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Logistic Regression Analysis of Mode of Delivery Influencing Nutritional Status among Under-Five Children in Bangladesh: Survey in Rural Area of Rajshahi District

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Abstract

Caesarean delivery is a surgical procedure in which a fetus is delivered through an incision in the mother's abdomen and uterus. If there are no complications with women pregnancy or labor, a vaginal birth is safer than a caesarean birth. Worldwide the rates of C-section have gradually increased in the latest decades. The aim of the study was to determine the prevalence of caesarian delivery, and to investigate the impact of caesarian delivery on nutritional status of under-five children in the rural area of Rajshahi district, Bangladesh. This was a cross sectional study. Data was collected from Rajshahi district using multistage sampling. A total number of 540 mothers having at least one under-five children currently living together were considered. In order to data analysis, descriptive statistics, Z-proportional test and both univariable and multivariable logistic regression models were in this study according to our objectives. This study revealed that the prevalence of caesarian delivery among mothers living in the rural area of Rajshahi, Bangladesh was 34.4%. The prevalence of stunting, underweight and wasting among under-five children were 43.70%, 39.63% and 27.96% respectively. The stunting, underweight and wasting under-five children were 32.6%, *28.0% and 29.1% respectively who were born* by caesarian delivery, these were significantly ($p<0.01$) *lower compared to children who were born by vaginal delivery. However, the logistic model demonstrated that* children who were born by vaginal delivery were more likely to have underweight [COR= 1.617; 95%CI: 1.114-2.347; $p<0.05$] compared to children who were born by caesarian delivery. After controlled the effect of other independent variables such as mothers' age, education, occupation, nutritional status, fathers, education, occupation, number of family members, type of family and social class, found that children who were born by vaginal delivery had a 1.589-fold higher chance to have underweight compared to children who were born by caesarian delivery [AOR= 1.589; 95%CI: 1.063-2.377; $p<0.05$]. This study found the high prevalence in stunting, underweight and wasting among under-five children

in the rural area of Bangladesh. Bangladesh government and other non-government organizations should take special attention to overcome the problem.

Keywords and Phrases: Mode of delivery; Nutritional Status; Logistic regression model.

AMS Classification: 97K80, 62J12.

1. Introduction

Now a day's caesarean delivery is one of the most common and intractable health problems in the world. Cesarean section (CS) was introduced in clinical practice as a lifesaving procedure both for the mother and the baby. As other procedures of some complexity, its use follows the health care inequity pattern of the world: underuse in low income settings, and adequate or even unnecessary use in middle and high income settings (Betran et al., 2007, and Althabe et al., 2006). Several studies have shown an inverse association between CS rates and maternal and infant mortality at population level in low income countries where large sectors of the population lack access to basic obstetric care (Thomas et al., 2007, and Ronsmans et al., 2006).

Bearing in mind that in 1985 the World Health Organization (WHO) stated: "There is no justification for any region to have CS rates higher than 10-15%", we set out to update previous published estimates of CS rates worldwide and calculate the additional number of CS that would be necessary in those countries with low national rates as well as the number of CS in excess in countries in which CS is overused. In addition to understand the resource-use implications of the 'needed' and 'excess' procedures, we perform a global costing analysis of both categories of C-section. A total of 54 countries had C-section rates below 10%, whereas 69 show rates above 15%. 14 countries are rates between 10 and 15%. We estimate that in 2008, 3.18 million additional CS is needed and 6.20 million unnecessary sections are perform. The cost of the global “excess” CS estimate approximately amount is U$S 2.32 billion, while the cost of the global “needed” CS on approximately U$S 432 million (WHO, 2010).Caesarean children has great risks such as-injury during the delivery, need for special care in the neonatal intensive care unit, immature lungs and breathing problems, the infant is delivered before 39 weeks of gestation, premature birth, and fetal injury. If there are no complications with women pregnancy or labor, a vaginal birth is safer than a caesarean birth. Worldwide the rates of C-section have gradually increased in the latest decades.

Therefore, the aim of the study was to determine the prevalence of caesarian delivery, and to investigate the impact of caesarian delivery on nutritional status of under-five children living in rural environment of Rajshahi district, Bangladesh.

2. Methods and Materials

The target area for the study was the rural area of Rajshahi district, Rajshahi district is in the north-western part of the Bangladesh. The total area of the district is 2425.37 square km and the population are 2,699,688 as per the 2011 (BSS, 2011). Rajshahi is a city at the western border of Bangladesh, separated from India by a branch of Ganges River (Padma branch). To the northwest of Rajshahi lies the elevated and undulating Barind region, to the south is the high, well-drained Padma Valley; and a swampy depression drains the land in the immediate vicinity of the city (Uddin et al., 2014).The population of this study was being considered all pre-school children and their mothers who were living the catchments area of community clinic in Rajshahi district. The present study was a cross sectional study. Both quantitative and qualitative methods were used in this study. The quantitative survey was in household level of the community clinic catchments

areas. A multi-indicator survey designed was prepared to explore a number of different and diverse issues related to health. For the qualitative portion of the survey, researcher was develop a plan according to tools and included that in the survey design plan for review by supervisor. The data was extracted from the field survey conducted from October to December 2016 in the catchment of community clinic in rural area of Rajshahi district, Bangladesh. All selected samples were interviewed by an expert researcher group.

Multistage sampling technique was utilized to select samples covering all the population from nine Upazilas of Rajshahi district. There are 9 Upazilas of Rajshahi district and in these Upazila 233 community clinics are working. In first stage sampling, 2 community clinics were selected from each Upazila taking into account all the community clinics by simple random sampling. In the second stage sampling, 2 villages were selected from the community clinic catchments areas (one is nearest and another is far distance village). In the third stage sampling, all the households of the selected villages those have under 5 children were identified by their identification number (holding number or listing) and then 15 households were selected from each village by simple random sampling constituting to total 540 households. From each household, the mother of the household will interview as sample.

2.1. Variable selection

Outcome variable: The outcome variable of the study was the nutritional status of under-five children. Three indicators were used to measure nutritional status of under-five children; (i) height-for-age (z-score) (HAZ) (stunting), (ii) weight-for-age (z-score) (WAZ) (underweight) and (iii) weight-for-height (z-score) (WHZ) (wasting). A child was considered as stunted if the child's HAZ score falls below minus two times the Standard deviation (SD) below the median of the WHO reference population. Similarly, a child was considered as underweight, if the child's WAZ score falls below minus two times the SD below the median of the WHO reference population, and a child was considered as wasting if the child's WHZ score falls below minus two times the SD below the median of the WHO reference population (WHO, 2020).

Independent variables: The main independent variable was mode of delivery. It was classified into two classes: (i) caesarian delivery: Caesarean delivery is a surgical procedure in which a fetus is delivered through an incision in the mother's abdomen and uterus, (ii) Vaginal delivery (normal delivery): A vaginal delivery is the birth of offspring (babies in humans) in mammals through the vagina. It is the natural method of birth for all mammals except monotremes, which lay eggs into the external environment. The other independent variables were; socio-economic, demographic and anthropometric factors. All independent variables have been mentioned in Table 1.

2.2. Statistical analysis

The prevalence of caesarian delivery and vaginal delivery among mothers in Rajshahi district, Bangladesh was calculated using by frequency distribution. Z-proportional test was utilized to find the difference between two proportions of two groups. Finally, both univariable and multivariable logistic regression models were used to determine the impact of mode of delivery on nutritional status of children. The underlying multivariable binary logistic regression can be described as follows:

$$\text{Log}[P/1\text{-}P] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_K X_k \quad \text{(i)}$$

where, P = Probability of early stunting (underweight, wasting) (coded as 1)

1-P = Probability of not stunting (not underweight, not wasting) (coded as 0)

X_is are respective independent variables (i=1,2,…,k), and β_is are the regression coefficients. We used the magnitude of the standard error (SE) for detecting the multicollinearity problem among the independent variables, if the magnitude of the SE lies between 0.001 and 0.5, it was judged that there was no evidence of multicollinearity (Chan, 2004). Statistical significance was accepted at $p<0.05$. All statistical analyses were performed using SPSS (IBM Version 21).

3. Results

In the present study, we determined the prevalence and associated factors of mode of delivery among mothers living in the rural environment of Rajshahi district, Bangladesh. We considered 540 mothers and their under-five children for getting their relevant information for our study. We selected appropriate statistical tools/models to fulfill our objectives.

Figure displays the prevalence of mode of delivery among mothers living in the rural area of Rajshahi district, Bangladesh. It was found that 34.40% mothers were delivered by caesarian while more than 65% mothers were delivered by vaginal.

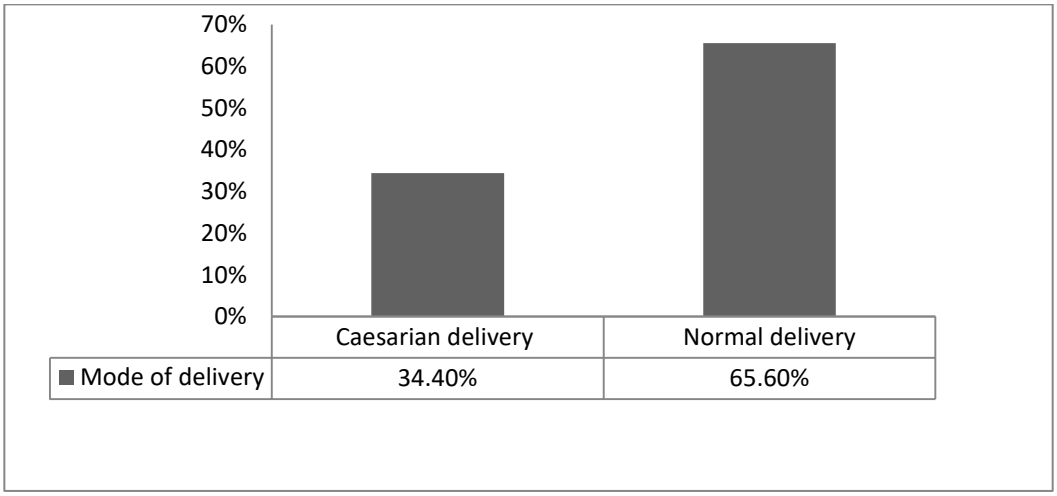

Figure: Prevalence of mode of delivery among mothers living in Rajshahi district

3.1. General characteristics of sample and cesarean delivery by the characteristics

We observed that maximum number (47.06%) of mothers' age was 26-34 years, still 14.07% mothers were uneducated and their 18.89% husbands were uneducated, and 96.29% mothers were housewives and 41.67% of their husbands were farmers. More than 50% families had 4-5 members, 69.44% were nuclear families, 21.2% mothers were living in hardcore poor family, and 68.89% households had hygienic toilets. It was observed that 17.78% mothers were suffering from chronic energy deficiency while 19.07% were over nourished (Table 1). It was found that the highest numbers of younger mothers (age<20 years) were delivered by cesarean, and more than half (57.5%) service holders' husbands wives underwent to cesarean delivery. More than half (51.6%) higher educated mothers and mothers (51.8%) those who had higher educated husbands underwent to cesarean delivery. More number of mothers (45.0%) who were not house wives underwent to cesarean delivery compared to mothers who were housewives (34.0%), and highest number of over nourished mothers (35.9%) underwent to cesarean delivery compared to mothers

who were undernourished or normal weight. There was no significant variation in cesarean delivery among family sizes and types of family. Increasing pattern was observed in cesarean delivery with increasing the social classes, and more number of mothers (41.7%) who were living in a household where hygienic toilets facilities available compared to their counterparts (Table 1).

Table 1: General characteristics of samples

	Mode of delivery			Mode of delivery	
Variable	Cesarean, N(%)	Normal, N(%)	Variable	Cesarean, N(%)	Normal, N(%)
Mother's age (in years)			Father's occupation		
<20, 41(7.60)	15(36.6)	26(63.4)	Farmer, 225 (41.67)	71(31.6)	154(68.4)
20-25, 206(38.15)	70(34.0)	136(66.0)	Daily labour, 192 (35.56)	58(30.2)	134(69.8)
26-34, 254(47.06)	91(35.8)	163(64.2)	Business, 83 (15.37)	34(41.0)	49(59.0)
≥35, 39(7.22)	10(25.6)	29(74.4)	Service, 40 (7.41)	23(57.5)	17(42.5)
Mother's education			Total household members		
No education, 76(14.07)	9(11.8)	67(88.2)	≤ 3, 115 (21.29)	40(34.8)	75(65.2)
Primary, 121(22.41)	35(28.9)	86(71.1)	4-5, 291 (53.89)	103(35.4)	188(64.6)
High school, 252 (46.67)	95(37.7)	157(62.3)	≥6, 134 (24.81)	43(32.1)	91(67.9)
Higher, 91 (16.85)	47(51.6)	44(48.4)	Type of household		
Mother's occupation			Nuclear, 375(69.44)	129(34.4)	246(65.6)
Housewife, 520 (96.29)	177(34.0)	343(66.0)	Joint, 165(30.56)	57(34.5)	108(65.5)
Others, 20 (3.70)	9(45.0)	11(55.0)			
Father's education			Socioeconomic status		
No education, 102 (18.89)	18(17.6)	84(82.4)	Hardcore poor, 99 (18.33)	21(21.2)	78(78.8)
Primary, 184 (34.07)	70(38.0)	114(62.0)	Poor, 258 (47.78)	79(30.6)	179(69.4)
High school, 140 (25.92)	39(27.9)	101(72.1)	Middle, 154 (28.52)	72(46.8)	82(53.2)
Higher, 114 (21.12)	59(51.8)	55(48.2)	Rich, 29 (5.37)	14(48.3)	15(51.7)
Nutritional status of mothers			Household toilet facilities		
Under nutrition, 96(17.78)	31(32.3)	65(67.7)	Unhygienic, 168 (31.11)	31(18.5)	137(81.5)
Normal, 341(63.15)	118(34.6)	223(65.4)	Hygienic, 372(68.89)	155(41.7)	217(58.3)
Over nutrition, 103(19.07)	37(35.9)	66(64.1)			

3.2. Nutritional status of under-five children by mode of delivery

In our study area, the prevalence of stunting, underweight and wasting among under-five children were 43.70%, 39.63% and 27.96% respectively. We noted that stunting under-five children were

born by caesarian delivery by 32.6%, and Z-proportional test demonstrated that the proportion of caesarian children significantly ($p<0.001$) lower than children who were born by *vaginal delivery (normal). 28.0% children were born by* caesarian *delivery who were underweight, and the proportion of the number was significant (*$p<0.001$) *lower compared to children who were born by vaginal delivery. It was found that 29.1%* caesarian children were wasting and it was significantly ($p<0.001$) lower than children *who were born by vaginal delivery (Table 2).*

Table 2: Difference in stunting, underweight and wasting between caesarian and normal deliveries

	Mode of delivery			
Nutritional status of children	Caesarian, N(%)	Normal, N(%)	Z-value	p-value
Stunting, 236(43.70%)	77(32.6)	159(67.4)	5.05	p<0.001
Underweight, 214(39.63%)	60(28.0)	154(72.0)	5.89	p<0.001
Wasting, 151(27.96)	44(29.1)	107(70.9)	4.74	p<0.001

3.3. Impact of mode of delivery on nutritional status of under-five children

Table 3 shows the impact of mode of delivery on nutritional status of pre-school children. Both univariable and multivariable logistic models were utilized, and univariable model showed that children who were born by vaginal delivery were more likely to have underweight [COR= 1.617; 95%CI: 1.114-2.347; $p<0.05$] compared to children who were born by caesarian delivery. When we controlled the effect of other independent variables such as mothers' age, education, occupation, nutritional status, fathers education, occupation, number of family members, type of family and social class, found that children who were born by vaginal delivery had a 1.589-fold higher chance to have underweight compared to children who were born by caesarian delivery [AOR= 1.589; 95%CI: 1.063-2.377; $p<0.05$].

Table 3: Impact of mode of delivery on nutritional status of pre-school children

Dependent variable	Independent variable	COR, 95% CI: (Lower-Upper)	p-value	AOR, 95% CI: (Lower-Upper)	p-value
Stunting	Model of delivery, Normal Vs Caesarian^R	1.154 (0.806-1.653)	0.434	1.114 (0.770-1.611)	0.566
Under weight	Model of delivery, Normal Vs Caesarian^R	1.617 (1.114-2.347)	0.011	1.589 (1.063-2.377)	0.024
Wasting	Model of delivery, Normal Vs Caesarian^R	1.398 (0.930-2.101)	0.107	1.338 (0.883-2.028)	0.169

4. Discussion

C- Section (CS) is a life reduction procedure for both the mother and the baby. The purpose of this study was to identify factors leading to CS and to evaluate the impact of mode of delivery on under-five children in Rajshahi district, Bangladesh. The prevalence underwent CS delivery in this study was 34.4% which was higher rate than the reported in national surveys. The national survey of Bangladesh (Bangladesh Demography and Health Survey (BDHS)) reported that the likelihood of delivering in a health facility increased over time. Between 1993-94 and 2017-18, facility deliveries rose from 4% to 49%, primarily as a result of the rapid increased in private sector deliveries since 2007. The percentage of women delivering in a private facility increased from 8% in 2007 to 22% in 2014 and 32% in 2017-18. In case of the public facilities, it increased from 7% in 2007 to 13% in 2014 to 14% in 2017-18. Consequently, the percentage of women with C-

section deliveries has continued to increase, from 3% in 1999-2000 to 9% in 2007, 17% in 2011, 23% in 2014, and 33% in 2017-18 (NIPORT, 2020). Using national data in Bangladesh this study assessed the recent changes of CS rate, and examined a range of socio-demographic characteristics that are likely to be determinants of CS use (Shariff et al., 2017). However, the impact of guidelines and recommendations in curbing their growth has been limited: in 1985, representatives of a study group convened by the World Health Organization wrote, "there is no justification for any region to have caesarean section rates higher than 10–15%." Although levels of 10–15% were considered high but acceptable at the time, average caesarean rates in most developed regions (with the exception of Eastern Europe) now exceed 20%; the recommendation thus appears to have been largely overtaken by events. If this trend continues then it is very likely that CS will bring more harms than benefits at the population level. CS also will increase the premature birth, maternal and fetal morbidity.

4.1. Impact of mode of delivery on nutritional status of under-five children

In the present study, we found that more number of children was stunting, underweight and wasting who were born by vaginal delivery compared to caesarian children, however logistic model demonstrated that the impact of mode of delivery on underweight children was significant. Same findings were observed in Brazil (Goldani et al., 2013). Moreover, it was noted that there was a significant association between mode of delivery and Zinc treatment during diarrhea. Our study showed that caesarian child face a higher odds of using Zinc treatment during diarrhea than who delivered by normal delivery. Our finding also agreed to the findings of other studies (Huurre et al., 2008; Sevelsted et al., 2015). We found initiation breastfeeding and mode of delivery was significant associated. Same finding also found in other studies (Hobbs et al., 2016; Exavery et al., 2015).

4.2. Limitation of the study

This study has a number of noteworthy limitations. First, in the present study, we considered only child who delivered at hospitals/Clinic and home in Rajshahi district, Bangladesh .This study is an analysis of primary data, and as it is bound by the limitation of those data. Secondly, besides the selective factors included in this analysis, child health factors are also significant predictors of women's pregnancy delivery method. Thirdly, CS in a nationwide study like ours could be affected by a range of factors, not all of those factors could be taken into consideration, as we used primary data. Fourthly, several impact factors have been mentioned in the literature all of which were not considered. Finally, patient's medical records were not examined to determine on what grounds the doctors opted for caesarean delivery therefore.

4.3. Conclusions

In the current study we considered 540 mothers and their under-five children living Rajshahi district in Bangladesh for investigating their impact of mode of delivery on nutritional status of children. The prevalence of caesarian delivery among mothers living in rural area of Rajshahi district, Bangladesh was 34.4%. Z-proportional test showed that significantly higher number of children were stunting, underweight and wasting who were born by vaginal delivery compared to borne by caesarian delivery. Logistic model provided that the impact of mode of delivery on children underweight was significant. World Health Organization (WHO) suggests that maximum 15% C-section delivery would be allowed in a particular population; however the prevalence of C-section delivery among mothers in Rajshahi district, Bangladesh is very high. So it is necessary to

take an action for making awareness about the bad effect of caesarean delivery among the women in Bangladesh. Special action should be taken to overcome the malnourished problems among under-five children in the country.

Ethical statement:

The study was approved by the Institute of Biological Science (IBSC), University of Rajshahi, Bangladesh, and their ethical clearance letter no. (Memo No: 69/320/IAMEBBC/IBSC).

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