Original Research Article

Risk Factors of institutional Delivery in Bangladesh: A Multilevel Analysis of a Nationwide Population-Based Survey

ABSTRACT

Background: A substantial number of mothers and infants lose their lives due to complications during childbirth. Institutional delivery can lower the number of fatalities. This study aims to explore the prevalence of institutional delivery and its multifaceted associated factors in Bangladesh.

Methods: The data were extracted from Bangladesh Demographic and Health Survey (BDHS), conducted during the period of 2017-18. Following data preprocessing, a total of 4918 women were included in this study. This study attempts to identify and assess the variables (at the individual and community levels) having the significant impact on the institutional delivery by using a multilevel binary logistic regression model.

Results: Approximately half of the deliveries among the women in Bangladesh were documented as taking place within a medical facility. The study found that women aged 20 or older had a 1.44 times greater likelihood of using healthcare facilities during childbirth (OR, 1.44, [1.23-1.69]) than those under 20. Women with higher levels of education were more than twice as likely to choose institutional delivery as those with no education, and the women whose husbands had higher education had the same likelihood. The likelihood of using an institutional delivery service was also boosted by women's higher socioeconomic status. Women with exposure to any form of media had a 37% (OR 1.37, [1.17-1.59] higher likelihood of accessing healthcare facilities during childbirth. Rural women had a 24% lower likelihood of receiving institutional delivery.The utilization of institutional delivery was positively correlated with religion, child ever born, and antenatal care visits (ANC). This study discovered significant variations at the community level.

Conclusion: In order to increase the prevalence of institutional delivery in Bangladesh, the study findings suggest that policymakers should focus on addressing socioeconomic and demographic factors, particularly on women's education, husbands' education, age at first delivery, frequency of ANC visits, and access to mass media.

KEYWORDS: Institutional delivery, BDHS, ANC, Socioeconomic and Demographic factors, Community level.

1. INTRODUCTION

The World Health Organization (WHO) defines maternal death as the passing of a pregnant person due to pregnancy-related problems, the pregnancy aggravating preexisting conditions, or the medical treatment of these conditions [1]. The global maternal mortality ratio (MMR), estimated from UN inter-agency data, decreased by 34% between 2000 and

2020, from 342 maternal deaths per 100,000 live births to 223 deaths per 100,000 live births [2]. However, a woman died from a condition associated with pregnancy or childbirth every two minutes in 2020. Nearly 95 percent of all maternal deaths took place in low and lower-middle-income countries. The majority of these fatalities were avoidable. Sub-Saharan Africa and Southern Asia accounted for over 87% (253 000) of the expected global maternal deaths in 2020 [2].

Maternal death was most frequently caused by high blood pressure during pregnancy, unsafe abortions, severe bleeding, and infections following delivery [3]. A third of all antepartum causes, such as intrapartum and postpartum hemorrhage, were linked to risky home delivery methods [4-5]. Institutional delivery is an essential strategy for lowering maternal mortality. Deliveries that are aided in a hospital or other setting, carried out under the supervision of qualified healthcare professionals in a friendly environment, and supported by effective referral networks can reduce delivery problems and maternal fatalities [6–9].

Although there has been a noticeable improvement in South Asia over the past 20 years in r elation to delivery in hospitals, the rate is still relatively low when compared to other regions. The main barriers that prevent women from seeking healthcare during childbirth are inadequate healthcare services, financial limitations, physical distance, cultural norms, and a lack of information [10–11]. Home births are more likely to occur in unsafe and unclean conditions for South Asian women, which poses a major risk to the health of both the mothers and their newborns [12].

In Bangladesh, institutional delivery is not a common practice, similar to many other low- and middle-income countries (LMICs) in the South Asian region. In Bangladesh, deliveries typically occurred at home, and around half of live births occurred outside of hospitals [13]. One-third of the women in a research conducted in rural Bangladesh claimed to have experienced difficulties at the birth of their most recent child [14].

A number of studies used fixed-effect models, such as binary logistic regression, conditional logistic regression, and multivariate statistical analyses, to determine the variables affecting institutional delivery in Bangladesh [15–18]. Some research was mainly concerned with problems at the individual level. But community variables can have a significant impact on healthcare.A few studies showed how social and communal factors play a part in determining how often women in South Asia and Africa use maternal health care [19-20].This study used a multilevel binary logistic regression model with a random intercept to examine the factors associated with institutional delivery in Bangladesh, taking into account individual and community-level variables. It also determined the prevalence of institutional delivery among women aged 15 to 49 in Bangladesh as well as any potential variations at the community level related to delivery outcomes.

2. MATERIAL AND METHODS

2.1 DATA SOURCE

This research utilized data obtained from the eighth iteration of the Bangladesh Demographic and Health Survey (BDHS), which was gathered through the DHS program [21]. The BDHS survey is a nationwide, cross-sectional study that took place between October 2017 and March 2018, aiming to provide a representative snapshot of the population's characteristics during that period. The BDHS was carried out by a local research institute, the National Institute of Population Research and Training (NIPORT), in

collaboration with the Medical Education and Family Welfare Division of the Ministry of Health and Family Welfare.

2.2. SAMPLE DESIGN

The population living in non-institutional dwelling units in Bangladesh was sampled using a two-stage cluster sampling technique. Bangladesh is divided into eight administrative divisions, and each of these divisions is subsequently subdivided into zilas (districts) and upazilas (townships). At the urban level, an upazila is segmented into union parishads and mouzas. Conversely, at the rural level, it is divided into wards and mohallas, which are subdivisions of the wards. In the first stage, 675 enumeration areas (250 in urban areas and 425 in rural areas) were selected with probability proportional to EA (enumeration area) size. In the second stage of sampling, a systematic sample of an average of 30 households per EA was selected to provide statistically reliable estimates of key demographic and health variables for the country as a whole, for urban and rural areas separately, and for each of the eight divisions. A total of 20,160 households were selected for the survey.The information on the child's prenatal and postpartum treatment was extracted from the Kids Record (KR) data file. The cohort's initial size was 8759. After data handling, a sample of 4918 people was obtained for data analysis.

2.3. DEPENDENT VARIABLE

The study's binary outcome variable was "institutional delivery," which was divided into two categories: "Yes" and "No." If a delivery occurred in a hospital, whether it was a public or private facility, it was labeled as a "facility-based" delivery; otherwise, it fell into the "No" category.

2.4. INDEPENDENT VARIABLES

This study took into account both individual level and community level factors as explanatory variables. The individual level factors were: age at first birth, women’s education, husband’s education, 4+ ANC visits, health care decision making, child ever born and exposure to mass media. On the other hand, the community level factors were: wealth index, religion, place of residence and administrative division.

2.5. STATISTICAL ANALYSIS

The data from the BDHS 2017-18 for this study were cleaned, coded, and analyzed using the statistical tools SPSS version 25(IBM Corporation, Armonk, NY, USA). Descriptive analysis was employed in this study to obtain a broad comprehension of the sample's traits and attributes. The chi-square test of independence was used to assess how chosen covariates and institutional delivery interacted. The multilevel binary logistic regression model contained components from both the individual and community levels. Individual-level determinants (respondents) were nested within the communities (clusters). We calculated the odds ratios, P values, and 95% confidence intervals for each factor's impact on institutional delivery. Intra cluster Correlation (ICC) was used to express random effects to assess the fitness of the model. The model was constructed by considering the binary response variable Y_{ij}, which represents "Institutional Delivery" (1 if women *i* in community *j* receive institutional delivery services and 0 otherwise) [22,23]. The two-level random intercept binary logistic regression model, which accounts for women at level 1 and communities (clusters) at level 2, can be expressed as follows:

$$\text{logit}\,(\pi_{ij}) = \log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j} + \sum_{k=1}^{m} \beta_k X_{ijk}\ ;$$

$$i = 1,2,\ldots\ldots n_j, j = 1,2,\ldots\ldots d$$

$$\text{With } \beta_{0j} = \beta_0 + \mu_{0j}\,;\, \mu_{0j} \sim \text{iid } N(0,\sigma^2_{\mu 0})$$

Where, π_{ij} =Pr (Y_{ij}=1) is the probability that the woman *i*in community *j* takes institutional delivery services, $X_{ijk}$is the values of *m* explanatory variables for women *i*in community *j*, $\beta_k$is a vector of regression coefficients to be estimated, and β_0 is a fixed component. $\mu_{0j}$is the random error at the community level.

3. RESULTS AND DISCUSSION

Table 1 provides insights into the sociodemographic traits of women in Bangladesh. The data indicates that the majority of the mothers delivered their children during their teenage years (under the age of 20). In terms of education, the largest proportion of women had completed secondary level of education (47.9%), followed by those with primary level of education (27.7%), and those with higher level of education (18.2%). Only a small proportion of women lacked any formal education (6.2%). Additionally, the majority of women's husbands had received primary or secondary levels of education, with each category accounting for one third of the respondents. **Table 1** also demonstrates that about two out five women were poor (41.8%) and almost the same proportion were rich (40.3%). Nearly two third of the women were exposed to mass media (64.3%) and nearly half of them received 4+ ANC visits (48.3%). Furthermore, most of the women were Muslim (91.5%), and a majority of them used to make health care decision self or jointly (72.9%). A majority of the women were residing in rural region (65.6%), and had two or more children (62.1%).

Table 1: Distribution of Bangladeshi women's sociodemographic characteristics

Variables	n (%)
Age at first birth	
<20 years	3391 (69)
≥ 20 years	1527 (31)
Women's education	
No education	304 (6.2)
Primary	1363 (27.7)
Secondary	2356 (47.9)
Higher	895 (18.2)
Husband's education	
No education	678 (13.8)
Primary	1654 (33.6)
Secondary	1629 (33.1)
Higher	957(19.5)

Wealth index	
Poor	2057 (41.8)
Middle	882 (17.9)
Rich	1979 (40.3)
Exposure to mass media	
Not exposed	1757 (35.7)
Exposed	3161 (64.3)
4+ ANC visit	
No	2542 (51.7)
Yes	2376 (48.3)
Religion	
Muslim	4500 (91.5)
Non-Muslim	418 (8.5)
Health care decision making	
Self or Jointly	3585 (72.9)
Others	1333 (27.1)
Child ever born	
1	1863 (37.9)
2-3	2457 (50.0)
4+	598 (12.1)
Place of residence	
Urban	1693 (34.4)
Rural	3225 (65.6)
Administrative division	
Barisal	522 (10.6)
Chattogram	816 (16.6)
Dhaka	728 (14.8)
Khulna	510 (10.4)
Mymensingh	592 (12.1)
Rajshahi	519 (10.6)
Rangpur	550 (11.2)
Sylhet	681 (13.8)
Institutional delivery	
Yes	2490 (50.6)

No	2428 (49.4)

The relationships between sociodemographic factors and the utilization of a healthcare facility during childbirth are depicted in **Table 2**. In this study, all of the covariates were significantly associatedwith institutional delivery. The proportion of women who opted for healthcare facility delivery was observed to be notably higher among the following demographic categories: older women (aged 20 years or older), women with higher levels of education, husbands with higher levels of education, women from wealthier backgrounds, those with exposure to mass media, women who attended more than four antenatal care (ANC) visits and individuals hailing from urban areas.

Table 2:Association between Bangladeshi women's socioeconomic characteristics andInstitutional delivery

Variables	Institutional delivery		χ^2 value (P-value)
	Yes (%)	No (%)	
Age at first birth			
<20 years	43.7	56.3	207.83 (<0.001)
≥ 20 years	65.9	34.1	
Women's education			
No education	75.3	24.7	574.22 (<0.001)
Primary	67.6	32.4	
Secondary	46.6	53.4	
Higher	79.8	20.2	
Husband's education			
No education	28.6	71.4	541.31 (<0.001)
Primary	38.8	61.2	
Secondary	55.2	44.8	
Higher	78.8	21.2	
Wealth index			
Poor	31.5	68.5	622.95 (<0.001)
Middle	49.8	50.2	
Rich	70.7	29.3	
Exposure to mass media			
Not exposed	32.7	67.3	352.79 (<0.001)
Exposed	60.6	39.4	
4+ ANC visit			

Yes	66.8	33.2	480.40
No	35.5	64.5	(<0.001)
Religion			
Muslim	49.6	50.4	24.47 (<0.001)
Non-Muslim	62.2	37.8	
Health care decision making			
Self or Jointly	51.5	48.5	4.19
Others	48.2	51.8	(<0.05)
Child ever born			
1	61.8	38.2	
2-3	47.6	52.4	224.0
4+	28.1	71.9	(<0.001)
Place of residence			
Urban	63.5	36.5	170.99
Rural	43.9	56.1	(<0.001)
Administrative division			
Barisal	41.8	58.2	
Chattogram	47.9	52.1	
Dhaka	60.2	39.8	112.97
Khulna	62.9	37.1	(<0.001)
Mymensingh	42.4	57.6	
Rajshahi	55.9	44.1	
Rangpur	52.0	48.0	
Sylhet	43.3	56.7	

Table 3 presents the factors influencing institutional delivery among women in Bangladesh. Women aged 20 and older were nearly 1.4 times more likely to access healthcare services during childbirth (OR 1.44, [1.23-1.69]) compared to younger women (under the age of 20). As the level of education of women increased, the likelihood of utilizing healthcare facilities for delivery also increased. Women with higher levels of education were more than twice as likely to opt for institutional delivery (OR 2.12, [1.44-3.11]) than uneducated women. Women with husbands who had a higher education had almost twice the chance of giving birth in a hospital. The socio-economic status of women had significant effects on the use of institutional delivery. Wealthy women had a 2.1-fold higher likelihood of it than economically disadvantaged women. Similarly, the likelihood of giving birth in a health facility among middle-class women was 34%.

Delivery in a medical facility was significantly impacted by the mass media. Access to mass media increased a woman's likelihood of choosing institutional delivery by 37% compared to her counterpart (OR 1.37, [1.17-1.59]. With an increase in ANC visits, there was a higher

chance of giving birth in a hospital. Non-Muslim women had a 1.46 times greater likelihood of giving birth in a medical facility than Muslim women. This study found no association between institutional delivery and health care decision-making abilities. The likelihood of choosing an institutional birth reduced as a mother had more children. Compared to urban women, rural women were 24% less likely to give birth in a hospital. Only Khulna and Rajshahi, two divisions out of seven, were statistically significant. The Khulna divisions had the highest likelihood of delivering in a medical setting (OR 1.69, [1.20-2.38]).

Table 3: Multilevel binary logistic regression analysis of individual and community-level factors associated with institutional delivery services among women in Bangladesh.

Variables	Adjusted Odds Ratio (95% CI)	p-value
Age at first birth		
<20 years	Ref.	
≥ 20 years	1.44 (1.23, 1.69)	<0.001
Women's education		
No education	Ref.	
Primary	1.05 (0.77, 1.46)	.73 > 0.05
Secondary	1.48 (1.07, 2.04)	.018 < 0.05
Higher	2.12 (1.44, 3.11)	<0.001
Husband's education		
No education	Ref.	
Primary	1.16 (0.92, 1.44)	.20 > 0.05
Secondary	1.34 (1.09, 1.74)	.00 < 0.05
Higher	2.17 (1.61, 2.91)	<0.001
Wealth index		
Poor	Ref.	
Middle	1.34 (1.11, 1.63)	.00 < .005
Rich	2.10 (1.73, 2.56)	<0.001
Exposure to mass media		
Not exposed	Ref.	
Exposed	1.37 (1.17, 1.59)	<0.001
4+ ANC visit		
No	Ref.	
Yes	2.17 (1.88, 2.49)	<0.001

Religion		
Muslim	Ref.	
Non-Muslim	1.46 (1.12, 1.90)	0.00 < 0.05
Decision making		
Self or Jointly	Ref.	
Others	0.89 (0.77, 1.04)	0.15> 0.05
Child ever born		
1	Ref.	
2-3	0.68 (0.58, 0.78)	<0.001
4+	0.55 (0.43, 0.69)	<0.001
Place of residence		
Urban	Ref.	
Rural	0.76 (0.63, 0.91)	0.00 < 0.05
Administrative division		
Barisal	Ref.	
Chattogram	1.05 (0.77, 1.45)	0.73 > 0.05
Dhaka	1.30 (0.94, 1.81)	0.11 > 0.05
Khulna	1.69 (1.20, 2.38)	0.00 <0.001
Mymensingh	1.01 (0.73, 1.42)	0.92 > 0.05
Rajshahi	1.53 (1.08, 2.14)	0.01 < 0.05
Rangpur	1.38 (0.98, 1.94)	0.06 > 0.05
Sylhet	1.10 (0.79, 1.54)	0.57 > 0.05
Random-effect variance		
Community	0.316	<0.001
ICC	0.09	

The estimated Intra cluster Correlation Coefficient (ICC) for the model is 0.09, indicating that around 9% of the variation in mothers' utilization of institutional delivery services can be ascribed to disparities between communities. Therefore, using multilevel modeling with these data is justified. This suggests that community-level factors play a notable role in explaining the differences observed in the utilization of institutional delivery services among mothers.

4. DISCUSSION

This study focused on investigating the prevalence of institutional delivery and the factors that significantly contributed to it in Bangladesh. According to the findings of this study, there was a higher rate of health facility delivery among women with higher levels of education. These highly educated women were more likely to be informed and knowledgeable about health-related issues. This finding is consistent with previous studies [24-28]. Earlier research had also indicated that mothers with higher economic status were more inclined to

choose hospital deliveries [29-30]. This study yielded similar results. The poor's inability to pay for such services is one of the main barriers to the provision of health care. Rural women had a lower probability of delivering in a hospital compared to their urban counterparts. This discovery is consistent with the findings of a prior study conducted in Bangladesh [31]. Additionally, this study illustrated that the utilization of healthcare services during delivery was notably influenced by exposure to media. These findings were corroborated by earlier research [31-32]. However, conflicting findings were found in another study [24]. This study also found that women who had more than four ANC visits were more likely to deliver their babies in a hospital. Similar results were discovered in other studies [33-34]. Previous research indicated that women with low parity may be more motivated to choose health facility deliveries [24, 35,36]. This was in line with the study's findings. This trend could be attributed to the fact that first deliveries are often given more serious attention by family members. This study discovered an association between a woman's age at her first childbirth and her likelihood of delivering in a medical facility, which aligns with a similar finding from a study conducted in sub-Saharan Africa [4]. Women whose husbands have a high level of education were more inclined to give birth in a healthcare facility compared to those whose husbands had lower educational attainment. This pattern suggests that husbands with higher education levels tend to be more concerned about the health and well-being of their wives and children, which may lead to a higher likelihood of ensuring institutional delivery for their families. A comparable outcome was observed in a prior study conducted in Bhutan [37].

The study faced a notable limitation in its reliance on BDHS data, primarily due to the frequently limited sample sizes available at the country level. Another significant constraint is that our research only included deliveries resulting in live births because BDHS data lacks information on pregnancy outcomes other than live births and does not specify their delivery locations, which introduces a level of complexity and potential bias in our findings.

5. CONCLUSION

A primary challenge impeding the achievement of Sustainable Development Goal 3 (SDG 3) in numerous developing countries is the limited access to healthcare facilities. The current study's findings indicated that several factors, including higher levels of education among women, favorable socio-economic conditions, exposure to media, age at first childbirth, and the educational background of husbands, were all influential factors contributing to a higher likelihood of giving birthin a healthcare facility. In Bangladesh, substantial barriers persist due to a lack of awareness regarding the importance of seeking delivery care from trained healthcare providers. Raising public awareness could be significantly enhanced through mass media, and policymakers should consider initiatives to increase the frequency and reach of media exposure. Low parity influences the utilization of healthcare facility delivery. The emphasis on low-parity women should be strengthened even though research and policy are trending in that direction. Improving access to healthcare facility delivery, especially in rural areas, is of utmost importance. The insufficient utilization of healthcare facilities during delivery was largely linked to women's socioeconomic status and educational level. As a result, when shaping health policies and strategies, the government of Bangladesh should place heightened attention on addressing these two key factors.

CONSENT

N/A

ETHICAL APPROVAL

Not applicable as the study conducted entirely on the public domain dataset of Bangladesh which are available on online.

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