonable, especially when looking at the division of Sylhet – with the highest probability of women marrying at an age older than 18, as this is the richest division of Bangladesh. Being of either Hindu or Buddhist faith, also increases the probability a woman marries at an age older than 18, compared to as an 'adolescent' – by 7.2 and 21.1 percentage points, respectively. Also, coming from a large household increases this probability, by 4.1 percentage points.

As for coming from a 'poorer' or 'richer' household, living in the divisions Khulna or Rangpur, being of Christian faith or living in a smaller household, do not seem to influence the probabilities of marrying as a 'woman' when compared to marrying as an 'adolescent'.

Therefore, based on these results one might conclude that socioeconomic status, especially education, place of residence and religion, are all important predictors of age at marriage in Bangladesh.

5.3.Predictors of poor child health outcomes

In this chapter of the paper effects of socioeconomic status considering a woman's wealth status, highest obtained educational level, living standards, place of residence and access to maternal care on child health are considered.

The effects of our determinants and control variables on stunting and child mortality are estimated. These are the respondents' age at birth, her wealth status, highest obtained level of education and her place of residence, whether she lives in an urban or rural area and in which division of Bangladesh. Furthermore, whether or not she has received any maternal care during pregnancy and at delivery of her child is controlled for.

The marginal effects on the outcomes of child stunting and mortality are studied using Table 3 below. Firstly, the marginal effects on stunting (first column of results) are observed and then on child mortality (shown in third column of results).

Table 3: Marginal effects on HAZ stunting and child mortality

Variable	*HAZ, stunting*		*Child mortality*	
Age at birth	-0.067***	(0.015)	0.016**	(0.006)
Wealth group				
Poorest	0.088***	(0.020)	-0.004	(0.006)
Poorer	0.014	(0.019)	-0.000	(0.007)
Middle *(reference cat.)*				
Richer	-0.034*	(0.019)	0.003	(0.007)
Richest	-0.107***	(0.020)	-0.013**	(0.006)
Education level				
None *(reference cat.)*				
Primary	-0.033*	(0.018)	-0.007	(0.006)
Secondary or higher	-0.095***	(0.019)	-0.013**	(0.006)
Place of residence (urban area)	0.025*	(0.015)	0.009**	(0.005)
Division				
Barishal *(reference cat.)*				
Chittagong	-0.008	(0.022)	-0.018**	(0.008)
Dhaka	-0.005	(0.023)	-0.013	(0.008)
Khulna	-0.061**	(0.024)	-0.022***	(0.008)
Rajshahi	-0.093***	(0.023)	-0.014	(0.009)
Sylhet	0.033	(0.024)	-0.005	(0.009)
Rangpur	-0.022	(0.024)	-0.016*	(0.008)
Maternal care				
Antenatal care	-0.039***	(0.013)	-0.010**	(0.004)
Skilled attendance at delivery	-0.077***	(0.016)	0.012**	(0.005)

The figure shows marginal effects and standard errors for each category
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Analysis begins by looking at the age at birth. Giving birth at an age older than 18 decreases the probability a child will be stunted in 6.7 percentage points, compared to giving birth as an 'adolescent'. Next, data indicates that belonging to the 'poorest' socioeconomic wealth status increases this probability of a child to be stunted by 8.8 percentage points, ceteris paribus. At the same time an opposite effect can be observed for the better-off households. Being either 'richer' or 'richest' decreases the probability a child will be stunted by 3.4 and 10.7 percentage points, respectively. The education level of the respondent affects the probability of the child to be stunted, in such that it decreases it. Having at least a primary level of education decreases this probability by 3.3 and a secondary or higher level decreases the same by 9.5 percentage points. Furthermore, living in an urban area increases the probability a child will be stunted by 2.5 percentage points. Living in certain divisions of Bangladesh also influences this probability. For example, living in the divisions of Khulna and Rajshahi decreases the

probability a child will be stunted, compared to being a normal height for its' age, by 6.1 and 9.3 percentage points, respectively. It is important to note that these outcomes for the divisions Khulna and Rajshahi are not reasonable, since these belong to the poorest parts in the country. Nevertheless, this will be discussed in more detail in the discussion part of this paper. The marginal effects of access to maternal care were also crucial to consider in the analysis, as having antenatal care during pregnancy decreases the probability a child will be stunted by 3.9 percentage points, compared to being a normal height for its' age. Skilled attendance at delivery decreases the probabilities a child will live being stunted by 7.7 percentage points. Being part of a 'poorer' wealth group and living in any of the other divisions of Bangladesh do not seem to have a direct effect on the probability a child would be stunted.

Next, child mortality was studied and interpreted in the same fashion. First, the age at birth influences child survival in a way that it increases the probability an infant or child under the age of five will die, compared to that it will survive, by 1.6 percentage points, ceteris paribus. Considering the age at birth, women giving birth at an age older than 18 are compared to those who bore children at an age younger than 18. Wealth groups are also examined. All besides the 'richest' group do not seem to have an effect on the probability a child will die; while being one of the 'richest' group decreases this probability a child will die, compared to that it won't, by 1.3 percentage points. Next, results show that having obtained a secondary or higher level of education decreases the probability a child will die, by 1.3 percentage points. Living in an urban area, compared to a rural area, increases the probability a child will die by 0.9 percentage points. Also, living in either of the divisions of Chittagong, Khulna or Rangpur seem to have an effect – these decrease the probability an infant or child under the age of five will die, by 1.8, 2.2 and 1.6 percentage points, respectively. Furthermore, whether a woman has received antenatal care during pregnancy or has delivered her child with the help of a health professional also influences child survival. For example, having received antenatal care decreases the probability an infant or child will die by 1 percentage point, compared to those that survive. Having skilled attendance at delivery seems to increase this probability a child might die, by 1.2 percentage points. As for other fields, such as being part of the rest of the wealth groups, having obtained a primary education at least, or whether the respondent lives in either of the rest of the divisions, there is minimal to no direct influence on the probability of child mortality.

Therefore, based on these results one might conclude that age at birth, being in the 'richest' wealth group, having a secondary or higher education, living in an urban area and receiving maternal care, are all important predictors of child health in Bangladesh.

5.4.Decomposition of inequalities

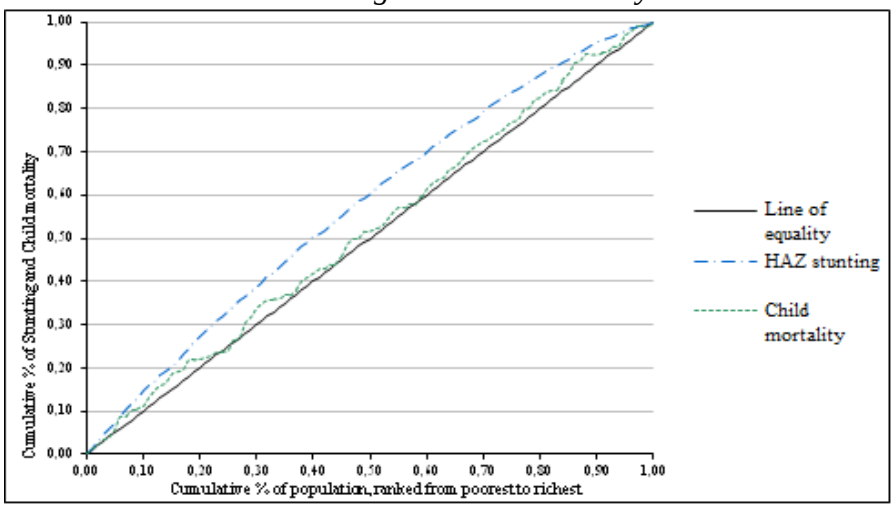
In this chapter of the research socioeconomic inequalities in child health will be discussed. Again, the outcomes of interest are stunting and child mortality in infants and children under the age of five. The goal is to isolate which inequalities drive the inequalities present in the child health outcomes and how large these are. Therefore, the method of decomposition is applied (O'Donnell et al. 2008) which calls for concentration indices to be calculated. Such a concentration index is directly correlated to the concentration curve, which helps visualize inequalities, how they are distributed and helps draw conclusions. A concentration curve is used in order to delineate in which group of the population an outcome is concentrated more, whether among the rich or the poor of the population.

Table 4: Results of the Erreygers corrected Concentration Index of Stunting and Child mortality (y variables)

Variable	Concentration index (CI) Rank=Wealth index	Std. Dev.	Obs.
Stunting	-0.191	0.015	6556
Child mortality	-0.004	0.005	7314

Based on Table 4 and Figure 11 one can conclude that stunting and child mortality are both disproportionately concentrated among the poor. The disproportionate inequality is larger in the outcome stunting (-0.1913) – whereas, in the outcome of child mortality this inequality is very small. Therefore, only the outcome of stunting will be observed in this chapter.

Figure 11: Concentration curve – Stunting and Child mortality[*]



In order to study these socioeconomic inequalities, it is crucial to first refer to the concentration indices and, thereafter, look at the contributions of each of these covariates to the inequality present. A summary of these outcomes is shown in Table 5 below.

Table 5: Decomposition of Erreygers' Corrected Concentration Index for Height-for-Age z-Scores of Infants and Children under five, Bangladesh, 2011

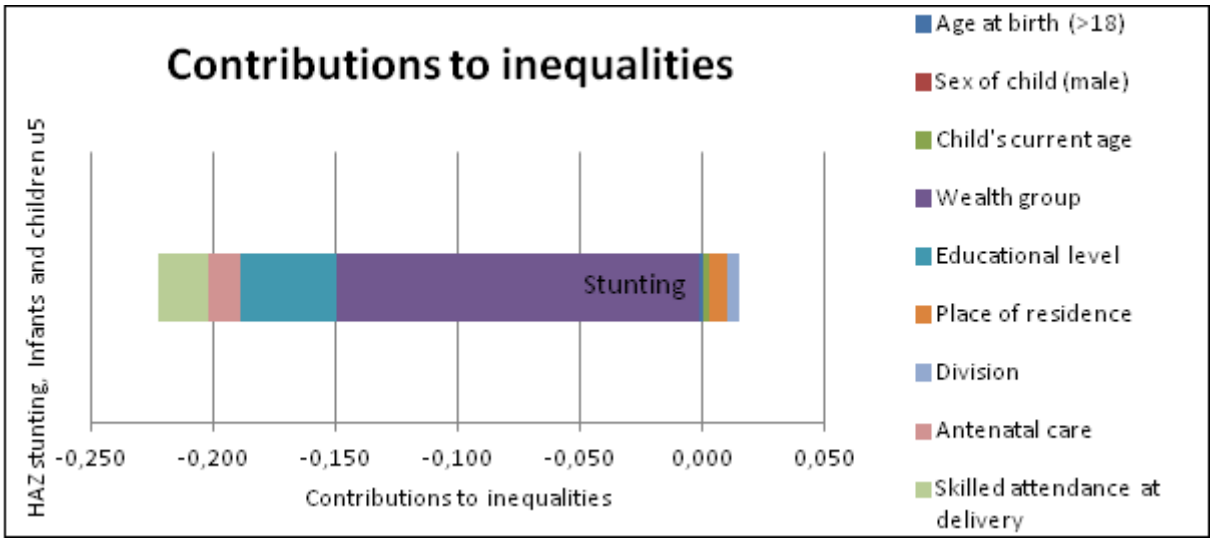
	Coef.	Mean	CI	Contribution
Age at birth (>18)	-0.060	0.815	0.007	-0.001
Sex of child (male)	0.017	1.483	-0.001	0.000
Child's current age				
<1	-0.175	0.227	-0.009	0.001
1	0.136	0.205	0.001	0.000
2	*(reference)*	0.184	-0.025	0.000
3	0.035	0.194	0.007	0.000
4	0.035	0.165	0.034	0.001
Wealth group				
Poorest	0.098	0.220	-0.780	-0.067
Poorer	0.018	0.200	-0.361	-0.005
Middle	*(reference)*	0.198	0.037	0.000
Richer	-0.035	0.197	0.432	-0.012
Richest	-0.106	0.185	0.815	-0.064
Educational level				
None	*(reference)*	0.192	-0.407	0.000
Primary	-0.032	0.302	-0.179	0.007
Secondary or higher	-0.088	0.506	0.262	-0.047
Place of residence	0.018	0.234	0.479	0.008
Division				
Barishal	*(reference)*	0.058	-0.160	0.000
Chittagong	0.002	0.216	0.069	0.000
Dhaka	-0.001	0.315	0.094	0.000
Khulna	-0.055	0.097	0.070	-0.001
Rajshahi	-0.092	0.136	-0.096	0.005
Sylhet	0.039	0.069	-0.032	0.000
Rangpur	-0.018	0.109	-0.243	0.002
Antenatal care	-0.033	0.628	0.160	-0.013
Skilled attendance at delivery	-0.055	0.239	0.395	-0.021
TOTAL CI				-0.191

Firstly, what should be observed is the negative concentration index in the last row. This figure shows, and confirms the previous statement, that there is inequality present in the outcome of stunting among infants and children under the age of five; and this outcome is concentrated more among the poor. Table 5 also shows the concentration indices of each factor and their total contributions to the concentration index of stunting. These contributions

are derived from a combination of both the strength of the association between the determinant and the outcome of stunting (Coef.), and the inequality in the determinant (CI). Based on Table 5 one can conclude that most of the socioeconomic-related inequality can be explained by the direct effects of belonging to a certain wealth group, having a higher education level and whether a woman had access to skilled attendance at the time of her delivery. Furthermore, one can also observe from the Table 5 that there are large wealth-related inequalities present in regards to whether a woman will have access to even lower levels of education, whether one will live in an urban area or not and whether a woman will have access to any maternal care. Although these inequalities are present, it seems they do not contribute directly to the concentration index of stunting among infants and children under five in Bangladesh.

These contributions to the inequalities are shown graphically in Figure 12 below.

Figure 12: Contributions to inequalities in the outcome of stunting in infants and children under the age of five



First of all, one can observe that Figure 12 confirms what we studied in Figure 11 and Table 5 – that the contributions belonging to pro-poor inequalities are present in stunting of infants and children under the age of five. Furthermore, the largest contribution to inequality in stunting is the household's wealth in which a child is born into. The second largest contribution to this inequality is the mother's educational level. Also, one can see that access to skilled attendance at delivery is a contributing factor. Skilled attendance is driven by its significant determinant (coefficient); while wealth and education are both driven by their significant determinants (coefficients) and their unequal distribution (CI).

Based on these observations, together with the analysis done earlier in this paper, a couple of conclusions can be drawn on whether socioeconomic inequalities exist in the outcomes of age at marriage and child health (stunting). Also, a conclusion on whether inequality in one outcome explains inequality in the other.

First conclusion that can be drawn so far is that the socioeconomic inequality in the age at which women marry in Bangladesh is pro-rich distributed and very small (see: Table 7 in Appendix). Therefore, one cannot infer it contributing to socioeconomic inequality in stunting. The age at birth (synonymous to age at marriage) does seem to be a significant determinant of stunting; but, at the same time, results confirm it doesn't contribute to the inequality present in stunting, as it shows a relatively equal distribution.

A second conclusion would be that there is socioeconomic inequality present in the outcome of stunting, in infants and children under the age of five in Bangladesh. This inequality is distributed at the expense of the poor of the population; with wealth status and education being the largest contributors.

6. Discussion and Conclusion

In this study the prevalence of child marriage and its effects on poor child health outcomes were studied through analyzing the socioeconomic factors of wealth status, living standards, education, place of residence, religion and access to maternal care.

By comparing the years of observations a declining trend was derived in the number of women that marry as 'children'. At the same time an increase in the proportions of women entering marriage as 'adolescents' and 'women' was observed. Further, with the help of the logistic models the determinants of child marriages in Bangladesh could be inferred. These determinants include the woman's wealth status, education, religion and place of residence.

Based on the results, it is understood that wealth status increases the probability a woman will marry both as a 'child' and 'woman'. The concentration index served to show there is an almost equal proportion in the age at marriage among the different wealth quintiles, which explains this outcome. This conclusion is therefore not in line with the reports of ICRW and UNICEF that argue that daughters of the poorest households are married off at an early age in order to relieve the financial burden of the family. Furthermore, the results have shown that if a woman has an education, the probability she will enter marriage as a 'child' decreases. This finding is in line with the conclusions Field et al. (2008) drew in their research – that when women who are forced to postpone marriage because of physical immaturity (the onset of their menstruation is at a later age) attain more schooling. Furthermore, programs constructed to increase schooling showed direct effects on both postponing marriage and childbearing (Adams et al., 2013). Research showed that significant improvements were made, but that still inequities prevail on the expense of the poor. Therefore, based on the findings, this research concludes that education, in part, explains the trend in the increasing age at marriage – as more and more women in Bangladesh become educated. Next, results showed that living in an urban area increases the chances a woman will marry as a 'child', but in greater extent that she will marry as a 'woman'. This is found to be reasonable, as the better-standing households more likely reside in urban areas than in rural. As for marrying as a 'child', these findings are not in line with UNICEF's report, as it states that child marriages are present more in the rural areas. For distribution across divisions consult Table 6 (Appendix).

This research was interested in researching how child marriages affect poor child health outcomes, in particular, the prevalence of stunting and child mortality in infants and children under the age of five in Bangladesh. The literature review included several researches that have shown a relationship between adolescent pregnancy and poor child health outcomes,

which laid a foundation for this research (Finlay et al. 2011; Rahman et al. 1989; Abdullah et al. 2006). Also, the ICRW and UNICEF reports cover related discussions, even stating there is a strong correlation between these health outcomes and the childbearing age of the mother.

By studying the occurrence of stunting and child mortality, it is discernible that these conditions have been declining over the last 18 years. Also, it was found that stunting prevailed more among children who were born to adolescent mothers, while cases of mortality were found more among children born to older mothers. This issue of child mortality can be explained by the fact that childbearing at older ages is also considered to be harmful. Furthermore, these findings are not entirely in line with the studied literature, as research showed that giving birth at an age younger than 17 was correlated to worse health outcomes (Finlay et al. 2011; Rahman et al. 1989; Abdullah et al. 2006). Therefore, findings in this research are only in line with the literature when considering stunting. Next, it was found that being part of the richer wealth quintiles and having an education decreases the probability of both these outcomes, while being part of a poor household increases the probability a child will grow up being stunted. These findings are reasonable and in line with the studied literature, as women who are educated and benefit a good social status are more likely to also benefit from good health themselves. Also, they are better informed about the dangers that might arise during pregnancy and at delivery (Christiansen et al.).

Furthermore, when observing access to maternal care, the results showed that receiving antenatal care during pregnancy decreases the probability of both the outcomes of stunting *and* infant and child mortality. While, having received skilled attendance by a health professional at delivery on one hand decreases the probability of stunting and on the other increases the probability of infant and child mortality. Also, living in an urban area increases the probabilities of both the outcomes of stunting and infant and child mortality. This is not in line with Cook's standpoint that poor child health outcomes are present more in the rural areas. Although, this finding has common ground with the research of Adams and her colleagues, as they state that the dwelling and slum populations of the urban areas are the most vulnerable as they do not benefit access to family planning programs. As for why skilled attendance increases the probability of infant and child mortality, inadequately trained health personnel could explain this, or possibly, these could represent cases of severe complications. Furthermore, Christiansen and her colleagues showed that although there are family planning programs present, the poorest of the population often do not have access to these information and services. The decomposition analysis conducted in this study proved to illustrate that

there are socioeconomic inequalities present in the occurrence of stunting – and furthermore that this is at the expense of the poor. Also, this method led to the conclusion that the drivers of this inequality are the wealth status of the mother and level of attained education.

Therefore, based on this research, I conclude that the harmful tradition of child marriages is changing for the better, as over the years more and more girls marry at more mature ages. Additionally, I would like to conclude that this did not prove to have an influence on child health outcomes. In both stunting and child mortality, this study has shown that the overall picture of child health is similarly improving. Although, still not enough for the poorest of the population. There is still room for improvement in the access to education. Nevertheless, this research confirms the underlying importance of investing in education. This is a long term investment. Since visible results can even be seen from the programs in this area of the last 20 years, the continuation of investment in education programs is the right strategy at the moment. Although on the right track, more strategic targeting should be implemented with a stronger orientation towards the poorest households in Bangladesh.

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Appendix

Table 6: Proportions of variables of interest

	1994	1997	2000	2004	2007	2011
Outcomes						
Age of marriage						
Child	46,3%	49,0%	36,8%	37,2%	29,1%	25,3%
Adolescent	45,6%	42,7%	52,2%	53,2%	59,3%	61,9%
Woman	8,1%	8,4%	11,0%	9,6%	11,6%	12,9%
Age at first birth						
Child	4,4%	5,6%	3,6%	32,2%	2,3%	3,4%
Adolescent	60,7%	61,7%	57,8%	60,8%	57,8%	56,1%
Woman	35,0%	32,7%	38,6%	36,0%	39,8%	40,4%
HAZ stunting	/	51%	40,6%	39,2%	33,6%	33,1%
Child mortality	6,6%	5,7%	4,7%	4,1%	3,1%	2,7%
Determinants						
Education						
None	56,4%	53,7%	43,4%	38,6%	33,3%	27,1%
Primary	27,9%	27,7%	28,4%	29,6%	30,1%	30,4%
Secondary or higher	15,7%	18,6%	28,2%	31,8%	36,6%	42,6%
Education of partner						
None	44,8%	44,5%	37,9%	36,1%	33,7%	30,0%
Primary	24,1%	25,0%	22,6%	25,4%	26,6%	27,4%
Secondary or higher	31,0%	30,6%	39,4%	38,5%	39,7%	42,6%
Wealth Tertiles						
Poorest	20,3%	20,0%	20,0%	20,0%	20,6%	20,2%
Poorer	19,8%	20,0%	20,0%	20,0%	19,4%	19,8%
Middle	20,0%	20,0%	20,0%	20,6%	20,1%	20,0%
Richer	20,0%	20,0%	20,0%	19,4%	19,8%	20,0%
Richest	20,0%	20,0%	20,0%	20,0%	20,0%	20,0%
Place of residence						
Rural	84,8%	84,1%	70,1%	65,9%	62,1%	65,1%
Urban	15,2%	15,9%	29,9%	34,1%	38,0%	35,0%
Maternal care						
Antenatal care	9,9%	14,9%	18,1%	25,5%	24,6%	25,7%
Skilled attendance at delivery	4,6%	5,3%	12,6%	12,6%	18,1%	25,2%
Control variables						
Household size*						
Very large	2,4%	1,8%	1,8%	1,6%	0,9%	0,7%
Large	7,5%	6,5%	7,7%	6,2%	4,7%	3,7%
Medium	44,2%	43,1%	43,0%	41,1%	37,2%	34,0%
Small	46,0%	48,6%	47,6%	51,0%	57,2%	61,6%
Religion						

Islam	87,5%	88,9%	86,7%	89,1%	90,1%	88,6%
Hinduism	0,3%	10,7%	12,3%	10,4%	9,3%	11,0%
Buddhism	0,1%	0,3%	0,8%	0,1%	0,2%	0,2%
Christianity	12,1%	0,1%	0,3%	0,4%	0,2%	0,3%
District						
Barishal	10,4%	10,3%	9,3%	11,9%	13,0%	11,5%
Chittagong	20,8%	14,9%	18,5%	18,1%	17,4%	16,0%
Dhaka	28,8%	27,7%	24,1%	22,6%	21,2%	17,4%
Khulna	13,0%	11,9%	17,2%	14,9%	15,8%	14,8%
Rajshahi	27,0%	25,4%	20,1%	22,4%	19,0%	14,6%
Sylhet	/	9,9%	10,8%	10,1%	13,6%	14,1%
Rangpur	/	/	/	/	/	11,7%

*Number of household members: XL = >15 mebers; L = 10>15 members; M = 5>10 members; S = 0>5 members

Table 7: Results of the Erreygers corrected Concentration Index of Age at marriage (y variable)

Variable	Concentration index (CI) Rank = Wealth index	Std. Dev.	Obs
Age at marriage	0.00347598	0.01236754	17749

Table 8: Results of the Multinomial Logistic Regression of Age at Marriage

Age at marriage	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Child						
wealth_quintile						
1	-.0625244	.0625567	-1.00	0.318	-.1851333	.0600845
2	.0386057	.0566151	0.68	0.495	-.0723578	.1495692
4	.1673314	.0577008	1.21990	0.004	.0542399	.2804229
5	.0107239	.0617094	0.17	0.862	-.1102243	.1316722
educ						
1	-.22434	.0466041	-4.81	0.000	-.3156824	-.1329975
2	-1.17827	.056582	-20.82	0.000	-1.289169	-1.067371
educ_husb						
1	-.1931269	.0478777	-4.03	0.000	-.2869654	-.0992883
2	-.1939783	.052649	-3.68	0.000	-.2971684	-.0907882
urbrur	.1501543	.0428957	3.50	0.000	.0660802	.2342283
district						
2	-.3770829	.0759526	-4.96	0.000	-.5259472	-.2282186
3	.0923037	.0707393	1.30	0.192	-.0463428	.2309502
4	.3205135	.0717056	4.47	0.000	.1799731	.4610539
5	.1743392	.0720582	2.42	0.016	.0331077	.3155707
6	-.7645201	.0886419	-8.62	0.000	-.938255	-.5907853
7	.4725401	.071674	6.59	0.000	.3320617	.6130186
member						
1	-.2206517	.2436636	-0.91	0.365	-.6982235	.2569202
2	-.1824235	.2236419	-0.82	0.415	-.6207536	.2559067
3	-.1865409	.2242121	-0.83	0.405	-.6259885	.2529067

religion						
2	-.6357104	.0717747	-8.86	0.000	-.7763861	-.4950347
3	-1.152222	.7493367	-1.54	0.124	-2.620895	.3164507
4	-1.6862	.6099512	-2.76	0.006	-2.881683	-.4907181
_cons	-.2054817	.2359072	-0.87	0.384	-.6678514	.256888
Adolescent	(base outcome)					
Woman						
wealth_quintile						
1	.2333201	.0782584	2.98	0.003	.0799364	.3867038
2	-.0413853	.0845977	-0.49	0.625	-.2071938	.1244231
4	.0202806	.0798871	0.25	0.800	-.1362953	.1768564
5	.1969433	.0774882	2.54	0.011	.0450692	.3488175
educ						
1	.0690908	.0893359	0.77	0.439	-.1060044	.244186
2	.8816276	.0843366	10.45	0.000	.7163309	1.046.924
educ_husb						
1	-.0977831	.0856338	-1.14	0.254	-.2656222	.0700561
2	.6509673	.0793712	8.20	0.000	.4954027	.806532
urbrur	.4909512	.0525414	9.34	0.000	.3879718	.5939305
district						
2	.3675986	.0939244	3.91	0.000	.1835101	.5516872
3	.4387965	.0943972	4.65	0.000	.2537815	.6238115
4	-.0034188	.1011846	-0.03	0.973	-.2017369	.1948993
5	.24553	.0998334	2.46	0.014	.04986	.4411999
6	1.118582	.0964145	11.60	0.000	.9296127	1.307.551
7	-.0039109	.1075558	-0.04	0.971	-.2147164	.2068946
member						
1	.3614062	.2498637	1.45	0.148	-.1283176	.8511301
2	.1057989	.2348763	0.45	0.652	-.3545501	.5661479
3	.0434302	.2357785	0.18	0.854	-.4186871	.5055475
religion						
2	.5094011	.066401	7.67	0.000	.3792577	.6395446
3	1.227104	.3791528	3.24	0.001	.4839779	197.023
4	.516521	.3714592	1.39	0.164	-.2115257	1.244.568
_cons	-3.234864	.2639582	-12.26	0.000	-3.752213	-2.717516

Table 9: Results of the Logistic Regression of HAZ, stunting

HAZ, stunting	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Age at birth	-.3065065	.0699103	-4.38	0.000	-.4435281	-.1694849
Wealth group						
Poorest	.3779901	.0858742	4.40	0.000	.2096797	.5463005
Poorer	.0616498	.0855938	0.72	0.471	-.1061109	.2294106
Middle *(reference cat.)*						
Richer	-.156538	.0885723	-1.77	0.077	-.3301364	.0170605

Richest	-.5380172	.1038462	-5.18	0.000	-.741552	-.3344824
Education level						
None *(reference cat.)*						
Primary	-.1444556	.0783052	-1.84	0.065	-.297931	.0090198
Secondary or higher	-.4313009	.0828496	-5.21	0.000	-.593683	-.2689187
Place of residence (urban area)	.1146582	.0677927	1.69	0.091	-.0182131	.2475294
Division						
Barishal *(reference cat.)*						
Chittagong	-.035271	.1005492	-0.35	0.726	-.2323437	.1618018
Dhaka	-.0213845	.1029821	-0.21	0.836	-.2232257	.1804567
Khulna	-.2840646	.1132415	-2.51	0.012	-.5060139	-.0621153
Rajshahi	-.451911	.1129607	-4.00	0.000	-.67331	-.2305121
Sylhet	.1429396	.106844	1.34	0.181	-.0664708	.3523501
Rangpur	-.0986815	.1070047	-0.92	0.356	-.3084069	.1110439
Maternal care						
Antenatal care	-.1791821	.0619232	-2.89	0.004	-.3005494	-.0578148
Skilled attendance at delivery	-.3552527	.0747426	-4.75	0.000	-.5017455	-.2087599
Constant	.0795694	.1373428	0.58	0.562	-.1896176	.3487564

Table 10: Results of the Logistic Regression of Child mortality

Child mortality	Coef.	Std. Err.	z	P>z	[95%Conf.	Interval]
Age at birth	.6232892	.2413557	2.58	0.010	.1502407	1.096.338
Wealth group						
Poorest	-.1382	.2378568	-0.58	0.561	-.6043908	.3279907
Poorer	-.0011639	.2347724	-0.00	0.996	-.4613093	.4589816
Middle *(reference cat.)*						
Richer	.0985244	.2295057	0.43	0.668	-.3512985	.5483474
Richest	-.5648238	.2870447	-1.97	0.049	-1.127421	-.0022265
Education level						
None *(reference cat.)*						
Primary	-.2432116	.1966549	-1.24	0.216	-.628648	.1422249
Secondary or higher	-.4756007	.2159445	-2.20	0.028	-.8988442	-.0523572
Place of residence (urban area)	.361356	.1747073	2.07	0.039	.018936	.703776
Division						
Barishal *(reference cat.)*						
Chittagong	-.6451173	.2591267	-2.49	0.013	-1.152996	-.1372384
Dhaka	-.4079948	.2553707	-1.60	0.110	-.9085121	.0925225
Khulna	-.8219419	.3179614	-2.59	0.010	-1.445135	-.1987489
Rajshahi	-.4337823	.2718168	-1.60	0.111	-.9665334	.0989688
Sylhet	-.1260863	.2483745	-0.51	0.612	-.6128913	.3607187
Rangpur	-.5269784	.2824018	-1.87	0.062	-1.080476	.026519
Maternal care						
Antenatal care	-.3741703	.1676143	-2.23	0.026	-.7026883	-.0456523
Skilled attendance at delivery	.4652172	.1860315	2.50	0.012	.1006021	.8298323
Constant	-3.335077	.3773256	-8.84	0.000	-4.074622	-2.595532