

# A Study on Factors Associated with Caesarean Section Delivery at Tangail District of Bangladesh

Khan Md. Murtaja Reza Linkon<sup>1</sup>, Marjina Akter<sup>1</sup>, Amina Akther Urmi<sup>1</sup>, Md. Jahidul Islam<sup>1</sup>, Md. Faridul Islam<sup>1</sup>, Mahfujul Alam<sup>2</sup>, Rehnova Mostafa Nitu<sup>1</sup>, Md. Abdul Alim<sup>1,\*</sup>

<sup>1</sup>Department of Food Technology and Nutritional Science, Mawlana Bhashani Science and Technology University, Tangail, Bangladesh

<sup>2</sup>Department of Agro Product Processing Technology, Jashore University of Science and Technology, Jashore, Bangladesh

## Email address:

murtaja.kus@mbstu.ac.bd (K. M. M. R. Linkon), suchana0019@gmail.com (M. Akter), urmi.amina2@gmail.com (A. A. Urmi), jahidfn16016@gmail.com (Md. J. Islam), faridul.nutrition@gmail.com (Md. F. Islam), ma.alam@just.edu.bd (M. Alam), nitu13nitu@gmail.com (R. M. Nitu), alim.food@mbstu.ac.bd (Md. A. Alim)

\*Corresponding author

## To cite this article:

Khan Md. Murtaja Reza Linkon, Marjina Akter, Amina Akther Urmi, Md. Jahidul Islam, Md. Faridul Islam, Mahfujul Alam, Rehnova Mostafa Nitu, Md. Abdul Alim. A Study on Factors Associated with Caesarean Section Delivery at Tangail District of Bangladesh. *Journal of Health and Environmental Research*. Vol. 8, No. 1, 2022, pp. 22-28. doi: 10.11648/j.jher.20220801.14

**Received:** December 29, 2021; **Accepted:** January 19, 2022; **Published:** February 5, 2022

**Abstract:** *Background and Objectives:* Caesarean section or C-section is a major obstetric life-saving intervention that has a substantial effect on maternal and neonatal health. This study sought to explore factors associated with increasing C-section rate at Tangail district in Bangladesh. *Materials and Methods:* A cross-sectional survey was conducted using a structured questionnaire at different hospitals and clinics in Tangail among 200 women who underwent cesarean. For analyzing the factors of C-section, the explanatory variables were demographic and anthropometric data, pre-pregnancy history, pregnancy period and delivery information. *Results:* The common medical indicators for C-section were prolonged labor (21%), fetal distress (19%), previous C-section (13%), amniotic rupture (12.5%), abnormal presentation of the baby (12%), uterine rupture (8.5%), failed labor induction (7.5%) and eclampsia/hypertension (3%). The majority (49.5%) of C-section was performed because of maternal request, 34% were emergency and 16.5% were elective. Majority of the respondents showed neutral (46%) to negative (51%) mindset towards C-section. C-section decision making influences included family pressure (25%), afraid of labor pain (11.5%), mother's health risk (15%), baby's health risk (38.5%), both mother and baby's health risk (19.5%), presence of medical complications (62%), respondent's choice (23%), doctor's preference (5%), other related reasons (10%). *Conclusions:* It is concluded that a combination of both medical and non-medical factors is associated with C-section delivery.

**Keywords:** C-section Delivery, Pregnancy, Maternal Health, Health Risk

## 1. Introduction

A cesarean section, sometimes known as a C-section, is a medical procedure in which the baby is delivered through an incision in the mother's lower belly and the anterior uterine walls. If difficulties arise, a C-section can be a life-saving procedure for both the infant and the mother. According to the WHO, there is no proof that C-section has any benefits for mothers or infants who do not have any emergency difficulties. Furthermore, several research demonstrate that higher rates are associated with harmful outcomes that may

jeopardize mother and child health and have implications for next pregnancies. Women with inadequate access to comprehensive obstetric care are especially vulnerable [1]. The rising number of caesarean sections is a global issue, however there is no consensus on the appropriate C-section rate. It's linked to unnecessary short-term and long-term risks, as well as additional expenditures, which can put a strain on a low-income household. In the past, progressive obstetrics and increasingly problematic births that required an emergency or elective cesarean section were common procedures in Bangladesh. Several obstetric issues, such as obstructed labor and fetal distress, rather than background

traits considered to constitute a risk, were the major causes for cesarean section [2].

According to the Bangladesh Maternal Mortality and Health Care Investigation 2016 report, the rate has risen to 31%, implying that nearly one out of every three newborns in a health institution is delivered via C-section. The C-section delivery rate was reported to be 33% in the 2017-2018 Bangladesh Demographic and Health Survey, while it was reported to be 36% in the 2019 Multiple Indicator Cluster Survey (MICS) [3]. Asia and Northern America were the regions with the highest and lowest average annual rate of increase (6.4% and 1.6%, respectively) [4]. Participants with low maternal childbirth self-efficacy were more likely to request caesarean sections themselves [5]. Most of the countries follow an independent pattern to prevalence the C section. Between South and South-East Asian countries overall C-section prevalence is 13% and increasing day by day [6]. Doctors' influence was one of the notable risk variables of enduring caesarean section, with doctor determined reasons, according to multinomial regression analysis. C-sections are becoming more common in medical practice, with the goal of preserving lives in the event of major hurdles. The majority of the time, women are unaware of how to agree to a C-section and are motivated by a pitiful understanding of the risks and benefits [7].

Both institutional and community-based births in Bangladesh have increased from almost 3% in 2000 to approximately 24% in 2014. The Bangladesh Demographic and Health Survey (BDHS) association detailed the obstacles to delivery, as well as the mothers' socio-demographic, healthcare, and geographical physiognomies. Age, obesity, living in a city, first delivery, mom perception of big baby size, husband being a professional, larger number of antenatal care (ANC) providers, and delivering in a private hospital were all statistically linked to higher C-section rates [8]. The selection of C-section births is usually based on socioeconomic and demographic factors [9]. There is evidence that around 9.4% of women had caesarian sections without pregnancy or delivery problems. Furthermore, the frequency of caesarian sections varies according to urban and rural disparities, with roughly 38 percent in urban regions and 18 percent in rural areas in 2014 [10].

The steady rise in C-section rates has become a global issue, and there is no evidence that it will slow down anytime soon. The rate of needless C-sections is rising, especially in poorer nations. C-sections now account for more than 1 in 5 (21%) of all childbirths, according to the World Health Organization (WHO). C-sections that are medically necessary can minimize maternal and perinatal mortality and morbidity. Birth injuries including as hypoxia (oxygen deprivation), shoulder dystocia, and fractures can be reduced with a scheduled cesarean section. Bangladesh, like many other underdeveloped nations, has a higher C-section rate, despite the fact that they are not necessary. Despite the fact that this is a big health concern, there isn't enough regional research on the subject in Bangladesh. The present research evaluated a large number of women who had a cesarean

section in Tangail region, gathering demographic, anthropometric, and pre-pregnancy information. The current study also collected pregnancy period data and delivery information and tried to learn about the factors which led them to choose C-section over normal delivery. This study will expand the horizon of knowledge regarding this issue which will be helpful for developing relevant programmer on their issue and provide information for further study on this topic. This study will also help different organizations to apply proper policy for creating awareness among the general public about the benefits of natural delivery and danger of C-section.

## 2. Materials and Methods

### 2.1. Sample Collection and Questionnaire Preparation

The experiment was a descriptive type of cross-sectional study. This study was carried out at different hospitals in Tangail among 200 women who underwent cesarean section. The study was conducted from December 2020 to September 2021. Simple random sampling method was followed and data were collected as per structured self-administered scaling questionnaire. Basic core, expanded, and optional variables with regards to socio-economic and demographic data (age, gender, religion, location, education, occupation, and monthly income), physical activity was incorporated into the questionnaire. The socio-economic status such as family size, monthly income, education level of the household member, employment pattern etc. were obtained mainly from the household head and other members present during the interview also provided necessary information. The questionnaire was carefully filled up after interviewing avoiding any discrepancy and misinformation. All of the information was recorded in the respective places on the questionnaire. Informed consent was taken from the respondents regarding confidentiality, respect and dignity of data in the study.

Height of the respondent in standing condition was measured using suitable scales. At first, the subject was positioned fully upright, with the bean in the Frankfurt flat. Also, the back of the head, thoracic spine, buttocks and heels touched the vertical axis to the balance beam scale and the heels were together. Height was recorded to the nearest 5mm or 0.5 cm. The balance was positioned on a hard flat surface and checked for zero balance before measurement. The subjects were in the center of the platform wearing light clothes without shoes. Weight was recorded to the nearest 0.5 kg. The body mass index (BMI) was calculated using the following formula where weight in kg was divided by the square of height in meters.

$$BMI = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$$

### 2.2. Nutritional Status

The current nutritional status of a person or a population group related to the state of nourishment. It was determined

by a complex interaction between internal/constitutional factors and external environmental factors: Age, sex, behavior, nutrition, physical activity and diseases are the internal or constitutional factors and food safety, cultural, economic and social circumstances are categorized as external environmental factors. The nutritional status was determined by WHO (1999) guidelines.

### 2.3. Medical History

Different types of health-related issues of the respondents such as presence of fatal disease or viral infection during pregnancy, previous history of C-section, abortion and miscarriage, vaccination during pregnancy, complications during pregnancy and delivery etc. were included in this section.

### 2.4. Statistical Analysis

All of the data processing and statistical analysis were carried out by SPSS version 25.0 for Windows (IBM Corporation, Armonk, New York, USA). The descriptive statistics was studied in terms of standard deviation, percentage, means and frequency distribution. In terms of geographical representation, charts, tabular and Microsoft Word and Microsoft Excel were used.

## 3. Results

### 3.1. Socio-demographic, Educational and Economic Information

From the study, it was observed that among the 200 respondent's residences 62.5% were from rural and 37.5% from urban area. This indicates more than half of the respondents were from rural area. The religion of the respondent's resultant that 74% were Muslim and 26% were non-Muslim of total respondents. The number of family members of the respondents was 62% of the respondents had less than four or four family members and 38% were more than four. More than half of the respondents had a small family. It was found that among the respondent's 96.5% of the respondent's were housewives and 3.5% of them were working women. From the observation, it was found that, the respondent's education level were primary level 56%, secondary level 34% and higher level 10% of the education. Half of the respondents only had primary level of education. 44.5% of the respondent's husbands had primary level, 39% had secondary level, 16% had higher level of education and 0.5% had no education at all. About 26% of the respondent's family income was less than 5000 TK and 54.5% of them earned between 5000 to 20000 TK. Again, a significant number (19.5%) of respondent's income was more than 20000 TK.

**Table 1.** Distribution of the respondents by socio-demographic, educational and economic information.

Residence	Frequency	Percent
Rural	125	62.50
Urban	75	37.50
Total	200	100
Religion	Frequency	Percent
Muslim	148	74
Non-Muslim	52	26
Total	200	100
No. of family members	Frequency	Percent
<=4	124	62
>4	76	38
Total	200	100
Respondent's Occupation	Frequency	Percent
Housewife	193	96.50
Working Women	7	3.50
Total	200	100
Respondents Education Level	Frequency	Percent
Primary	112	56
secondary	68	34
Higher	20	10
None	0	0
Total	200	100
Husband's Education Level	Frequency	Percent
Primary	89	44.50
secondary	78	39
Higher	32	16
None	1	0.50
Total	200	100
Monthly Income	Frequency	Percent
<5000TK	52	26
5000 to 20000TK	109	54.50
>20000TK	39	19.50
Total	200	100

### 3.2. Anthropometric Data and Respondent Knowledge on Various Parameters

From the analysis of the observations, the mean height in the respondents was  $1.54 \pm 0.047$  (m) and mean weight was  $55.69 \pm 9.70$  (kg). About 55.5% of the respondents BMI were between 18.5 and 24.99, 36% were more than 25 and 8.5% were less than 18.5. Only half of the respondents had normal BMI value and notable number of the respondents was overweight. About 55.5% of the respondents were normal, 36% were overweight and 8.5% were underweight. Almost half of the respondents (48.5%) were less than 18 years old during their marriage and 51.5% were 18 or more than 18 years old.

**Table 2.** Anthropometric data and respondent knowledge on various parameters.

Parameters	Frequency	Value
Distribution on height and weight of the respondents		
Height (m)	200	$1.54 \pm 0.047$
Weight (kg)	200	$55.69 \pm 9.70$
Nutritional status of the respondents (BMI)		
Under weight (BMI<18.50)	17	8.5%
Normal (BMI=18.50-24.99)	111	55.5%
Overweight ( $\geq 25$ )	72	36%
Total	200	100%
Distribution of the respondents by age of marriage		
<18 years old	97	48.5%
$\geq 18$ years old	103	51.5%
Total	200	100%
Age of Child Birth		
$\geq 20$ years	121	60.5%
<20 years	79	39.5%
Total	200	100%
Number of children		
1-2	194	97%
>2	6	3%
Total	200	100%
Presence of Fatal Disease/Viral Infection		
Yes	9	4.5%
No	191	95.5%
Total	200	100%
Distribution of the respondents by knowledge about family planning		
Yes	176	88%
No	24	12%
Total	200	100%
Distribution of the respondents by knowledge about balanced diet		
Yes	175	87.5%
No	25	12.5%
Total	200	100%

The Table 2 also indicates the respondent's age of child birth. 60.5% respondents were more than 20 or 20 years old during their pregnancy and 39.5% were less than 20 years old. A large number of the respondents were pregnant before their twenties. The distribution of all the respondents by their number of children and indicated that the majority (97%) of them have one or two children. Only 3% of them have more

than 2 children. Very few of the respondents (4.5%) had suffered from fatal disease or viral infection during pregnancy. Most of them (95.5%) were in good health. The table also shows that 88% of respondents were aware of family planning and 12% of them were lacking the proper knowledge about it. So, most of the respondents had proper knowledge about family planning. The majority (87.5%) of them knew about balanced diet. Some of them (12.5%) didn't have enough knowledge about balanced diet.

### 3.3. Knowledge About Basic Health and C-section

It was found that about 70% of the respondents were familiar with the idea of contraceptives and 30% didn't have sufficient knowledge about it. Almost everyone (98%) had a general concept about the vaccination during pregnancy and 2% were not very aware about it. The table 3 also shows the respondent's pregnancy history. For 86% respondents, it was their first-time pregnancy and for 14% it was not. The respondent's history of C-section. For 87%, it was first time they were having a C-section and 13% did have a previous C-section. Only few of them respondents had previous experience of C-Section. The table 3 also shows the respondent's perspective about C-section. Majority of the respondents (51%) showed negative mindset, 46% were neutral and 3% were positive towards C-section. About 82.5% of the respondents had 1 to 3 visits for antenatal check-ups, 8% had more than 4 visits and 9.5% didn't have any check-up.

**Table 3.** Distribution of the respondents by knowledge on basic health and C-section.

	Frequency	Percent
Knowledge about Contraceptive		
Yes	140	70
No	60	30
Total	200	100
Knowledge about vaccination		
Yes	196	98
No	4	2
Total	200	100
Distribution of the respondents by first time pregnancy		
Yes	172	86
No	28	14
Total	200	100
Distribution of the respondents by history of previous C-section		
Yes	26	13
No	174	87
Total	200	100
Distribution of the respondents by perspective about C-section		
Positive	6	3
Negative	102	51
Neutral	92	46
Total	200	100
Distribution of the respondents by number of antenatal care visit		
None	19	9.5
1-3	165	82.5
>4	16	8
Total	200	100

### 3.4. Respondents' Supplementation Intake, Proper Food and Heavy Work During Pregnancy

Around 95.5% of the women took supplementation during pregnancy and 4.5% didn't take any. Most of the respondents took necessary supplement during their pregnancy. Most of the respondents (92%) ate proper food during pregnancy period and 8% of them didn't have sufficient food intake which a pregnant woman requires. The respondents (93.5%) during pregnancy didn't do much heavy work. Only 6.5% of all respondents did heavy work despite being pregnant.

**Table 4.** Distribution of the respondents by supplementation intake, Proper food and heavy work during pregnancy.

	Frequency	Percent
Supplementation Intake		
Yes	191	95.5
No	9	4.5
Total	200	100.0
Proper food intake		
Yes	184	92.0
No	16	8.0
Total	200	100.0
Heavy work during pregnancy		
Yes	13	6.5
No	187	93.5
Total	200	100.0

### 3.5. Respondents Condition During Pregnancy

About 95.5% of the respondents had proper rest but 4% didn't take enough rest which is necessary for a pregnant woman. The Table 5, shows if the respondents did physical exercise during pregnancy or not. Almost all of them did some form of physical exercise. 97.5% women did some form of physical exercise during pregnancy period and 2.5% didn't. 99.5% of the respondent's family were supportive during their pregnancy period and took proper care of them. Only 0.5% didn't give enough support. About 96% of them answered that they were emotionally sound and well balanced but 4% responded that they were under some kind of stress or pressure mentally.

**Table 5.** Distribution of the respondents by taking sufficient rest, Physical exercise, family support and mental pressure during pregnancy.

	Frequency	Percent
Sufficient Rest		
Yes	192	96.0
No	8	4.0
Total	200	100.0
Physical exercise during pregnancy		
Yes	195	97.5
No	5	2.5
Total	200	100.0
Family support		
Yes	199	99.5
Neutral	1	.5
Total	200	100.0
Mental Pressure during pregnancy		
Yes	8	4.0
No	192	96.0
Total	200	100.0

### 3.6. Pregnancy Duration, C-section Planning, Causes and Family Influences

Most of their (98.5%) pregnancy duration was more than 8 months whereas only 1.5% had less duration and gave birth early. About 23.5% of the c-section was preplanned and 76.5% were not before pregnancy. Which means most of the C-section was not preplanned. 15% C-sections were done because of mother's health risk, 38.5% for baby's health risk, 19.5% for both mother and baby's health risk and 27% were done without any particular reason. A noticeable number of the C-sections were done without a suitable reason. About 75% of the respondent's family had no influence on the respondent's decision for c-section but 25% had. The table also illustrates causes for performing respondent's C-section. 62% were done because of medical complications, 23% because of respondent's choice, 5% because of doctor's preference, and 10% because of other related reasons. The table 6 also compares the types of C-sections that were performed on the respondents. 16.5% were elective, 34% were emergency, 49.5% were because of maternal request. Half of the C-section were done because of maternal request and notable number of them are because of emergency.

**Table 6.** Distribution of the respondents by pregnancy duration, C-section planning, causes and family influences.

	Frequency	Percent
Pregnancy duration		
7-8months	3	1.5
>8months	197	98.5
Total	200	100
C-section planned before		
Yes	47	23.5
No	153	76.5
Total	200	100
Causes of C-section		
Mother's health risk	30	15
Baby' health risk	77	38.5
Both	39	19.5
None	54	27
Total	200	100
Family Influence		
Present	50	25
Absent	150	75
Total	200	100
Cause of C-section delivery decision		
Doctors' preference	10	5
Respondents' choice	46	23
Medical complications	124	62
Others	20	10
Total	200	100
Type of C-section delivery		
Elective	32	16
Emergency	69	34.50
Maternal	99	49.50
Total	200	100

### 3.7. Medical Complications During Delivery

The percentage of cases suffering from complications were 12% of abnormal presentation of the baby, 21.5% of prolonged labor, 19% of fetal distress, 8.5% of uterine

rupture, 12.5% of amniotic rupture, 3% of eclampsia/hypertension, 7.5% of failed labor induction, 40.5% case had no complication.

**Table 7.** Distribution of the respondents by medical complications present during delivery.

Medical Complications present	Responses		Percent of Cases
	N	Percent	
Abnormal presentation of baby	24	9.6%	12.0%
Prolonged labor	43	17.3%	21.5%
Fetal distress	38	15.3%	19.0%
Uterine rupture/risk	17	6.8%	8.5%
Amniotic rupture	25	10.0%	12.5%
Eclampsia/Hypertension	6	2.4%	3.0%
Failed labor induction	15	6.0%	7.5%
No complication	81	32.5%	40.5%
Total	249	100.0%	124.5%

## 4. Discussion

When medically necessary, C-sections can assist avoid maternal and perinatal death and morbidity. However, needless C-sections are linked to substantial risks for both mother and child, as well as future pregnancies. The use of caesarean sections is on the rise across the world, and the WHO recommends that no region's C-section rate exceeds 10%. The C-section delivery rate was reported to be 33% in the 2017-2018 Bangladesh Demographic and Health Survey, while it was reported to be 36% in the 2019 Multiple Indicator Cluster Survey (MICS) [3]. To determine the primary causes of the rapidly growing c-section rate, a cross-sectional study was conducted among 200 randomly selected women who underwent cesarean section at several hospitals in the Tangail region. The majority of the respondents were from rural areas and had completed elementary and secondary schooling. The majority of the respondents were housewives between the ages of 21 and 25. The current study also shows that beyond the age of 30, the number of C-sections performed on pregnant women decreased. Previous research has connected caesarean section delivery to the mother's age, educational level, parity, home socioeconomic position, district of residence, household head's degree of education, and lack of knowledge about C-section [7, 11]. The respondent's weight, height was taken for the analysis of anthropometric information, BMI and nutritional status. Mean height in the respondents was  $1.534 \pm 0.047$  (m) and mean weight was  $55.69 \pm 9.70$  (kg). About half of the respondents BMI were normal, almost quarter of the respondents were overweight. Another study found that Overweight or obese women contributed the most to the risk of CS delivery 23.36%, followed by age at first birth (> 20 years) 18.97%, highest wealth quintile 17.39%, higher education (15.93%), living in an urban environment 14.39 percent, delivering large size of child at birth 11.13% and women with a higher BMI are treated differently than women of average weight in labour [12, 13]. Past history of pregnancy has been asked during data collection. Almost half of the respondents were less than 18 years old during their marriage and rest of them were 18 or more than 18 years old.

Very few of the respondents had suffered from fatal disease or viral infection during pregnancy. Most of them were in good health and aware of family planning. The majority (87.5%) of them had knowledge about balanced diet and were familiar with the idea of contraceptives and general concept about vaccination during pregnancy. For almost 86% of the respondents, it was first-time pregnancy and first time they were having a C-section. Majority of the respondents (51%) showed negative mindset, 46% were neutral and 3% were positive towards C-section. It was also various reasons for performing C-section such as, medical complications, respondent's choice, doctor's preference, and other related reasons whereas, 23.5% of the C-section were preplanned and 76.5% were not. Majority of the C-sections were not preplanned and performed because of mother's or baby's health risk. A significant number of C-sections were performed because of maternal request and emergency condition. About 75% of the respondent's family had no influence on the respondent's decision for C-section but 25% had. In the targeted area, the facility delivery rate was 84%, and the population-based C-section rate was 35% of all deliveries. Repeat C-sections (24%), fetal distress (21%), prolonged labor (16%) oligohydramnios (14%), and post-maturity (14%) were the most common reasons for C-sections (13%). C-sections were performed at for-profit private clinics in excess of 80% of the time. Improved socioeconomic level, more education, lower birth order, and higher age all raised the likelihood of a C-section delivery [14]. In the context of C-section, a rather high contribution of non-medical elements was discovered. All of these factors have an impact on society's knowledge, attitudes, and norms [15]. This study carried out that after delivery most of the babies were normal weight. Different types of medical complications were present during pregnancy period and delivery. The percentage of cases suffering from complications were varies from different parameters like abnormal presentation of the baby, prolonged labor, fetal distress, uterine rupture, amniotic rupture, eclampsia/hypertension, failed labor induction.

## 5. Conclusion

According to demographic data analysis, the majority of the respondents in this study were between the ages of 21 and 25, came from rural regions, and had just a primary level of education. The majority of respondents were well-informed on a healthy diet, family planning, contraception, and vaccination, and had no incidences of viral infections or deadly illnesses, as well as a normal BMI. The almost all of respondents had a neutral to unfavorable attitude towards C-sections. During their pregnancy, a significant number of the respondents had difficulty eating and had some form of physical condition, while the most of the respondents had few prenatal check-ups. The large number of C-sections were not planned and done due to a risk to the mother or the baby's health. Because of the maternal desire and the emergency situation, a substantial number of C-sections were done. The

percentage of cases suffering in C-section from different medical complications like abnormal presentation of the baby, prolonged labor, fetal distress, uterine rupture, amniotic rupture, eclampsia/hypertension, failed labor induction etc. The above findings imply that C-section delivery is linked to a combination of medical and non-medical variables, but a significant percentage of C-section births are performed without clear medical rationale. So, it is recommended that due to the long-term complications of the mothers and babies from C-section delivery government and peoples should be more concern about it and try for normal delivery by following safe delivery guidelines. Further follow-up study should be done and create awareness about the risks of C-section delivery.

## Conflict of Interest

The authors have no conflicts of interest.

## Acknowledgements

The authors are grateful to the Mawlana Bhashani Science and Technology University's Department of Food Technology and Nutritional Science for logistical help and ethical authorization. The authors also appreciate the collaboration of research subjects and hospitals in Bangladesh's Tangail district.

## References

- [1] WHO (2018). WHO recommendations non-clinical interventions to reduce unnecessary caesarean sections. WHO Reproductive and Health Library, Geneva? <https://www.who.int/reproductivehealth/publications/non-clinical-interventions-to-reduce-cs/en/>.
- [2] Abebe, F. E., Gebeyehu, A. W., Kidane, A. N., Eyassu, G. A. (2016). Factors leading to cesarean section delivery at Felegehiwot referral hospital, Northwest Ethiopia: a retrospective record review. *Reproductive health*, 13 (6). <https://doi.org/10.1186/s12978-015-0114-8>.
- [3] Islam, M. M., Alam, M. Z., Bidisha. S. H., Abdullah. S. M. (2021). Why C-section deliveries on the rise? The Financial Express. <https://thefinancialexpress.com.bd/views/why-c-section-deliveries-on-the-rise-614954892>.
- [4] WHO (2017). Robson Classification: Implementation Manual, World Health Organization, Geneva. [https://www.who.int/reproductivehealth/publications/maternal\\_perinatal\\_health/robson-classification/en/](https://www.who.int/reproductivehealth/publications/maternal_perinatal_health/robson-classification/en/).
- [5] Ji, H., Jiang, H., Yang, L., Qian, X., Tang, S. (2015). Factors contributing to the rapid rise of caesarean section: a prospective study of primiparous Chinese women in Shanghai. *BMJ open*, 5 (11). <https://doi.org/10.1136/bmjopen-2015-008994>.
- [6] Verma, V., Vishwakarma, R. K., Nath, D. C., Khan, H. T. A., Prakash, R., Abid, O. (2020). Prevalence and determinants of caesarean section in South and South-East Asian women. *PloS one*, 15 (3). <https://doi.org/10.1371/journal.pone.0229906>.
- [7] Schantz, C., Sim, K. L., Petit, V., Rany, H., & Goyet, S. (2016). Factors associated with caesarean sections in Phnom Penh, Cambodia. *Reproductive health matters*, 24 (48), 111–121. <https://doi.org/10.1016/j.rhm.2016.11.009>.
- [8] Rahman, M. M., Haider, M. R., Moinuddin, M., Rahman, A. E., Ahmed, S., Khan, M. M. (2018). Determinants of caesarean section in Bangladesh: Cross-sectional analysis of Bangladesh Demographic and Health Survey 2014 Data. *PLoS ONE*, 13 (9). <https://doi.org/10.1371/journal.pone.0202879>.
- [9] Karim, D. R. M. (2012). A Study on the Causes and Consequences of High Caesarean Section (C-section) Incidence Rate in Public, Private and NGO Health Facilities in Bangladesh. <https://bea-bd.org/site/images/pdf/062.pdf>.
- [10] WHO (2015). Alliance for Health Policy and Systems Research. Success Factors for Women's and Children's Health, Bangladesh. [http://www.who.int/pmnch/knowledge/publications/bangladesh\\_h\\_country\\_report.pdf?ua=1](http://www.who.int/pmnch/knowledge/publications/bangladesh_h_country_report.pdf?ua=1).
- [11] Manyeh, A. K., Amu, A., Akpakli, D. E., Williams, J., Gyapong, M. (2018). Socioeconomic and demographic factors associated with caesarean section delivery in Southern Ghana: evidence from INDEPTH Network member site. *BMC pregnancy and childbirth*, 18 (1): 1-9. <https://doi.org/10.1186/s12884-018-2039-z>.
- [12] Hasan, F., Alam, M. M., Hossain, M. G. (2019). Associated factors and their individual contributions to caesarean delivery among married women in Bangladesh: analysis of Bangladesh demographic and health survey data. *BMC pregnancy and childbirth*, 19 (1), 1-9.
- [13] Abenhaim, H. A., & Benjamin, A. (2011). Higher caesarean section rates in women with higher body mass index: are we managing labour differently? *Journal of obstetrics and gynaecology Canada: JOGC=Journal d'obstetrique et gynecologie du Canada: JOGC*, 33 (5), 443–448. [https://doi.org/10.1016/S1701-2163\(16\)34876-9](https://doi.org/10.1016/S1701-2163(16)34876-9).
- [14] Begum, T., Rahman, A., Nababan, H., Hoque, D., Khan, A. F., Ali, T., & Anwar, I. (2017). Indications and determinants of caesarean section delivery: Evidence from a population-based study in Matlab, Bangladesh. *PloS one*, 12 (11), e0188074. <https://doi.org/10.1371/journal.pone.0188074>.
- [15] Rajabi, A., Maharlouei, N., Rezaianzadeh, A., Rajaeefard, A., & Gholami, A. (2015). Risk factors for C-section delivery and population attributable risk for C-section risk factors in Southwest of Iran: a prospective cohort study. *Medical journal of the Islamic Republic of Iran*, 29, 294.