

## Rising Trends of Cesarean Section in Bangladesh: Associated Factors and Long-Term Complications on Health of Mother and Children

Md. Altaf Hossain<sup>1,2)</sup>, Ishrat Jahan<sup>1)</sup>, Mohammad Mozibul Haque<sup>1)</sup>,  
Nazmul Sarwar<sup>3)</sup>, Nilufa Yeasmin<sup>1)</sup>, Dilshad Islam<sup>4)</sup>

<sup>1</sup>Department of Applied Food Science and Nutrition, Chattogram Veterinary and Animal Sciences University, Chattogram, Bangladesh

<sup>2</sup>Department of Animal Resources Science, Suncheon National University, Suncheon, South Korea

<sup>3</sup>Department of Food Processing and Engineering, Chattogram Veterinary and Animal Sciences University, Chattogram, Bangladesh

<sup>4</sup>Department of Physical and Mathematical Sciences, Chattogram Veterinary and Animal Sciences University, Chattogram, Bangladesh

### ABSTRACT

**Background:** With taking into consideration of the high cesarean section (CS) rate, the objectives of this study were to ascertain factors associated with and point out metamorphose complications with high CS rates in Bangladesh.

**Subjects and Method:** A cross-sectional study accounted for data collection from rural (196) and urban (241) women who gave birth to babies between 2005 and 2018 in Chattogram, Bangladesh. The study subjects were selected by using a systematic random sampling technique and the sample size was determined by using web-based Raosoft software. The delivery modes were dependent variables whereas influential factors and complications related to delivery were independent variables. The data were collected through face-to-face interviews using a pre-structured questionnaire. The height and weight of the participants were measured by using a stadiometer and weighing machine respectively. Data analysis was done by using regression analysis.

**Results:** The results divulged that mingling of relative influence and doctor's profit-making tendency, obstetric factors, and demand from a family with higher socioeconomic status contributed to the recent increased cesarean rate in urban areas (41.5%). The distended abdomen in mothers (OR= 5.11, 95% CI= 2.98 to 8.76) was strongly associated with CS ( $p < 0.05$ ), and back pain, and urinary incontinence were about one and half times higher in CS mothers. However, miscarriage and pelvic organ prolapse were associated with decreased risks of CS. Postnatal complications include cold fever (OR= 11.95, 95% CI= 7.02 to 20.35), and pneumonia (OR= 5.79; 95% CI= 2.71 to 12.36) were highly prevalent in children with cesarean delivery.

**Conclusion:** Cesarean section has become alarmingly increased in urban rather than rural areas of Bangladesh in recent decays. Awareness-raising, doctor commitment, government policy, and strict monitoring of private health facilities are needed to control high rates of cesarean delivery.

**Keywords:** cesarean delivery; vaginal delivery; demographic factors; obstetric factors; postpartum complications.

### Correspondence:

Md. Altaf Hossain, Department of Animal Resources Science, Suncheon National University, Suncheon, Jeollanam-do, South Korea. Telephone: +8201098532108; Email: altaf@cvasu.ac.bd

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## BACKGROUND

The Cesarean section (CS) has been considered a life-saving method for fetuses and mothers to improve the parturition outcome, though the procedure by itself carries inherent risks (Diana and Tipandjan, 2016). CS had introduced in Bangladesh in the late 1990s. Initially, it was performed, when vaginal delivery was not possible, and the life of the mother or baby was in peril, but now the prevalence rate in Bangladesh is alarmingly increased (36.1%) while World Health Organization (WHO) recommends not exceeding 5-10% in a country (Islam and Noor, 2021).

Recently, in Bangladesh, the trends of CS without any complications remarkably have increased (Ahmed et al., 2021). In Bangladesh, various socio-demographic factors and the profit-making intention of private health clinics are responsible for rising rate of CS (Hasan et al., 2019). Though the importance of CS is undeniable, it has several postpartum and postnatal complications. The Most common postpartum complications among CS mothers are pain, infection in the incision area, postpartum depression, cystotomy, urinary complications Mascarello et al., 2017). Several studies have shown that CS babies have faced different short-term complications such as allergic diseases, frequent infections and dysbiosis than a vaginal delivery baby (Sandall et al., 2018).

Although multiple studies with using secondary data have shown that multiple factors are associated with CS (Rahman et al., 2014; Shahabuddin et al., 2016), however, there have been very few studies that differentiate the rural and urban determinants of CS and the long-term impacts of CS on maternal and child health in Bangladesh. Therefore, the aim of this study was to determine the inherent factors aligned with CS between rural and urban

areas of Bangladesh and to identify the long-term complications in mothers and CS children.

## SUBJECTS AND METHOD

### 1. Study Design

This was a quantitative cross sectional descriptive study using a retrospective review of mothers' history. The quantitative design was chosen so that collected data could be analyzed for statistical significance of associations between predictor and outcome variables. This study was conducted in city and rural areas of Chattogram division of Bangladesh.

### 2. Population and Sample

Women who were interested to participate in this study, whose age range was 15-44 years and gave childbirth by CS or vaginal delivery (VD) between 1st January 2005 and 31st December 2018. A systematic random sampling method was used to select women and places. This sample size was calculated using a web-based automated calculator, Raosoft software with a 5% margin of error and a confidence level of 95%. After calculation, the sample size was 351 for rural and 371 for the urban areas but due to lack of time and budget this took 196 and 241 samples respectively.

### 3. Study Variables

The dependent variables of this study are vaginal and cesarean delivery and the independent variables are demographic characteristics, obstetric factors, influential factors and health complications

### 4. Operational Definition

Vaginal delivery refers to giving birth to offspring through the vagina, and cesarean delivery refers to birth a child by surgery through an incision of the abdomen. Demographic characteristic defines the distribution of some particular attributes of the target population, such as age, education, economic condition, etc. Obstetric factors

are life-threatening health complications of mother and neonate during pregnancy. Influential factors refer to the factors that motivate to decide cesarean delivery. Here health complications imply the postpartum and postnatal complications among mothers and children due to cesarean delivery.

### 5. Instruments of the Study

The In this study, face to face interview data was collected from mothers using a pre-structured questionnaire data collection sheet by trained interviewers following a standardized interview protocol. The height of mother was determined by using a stadiometer (model: PRESTIGE - SM) and weight was measured by a weighing machine (model: BS-150K100)

### 6. Data Analysis

Data from questionnaire were captured in a Microsoft excel spreadsheet for data cleaning and coding. Then data imported to IBM Statistical Package for the Social Sciences SPSS (version 17.0) for data analysis. Frequencies of different variables were tabulated. Bivariate analyses of demographic variables, obstetric and non-obstetric variables were done using Chi square and Fisher's exact tests. Finally, binary logistic regression analysis was used for each of the health outcomes separately adjusted with basic socio-demographic characteristics. Level of significance was set at  $p < 0.05$ .

### 6. Research Ethics

This study was carried out with the informed consent of participants. During the study, the researcher was committed to the participants that data will use only for research purposes with maintaining anonymity and confidentiality

## RESULTS

The age range of participants in this study was 16 -40 years. Though one-third of rural mothers' age was under 19 years, the teenagers in urban areas were only 3%. The

demographic variables of mothers are shown below in Table 1.

The total, primary and repeated CS rates had higher in urban areas in contrast to rural areas. However, the rural (54.40%) area had a higher VD rate compared to the urban (45.60%) areas Figure 1.

The close relatives and friends of mothers tremendously influence in decision-making of the delivery methods. The decision of VD was influenced by relatives (66%), friends (13.3%), and media (8.4%), shown in Figure 2.

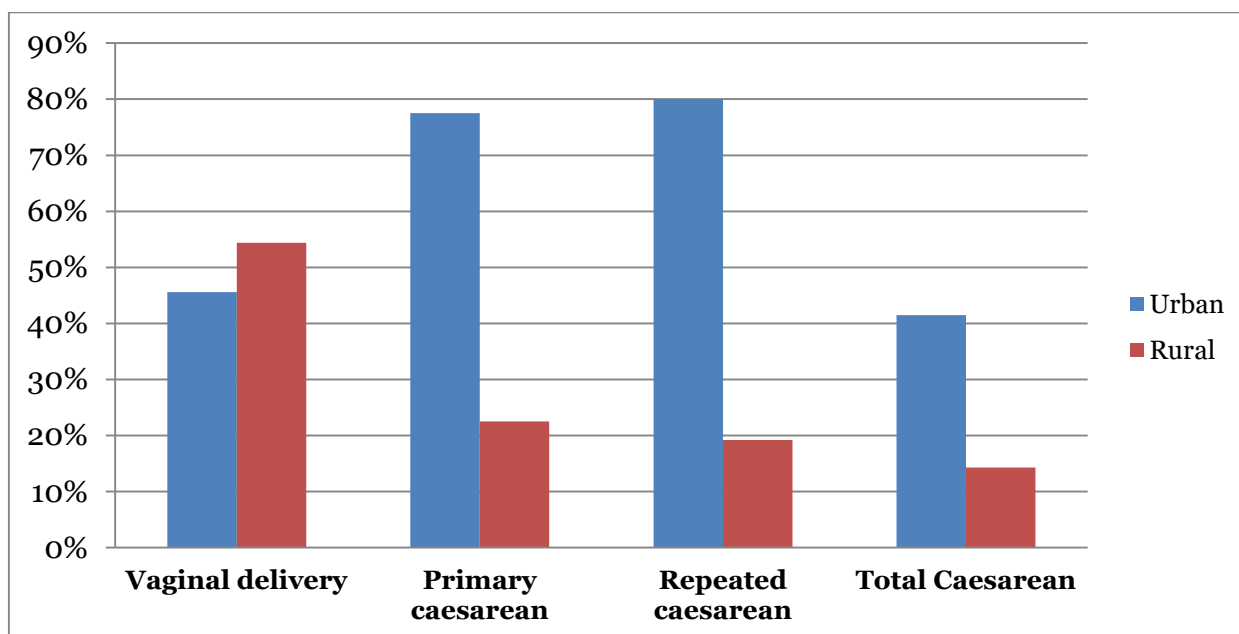
Similarly, mothers took their decision for cesarean delivery (CD) by influencing relatives (40.60%), doctors (34.4%), and friends (13.3%). The results show that the all-demographic variables of participants had a statistically significant association with methods of delivery shown in Table 2. Similarly, fetal obstetric variables such as breech presentation, large-baby, and twins/triplets and maternal obstetric variables (previous caesarean, long maternal leave, fear of pain, and no pain progress) also significantly associated with delivery options. As tabulated in Table 2, the results show postpartum complications of back pain and abdomen distention are statistically significant association with delivery status ( $p = 0.028$  and  $p = 0.001$ ). Conversely, urinary incontinence (UI), pelvic organ prolapse (POP), and miscarriage had no significant association. We found a significant difference frequently occurring colds fever, and pneumonia but neonatal death had no statistically significant association with delivery status. By performing the regression model analysis, we examined the effects of CS on health outcomes of mother and baby and found abdomen distention 5.11 (95% CI= 2.98 to 8.76) times, and UI and POP were about one and half times higher in CD than VD. A significantly higher risk of cold fever (OR= 11.95, 95%

CI= 7.02 to 20.35) and pneumonia (OR= 5.79, 95% CI= 2.71 to 12.36) were observed

in children born by CD than VD shown in Table 3.

**Table 1. Frequency distribution of demographic variables in studied women**

Characteristic		Rural (N= 196)	Percentage (%)	Urban (N=241)	Percentage (%)
<b>Age</b>	≤19	73	37.2	7	2.9
	20-34	115	58.7	222	92.1
	≥35	8	4.1	12	5.0
<b>BMI</b>	≤18.4	72	36.7	8	3.3
	18.5-24.9	99	50.5	145	60.2
	≥25	25	12.8	88	36.5
<b>Mother's occupation</b>	Housewife	174	88.8	163	67.6
	Jobholder	22	11.2	78	32.4
	Primary	56	28.6	5	2.1
<b>Mother's education</b>	High school	105	53.6	14	5.8
	College	26	13.3	119	49.4
	Graduation	9	4.6	103	42.2
<b>Husband's occupation</b>	Day labor	105	53.6	6	2.5
	Jobholder	51	26.0	123	51.0
	Businessman	40	20.4	112	46.5
<b>Husband's education</b>	Primary	78	39.8	13	5.4
	High school	57	20.1	31	12.9
	College	46	23.5	19	7.9
	Graduation	15	7.7	178	73.9



**Figure 1. Comparison of Cesarean Delivery Rates in Urban and Rural Area**

**Table 2. Association between delivery mode and various sample characteristics based bivariate analysis**

Variables		Vaginal delivery N (%)	Caesarean delivery N (%)	Total N (%)	Pearson's $\chi^2$ (df)	p
<b>Association of demographic characteristics with method of delivery</b>						
Age	≤19	76 (24.6)	4 (3.1)	80 (18.3)	28.127 (2)	0.001
	20-34	219 (70.9)	118 (92.2)	337 (77.1)		
	≥35	14 (4.5)	6 (4.7)	20 (4.6)		
BMI	≤18.4	71 (23)	9 (7)	80 (18.3)	15.729 (2)	0.001
	18.5-24.9	165 (53.4)	79 (61.7)	244 (55.8)		
	≥25	73 (23.6)	40 (31.3)	113 (25.9)		
Mothers' occupation	Housewife	252 (81.6)	85 (66.4)	337 (77.1)	11.767 (1)	0.001
	Jobholder	57 (18.4)	43 (33.6)	100 (22.9)		
	Primary	59 (19.1)	2 (1.6)	61 (14)		
Mothers' education	High school	103 (33.3)	16 (12.5)	119 (27.2)	57.006 (3)	0.001
	College	83 (26.9)	62 (48.4)	145 (33.2)		
	Graduation	64 (20.7)	48 (37.5)	112 (25.6)		
Husband's occupation	Day labor	106 (34.3)	5 (3.9)	111 (25.4)	44.555 (2)	0.001
	Jobholder	111 (35.9)	63 (49.2)	174 (39.8)		
	Businessman	92 (29.8)	60 (46.9)	152 (34.8)		
Husband's education	Primary	88 (28.5)	3 (2.3)	91 (20.8)	104.263 (3)	0.001
	High school	81 (26.2)	7 (5.5)	88 (20.1)		
	College	50 (16.2)	15 (11.7)	65 (14.9)		
	Graduation	90 (29.1)	103 (80.5)	193 (44.2)		
<b>Association of Fetal obstetric variable with method of delivery</b>						
Breech Presentation	No	297 (96.1)	90 (23.3)	387(88.6)	59.476 (1)	0.001
	Yes	12 (3.9)	38 (29.7)	50 (11.4)		
Large Baby	No	305(98.7)	113 (88.3)	418 (95.7)	23.642 (1)	0.001
	Yes	4 (1.3)	15 (11.7)	19(4.3)		
Twins/Triplets	No	308(99.7)	121 (94.5)	429(98.2)	13.332 (1)	0.001
	Yes	1 (0.3)	7 (5.5)	8 (1.8)		
<b>Association of Maternal obstetric variable with method of delivery</b>						
Previous caesarean	No	308(99.7)	96 (75)	404(92.4)	78.944 (1)	0.001
	Yes	1 (0.3)	32 (25)	33 (7.6)		
Long maternal leave	No	294(95.1)	107 (83.6)	401 (91.8)	15.977 (1)	0.001
	Yes	15 (4.9)	21 (16.4)	36 (8.2)		
Fear of pain	No	298(96.4)	113 (88.3)	411 (94.1)	10.767 (1)	0.001
	Yes	11 (3.6)	15 (11.7)	26 (5.9)		
No pain progress	No	309 (100)	96 (75)	405(92.7)	83.354 (1)	0.001
	Yes	0	32 (25)	32 (7.3)		
<b>Association of Postpartum Complications to delivery in studied women</b>						
Back pain	No	243 (78.6)	88 (68.8)	331 (75.7)	4.819 (1)	0.028
	Yes	66 (21.4)	40 (31.3)	106 (24.3)		
Urinary incontinence	No	238 (77)	90 (70.3)	328 (75.1)	2.177 (1)	0.140
	Yes	71 (23)	38 (29.7)	109 (24.9)		
Pelvic organ prolapse	No	248 (80.3)	106 (83.5)	354 (81.2)	0.606 (1)	0.436
	Yes	61 (19.7)	21 (16.5)	82 (18.8)		
Miscarriage	No	296 (95.8)	127 (99.2)	423(96.8)	3.42 5(1)	0.076
	Yes	13 (4.2)	1 (0.8)	14(3.2)		
Abdomen distention	No	280 (90.6)	84 (65.6)	364(83.3)	40.621 (1)	0.001
	Yes	29 (9.4)	44 (34.4)	73 (16.7)		

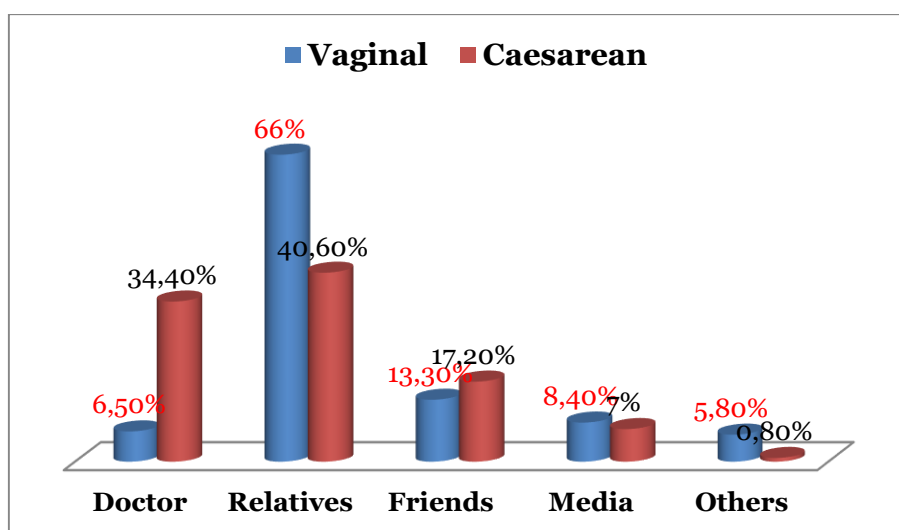
<b>Child Health Outcomes with method of delivery</b>						
Neonatal death	No	295 (95.5)	127 (99.2)	422 (96.6)	3.839 (1)	0.078
	Yes	14 (4.5)	1 (0.8)	15 (3.4)		
Cold and fever	No	279 (90.3)	55 (43)	334 (76.4)	106.135 (2)	0.001
	Yes	30 (9.7)	72 (56.3)	102 (23.3)		
Pneumonia	No	294 (95.1)	99 (77.3)	393 (89.9)	31.676 (1)	0.001
	Yes	15 (4.9)	29 (22.7)	44 (10.1)		

\* Chi-square test or Fisher's exact test or likelihood test (P < 0.050 was considered statistically significant)

\*χ<sup>2</sup> = Chi square\* df= Degrees of freedom

**Table 3: Association between delivery mode and health outcome of mother and children based on multivariate analysis**

Variable	Method of delivery	OR (95% CI)	SE	p
<b>Maternal Health outcome</b>				
Back pain	VD	1	0.250	0.043
	CD	1.66 (1.02-2.71)		
Urinary incontinence	VD	1	0.251	0.065
	CD	1.59 (0.97-2.60)		
Pelvic organ prolapse	VD	1	0.298	0.387
	CD	0.77 (0.43-1.39)		
Abdomen distension	VD	1	0.275	0.001
	CD	5.11 (2.98-8.76)		
Miscarriage	VD	1	1.049	0.204
	CD	0.26 (0.03-2.05)		
<b>Constant</b>		<b>0.247</b>		
<b>Children health outcome</b>				
Neonatal death	VD	1	1.096	0.190
	CD	0.24 (0.03-2.04)		
Cold and fever	VD	1	0.271	0.001
	CD	11.95 (7.02-20.35)		
Pneumonia	VD	1	0.387	0.001
	CD	5.79 (2.71-12.36)		
<b>Constant</b>		<b>0.165</b>		



**Figure 2: Effects of influential variables on vaginal and caesarean delivery**

## DISCUSSION

This study classified mother as teen ( $\leq 19$ ), normal (20-34), and advanced age ( $\geq 35$ ) based on their age. The results of this study show about one-third of rural mothers are teen deliveries which is consistent with a study result (30.8%) where, in urban areas, the number is below 3% (Islam et al., 2017). The causes of this situation are superstition, poverty, lack of awareness and education, low economic and social status among rural people. However, the findings of this study reveal that the CS rate is higher in urban mothers than rural and rationale with findings of other studies. (Betrán et al., 2007; Leone et al., 2008).

Modern health facilities and economic solvency of urban participants cause a higher rate of CS in urban than rural parts of Bangladesh (Feng et al., 2012; Kamal, 2013). The rates of CD were also observed higher in the overweight group, and the finding is similar to previous study Rahman et al. (2018). This is due to obese mothers facing severe problems such as diabetes, anemia, eclampsia, and preterm delivery that trigger them to go under CS. Several studies give evidence that rates of CS are associated with education (Nazir, 2015; Shabnam, 2016). The results of this study also show lower the education level higher the VD, and vice versa. Besides the education higher economic society's mothers are inclined to CS, similar to evidence from studies that women who came from better socioeconomic status had higher rates of CS births (Betrán et al., 2007; Feng et al., 2012; Nazir, 2015).

A previous study conducted in Bangladesh also reported 28.4% and 3.35% of the rich and poor households go under CS (Anwar et al., 2008). The outcomes of this study reveal that family members or relatives (40.6%) greatly influenced mothers to take their CS decision. A similar study conducted in Bangladesh reported higher per-

centage (60%) of women took their decision by themselves or jointly by family members (Farzana and Kabir, 2014). In addition, advice from doctors (34.4%) also modifies the maternal decision on mode of delivery. A study found higher number (58%) of mothers were influenced by doctors, and changed their decision of VD to CD after a repeated visit to doctors (Hou et al., 2014). Doctors usually prepare CS delivery over VD as it requires long time and staff's insufficiency in hospitals. Additionally, a lack of modern vaginal delivery-related pieces of equipment and experts' personnel on painless vaginal delivery provoke the rate of CS (Sikder et al., 2015).

In this study, we considered the three most common fetal obstetric indications for CS such as fetal distress or breech presentation, large baby and twin or triplets. One of the common causes of emergency CS worldwide is fetal distress. Most doctors prefer to avoid risk and suggest delivery by CS in that case. In this study, 29.7% of patients went through under CS for this and the finding is indistinguishable to Jordan (30%) and higher than Pakistan (16.3%), Zambia (21%), Bahrain (19%), and Bhutan (15.5%) (Dorji et al. 2021). Another fetal obstetric, large baby, or fetal macrosomia (weight  $\geq 4$  Kg) is responsible for 11.7% of CS in this study, whereas a meta-analysis reported the percentage is slightly higher (19.3%) (Beta et al., 2019). Macrosomic fetal found in mothers who suffered from overweight, diabetes, overdue pregnancy, and the outcome is fetal's shoulder stuck during labor (Agudelo-Espitia et al., 2019). This study found only 5.5% of women did their cesarean section due to multiple gestations and the result is similar to a study conducted in the United States (5%) (Lee et al., 2011).

Women with previous CS were more likely to experience for subsequent CD. This result is consistent with the findings of the

studies conducted in different parts of the world (Leone et al., 2008; Busaidi et al., 2012; Gondwe et al., 2019). The previous CS increases the risk of uterine rupture and bleeding, that is why doctors suggest mothers likely to go under CS (Nazir, 2015). A highly significant association between CD with a long maternal gap, fear of pain, no pain progress was also found in this study. However, a study conducted in Oman found birth spacing was negatively associated with CD (Busaidi et al., 2012), but the higher age of mother increase the CS risk (Cegolon et al., 2020). In Bangladesh, failure to labor progress is now a common problem in pregnancy, which is due to premature rupture of membranes, labor induction, maternal age > 35 years, fertility treatment, and hypertensive disorders (Sheiner et al., 2002).

Though CS is a life-saving method when VD is impossible, it has several adverse health outcomes for mothers and children. We found a strong association between abdomen distension (AD) (OR=5.11, 95% CI, 2.98 to 8.76) with delivery mode, agreeing with a study where they found Ogilvie's syndrome is the causal factor of AD (Kotsev, 2011). Additionally, back pain and urinary incontinence were highly associated with CS. Finding is coherent with the findings of a study conducted in Bangladesh, in which they found backbone pain (OR= 3.58; 95% CI= 2.12 to 4.70) due to inserting a needle into the spinal cord during anesthesia (Keag et al., 2018), whereas, urinary incontinence decreased among CD women (OR= 0.56; 95% CI= 0.47 to 0.66) (Sandall et al., 2018).

Furthermore, organ prolapse and miscarriage were lower odds among CS, consistent with a study that found organ prolapse associated with decreased risk (OR= 0.29; 95% CI= 0.17 to 0.51) (Sandall et al., 2018). Recent evidence shows children born with CS face several long-term complications. We also found CS children are more frequently

infected with cold flue than VD that consistent with the study conducted by Miller et al. (2020), because their gut contains less amount of good bacteria than VD, which may endanger their immune system (Kulas et al., 2013). On the contrary, a study did not find any association between CD and cold flue (Moore et al., 2012).

Although several previous studies were conducted in Bangladesh to ascertain the risk factors, and health outcomes of CS separately, most of them used secondary databases. In our study, we used primary data to demonstrate the comparative rate of CS between rural and urban areas, inherent risk factors, and long-term effects on the health of mothers and children. The findings of this study will help the government of Bangladesh to make health policies for rural and urban areas to reduce the alarming rate of CS. However, the sample size of our study was limited, the health outcome variables were few, overall, and our findings are not nationally representative.

The number of CS without medical indication is alarmingly increasing worldwide. This study synthesized the risk factors and health outcomes of this burning issue and found demographic and obstetric factors are strongly associated with cesarean delivery, and CS impacts both mother and children's health. So, to protect both mother and children, unnecessary CS must be avoided considering the post-operative risks.

#### **AUTHOR CONTRIBUTION**

Md. Altaf Hossain conceptualized, supervised the study and reviewed writing draft; Ishrat Jahan collected data and wrote original draft; Mohammad Mozibul Haque analysed and interrupted the data; Nazmul Sarwar conceptualized and reviewed writing critically; Nilufa Yeasmin revised final manuscript; Dilshad Islam co-supervised the study and analysed the data.



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### CONFLICT OF INTERESTS

None.

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