Original Research Article

Measuring the Caesarean Risk Factors in Bangladesh by Using Binary Logistic Regression Model

ABSTRACT

The caesarean delivery rate is increasing day by day in most developing countries like Bangladesh and number of caesarean births has almost doubled in the last eight years in Bangladesh largely due to socio-economic and demographic factors. Rather than numerous impediments, cesarean conveyances are most basic among woman's however it isn't clinically advocated. For enhancing the maternal wellbeing status, it is basic to decide the risk components of cesarean conveyance. The primary focal point of this examination is to research and recognize the cesarean risk factors in the entire territory of Bangladesh. For this investigation we have gathered auxiliary information from the Bangladesh Demographic and Health Survey (BDHS) 2014.This dataset has one record for every eligible woman as defined by the household schedule. It contains 17864 data which is collected in the woman's questionnaire plus some variables from the household. For the examination, chi-square test was performed to identify the significant association between conveyance type (cesarean/non-cesarean) and socio demographic and financial factor's individually. A binary logistic regression was completed to recognize the most effect factors on cesarean conveyance. We found that 5 factors were measurably connected with conveyance type out of 13 chance elements. From this investigation, it is obvious to us that above powerful factors may influences the mother's wellbeing status in Bangladesh.

Keywords: Logistic Regression, Caesarean Risk Factors, Bangladesh.

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1.Background of the study

1.1Introduction

Caesarean section (CS) is the most commonly performed surgical operation in the world. This surgery is lifesaving when performed in time to overcome certain types of dystocia and other complications. Now a days the maximum women are interested in caesarean section

than normal delivery for removing delivery and other complications. Over the last few years, caesarean delivery rates in South-Asian country increase annually for Bangladesh (1.19%), India (1.09%), Nepal (1.15%) and Pakistan (1.08%).The average CS rate in Asia is 15.9%. China, Malaysia (15.7%), Hong Kong and Lebanon present the highest CS rates in Asia, with estimates of 40.5%, 27.4% and 23.3%, respectively. Nepal and Cambodia's rates are lowest (1%), followed by Yemen (1.5%) [1,2,3]. The caesarean delivery rate is increasing day by day in most developing countries like Bangladesh and number of caesarean births has almost doubled in the last eight years in Bangladesh largely due to maternal, socio-economic and demographic factors. The World Health Organization recommends that a country should keep births through caesarean section below 15%, as it is a major operation that carries risks and takes a lot longer for a patient recover compared to a normal delivery [4,1]. Instead of some advantages of caesarean delivery, most of mothers and baby are sufferings from various health problems such as infection, hemorrhage, injury to organs, adhesions, reactions to medicine, maternal mortality rate, effects of future pregnancies, remove the uterus (hysterectomy) and premature birth, fetal injury, breathing problems respectively [5]. So, increasing C-section rate is one of the main concern in most of the countries in the world and now, it is an identified as emerging "global epidemic" [6,7]. The increase in caesarean deliveries has been attributed to multiple factors ranging from maternal, socio-demographic, socio-economic and institutional factors. There are some common factors which are related to caesarean delivery such as maternal age at birth, order of birth, baby birth weight, socioeconomic status, high levels of maternal education [8,9,10]. Age at marriage is also a significant cause of caesarean birth rates in the developing countries [11]. Many study were conducted about on this topic and many factors have been identified which are related to caesarean delivery but some factor were not included in the previous study. This study presents the most recent estimate of caesarean delivery in Bangladesh and identified some new factors which effect on the motivation of caesarean delivery by using data.

1.2 Objectives of the study

Objective of the study are:

1. To perform an exploratory analysis of Socio-demographic and economic factors of caesarean section (CS).
2. To visualize the different factors by applying bar diagram and pie chart.
3. To find the association between two attributes by using chi-square test.
4. Fit a binary logistic regression model and identify the caesarean risk factors in Bangladesh

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2.Methodology

2.1 Literature review

Caesarean birth are influence by various factor such as maternal, socio-demographic, socio-economic and other relevant factors[4]

In the North region of Bangladesh the most independent risk factors for caesarean deliveries are mother age, age at marriage and order of birth etc[11]

In the previous study maternal, socio-demographic, socio-economic factors, mother age, age at marriage and order of birth etc are the most influential factors are caesarean deliveries on the other hand in our study we try to find out some new most important caesarean risk factors in Bangladesh is not conducted in the past recherché.

2.2Data collection system

For this study we have collected secondary data from the Bangladesh Demographic and Health Survey (BDHS) 2014 for whole Bangladesh. After collecting data, information were arranged in tables and analyzed. The secondary data of our paper, the BDHS women's questionnaires was pretested and the men's questionnaire was pretested. For the pretest, male and female interviewers trained at the office of mitral and associates. Recruitment criteria include educational attainment, maturity, ability to spend one month in training and at least four month in the field, and experience in other surveys. Trainees whose performance was considered superior were selected as supervisors and field editors. Fieldwork for the BDHS was carried out by 12 interviewing teams. Each consisted of one male supervisor, one female field editor, five female interviewers, two male interviewers, and one logistics staff person, for a total of 120 field staff for the survey.

2.3 Computerization

In the study we use a computer package named R Programming and SPSS 16.0 for data entry and data analysis purpose. Beside the other well-known package MS Excel and MS Word was also used for analysis and writing the report.

2.4 Statistical equipment

After collecting data, information was organized in table and analyzed using some statistical tools. In the beginning some percentage distribution and graphical representation were presented to realize the scenario of caesarean delivery and its related factors. Categorical or nominal variables were analyzed by the Chi-square test or Fishers exact test according their suitability. Finally, binary logistic regression analysis was conducted to separate factors which are connected to caesarean delivery. Here, tolerable 5% level of significance was considered for each of the test.

2.4.1 Chi-square Test

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Chi-square test is a statistical test commonly used for testing independence and goodness of fit[12] .The independent test is applied when you have two categorical variables from a single population. Independence test is used to determine whether there is a significant association between the two variables and Goodness of fit test is used to determine whether observed frequency distribution matches the theoretical frequency distribution.The chi-square test statistics for both cases are defined as,

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(O_{i,j} - E_{i,j})^2}{E_{i,j}} \sim \chi^2_{(r-1)(c-1),\alpha}$$

Where (r-1) (c-1) is the degrees of freedom

χ^2 = Chi-square test statistic,

$O_{i,j}$ = Observed frequency of type (i, j), $E_{i,j}$ = Expected frequency of type (i, j), r = Number of row in contingency table, c = Number of column in contingency table, α = Level of significance.

2.4.2 Binary Logistic Regression Model

Logistic regression model is useful to find out the best fitting, reasonable model to establish the relationship between dependent variable or response variable (dichotomous) and set of explanatory or independent variable (dummy or categorical)[13]. Binary logistic regression estimates the probability that a characteristic is present (e.g. estimate probability of "success") given the values of explanatory variables. Probability of success will depend on levels of the risk factor.

For single variable the model can be defined as $prob(event) = \frac{1}{1+e^{-(\beta_0+\beta_1 x)}}$

Where β_0 and β_1 are regression coefficients estimated from the data and x is the independent variable. For more than one independent variable the model is

$$prob(event) = \frac{1}{1+e^{-(\beta_0+\beta_1 x_1+\beta_2 x_2 \ldots\ldots\ldots\ldots \beta_p x_p)}}$$

The log-odds and odds ratio can be defined as

$$\ln\left(\frac{prob(event)}{prob(nonevent)}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 \ldots\ldots\ldots \beta_p x_p$$

$$Odds\ ratio = \frac{prob(event)}{prob(nonevent)} = e^{\beta_0} e^{\beta_1 x_1} \ldots\ldots\ldots . e^{\beta p x_p}$$

Odds Ratio changes when the ith independent variable increases by one unit. If β_i is positive then the Odds Ratio are increased which indicates that the probability of occur an event is greater than the probability of occur non-event. If β_i is negative then odds Ratio are decreased.

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3.Discussion and result

3.1 Distribution of respondent's age in 5 years group

Table 1:

Variable	Delivery type				P-value		Odds ratio	95% Confidence interval
	Non-Caesarean Delivery		Caesarean delivery		Generally	Categorically		
Age in 5-years group	n	%	n	%				
"15-19"	1496	73.94	527	26.05	0.003*		1.00	
"20-24"	2333	73.80	828	26.19		0.027*	0.994	[0.875,1.129]
"25-29"	2340	69.99	1003	30.00		0.002*	1.221	[1.078,1.384]
"30-34"	2142	71.12	870	28.88		0.007*	1.195	[1.051,1.360]
"35-39"	1665	71.15	675	28.84		0.003*	1.234	[1.076,1.416]
"40-44"	1525	70.28	645	29.72		0.000*	1.313	[1.140,1.513]
"45-49"	1234	71.03	580	28.97		0.000*	1.484	[1.283,1.718]

From the above table we observe that, the percentage of non-caesarean in the age interval "15-19" is higher among all other age interval and the percentage of caesarean delivery in the age interval "25-29" is higher among all other age interval. Here, we get generally ($p = 0.003$) <0.05, so the variable (respondent age) is statistically associated with delivery type and also get in categorically all of the p- values are statistically associated with delivery type. That means, respondent age effects on delivery type. The possibility of caesarean delivery of age group "15-19" is more than the age group "20-24" and the possibility of caesarean delivery of age group "15-19" is less than the age group "25-29". The others are interpreted by similar way.

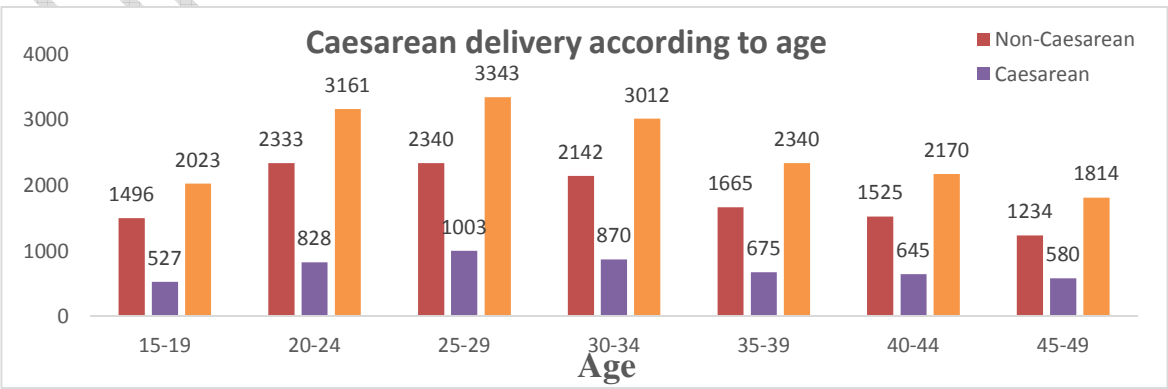

Figure .1: Bar diagram of caesarean delivery according to age

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From the above we observe that those women whose age is between 15 to 19 years old, the percentage of non-caesarean are 73.94% and caesarean are 26.05%. Similarly ,in aged 20 to 24 years old, non-caesarean are 73.80% and caesarean are 26.19%, age between 25 to 29 years old the percentage of non-caesarean are 69.99% and caesarean are 30.00%,Between 30 to 34 years and also 35 to 39 years old women are the same percentage of non-caesarean are 71.15% and caesarean are 28.84%, age between 40 to 44 years old the percentage of non-caesarean are 70.28% and Caesarean are 29.72%. At last the age between 45 to 49 years old, the percentage of non-caesarean are 71.03% and caesarean are 28.97%.

3.2Distribution of respondent's place of residence

Table 2:

Variable	Delivery type				P-value		Odds ratio	95%Confidence interval
	Non-Caesarean delivery		Caesarean delivery		Generally	Categorically		
Type of place of residence	n	%	n	%				
"Urban"	4154	67.35	2013	32.64	0.000*		1.00	
"Rural"	8581	73.37	3115	26.63		0.000*	0.808*	[0.754,0.866]

From the above table we observe that, the percentage of non-caesarean in the rural area is higher than the urban area and the percentage of caesarean delivery in rural area is lower than the urban area. Here, generally ($p = 0.000$) <0.05, so the variable (place of residence) is statistically associated with delivery type and also get in categorically all of the p- values are statistically associated with delivery type.That means the place ofresidence effects on the delivery type. The possibility of caesarean delivery in urban area is more than the rural area.

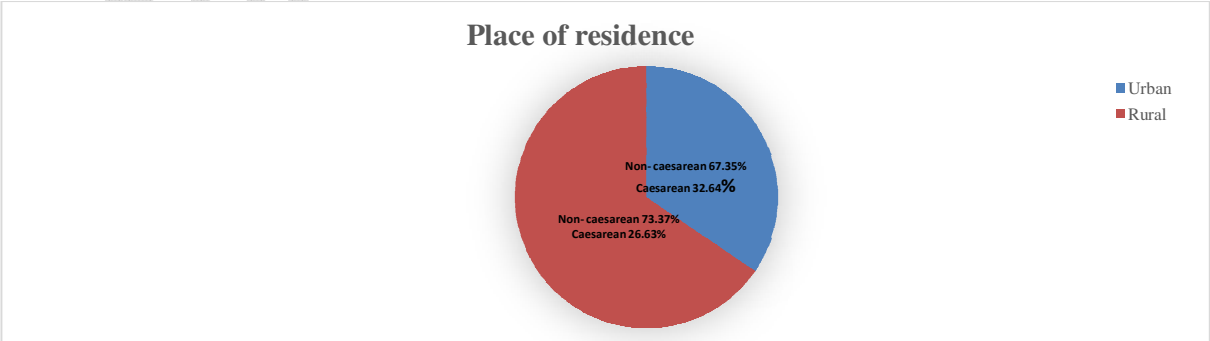

Figure .2: Pie chart of Place of residence

From the above figure we observe that in the rural area the percentage of non-caesarean are 73.37% and caesarean are 26.63%. In the urban area the percentage of non-caesarean are 67.35% and caesarean are 32.64%.

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4.3Distribution of respondent's husband's occupation

Table 3:

Variable	Delivery type				P-value		Odds ratio	95% Confidence Interval
	Non-Caesarean delivery		Caesarean delivery		Generally	Categorically		
Husband occupation	n	%	n	%				
"Land owner"	45	77.58	13	22.41			1.00	
"Farmer"	1965	72.53	744	27.46		0.002*	0.903*	[0.828,2.925]
"Agricultural worker"	1252	74.39	431	25.60		0.043*	1.455	[1.797,2.845]
"Fisherman"	234	80.68	56	19.31		0.045*	1.024*	[0.527,2.103]
"Poultry raising, cattle raising"	24	70.58	10	29.41		0.049*	1.571*	[0.589,4.125]
"Home-based manufacturing "	29	59.37	13	30.95		0.018*	1.851*	[0.748,4.662]
"Rickshaw driver, brick breaking, construction worker"	1456	76.91	437	23.08		0.015*	1.21*	[0.664,2.365]
"Domestic servant"	13	68.42	6	31.57	0.000*	0.017*	1.800*	[0.543,5.596]
"Factory worker, non-agricultural worker"	1040	72.67	391	27.32		0.028*	1.406*	[0.469,2.746]
"Tailor, armed services, police man"	2716	70.65	1128	29.34		0.037*	1.457*	[0.805,2.828]
"Doctor, lawyer, accountant, teacher, nurse, high level	754	60.90	484	39.09		0.032*	1.755*	[0.985,3.439]

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services”								
“Big businessman”	360	67.28	175	32.71		0.023*	1.494*	[0.805,2.958]
“Small business/trader ”	2393	69.48	1051	30.51		0.014*	1.557*	[0.859,3.024]
“Unemployed/ student”	88	74.57	30	25.42		0.009*	1.215*	[0.858,2.627]
“Retired”	30	73.17	11	26.82		0.025*	1.286*	[0.501,3.268]
“Others”	288	70.58	120	29.41		0.042*	1.479*	[0.789,2.958]
“Don’t know”	14	66.66	7	33.33		0.026*	1.738*	[0.558,5.185]

From the above table we observe that, the percentage of non-caesarean which have farmer partners is higher among all others. Here, generally ($p = 0.000$) <0.05, so the variable (husband occupation) is statistically associated with delivery type and also get in categorically all of the p- values are statistically associated with delivery type. That means, respondent husband occupation effects on delivery type. The possibility of caesarean delivery of land owner’s wife is more than the farmer’s wife and the possibility of caesarean delivery of land owner’s wife is less than the Doctor, lawyer, accountant, teacher, high level service holder’s wife. The others are interpreted by similar way.

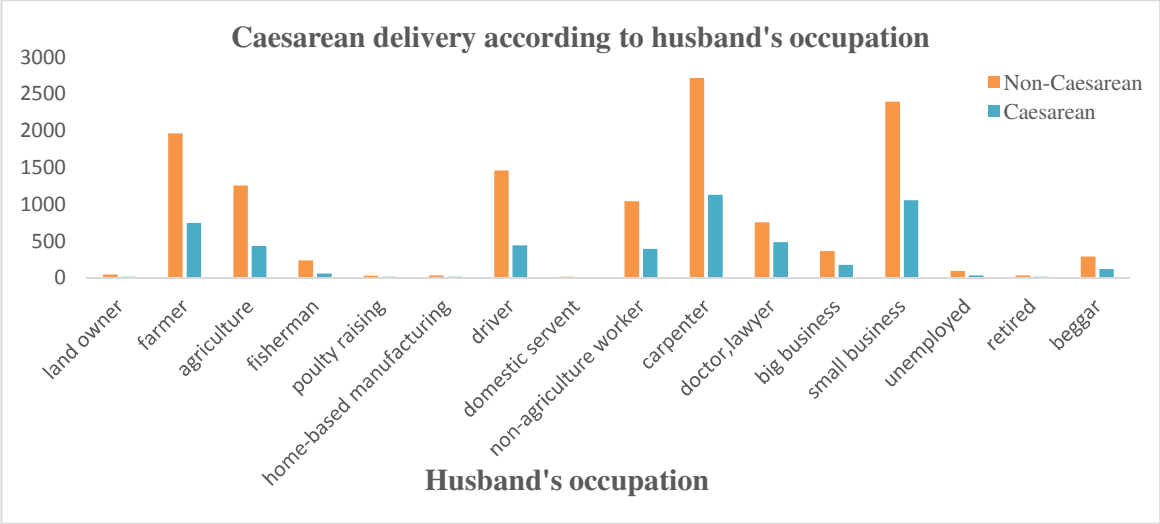

Figure .3: Bar diagram of respondent’s husband occupation

From the above figure we observe that those who are land owner the percentage of non-caesarean are 77.58% and caesarean are 22.41%. Similarly, for farmer the percentage of non-caesarean are 72.53% and caesarean are 27.46% and the percentage of caesarean in other occupation calculated by similar way.

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4.4Distribution of respondent's highest education level

Table 4:

Variable	Delivery type				P-value		Odds ratio	95% Confidence interval
	Non-Caesarean delivery		Caesarean delivery		Generally	Categorically		
Highest education level	n	%	n	%				
"No education"	3075	73.10	1131	26.89			1.00	
"Primary"	3856	73.78	1370	26.21		0.038*	1.020*	[0.929,1.121]
"Secondary"	4767	70.91	1955	29.08	0.000*	0.000*	1.222*	[1.113,1.342]
"Higher"	1037	60.67	672	39.32		0.000*	1.809	[1.596,0.052]

From the above table we observe that, the percentage of non-caesarean in the primary educational level is higher among all others. Here, generally ($p = 0.000$) <0.05, so the variable (highest education level) is statistically associated with delivery type and also get in categorically all of the p- values are statistically associated with delivery type. That means, respondent highest education level effects on delivery type. The possibility of caesarean delivery in No education level is less than the primary education level. The others are interpreted by similar way

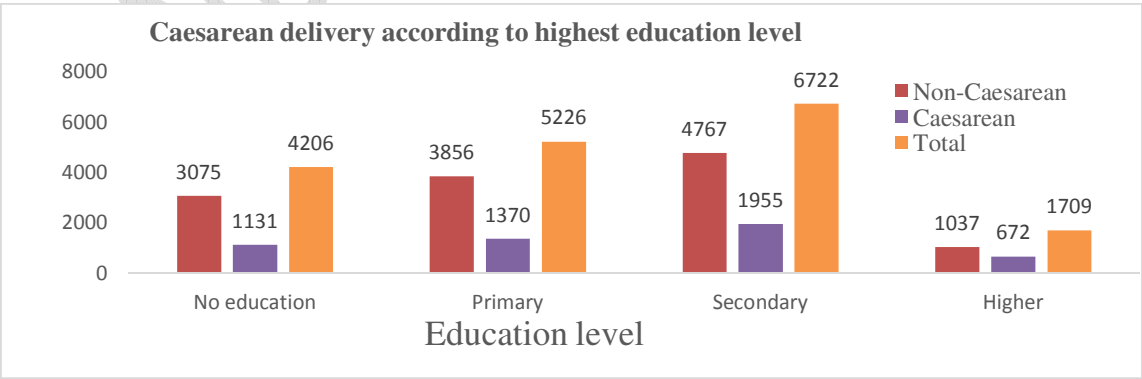

Figure .4: Bar diagram of respondent's education level

From the above figure we observe that those who are non-education, the percentage of non-caesarean are 73.10% and caesarean are 26.89%. Similarly for primary education the percentage of non-caesarean are

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73.78% and caesarean are 26.21%. For secondary education the percentage of non-caesarean are 70.91% and caesarean are 29.08%. Finally, for the higher education the percentage of non-caesarean are 60.67% and the caesarean are 39.32%.

4.5 Distribution of respondent's religion

Table 5:

Variable	Delivery type				P-value		Odds ratio	95% Confidence interval
	Non-Caesarean delivery		Caesarean delivery		Generally	Categorically		
Religion	n	%	n	%				
"Islam"	11532	71.47	4603	28.52	0.099		1.00	
"Hinduism"	1099	69.03	493	30.96		0.154	1.129*	[1.008,1.262]
"Buddhism"	7921	99.73	21	0.27		0.117	6.871	[0.413,1.0920]
"Christianity"	3	21.42	11	78.57		0.864	1.254*	[0.528,2.558]

From the above table we observe that, the percentage of non-caesarean in Buddhism is higher among all other religion. Here, generally ($p = 0.099$) >0.05, so the variable (religion) is not statistically associated with delivery type and also get in categorically all of the p- values are not statistically associated with delivery type. That means, respondent's religion doesn't effect on delivery type. The possibility of caesarean delivery of Muslim respondent is less than the Hinduism. The others are interpreted by similar way.

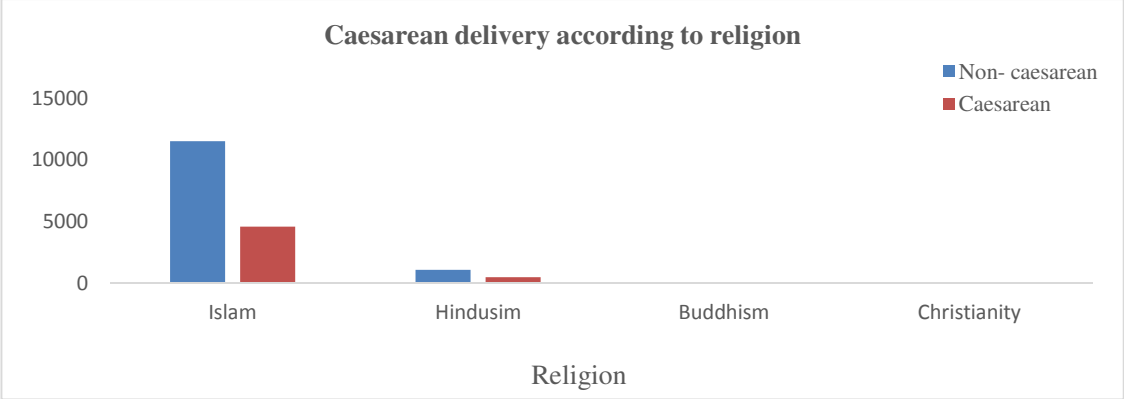

Figure 5: Bar chart of respondent's religion

From the above figure we observe that, those are religion of Islam, the percentage of non-caesarean are 71.47% and caesarean are 28.52%. Similarly, those are religion of Hinduism, the percentage of non-caesarean are 69.03% and caesarean are 30.96% and the percentage of other religion calculated by similar way.

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4.6 Distribution of respondent's wealth index

Table 6:

Variable	Delivery type				P-value		Odds ratio	95% Confidence interval
	Non-Caesarean delivery		Caesarean delivery		Generally	Categorically		
Wealth index	n	%	n	%				
"Poorest"	2476	76.16	775	23.83	0.000*		1.00	
"Poorer"	2514	74.82	846	25.17		0.002*	1.045*	[0.932,1.171]
"Middle"	2621	72.38	1000	27.61		0.015*	1.152*	[1.029,1.291]
"Richer"	2632	69.85	1136	30.14		0.000*	1.266*	[1.127,1.421]
"Richest"	2491	64.50	1371	35.49		0.000*	1.469*	[1.298,1.662]

From the above table we observe that, the percentage of non-caesarean in the poorest level is higher among all others.Here, generally ($p = 0.000$) <0.05, so the variable (wealth index) is statistically associated with delivery type and also get in categorically all of the p- values are statistically associated with delivery type. That means, respondent wealth index effects on delivery type. The possibility of caesarean delivery of poorest women is less than the richest women. The others are interpreted by similar way.

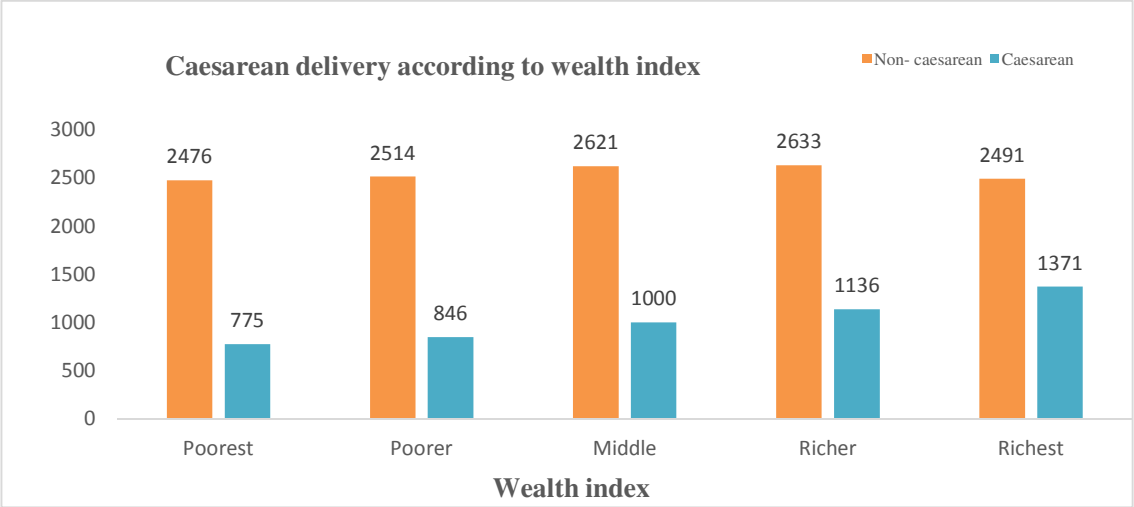

Figure 6: Bar diagram of respondent's wealth index

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From above the figure we observe that, the poorest respondent's non-caesarean are 76.16% and caesarean are 23.83%. The poorer respondent's non-caesarean are 74.82% and caesarean are 25.17%. The middle respondent's non-caesarean are 72.38% and caesarean are 27.61%. Similarly, the richer respondent's non-caesarean are 69.84% and caesarean are 30.14% and the richest respondent's non caesarean are 64.50% and caesarean are 35.49%.

4.Recommendation and Conclusion

4.1 Conclusion

Mothers in Bangladesh need to delay their first birth until their age is 24-29 years old. The rate of caesarean delivery in age 25-29 is higher and the lower rate belongs to age 15-19. The rate of caesarean delivery in rural area is 26.63% and the urban area is 32.64%. In the family of doctor, lawyer, accountant, the rate of caesarean delivery is 39.09%. The caesarean rate of higher education level is 39.32%. In the wealth index factor, the caesarean rate of the richest category is 35.49% which is high. Finally we identified, the variables respondent age, respondent highest education level, husband's occupation, type of place of residence, wealth index are statistically associated with delivery type. But the variable, respondent's religion is not statistically associated with delivery type. In previous research, mother's age at birth, husband occupation, Pregnancy induced swollen of leg, mother's age, high blood pressure, order of birth were most influential factors of caesarean delivery. This evidence confirm our study and also we have found some new most influential factor's which were absent in the past study.

4.2Recommendation

The following suggestions may be recommended in view of our observation:

- In this study, the rate of caesarean delivery is higher for the maternal whose age is (25 -29) years.
- Balanced and nutritional diet may be beneficial for pregnant women. For this purpose Govt. and non Govt. organization should conduct healthcare programs.
- Increasing awareness of women on suitable delivery type may influence the motive of caesarean delivery.
- Moreover, public awareness of harmful and long term effects of caesarean deliveries are needed to confirm a stable mother's health.

4.3Limitations

Our paper is fully based on the survey. Since we work to secondary data so we face some problems. But we tried to recover those problems. We have tried to recognize a good questionnaire but there may be missing some variables or factors which are associated with

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delivery type. There may be some ethical questions in our questionnaire. In this case, the respondents were not spontaneously answers these questions

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