CHAPTER FIVE

DETERMINANTS OF CAESAREAN SECTION DELIVERY IN INDIA

5.1 Introduction

The previous chapter highlighted the current trends and levels in caesarean births in India and all states in past two decades based on national level data. But what could be the possible reasons for such scenario? The objective of this chapter is to focus on importance of different factors in determining the high incidence of caesarean section. This chapter adopts both simple and advanced statistical methods. Multivariate models are used to understand the relative importance of different factors using the data from NFHS of 2005-06. The first section of the chapter deals with review of studies, which explored different sets of factors behind the performance of this surgical intervention. The second section discusses the explanations of different factors, which have been considered within the framework of present study. Analyses of different factors which determine the performance of caesarean intervention have been explained in the third section followed by summary in the fourth section.

However, before going into the analysis it is indeed important to discuss the studies that have been carried out on different factors behind caesarean section delivery. The factors mostly can be divided under two broad heads viz. the medical factors and the socio-economic factors. A

significant body of research concerning the determinants of caesarean sections addresses a number of medical factors that are associated with performance of caesarean delivery. The commonly observed medical factors are high maternal age, pregnancy induced hypertension (PIH), breech presentations, large size of baby and unable to progress in labour. The interplay between these factors have been discussed in many scholarly studies on which we can have a short look. As we know that surgical intervention during pregnancy is usually performed to ensure safety of the mother and child under conditions of obstetric risks (Mishra and Ramanathan, 2002). This medical intervention is more or less justified under certain circumstances such as breech presentation, dystocia, previous caesarean section and suspected fetal compromise (Baskett and McMillen, 1998). Another study by Cai et al (1998) revealed that the performance of c-section was mainly associated with self-reported complications during pregnancy, higher birth weight and maternal age. A report by Parliamentary Office of Science and Technology in UK shows that, the increasing use of IVF (in vitro fertilization) has led to an increase in the number of multiple births and these babies are usually delivered by c-section (POST, 2002). Keeler and Brodie (1993) argued that, ignoring the financial costs, a c-section is best if the price in terms of morbidity and risk to mother of the operation is less than the discomfort and risk to mother and child of prolonged normal delivery.

At the same time, there is a parallel argument among social scientists, that the decision to perform a caesarean section is often strongly influenced by non-

medical factors along with the medical determinants. Researchers have found a strong correlation between increasing c-section delivery and socio-economic and cultural factors. Studies show that in case of developed countries, doctor's preference for this surgical procedure, coupled with women's demand are responsible for the increasing trend. Different rates of c-section in public and private hospitals suggest that non-medical factors, such as economic gain and pressures of private practice, may motivate doctors to perform surgical deliveries (Potter et al. 2001). It is also believed that the increasing trend of the caesarean delivery in the developed countries attributes to the increasing demand from patients and informed decision making. Women's requests for caesarean section is considered to be an important determinant of birth outcome, particularly in countries with growing privatization and options for patient choice (Ash and Okah, 1997). It is often argued that, power for decision making in the home and seeking medicalised health care were associated with higher maternal education and family incomes (Potter et al. 2001). And women's request for c-section is an important determinant of birth outcome, particularly in countries with growing privatization and options for patient's choice. Most of the research focused on women's fear of the physiological consequences of normal delivery (Behague, 2002). On the other hand, Taffel et al. (1989) argued that the decision to perform c-section is prompted by the physician's concern for the life and health of the mother or the child.

In case of developing countries like India it is still unclear as to what could be the motivation behind the increasing trend of c-section. In general, it is often argued that, beside the medical factors, physician's interest determines the choice of c-section (Mishra and Ramanathan, 2002). The physician factors that affect c-section incidence include physician practice styles, the obstetrician's clinical attitude and fear of litigation, physician's convenience and more importantly the economic incentives (Belizan et al. 1999). Economic motives may include both doctors' fear of malpractice as well as economic gain (Tussing et. al. 1992). At the same time, the source of payment for the delivery and the place of birth, i.e. whether it was a private or public sector institution also influences the performance of c-sections (Peterson, 1990). All these arguments put-forth by several social scientists point towards the concept of growing medicalisation of maternal health and increasing trend of c-section delivery both in developed as well as in developing countries.

5.2 Effect of different factors on the performance of caesarean delivery:

As already discussed above the interplay between different factors in determining the performance of caesarean births is a complex procedure. As against different studies which looked into the determinants of caesarean sections from either side of the scenario, the present study adopts a framework which involves a holistic explanation of effect of different variables on performance of c-section. We considered medical factors as risk factors, socio-economic factors as demand factors. Moreover, to understand

the supply side of phenomenon we considered health facilities as institutional factors. In the following section, description of different factors adopted in this framework of analysis has been discussed.

5.2.1 Framework for the study: The framework adopted for the present study takes into consideration the risk factors, socio-economic factors as well as institutional factors which may affect performance of c-section delivery.

Risk factors: Studies have shown that a number of factors play a significant role in deciding the type of delivery whether normal or by caesarean. For most women, normal delivery is spontaneous, but in some cases with pregnancy complications c-section delivery is preferred to save mother and child. A number of medical factors such as mother's age, breech presentation of the baby, size of child at birth are considered as possible risk factors leading to c-section delivery. In other words, pregnancy complications are generally considered as risk factors.

Mother's age at birth: Age of mother at the time of birth is considered as one of the important factors that determines performance of c-section. Several studies have shown a positive association between maternal age and caesarean intervention especially when the mother is above 35 years of age (Rosenthal & Paterson, 1998; Padmadass et.al. 2000). Some studies explained that both mother at high age and low age of pregnancy are at risk of caesarean section. Women who deliver at ages below 18 years or in later ages i.e. above 35 years are said to be at high risk for delivery related complications, are

considered as high risk patients (Bottoms et.al. 1980; Mishra & Ramanathan, 2002).

BMI of mother

In many developed countries the growing incidence of caesarean births are taking place due to increasing obesity among mothers in the childbearing age. A study by Weiss et.al (2004) shows that with a high BMI of patients the chances of caesarean intervention increases.

Breech presentation

Perhaps the most important cause to perform a c-section intervention is the breech presentation of baby. Breech presentation means that the foetus is positioned feet or bottom down for the time leading to delivery instead of usual position of head first (vertex presentation). This situation is associated with increased neonatal mortality and morbidity irrespective of when delivery is vaginal or by caesarean.

Foetus distress

In general, foetus distress means that the baby is showing evidence of suffering from lack of oxygen (asphyxia) which could lead to brain damage.

Demand factors: As already pointed out, the performance of c-section delivery also influences by non-medical factors. The request from women and other socio-cultural factors can influence the decision of c-section delivery. Factors such as maternal request, doctor's preference, and other socio-cultural

factors play important role in determining the type of delivery. The present analysis has been done after taking into consideration these non-medical factors as background variables.

Education of mother

One of the important socio-economic factors that determines the performance of caesarean delivery both in developed as well as developing countries is educational status of mother. It has been found in many studies there exists a highly positive correlation between women's education and birth due to caesarean. Perhaps, women with good educational attainment are in a position to demand for caesarean section which has been justified in many scholarly articles. A study by Chacham and Perpetuo (1998) in Brazil clearly documented the association between maternal education and type of deliveries, particularly caesarean sections.

Place of residence

In many developed countries, caesarean section births are more inclined to occur in urban areas, specifically in private health institutions (Parazzini et al. 1992). Analysis of NFHS data in previous chapter suggests that in India and many states, there is a clear difference between rural urban scenarios of caesarean births.

Sex of the child: Sex of the child can be considered as an important determinant in the decision making process of type of delivery. Though it has

not been justified in studies based on secondary data, a few qualitative studies have argued that during the decision making process desire for male child acts as a catalyst for caesarean births (Pande, 2004).

Institutional factors: Some studies suggest a strong correlation between the place of delivery whether public or private health facility and performance of c-section delivery. It has already been pointed out that there is a high prevalence of c-section in private health facilities rather than in public ones. But the reason is unclear for this occurrence.

In the previous chapter it was mentioned that there has been an increase in c-section associated with availability and type of health facilities i.e. whether the facilities are in private sector or public sector. Since, availability of private health facilities mainly in urban areas triggered the rate of c-section births in many developed countries it now considers one of the agents of medicalisation and c-section births.

5.2.2 Results and discussion

Both bivariate and multivariate techniques have been employed to test the effect of selected socio-economic characteristics on dependent variable performance of c-section delivery. The dependent variable is dichotomous coded as 1 for mothers who had caesarean section delivery and 0 for those who had normal delivery. A set of independent variables that included in the study are discussed in the following section along with the framework.

Bivariate analysis

Risk factors: For the present study, factors such as mother's age at birth, size of child at birth, birth weight, BMI (body mass index) of mother and complications during pregnancy are considered as risk factors. The influence of these factors on caesarean section deliveries in West Bengal and India is presented in Table 5.1. It reflects from the analysis that mother's age plays an important role in performance of c-section. Mothers aged 30 or more are having more chances of caesarean baby than their younger counterpart/s. Women today embark on a pregnancy at a late age and therefore, their chances of undergoing caesarean delivery are high. Another important factor is child's size at birth. Larger size babies are at higher risk of being delivered through c-section. Babies with birth weights more than 3 kg is usually considered as larger size babies.

Demand factors: As already pointed out, non-medical factors are also plays and important role in enhancing c-section delivery. In case of India as well as in West Bengal, relationship between socio-economic factors and birth by c-section delivery has been presented in table 5.1. The most important variable is mother's education. Mother's education is classified into seven broad groups (No education, Incomplete Primary, Complete Primary, Incomplete Secondary, Complete Secondary, Higher). It reflects from the analysis that, proportion of c-section is much higher among mothers having secondary and higher education than mothers with `no education` and `primary education`. In West Bengal, proportion of c-section delivery is very high among the

mothers with high educational background which elucidates that women from high educational background, perhaps, are able to make decision   on their own health care. Similarly, caesarean deliveries are more frequent among women from urban areas. This is because, access to medical institutions, standard of living are playing important role in urban areas. In case of West Bengal, the difference between rural and urban areas in c-section deliveries is highest when compared to other states.

Institutional factors: Provision of institutionalized birth is an important indicator to combat with maternal morbidity and mortality. Institutional delivery provides an opportunity to deal with delivery complications. However, at the same time, the institutional births are prone to c-section delivery and therefore there is a growing trend in c-section births with the increasing institutionalized births. It is evident from three consecutive years' data from NFHS that the proportion of c-section deliveries increased with the increase in institutionalized births from 1989 to 2006. More importantly caesarean childbirths are more in private health facilities than in public. The analysis on the association between birth in private and public health institution shows that in India, nearly 39 percent of births take place in health institution and among these births in private health facilities are more than what is prevalent in public health facilities.

Table 5.1 Percentage of Caesarean delivery by Various Characteristics in India and West Bengal, 2005-06 (NFHS-3)				
Background characteristics	West Bengal	Total births	India	Total births
Risk factors				
Age of mother at birth				
< 25	11.0	1,537	9.1	27,981
25-29	22.2	568	12.4	14,442
30>	22.8	263	12.5	9,066
Size of child at birth				
Very large	20.0	110	15.6	1,913
Larger than average	18.5	601	12.3	9,607
Average	15.9	1,066	10.3	28,711
Smaller than average	9.1	328	9.2	7,273
Very small	10.7	206	10.1	3,098
Birth weight				
< 3 kg	25.2	746	22.1	2,305
> 3 kg	31.9	454	23.2	2,486
Birth order				
1	23.4	912	17.5	16,543
2	14.8	730	12.6	14,399
3+	4.7	726	3.7	20,556
Complications during pregnancy				
Yes	12.2	1,220	9.0	31,078
No	17.9	1,148	13.2	20,433
BMI of mother#				
Thin	5.1	1,147	5.7	19,512
Moderate	20.3	1,000	10.5	25,077
Overweight	41.9	155	27.6	3,929
Obese	51.4	37	40.8	824
Demand factors				
Mother's education				
No education	3.2	903	3.0	21,048
Incomplete Primary	5.6	376	6.1	3,984
Complete Primary	15.4	156	7.9	3,491
Incomplete Secondary	22.0	732	14.5	16,481
Complete Secondary	42.2	83	21.0	2,595
Higher	72.0	118	35.4	3,911
Wealth index				
Lowest	1.7	634	1.4	9,198
Second	1.2	512	3.4	9,569
Middle	12.7	408	6.6	10,649
Fourth	22.5	475	13.1	11,288
Highest	52.8	339	26.2	10,807

Religion	19.6	1,459	11.1	35,469
Hindu	6.7	876	9.5	8,591
Muslim	30.4	23	8.3	5,059
Christian	30.0	10	12.0	2,392
Others				
Place of residence				
Rural	5.8	1,441	6.3	32,050
Urban	29.2	927	17.8	19,461
Caste/tribe#				
Scheduled caste	9.0	511	8.0	9,160
Scheduled tribe	1.8	113	4.0	8,379
Other backward class	16.7	60	9.8	16,735
Other	20.5	1,332	16.3	15,055
Working status of mother				
Currently not working	16.9	1808	11.8	36,489
Currently working	8.8	560	7.8	14,910
Sex of the child				
Male	16.7	1215	11.0	26,775
Female	13.2	1153	10.2	24736
Institutional factors				
Place of delivery				
Public	20.8	893	18.1	12,041
Private	50.5	313	30.2	10,664
Total	15.0	2,368	10.6	51,511

Multivariate analysis:

Apart from the bivariate analysis, to examine the relative importance of these factors and its statistical significance a logistic regression model has been applied. The dependent variable is women who had caesarean delivery in the last three years preceding the survey. As the dependent variable cesarean delivery is dichotomous in nature (0- No or mother who had normal delivery, 1- Yes or mother who had c-section delivery) logistic regression is used for the analysis.

The logistic regression model can be stated as:

$$\frac{P(x)}{1-P(x)} = \alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots \ldots \beta_i x_i$$

(Where, α is constant and β is coefficient of variable)

This indicates that the log odds of caesarean delivery are linear function of the independent variables. In order to understand the risk factors, socio-economic and institutional factors associated with c-section deliveries, a set of variables has been selected from the NFHS data sets both for West Bengal as well as India based on the framework adopted for the study. For the purpose of multivariate analysis, different categories of the variables like size of the child at birth, mother's education and wealth status recoded into smaller categories.

The variable sex of the child has been dropped from the model as we do not get the demand for caesarean based on sex of the child from secondary data source.

The influences of background variables on c-section deliveries in West Bengal and in India are shown in Table 5.2 and 5.3, respectively. For this purpose, three models have been considered. In the first model only risk factors are considered for the analysis. In the second model, the demand factors are considered along with the risk factors and in the third model the institutional factors are added to the earlier model. In the first model all the risk factors show significant impact on c-section. In West Bengal, it reflects from the regression analysis that mothers' age at birth is playing significant role in determining the type of delivery. Caesarean deliveries are significantly more likely to occur among the mothers of high age or aged more than 30 years. Factors such as size of the child at birth, complications during pregnancy and BMI are significant. However, in the second model when demand factors are taken into consideration, the importance of risk factors has reduced significantly. In West Bengal, demand factors are very important in the preference for c-section delivery. Table 5.2 also shows that the c-section delivery is more likely among mothers having higher education and have high wealth index. Mothers from urban areas are more likely to deliver by c-section. Nevertheless, the variable current work status of mother is not significant in the analysis. In the third model, institutional factor i.e. deliveries

in public or private institution have been analyzed which shows that c-section deliveries are more likely to occur among the births in private institutions.

In the case of India as could be observed from Table 5.3, mother's age, size of the child at birth, and pregnancy complication and BMI of mother are playing significant role in deciding the c-section. C-section delivery is more likely to occur among mothers aged 30 or more. The occurrence of c-section is negatively related with size of child at birth and order of birth. Children with smaller size are less likely to be delivered by c-section. Similarly, higher order births are also less likely to be by c-section. These are important risk factors for the performance of c-section delivery. In addition, mothers who had complications during pregnancy, chances of caesarean delivery are more likely to occur. Similarly, demand factors are also playing important role. Women's education, wealth and place of residence are important determinants in preferring caesarean delivery. The c-section deliveries are more likely to occur in urban areas as compared to rural areas. In the third model, delivery in health institutions has been considered. Deliveries in private health institutions are more likely to be performed by c-section.

	Model I (N=2368)		Model II (N=2368)		Model III (N=1229)	

Table 5.2 Results of the Logistic regression model showing the effects of selected determinant factors on c-section deliveries in West Bengal, 2005-06 (NFHS 3)

Independent variables	Model I (N=2368)		Model II (N=2368)		Model III (N=1229)	
	Regression coefficient 'b'	Odds ratios	Regression coefficient 'b'	Odds ratios	Regression coefficient 'b'	Odds ratios
Risk Factors						
Age of mother at birth						
<25 ®						
25-29	1.416	4.121***	0.492	1.635**	0.350	1.419*
30>	1.763	5.832***	1.150	3.157***	1.012	2.750***
Size of child at birth						
Large ®						
Average	-0.210	0.810	-0.209	0.811	-0.150	0.860
Small	-0.526	0.591**	-0.212	0.809	-0.104	0.901
Birth order						
1						
2	-946	0.388***	-0.549	0.578**	-0.446	0.640**
3+	-2.753	0.064***	-1.406	0.245***	-1.125	0.325***
Complication during pregnancy						
No®						
Yes	0.238	1.268***	0.227	1.254	0.242	1.273*
BMI of mother		3.625***				
Thin	1.288	7.671***	0.838	2.311**	0.743	2.102***
Moderate	1.037	12.712***	1.114	3.047***	0.901	2.461***
Overweight	2.543		1.257	3.515***	1.227	3.410***
Obese						
Socio-economic factors			0.449	1.567*	0.310	1.363
Mother's education			0.838	2.312**	0.501	1.650*
No education ®			1.895	6.650***	1.249	3.485***
Primary						
Secondary						
Higher			1.718	5.573***	1.378	3.966***
Wealth index			2.331	10.286***	1.678	5.354***
Low ®						
Middle						
High			0.319	1.376*	-0.016	0.984
Place of residence						
Rural ®						
Urban			-0.435	0.647*	-0.249	0.780
Religion			0.558	1.748	1.738	5.684*
Hindu			-1.043	0.352	-1.028	0.358
Muslim						
Christian						
Others						
Working status of mother			-0.160	0.853	0.013	1.013
Currently not working®						
Currently working						
Institutional factor						
Place of delivery						
Public®					0.676	1.965***
Private						

* p<=0.05, **p<= 0.01 and ***p<=0.001
Dependent variable: Delivery by caesarean section (0- No, 1- Yes).

Table 5.3: Results of the logistic regression model showing the effects of selected determinant factors on c-section deliveries in India, 2005-06 (NFHS 3)						
	Model I(N=51,511)		*Model II(N=51,511)*		*Model III (N=23,093)*	
Independent variables	Regression coefficient 'b'	Odds ratios	Regression coefficient 'b'	Odds ratios	Regression coefficient 'b'	Odds ratios
Risk Factors						
Age of mother at birth						
<25 ®						
25-29	0.749	2.115***	0.452	1.571***	0.324	1.383***
30>	1.123	3.075***	0.826	2.377***	0.696	2.005***
Size of child at birth						
Large ®						
Average	-0.216	0.806***	0.221	0.802	-0.142	0.867
Small	-0.242	0.785***	0.120	0.887**	-0.072	0.930
Birth order						
1						
2	-0.641	0.527	-0.512	0.599	-0.337	0.714***
3+	-2.236	0.107**	-1.540	0.214*	-1.055	0.348***
Complication during pregnancy						
No®						
Yes	0.400	1.493***	0.332***	1.394***	0.232	1.261***
BMI of mother						
Thin						
Moderate	0.546	1.726***	0.341	1.407***	0.271	1.311***
Overweight	1.492	4.448***	0.928	2.528***	0.723	2.060***
Obese	2.080	8.003***	1.401	4.058***	1.113	3.044***
Socio-economic factors						
Mother's education						
No education ®						
Primary			0.483	1.621***	0.172	1.188*
Secondary			0.778	2.176***	0.187	1.205**
Higher			1.124	3.076***	0.361	1.435***
Wealth index						
Low ®						
Middle			0.596	1.815***	0.119	1.126*
High			1.017	2.766***	0.240	1.271***
Place of residence						
Rural ®						
Urban			0.298	1.347***	0.056	1.057
Religion						
Hindu						
Muslim			0.017	1.017	0.015	1.016
Christian			0.502	0.605***	-0.205	0.815**
Others			-0.167	0.846*	-0.131	.877*
Working status of mother						
Currently not working®						
Currently working			-0.045	0.956	0.007	1.007
Institutional factor						
Place of delivery						
Public®					0.440	1.553***
Private						
* p<=0.05, **p<= 0.01 and ***p<=0.001						
Dependent variable: Delivery by caesarean section (0- No, 1- Yes).						

5.3 **Summary**

The main objective of this chapter is to focus on understanding how various demographic as well socio-economic characteristics determine the performance of caesarean delivery in India and in West Bengal. Moreover, what is the role of institution in triggering the rate of caesarean intervention is also discussed. The results of the analysis carried out in this chapter clearly have demonstrated that socio-economic characteristics which have been considered as demand factors and institutional factors have greater influence than medical or risk factors.

The bivariate analysis helps to understand the relations between the c-section delivery and its effect on different risk factors and demand factors for the preference of c-section delivery. Analysis shows that factors like mother's high age, size of the child at birth influence the decision to perform c-section. In addition, a number of demand factors or socio-economic characteristics are significantly related with caesarean delivery. Women's education and wealth status are important deciding factors. Mothers with high educational status may have decision making power for their own health care and autonomy to decide the preference for institutional delivery. The multivariate analysis shows that a number of socio-economic factors are responsible for the performance of c-section delivery. Thus the three sets of indicators considered for the multivariate analysis such as risk factors, socio-economic factors and institutional factors provided vital information on the characteristics that have contributed to the high incidence of c-section delivery. From the available

secondary data, it was not possible to consider all the variables in framework due to data constraint. Furthermore, due to unavailability of information the variables in risk factors such as breech presentation and foetal distress could not be captured in the model. Hence, for a better understanding of the interplay of different factors from a micro point of view, an intensive qualitative study was carried out which we will discuss in the next chapters.