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# On Analyzing Factors Affecting Severe Pregnancy Complications in Urban Areas of Bangladesh

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**Abstract:** Pregnancy is a period of increased vulnerability of a woman's life and this study is designed to identify potential determinants of complications that women in urban areas of Bangladesh face during pregnancy, delivery or after delivery. For the purpose of analysis, data extracted from Urban Health Survey (UHS), 2013 has been used. Bivariate analysis has been performed using Chi-square test and multiple logistic regression model is used to assess the adjusted effect of potential determinants on the pregnancy complications. Migration status, mothers' education level, wealth index, working status of mothers, NGO (non-governmental organization) membership, received ANC (antenatal care), place of delivery and wanted pregnancy are found to have significant association with severe pregnancy complications. To reduce severe pregnancy, delivery or after delivery complications, the migrant women should be more health conscious during this period; women's decision regarding pregnancy should be valued considerably and their perception towards health care seeking behavior should be changed.

**Keywords:** Chi-square Test, Migration, Multiple Logistic Regression, Severe Pregnancy Complications, UHS

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## 1. Introduction

One of the prerequisites for the development of a country is to improve its reproductive health care. Reproductive health services encompass a variety of areas one of which is maternal health care [1]. In Bangladesh, pregnancy and post-partum period has become a life-threatening period for women as they experience varied complications at this stage. According to BMMS (Bangladesh Maternal Mortality and Health Care Survey) report 2016 [2], pregnancy-related maternal mortality ratio (PrMR) has been decreased from 382 to 201 per 100,000 live births by 2010 and in 2016 the PrMR is 205 per 100,000 live births. That means, a considerable reduction in pregnancy-related maternal deaths has been achieved in the last decade which has now stalled. According to a United Nations Population Fund (UNFPA) report, around 5,200 women in Bangladesh die annually due to pregnancy related complications that makes up 8% of total deaths of the women during their reproductive age [3]. The health-care workers, program managers and policy makers who are responsible for the quality of maternal health care should implement appropriate interventions to prevent pregnancy

related complications.

Despite the adverse outcome of complications during pregnancy, this topic has not attained sufficient attention of the researchers of Bangladesh. Only a few studies in Bangladesh were concentrated on the pregnancy and delivery related complications. *Ferdos et al.* [4] performed multivariate logistic regression model to assess the relationship between intimate partner violence and pregnancy complications after controlling for potential confounders. *Mullah et al.* [5] analyzed longitudinal data related to maternal morbidity using generalized linear mixed model and determined potential factors of pregnancy related complications. *Islam et al.* [6] identified potential risk factors for complications at the time of delivery and during the post-partum period. *Rahman et al.* [7] attempted to identify the significant factors that are associated with major pregnancy related complications during antenatal period. A study was conducted by *Huda et al.* [8] that analyzed the types and severity of maternal and foetal complications among women whose child were born in hospitals of Matlab and Chandpur of Bangladesh. Another study was conducted in rural Bangladesh by *Chakraborty et al.* [9] to analyze the ante-

partum maternal morbidity. Apart from these studies, numerous studies were conducted for analyzing maternal morbidity during pregnancy in different countries other than Bangladesh. For example, *Backos et al.* [10] studied obstetric period of women who had history of recurrent miscarriages, *Kilpatric et al.* [11] developed a document in which they made recommendations on the identification process of maternal morbid cases, *Callaghan et al.* [12] attempted to propose a new standard for monitoring severe maternal morbidity during both delivery and post-partum hospitalizations in the United States, *Kilpatric et al.* [13] conducted another study that assessed the relationship between true severe maternal morbidity and preterm delivery and a study was conducted by *Bhatia* [14] in southern India that determined the socio-economic and demographic factors of maternal morbidity. Another study was conducted by *Almeida et al.* [15] who analyzed maternal health-care in immigrant population through carrying out a systematic review of the scientific literature. In this study, the core aspects of the health-care received during pregnancy by the migrant women were investigated and the factors that make pregnancy and delivery period of migrant women complicated were identified. Such relationship between migration and pregnancy related complications can be very decisive for a country like Bangladesh where the recent pattern of migration shows the wave of rural people into slum areas of the city-corporations.

According to UN estimates in World Urbanization Prospects 2012, the annual increment in urban population of Bangladesh is currently 1.6-1.7 million and will peak at 1.9 million within the next few years, two-thirds of which will be due to in-migration from the rural areas [16]. The migrant women are usually exposed to biological and psychological risks as they are confronted with new contexts, environment and lifestyle. As a result, these migrant women become more susceptible of being morbid case during their pregnancy period [15].

Complications of women in urban areas of Bangladesh during pregnancy, delivery or after delivery periods are investigated and factors associated with such complications are identified. It is also examined that whether migrant women are prone to complications during this period. For the purpose of analysis UHS, 2013 [16] data set has been used and multiple logistic model is used to find out potential factor for complications during pregnancy, delivery or after delivery. This study is organized in five sections. The next section, i.e., Section 2 briefly discusses data and methodology used in this study. The results obtained from univariate analysis, bivariate analysis and regression model are presented and discussed in Section 4. Finally, this paper concludes in Section 5.

## 2. Method

### 2.1. Data and Variables

This paper analyzed secondary data extracted from Urban

Health Survey (UHS), 2013 [16]. This survey was conducted to provide information on intra-urban differentials so that the health challenges and use of services of different subpopulations of the cities can be identified. The UHS, 2013 was based on a stratified three-stage sampling procedure. At the first stage, 450 and 184 Mohollas were randomly selected in the city-corporation and other urban areas, respectively. Then, a mapping activity was conducted only in the city-corporation strata and two slum clusters and one non-slum cluster were selected randomly from each selected Mohollas. In the other urban strata, two clusters were randomly selected from each selected Mohollas. Finally, the third stage resulted in the random selection of households from each selected cluster. From these selected households, 15-49 aged ever married women were interviewed on a complete history of their individual characteristics, birth history, migration, family planning, child health and nutrition and maternal health care practices. The analysis has been performed using information collected from 9,014 women whose youngest child born preceding three years of the survey.

The response variable of this study is the severe complications that a woman had experienced during pregnancy, delivery or after delivery period. Severe pregnancy complications are usually defined as potentially life-threatening conditions [17]. In this study, among ten potentially life-threatening conditions which are severe headache or blurred vision, convulsion or fits, high blood pressure, severe bleeding, leaking membrane, mal-presentation, prolonged labor, retained placenta, high fever with smelly discharge and oedema, the presence of at least three of these conditions during pregnancy, delivery or after delivery is considered as a severely complicated pregnancy. That means, the response variable is a binary variable that takes a value 1 if a woman faces at least three of the given complications during her last pregnancy, delivery or after delivery, otherwise the value of the variable is 0. Among 9,014 women only 407 are found to experience severe complications during this period. One of the important independent variables of this study are the migration status. A migrant is defined as an individual whose place of birth is different from his current living place and/or one who has not “always lived” in his current living place [16]. In this study, only the recent migrants, i.e., who are residing in the current city for not more than two years, are considered as migrants. On the basis of previous studies [4-15], a set of socio-economic and health related variables are selected to identify the potential determinants of severe pregnancy complications. These variables are migration status (Migrants, Non-migrants or long-term migrants), place of resident (City Corporation: slum, City Corporation: non-slum, Rest urban area), mothers' education level (No education, Lower, Higher), wealth index (Poor, Middle, Rich), working status of mothers (Working, Not working), exposed to media (Exposed, Unexposed), NGO membership (Member, Non-member), received ANC (Yes, No), place of delivery (Home, Other than home), wanted pregnancy (Yes, No) and parity (0, 1-2, 3<sup>+</sup>).

## 2.2. Stistical Methods

This study has examined both unadjusted and adjusted effects of the selected variables on the severe pregnancy complications. The unadjusted association between severe pregnancy complications and the selected socio-economic and health related variables are determined by chi-square test [18] and the covariates found to have significant association with severe pregnancy complications are included in the multiple logistic regression model [19] to examine adjusted effect of these covariates on the response of interest.

Logistic regression model is a generalized linear model (GLM) where the response is a binary variable. Let  $Y_i$ ,  $i = 1, 2, \dots, n$ , be a binary random variable having a Bernoulli distribution with mean  $\mu_i$  and variance  $\mu_i(1 - \mu_i)$ ,  $X_i = (x_{i1}, \dots, x_{ij}, \dots, x_{ip})'$  be a  $p \times 1$  vector of covariates that could be both quantitative and qualitative and  $\beta = (\beta_1, \dots, \beta_j, \dots, \beta_p)'$  be the set of regression coefficients associated with  $X_i$ . The logistic regression model can be defined as

$$\mu_i = \frac{e^{x_i' \beta}}{1 + e^{x_i' \beta}}; i = 1, 2, \dots, n,$$

where the mean of response, i.e.,  $\mu_i$  is actually the probability  $P(Y_i = 1 | X = x_i)$  and the link function, that specifies how the mean of response relates to the covariates in the linear predictor ( $X_i' \beta$ ), of this model is the logit link function which is defined as follows

$$g(\mu_i) = \ln\left(\frac{\mu_i}{1 - \mu_i}\right); i = 1, 2, \dots, n.$$

The main parameters of interest of this model are the regression coefficients and these parameters are estimated through the maximum likelihood estimation procedure and

the estimated parameters are interpreted in terms of the odds ratios. The odds ratio is the ratio of two odds and the odds of occurring an event is the ratio of the probability that the event of interest occurs to the probability that it does not. Under the logistic regression model, the odds ratio (OR) for the covariate  $x_j$  can be expressed as

$$OR(x_j) = e^{\beta_j},$$

where all other covariates are considered at a fixed level and the model does not contain any interaction term involving the covariate  $x_j$ .

## 3. Result

### 3.1. Univariate Analysis

Descriptive statistics of the selected set of covariates are given in Table 1. The result of Table 1 reveals that only 6.8% of the respondents are recent migrants and 93.2% are either non-migrants or long-term migrants. Most of the respondents (45.1%) reside in city-corporation: slum and 23.0% and 31.9% of the respondents are respectively from city-corporation: non-slum and rest urban areas. Among all mothers in the study 15.9% are illiterate and most of them (70.6%) are lower educated and only 13.6% belong to the higher educated group. More than half of the respondents (55.2%) are from poor families and only 17.3% are currently working. A large number of mothers (88.0%) are found to be exposed to media and only 16.5% are involved to NGO. More than half of the mothers (78.6%) received antenatal care during their last pregnancy and for 50.6% of the mothers, the place of delivery was home. More than half of the mothers (83.9%) wanted the last pregnancy at the time it occurred and most of the respondents (48.5%) are found to have parity 1 or 2.

**Table 1.** Descriptive statistics of the selected covariates and percentage distribution of severe pregnancy complications by the selected covariates along with the p-values of Chi-square test.

Covariates	Percentage	Pregnancy Complications		p-value
		No% (n=8607)	Yes% (n=407)	
Migration Status				
Migrants	6.8	93.6 (573)	6.4 (39)	0.022
Non-migrants or long-term migrants	93.2	95.6 (8034)	4.4 (368)	
Place of resident				
City-corporation: slum	45.1	94.7 (3851)	5.3 (215)	0.005
City-corporation: non-slum	23.0	96.0 (1992)	4.0 (84)	
Rest urban area	31.9	96.2 (2764)	3.8 (108)	
Mothers' education level				
No education	15.9	95.2 (1362)	4.8 (69)	0.039
Lower	70.6	95.3 (6061)	4.7 (300)	
Higher	13.6	96.9 (1184)	3.1 (38)	
Wealth index				
Poor	55.2	94.8 (4717)	5.2 (258)	0.001
Middle	19.4	95.8 (1679)	4.2 (73)	
Rich	25.4	96.7 (2211)	3.3 (76)	
Working status of mothers				
Working	17.3	94.5 (1476)	5.5 (86)	0.038
Not working	82.7	95.7 (7131)	4.3 (321)	
Exposed to media				
Exposed	88.0	95.6 (7585)	4.4 (346)	0.059
Unexposed	12.0	94.4 (1022)	5.6 (61)	
NGO membership				< 0.001

Covariates	Percentage	Pregnancy Complications		p-value
		No% (n=8607)	Yes% (n=407)	
Member	16.5	93.6 (1395)	6.4 (95)	
Non-member	83.5	95.9 (7212)	4.1 (312)	
Received ANC				
Yes	78.6	95.1 (6738)	4.9 (345)	0.002
No	21.4	96.8 (1869)	3.2 (62)	
Place of Delivery				
Home	50.6	96.4 (4397)	3.6 (162)	< 0.001
Other than home	49.4	94.5 (4210)	5.5 (245)	
Wanted pregnancy				
Yes	83.9	96.1 (7262)	3.9 (298)	< 0.001
No	16.1	92.5 (1345)	7.5 (109)	
Parity				
0	40.9	95.2 (3518)	4.8 (176)	0.118
1-2	48.5	95.9 (4189)	4.1 (179)	
3 <sup>+</sup>	10.6	94.5 (900)	5.5 (52)	

### 3.2. Bivariate Analysis

Bivariate analysis has been performed to examine the association between complications and selected covariates and Chi-square test which is used to assess whether a specific covariate has significant association with severe pregnancy complications (SPC). The results are given in Table 1. It is observed from Table 1 that the variables migration status, place of resident, mothers' education level, wealth index, working status of mothers, exposed to media, NGO membership, received ANC, place of delivery and wanted pregnancy are significantly associated with SPC as corresponding p-values are too small. Table 1 reveals that recently migrant mothers experience higher percentage of SPC. The percentage of experiencing SPC is highest among the city-corporation: slum dwellers and lowest among the mothers of rest urban area. Illiterate mothers experience highest percentage of SPC whereas lowest percentage of SPC are found among the higher educated group. The mothers from poor families are found to have highest percentage of SPC and the lowest one is found for the mothers belonged to

rich families. The working mothers are found to experience higher percentage of SPC and lower percentage of SPC are found for the mothers with exposure to media than those who are not. The respondents who are affiliated with NGO experience higher percentage of complications during pregnancy, delivery or after delivery. Higher percentage of SPC is found among the mothers who received ANC and whose delivery did not occur at home. The mothers who did not want the pregnancy at the time it occurred experience higher percentage of complications during their pregnancy, delivery or after delivery.

### 3.3. Multiple Logistic Regression Model

The covariates found to have significant association with SPC are included in the multiple logistic regression to assess the adjusted effect of these covariates on SPC. The results obtained from the multiple logistic regression model, odds ratio and p-values obtained to test the null hypothesis that the covariate of interest has no impact on SPC are presented in Table 2.

**Table 2.** Estimates of regression coefficients, standard errors (SE) and odds ratios (OR) of experiencing SPC along with p-values.

Covariates	Estimates	SE	OR	p-value
Migration Status				
Migrants	0.45908	0.17904	1.583	0.010
Non-migrants or long-term migrants (RC)	-	-	-	-
Place of resident				
City Corporation: Slum	0.08375	0.14905	1.087	0.574
City Corporation: Non-slum (RC)	-	-	-	-
Rest Urban Area	-0.16133	0.15537	0.851	0.299
Mothers' education level				
No education	-0.04908	0.14406	0.952	0.733
Lower (RC)	-	-	-	-
Higher	-0.32889	0.19662	0.720	0.094
Wealth index				
Poor (RC)	-	-	-	-
Middle	-0.25435	0.14431	0.775	0.078
Rich	-0.43430	0.17003	0.648	0.011
Working status of mothers				
Working	0.21864	0.12981	1.244	0.092
Not working (RC)	-	-	-	-
Exposed to media				
Exposed	-0.21134	0.15240	0.809	0.166
Unexposed (RC)	-	-	-	-
NGO membership				
Member	0.39275	0.12530	1.481	0.002

Covariates	Estimates	SE	OR	p-value
Non-member (RC)	-	-	-	-
Received ANC				
Yes	0.46619	0.15242	1.594	0.002
No (RC)	-	-	-	-
Place of Delivery				
Home (RC)	-	-	-	-
Other than home	0.62253	0.11542	1.864	<0.001
Wanted pregnancy				
Yes	-0.64156	0.11864	0.526	<0.001
No (RC)	-	-	-	-
Intercept	-3.04005	0.24210	0.048	<0.001

RC=Reference Category

It is found from Table 2 that the variables migration status, mothers' education level, wealth index, working status of mothers, NGO membership, received ANC, place of delivery and wanted pregnancy have significant impact on SPC. The results given in Table 2 implies that recently migrant mothers have 58.3% higher odds of experiencing SPC compared to the non-migrant or long-term migrant mothers and this result is significant at 5% significance level. For the variable mothers' education level, the difference in the odds of having SPC is found significant (p-value= 0.094) only for higher educated mothers and it is 28.0% lower compared to the lower educated group. Wealth index is another potential determinant of SPC. Mothers from middle class and rich families have respectively 22.5% and 35.2% lower odds of experiencing severe complications during pregnancy, delivery or after delivery compared to the mothers from poor families and both of these results are found significant as the p-values are respectively 0.078 and 0.011. Working status of mothers is also responsible for SPC. The odds of having SPC is 24.4% higher among the working mothers compared to the mothers who are not working. The NGO members are found to experience 48.1% higher odds of severe complications during their pregnancy, delivery or after delivery compared to the mothers who are not NGO members. The variable received ANC is another significant (p-value= 0.002) determinant of SPC. The mothers who have received ANC are 1.594 times more likely to have severe complications during this period. The odds of experiencing SPC are 86.4% higher for the mothers whose place of delivery was other than their home compared to their counterpart and this result is significant at 1% level of significance. Wanted pregnancy has a significant (p-value= <0.001) impact on SPC and it is observed that the odds of having severe complications during pregnancy, delivery or after delivery of the mothers who wanted pregnancy at the time it occurred is 47.4% less likely compared to the mothers who did not want that pregnancy. No significant impact has been found for the variables place of resident and exposed to media on SPC.

#### 4. Discussion

Though giving birth is a time of immense joy for a woman's life, the pregnancy period may end up with

adverse outcomes, such as maternal death, child death, disabilities of newborn etc. due to various complications during pregnancy or delivery period or period after delivery. The women of a developing country like Bangladesh suffer from numerous life-threatening diseases related to pregnancy during or after their delivery. For this reason, maternal morbidity has now become an imperative research topic for Bangladesh.

One of the most important covariates found to have significant impact on SPC are migration status. Recently migrant women are found to have higher risk of experiencing SPC and similar result for the immigrant women was obtained by *Almeida et al.* [15]. This is expected because recently migrant women are most likely to change their living place during their pregnancy, delivery or after delivery period and hence, new environment and lifestyle may act as barriers that hinder the access to health systems during this period. It is observed that higher educated women are less likely to face SPC than lower educated women while no such significant difference has been found between illiterate and lower educated women. That means, only the achievement of higher education can make difference in the experience of severe complications during pregnancy, delivery or after delivery for a mother, but a slightly different result was found by *Choolani and Ratnam* [20]. They found a low incidence of maternal morbidity among all educated mothers. This result is not surprising because, higher education stimulates new values and attitudes towards seeking skilled care and also empowers women so that they can access such care. This study also reveals the decrease in the risk of experiencing SPC with the increase in wealth index of mothers. The women from wealthier families have higher likelihood of receiving health care facilities during pregnancy, delivery or after delivery that may result in a low incidence of maternal morbidity during this period. Working women and NGO members are found to have higher risk of SPC which contradicts the findings of previous study [7]. This is because the women who are currently working have to remain busy with their work and the same is true for NGO members. The NGO members have to do many difficult works and pregnancy leave is not always available for them. That's why, both working women and NGO members have to face various complications during this period. Conforming to previous study [8] it is found that the women who received ANC and whose delivery occurred at place other than their

home, i.e., in hospitals or clinics, are more likely to experience SPC. This result is not surprising for Bangladesh, since most of the women of this country seek hospital care during pregnancy or delivery period only when they have complications. Wanted pregnancy has emerged as another influential factor for SPC. Facing some severe complications during pregnancy, delivery or after delivery is found lower for women who wanted pregnancy at the time it occurred than those who did not. Similar result was obtained by *Mullah et al.* [5] and *Rahman et al.* [7].

## 5. Conclusion

This study emphasized the pregnancy, delivery or after delivery complications so that the program managers of health sector can take proper steps to reduce severe complications during this period and avoid the adverse outcomes of such complications. Using data extracted from UHS 2013 [16], the potential factors of SPC have been determined in this study.

To improve the reproductive health outcomes conspicuously, it is important to pay extra attention to the recently migrant women specially those who are currently pregnant, women education should be emphasized, work pressure of the currently pregnant working women or NGO member should be lessened, women's opinion regarding pregnancy should essentially be taken into consideration and finally, government should take immediate action to increase awareness among women regarding reproductive health care so that women can understand the adverse consequences of avoiding health care seeking behavior.

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