

Caesarean Section Delivery in India: Public and Private Dichotomy

Sibabrata Das^{*1} and Harihar Sahoo²

Abstract: The substantial increase in caesarean section (C-section) delivery in the last two decades has become a cause of worry in India. This paper analyses the changing trends and determinants of the practice of C-Section delivery in India emphasising on the roles of private and public health facilities in rising C-section delivery. This study used data from all the four rounds of the National Family Health Survey, the Indian version of the Global Demographic Health Survey (DHS). The bivariate and multivariate analyses were employed to find out the factors determining the C-section delivery. Findings reveal a rising trend of C-section delivery in India since early 1990s. In almost all socioeconomic groups, the C-section delivery is found to be higher in private health facilities compared to public ones. The higher likelihood of richer household opting for C-section deliveries in private sector in recent years speaks about the inability of poorer household to afford the cost incurred for C-section deliveries. Rising C-section delivery in public sector facilities points towards the role of other factors such as changing socioeconomic conditions, demographic aspirations, health situations and perceptions of people regarding C-section delivery. Increased C-section delivery in India have been driven in part by the private sector. Holistic programmes in terms of public-private partnerships are needed to reduce medically unnecessary C-section cases and improve women's health.

Keywords: Caesarean Section, Delivery, India, Public Hospital, Private Hospital.

Introduction

The rise in the caesarean section (C-section) deliveries in India and in many developing countries has been a matter of concern. C-section delivery is defined as “a method of birth in which the baby is directly removed from the uterus through an incision made in the mother's abdomen” (Australian Institute of Health and Welfare, 2016). C-Section delivery has a serious impact on the health of mothers and their ability to continue work after delivery. Additionally, it affects maternal and neonatal mortality. Repeated C-section surgeries worsen the situation. However, C-section delivery cannot be avoided under certain critical medical cases as a C-section refers to a “life-saving surgical procedure when certain complications arise during pregnancy and labour” (Betrán *et al.*, 2016).

C-section delivery have risen substantially worldwide over the past decades (Ye *et al.*, 2015; Molina *et al.*, 2015; Betrán *et al.*, 2016). As per the World Health Organisation (WHO) guidelines, 10-15 % deliveries being C-sections is considered appropriate (WHO, 2015). However, the global level has increased from 4.4 percent to 19.5 percent between 1990 and 2014. The steady increase in C-section delivery worldwide with Asia and Northern America

* Corresponding author; E.Mail: sibabrata2007@gmil.com

¹ Assistant Professor, Department of Applied Geography, Ravenshaw University, Cuttack, Odisha-753003.

² Assistant Professor, International Institute for Population Sciences, Mumbai.

An earlier version of this paper was presented at the 4th Asian Population Association (APA) conference, Shanghai, July 11-14, 2018.

being the regions with the highest and lowest average annual rate of increase (6.4% and 1.6% respectively) has become a cause of concern (Betrán *et al.*, 2016). The association between C-section delivery and maternal mortality and neonatal mortality is very complex and vary by levels of C-section rates. Examination of data of 159 countries from 2000 to 2012 reveals a negative association between C-section rates and mortality outcomes, especially among the least developed countries. After adjusting for human development index values, this effect was much smaller and was only observed below a C-section rate of 5 -10%. No important association between the C-section rate and maternal and neonatal mortality was observed when the C-section rate exceeded 10% (Ye *et al.*, 2015). A Cross-sectional and ecological study estimating annual C-section rates from data of 2012 for all 194 WHO member states reveals that national C-section rates of up to 19 per 100 live births were associated with lower maternal or neonatal mortality rate (Molina *et al.*, 2015). Mehta *et al.* (2001), by analysing time-trends in C-section rates in relation to perinatal and maternal mortality rates in a maternity hospital setting of Bombay by using 1957-1998 data on retrospective cohort, did not observe any improvement in the perinatal outcome beyond a C-section rate of 10%. Findings from the most of the research articles converge at the point that although C-section is an effective intervention to save maternal and infant lives, the rates higher than 10% at the population level are not associated with decrease in maternal and neonatal mortality rates, and thus may not be necessary to achieve the lowest maternal and neonatal mortality level.

In recent times, India has seen an unprecedented increase in C-section surgeries (Ghosh and James, 2010; Mehta *et al.*, 2001). As per the first round of National Family Health Survey (NFHS I), conducted in 1992-93, the C-section rate was only 2.6 percent which was increased to 7.1 percent in 1998-99 (NFHS II), 9 percent in 2005-06 (NFHS III) and finally 17.2 percent in 2015-16 (NFHS IV). The increasing trend will pose a serious threat to the reproductive health of women in the country and the current figure is more than the normal level as recommended by the WHO. Further, C-section deliveries are more common in urban and in private health facilities (Ghosh and James, 2010). Singh *et al.*, (2018), analysing DLHS IV (2012-13) data, concluded that C-section births are nearly three times more in private as compared to public sector health facilities. Based on the analysis of NFHS-1, 1992-93 data on C-section delivery for 18 states of India, Mishra and Ramanathan (2002) observes a significant association of occurrence of C-section with private sectors institutions. The risk of undergoing C-section deliveries in private sector health facilities is four or more times higher than in public health facilities in Gujarat, Bihar, Andhra Pradesh, Karnataka, Uttar Pradesh and Punjab. Further, the authors conclude that ‘this extremely useful surgical procedure is being misused for profit purposes in the private sector in the several states’ (p.97).

A study on the determinants of C-section deliveries in Pakistan observed that the higher likelihood of caesarean deliveries is associated with mothers aged more than 24 years, women from Punjab province, women belonging to the richest class, women with higher education, women employed at professional/managerial/technical level, and women residing in an urban setting, women with pregnancy complications, women having access to antenatal care and deliveries in private hospitals (Amjad *et al.*, 2018). Another study in the Indian state of Gujarat reveals that the differences in the of C-section deliveries between tribal and non-tribal women are explained partly by age of the mother, parity, previous caesarean case and distance from the hospital. The most common indications of C-section were foetal distress (31.2%), previous C-section, breech and prolonged labour (Desai *et al.*, 2017). Based on the results from logistic regression models, Padmadas *et al.* (2000) observe significant

associations of maternal age, birth order, current age, births in health institutions and spatial differences with caesarean section deliveries in Kerala. This paper examines the trends in C-section delivery in India, variations in it across states and regions, and differentials by the socioeconomic backgrounds of women. Taking clue from the literature, this paper also looks at the role of private sector health institutions in rising trends of C-section deliveries in the country.

Data and Methods

Data for the study have been used from all the four rounds of the National Family Health Survey (NFHS), the Indian version of the Global Demographic Health Survey (DHS). The first round of the NFHS was carried out during 1992-93 followed by the second, third and fourth round during 1998-99, 2005-06 and 2015-16 respectively. NFHS is a nationally representative survey and provides enormous information on the demographic, health and social indicators. More specifically, these surveys provide rich information on fertility, contraception, reproductive health. In the first round of NFHS I, interviews were conducted with a nationally representative sample of 88,562 households and 89,777 ever married women aged 13–49 years across India. NFHS II covered a representative sample of 91,196 households and interviewed 89,199 ever-married women aged 15–49 years. NFHS III collected information from a nationally representative sample of 109,041 households and 124,385 women aged 15–49 years. NFHS IV covered a representative sample of 601,509 households and 699,686 ever married women aged 15-49 years. In NFHS I, the information on deliveries happened in the last 4 years preceding the survey are available while for NFHS II, it is in the last three years but in NFHS III and IV, all the deliveries happened in the last five years are available. Therefore, to make a comparative analysis of all the four rounds of NFHS, deliveries happened in the three years preceding the surveys have been considered.

To find out how the C-section delivery varies across the background characteristics, a set of socioeconomic variables has been considered based on the review of the literature. These are age of mother at birth, birth order, whether birth is single or multiple, educational level of the mother, exposure to mass media, caste, religion, work status of women, wealth index of the household, place of residence, region, Body Mass Index (BMI) of the mother. The age of mother at birth has been divided into three categories, i.e., less than 20, 20-29 and 30+. The birth order has been categorized into one, two and more than two while multiple births into single or multiple. The educational level of women has been divided into four categories- no education, primary, secondary and higher. Exposure to mass media has been used as a dichotomous variable- whether women are exposed to any mass media or not. In India, Scheduled Caste (SC) and Scheduled Tribe (ST) are two officially recognized socially backward groups which have been historically excluded and secluded from the mainstream society. People from these two groups lag behind those belonging to Other Backward Classes (OBC) and Non-SC/ST/OBC castes in every dimension of development including health. Therefore, caste has been measured in terms of four categories, namely, Scheduled Castes (SCs), Scheduled Tribes (STs), Other Backward Classes (OBCs) and Others. Religion has been grouped into Hindu, Muslim, Christian and Others.

Work status of women has been categorized into working or not working while the wealth index has been classified as poorest, poor, middle, richer, and richest. It is to be noted that NFHS computes the wealth index based on ownership of assets and housing conditions. The place of residence has been categorized as rural and urban. By clubbing states into

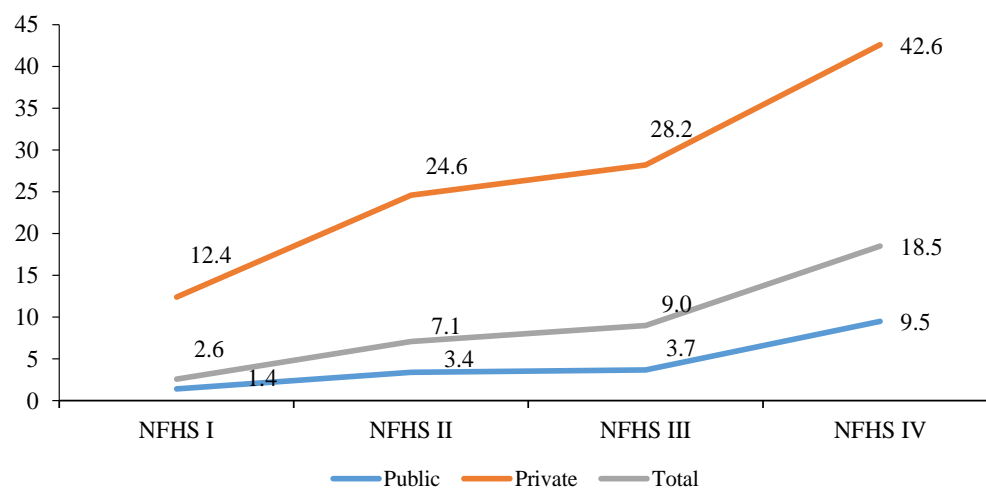
different geographical regions, the variable 'region' has been categorized as north, central, east, northeast, west and south (Table 1) while body mass index of the women has been classified into thin (<18.5 kg/m²), normal (18.5-24.9 kg/m²), overweight (>=25 kg/m²) and information not available. The bivariate and multivariate (binary logistic regression) analyses have been used to find out the factors responsible for the C-section delivery employing all the above socio-economic, demographic and spatial factors as covariates in the model. The analysis has been carried out using STATA 14.0 and ArcGIS.

Result and Discussion

Levels and Trends

As per the first round of NFHS conducted in 1992-93, C-section delivery was 2.6 percent, increased to 7.1 percent in 1998-99 (NFHS II), 9 percent in 2005-06 (NFHS III) and 18.5 percent in 2015-16 (Figure 1). The pace of increase in C-section delivery at public health facilities has been much slower as compared to that at private health facilities since early 1990s. According to the latest NFHS 4, the gap in C-section delivery between public and private health facilities was substantially high (31 percentage points) in 2015-16. Maps 1-4 reveals that the regional patterns of C-section delivery have changed a lot from 1998-99. The percentage of C-section delivery was in the acceptable range in 1992-93 in all the states; it ranged from 0.2 percent in Manipur to 14.1 percent in Kerala. Between 1992-93 and 1998-99, three states crossed the normal range (Goa, Kerala and Tamilnadu). In 1998-99, only two states (Goa and Kerala) had C-Section delivery above 20 percent; the number increased to three in 2005-06 and 16 in 2015-16. Further, one state in 2005-06 and six states in 2015-16 crossed the mark of 30 percent. This indicates that more and more states gradually experiencing a rapid rise in C-section delivery. In fact, it has increased in all states of India. While consistently higher percentage were reported for southern states, low was reported for north-central and eastern parts of the country.

Figure 1: Percent of caesarean section delivery by facility type, NFHS I-IV



Caesarean Section Delivery in India: Public and Private Dichotomy

Table 1: Percent of C-section delivery by States in the three years preceding the survey, NFHS I-IV

States	NFHS I	NFHS II	NFHS III	NFHS IV
North	2.1	5.4	8.6	16.4
Jammu and Kashmir	4.7	9.3	14.0	34.7
Himachal Pradesh	1.2	5.1	14.0	18.6
Punjab	4.0	8.2	18.2	26.3
Uttaranchal	NA	NA	8.4	14.5
Haryana	2.0	4.3	6.5	12.9
Chandigarh	NA	NA	NA	24.9
Delhi	4.8	13.4	13.9	30.4
Rajasthan	0.7	3.1	4.3	9.4
Central	0.8	2.9	4.6	10.1
Chhattisgarh	NA	NA	4.8	10.6
Madhya Pradesh	0.8	3.3	3.8	9.4
Uttar Pradesh	0.8	2.8	4.9	10.3
East	2.0	5.6	6.0	13.6
Bihar	1.0	3.0	3.9	7.1
Jharkhand	NA	NA	4.6	11.0
Orissa	1.3	5.0	5.7	16.2
West Bengal	3.9	10.3	10.1	26.0
Northeast	1.6	4.3	6.8	15.2
Arunachal Pradesh	0.8	5.4	3.4	10.8
Assam	1.5	3.8	6.3	15.3
Manipur	0.2	5.5	10.0	22.7
Meghalaya	2.9	2.8	4.1	7.7
Mizoram	2.3	10.8	6.1	15.5
Nagaland	1.2	1.7	2.3	7.0
Sikkim	NA	7.3	13.4	25.9
Tripura	3.5	8.0	14.2	22.0
West	3.4	8.0	11.0	21.3
Dadra and Nagar Haveli	NA	NA	NA	19.0
Daman and Diu	NA	NA	NA	16.6
Goa	14.1	20.2	27.2	35.0
Gujarat	2.9	8.5	9.2	20.3
Maharashtra	3.6	7.7	11.8	21.8
South	6.3	15.9	21.3	38.5
Andaman and Nicobar Islands				20.2
Andhra Pradesh	4.7	14.5	22.8	41.4
Karnataka	3.4	11.1	16.0	25.2
Kerala	14.2	29.3	31.1	37.1
Lakshadweep	NA	NA	NA	42.6
Puducherry	NA	NA	NA	36.4
Tamil Nadu	7.5	15.8	21.0	37.0
Telangana				58.7
India	2.6	7.1	9.0	18.5
No. of Cases	36850	33026	30402	153465

Source: Computed from NFHS I, II, III and IV data files

Maps 1-4: Percent of C-section delivery by States in the three years preceding the survey, NFHS I-IV

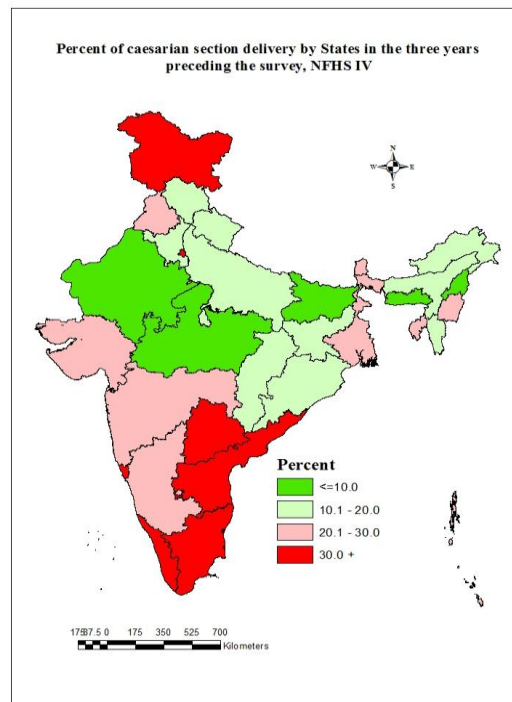
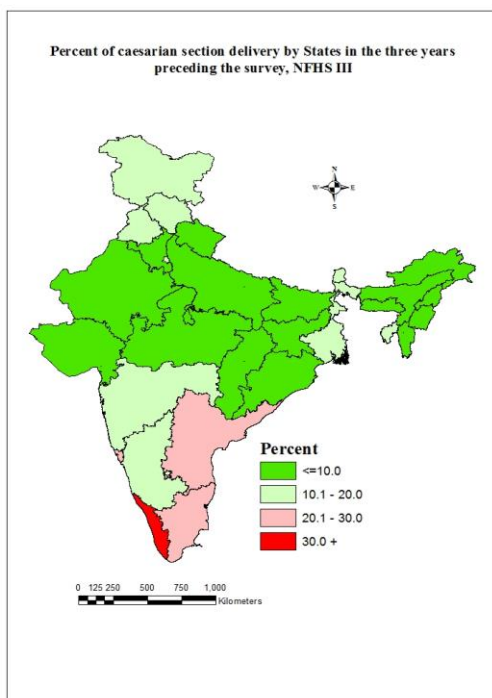
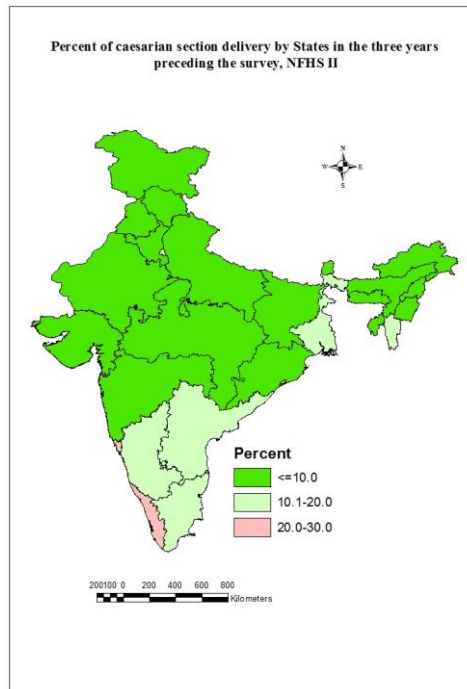
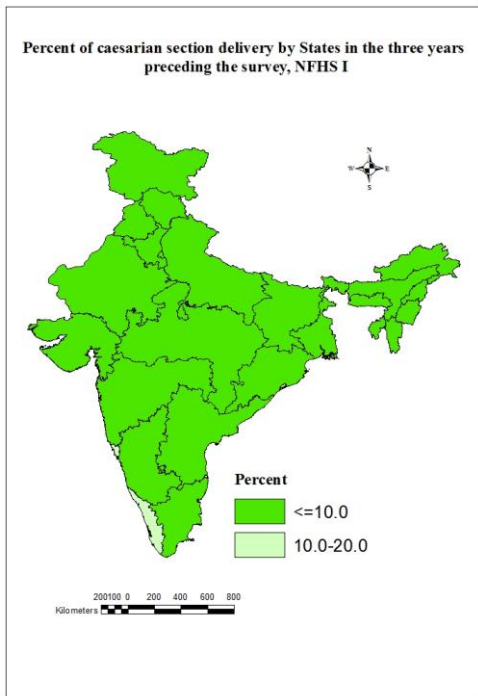


Table 1 gives the percent of C-section delivery for all states of India. As per the latest NFHS IV (2015-16), among the states, it ranges from 7 percent in Nagaland to 58.7 percent in Telangana. Beside Telangana, states having a very high percentage (≥ 30 percent) of C-section cases include Andhra Pradesh, Kerala, Tamilnadu, Goa, Jammu and Kashmir and Delhi. State such as Punjab, West Bengal, Sikkim, Karnataka, Chandigarh, Manipur, Tripura, Maharashtra, Gujarat fall in the category of 20-30 percent. States falling in the range of 10-21

Caesarean Section Delivery in India: Public and Private Dichotomy

percent include Uttar Pradesh, Chhattisgarh, Arunachal Pradesh, Jharkhand Haryana, Uttarakhand, Assam, Mizoram, Odisha, and Himachal Pradesh. Eleven states fall within the normal range (≤ 15 percent) out of which five states have below 10%. Low percentage of C-section delivery (≤ 10 percent) was reported in Nagaland (7), Meghalaya (7.7), Bihar (7.9), Madhya Pradesh (9.4), and Rajasthan (9.4).

The broad regional pattern reveals that C-section delivery is high (higher than 20 percent) in all southern and western states, along with Delhi, Punjab, West Bengal, Sikkim, Manipur and Tripura. The states with poor demographic and health indicators (officially known as Empowered Action Group states) are characterised by a lower percentage C-section delivery. Aggregate data at regional level show that C-section delivery is highest in south India followed by west, north, north-east, east and central.

Place of delivery

NFHS IV (2015-16) data show that more than 63 percent of C-section delivery was taken place in private hospitals while 37 percent cases were done in public health facilities during three years preceding the survey. There has been a considerable change in percent distribution of C-section delivery by place of delivery. Around 41.1 percent, 36.3 and 31.7 percent of cases were done in government facilities as per NFHS III, II and I respectively (Table 2). The share of private hospitals increased from 53.1 percent in NFHS I to 60.7 percent in NFHS II and 68 percent in NFHS III. The declining share of C-section at government and increasing use of private facility were clearly noticed until NFHS III. However, there has been a reversal of the trend during NFHS III and NFHS IV; the share of C-section cases increased in public facilities while it has declined in private health centres. The share of C-section cases taking place at home has declined from 5.9 percent in NFHS I to 3 percent in NFHS II, but NFHS III and NFHS IV did not report any single case at home.

Table 2: Percent distribution of caesarean section delivery in the three years preceding the survey by Place of delivery, NFHS I-IV

Place of delivery	NFHS I	NFHS II	NFHS III	NFHS IV
'Public health facilities'	41.1	36.3	31.7	37.3
Government hospital	38.2	31.4	28.0	26.6
Government dispensary	0.0	0.5	0.5	1.7
UHC/UHP/UFWC	0.0	0.7	0.4	1.4
CHC/Rural Hosp/PHC	2.6	3.1	2.3	7.0
Sub-centre	0.3	0.1	0.0	0.3
Other public	0.0	0.5	0.5	0.3
'Private health facilities'	53.1	60.7	68.1	62.8
Private hospital/maternity/clinic	53.1	57.8	66.7	60.7
Other private medical	0.0	0.5	0.3	1.0
NGO/Trust hospital/clinic	0.0	2.4	1.1	1.1
Others	5.9	3.0	0.0	0.0
Respondent's home	4.3	2.4	0.0	0.0
Other home	0.0	0.0	0.0	0.0
Parent's home	1.1	0.5	0.0	0.0
Other	0.5	0.1	0.0	0.0

Source: Computed from NFHS I, II, III and IV data files

Table 3: Percent of C-section delivery by Region and Place of delivery in the three years preceding the survey, NFHS I-IV

Region	NFHS I			NFHS II			NFHS III			NFHS IV		
	Public	Private	Total	Public	Private	Total	Public	Private	Total	Public	Private	Total
North	1.3	12.2	2.1	3.3	19.9	5.4	4.8	24.5	8.6	11.2	32.3	16.4
Central	0.6	5.6	0.8	1.2	23.6	2.9	1.2	27.3	4.6	3.7	34.7	10.1
East	1.3	14.5	2.0	3.7	25.6	5.6	2.4	27.0	6.0	6.4	48.5	13.6
Northeast	1.2	13.6	1.6	3.2	22.2	4.3	4.2	31.8	6.8	9.8	54.7	15.2
West	1.2	11.2	3.4	3.5	18.3	8.0	4.7	20.5	11.0	11.8	32.7	21.3
South	3.5	14.6	6.3	7.7	29.6	15.9	10.9	36.9	21.3	25.0	55.8	38.5
Total	1.4	12.4	2.6	3.4	24.6	7.1	3.7	28.2	9.0	9.5	42.6	18.5

Source: Computed from NFHS I, II, III and IV data files

Due to low sample size for some individual states, states are clubbed together into six regions and the percent of C-section delivery by region and place of delivery is given in Table 3. It is clear that the C-section delivery were higher in private health facilities than in public health facilities in all regions. South India tops the list with a C-section delivery of 55.8 percent in private health centres, followed by northeast, east, central, west and north. It is to be noted that south India has experienced a rapid rise in C-section delivery in private health facilities; the percentage increased from 14.6 percent in 1992-93, to 29.6 percent in 1998-99, 37 percent in 2005-06, and 55.8 percent in 2015-16. Other regions have recorded a rising trend too. But the increase from 27 percent to 48.5 percent and 31.8 percent to 54.7 percent in eastern and north-eastern India respectively between NFHS III and NFHS IV is eye-catching. However, a relatively slower increase in western India remains a puzzle and needs a separate detailed analysis.

Table 4: Timing of Decision to go for C-section Delivery by Regions and Place of Delivery, India, NFHS IV

Region	Public health facilities		Private health facilities		Total	
	Before onset	After Onset	Before onset	After Onset	Before onset	After Onset
North	6.5	4.5	16.5	15.2	8.9	7.2
Central	1.8	1.9	15.9	18.5	4.7	5.3
East	2.9	3.4	24.7	23.6	6.7	6.9
Northeast	4.7	4.9	34.0	20.3	8.2	6.7
West	6.5	5.2	19.2	13.4	12.3	8.9
South	15.2	9.6	33.6	21.9	23.2	15.0
Total	5.2	4.2	23.4	18.9	10.2	8.2

Source: Computed from NFHS IV data file.

Timing of Decision to have C-section Delivery

Table 4 provides a broad picture of the timing of the decision to go for C-section delivery. Of 18.5 percent deliveries performed via C-section, decisions to have C-section before the onset of labour were made for 10.2 percent cases while in 8.2 percent cases decision was taken after the onset of labour. The dichotomy between public and private health facilities are glaring. In substantially higher percentage of c-section cases, decisions to opt for C-section delivery were made before the onset of labour. Except central India, rest four regions of the country experience this pattern of timing of delivery. This pattern is more pronounced in the southern and western regions of the country. It clearly means that the decision to go for C-section delivery is not merely problem-driven; rather it appears that a host of other individual socioeconomic and supply-side factors play an intermediary role.

Caesarean Section Delivery in India: Public and Private Dichotomy

Table 5: Percent of C-section delivery by facility type and by background characteristics in three years preceding the survey, NFHS I-IV

Background Characteristics	NFHS I			NFHS II			NFHS III			NFHS IV		
	Public	Private	Total	Public	Private	Total	Public	Private	Total	Public	Private	Total
Age of mother at birth												
<20	1.2	11.9	2.2	2.8	20.3	5.5	3.0	24.1	7.0	9.1	38.6	16.1
20-29	1.6	11.9	2.9	3.8	25.4	7.9	4.0	28.1	9.6	9.7	42.6	18.9
30+	1.0	15.9	2.4	2.3	27.8	5.8	3.1	35.1	9.0	8.4	45.9	18.6
Birth Order												
1	3.0	15.5	5.2	6.7	29.9	13.0	7.0	33.7	15.7	13.9	46.6	25.2
2	1.6	14.1	3.4	4.0	24.7	8.2	4.7	28.7	10.6	11.2	44.0	20.6
3+	0.5	5.6	0.8	1.3	14.8	2.6	1.1	15.8	2.9	3.2	28.2	7.3
Multiple Births												
Single	1.4	12.4	2.6	3.3	24.4	7.0	3.6	27.8	8.8	9.4	42.2	18.3
Multiple	2.9	17.4	4.6	8.3	40.0	15.0	6.7	43.0	19.6	15.5	56.9	32.1
Educational Level												
Illiterate	0.6	7.1	0.8	1.4	17.5	2.4	1.1	15.7	2.5	3.3	28.2	6.4
Primary	1.8	8.6	2.7	4.0	19.9	6.5	3.4	23.7	6.5	7.3	35.0	12.2
Secondary	4.0	13.4	6.9	7.3	23.5	12.3	7.8	29.7	15.4	13.2	43.0	22.4
Higher	10.6	19.9	16.3	13.2	34.2	25.5	21.3	41.3	35.6	22.3	51.5	40.1
Exposure to Mass Media												
Not Exposed	0.6	10.6	0.9	1.4	16.0	2.3	1.0	15.6	2.2	2.8	26.4	5.5
Exposed	2.5	12.8	4.5	5.5	26.3	11.2	5.2	29.8	12.1	12.6	44.6	23.1
Caste												
SC	1.0	9.6	1.4	3.1	18.5	4.7	3.0	26.7	6.5	9.5	42.1	15.6
ST	0.8	8.8	0.9	1.3	19.0	2.4	1.4	26.7	3.1	5.5	35.2	9.2
OBC	NA	NA	NA	3.7	25.9	8.1	2.9	26.6	8.3	8.8	41.4	18.6
Others	1.5	12.7	3.0	3.8	25.6	8.5	6.4	30.4	13.7	13.2	45.8	25.1
Religion												
Hindu	1.4	12.3	2.5	3.3	25.0	6.9	3.7	28.4	9.1	9.3	43.7	18.7
Muslim	1.2	10.7	2.3	3.1	21.4	6.2	2.9	24.7	7.1	8.8	36.8	16.1
Christian	3.4	16.6	6.9	5.6	31.0	14.4	6.2	41.8	16.4	16.8	44.4	26.3
Others	2.3	15.4	4.6	6.3	22.5	11.0	5.6	28.3	13.2	13.1	42.6	22.1
Work Status of women												
Not working	1.6	12.3	3.0	3.9	24.8	8.1	4.5	29.1	10.9	NA	NA	NA
Working	1.0	13.4	1.7	2.2	24.0	4.7	2.3	25.0	5.4	NA	NA	NA
Wealth Index												
Poorest	0.4	11.6	0.5	1.5	19.6	2.2	0.9	17.5	1.8	2.8	28.4	5.0
Poorer	0.7	12.5	1.0	1.7	17.7	2.7	1.5	19.5	3.3	6.6	33.4	10.6
Middle	1.4	12.7	2.1	2.6	19.2	4.9	4.1	22.3	7.3	13.0	41.3	20.5
Richer	1.6	10.0	2.8	5.5	22.5	9.8	7.1	27.9	13.8	16.7	45.7	28.6
Richest	5.0	13.5	8.5	11.2	29.8	20.7	14.2	34.5	26.6	22.6	47.3	37.8
Residence												
Urban	3.1	12.8	5.9	8.0	26.7	14.7	8.4	30.8	17.3	17.7	46.8	30.2
Rural	1.0	12.0	1.7	2.4	22.9	4.9	2.5	25.9	6.2	7.2	39.4	14.1
BMI of Mother												
Thin	NA	NA	NA	3.1	18.3	5.1	2.2	20.9	4.9	6.1	35.1	12.0
Normal	NA	NA	NA	3.5	24.8	7.5	4.0	27.8	9.3	8.5	40.0	16.7
Overweight	NA	NA	NA	11.1	38.6	25.2	17.5	39.6	30.1	25.9	55.2	39.7
Not Available	NA	NA	NA	1.5	23.8	4.0	3.5	34.1	11.3	8.8	52.1	24.2
Total	1.4	12.4	2.6	3.4	24.6	7.1	3.7	28.2	9.0	9.5	42.6	18.5

Source: Computed from NFHS I, II, III and IV data files

Socioeconomic Differentials

The percentage of C-section delivery increases with the educational level of the mother, exposure of women to media, and the economic condition of the household (Table 5). The percentage of C-section delivery is highest among Christians (26.3 percent), followed by Hindus (18.7 percent) and Muslims (16.1 percent). The differential in C-section delivery by the place of residence is large i.e., 30.1 percent in urban areas as compared to 14.1 percent in rural areas. As far as social group is concerned, the gradient is clear; it is highest among the Non-SC/ST/OBC categories (25.1 percent) and lowest among Scheduled Tribes (9.2 percent). The corresponding figures for OBCs and SCs are 18.6 percent and 15.6 percent respectively. Demographic attributes do have an association with the C-section delivery. The C-section delivery increases with the age of the mother and decreases with birth order. The data substantiates the well-accepted finding that the women go for C-section delivery in case of multiple births. Similarly, there is a positive association between BMI and C-section delivery; the figure is appreciably high for overweight women as compared to women with normal BMI. Interestingly, the prevalence is found to be the lowest among thin women. More or less similar patterns are noticed in the case of C-section delivery in Government as well as private health centres. A closer look at the data at four time points (NFHS I, II, III and IV) indicates that the C-section delivery has increased both in public and private health facilities. However, it is to be noted that, in almost all socioeconomic and demographic categories, the C-section delivery is found to be higher in private health facilities compared to public health institutions.

The above discussion reveals wide socioeconomic and demographic differentials in the practice of C-section delivery in India. These differentials make one believe that there are some roles of the socioeconomic and other factors in causing differentials in the C-section delivery. In a sense, the differentials noted above are gross and in order to access the 'net' effects of each variable, the effects of other confounding factors need to be eliminated or adjusted. To this end, logistic regression analysis has been employed to determine the factors having a statistically significant effect on C-section delivery.

Results from Multivariate Analysis

Table 6 provides odds ratios showing the effect of background variables on the caesarean section delivery in three years preceding the survey. The probability of a woman undergoing C-section delivery increases with age of mother at birth, birth order, educational level, and wealth index which across the surveys. As compared to single birth, the chance of C-section delivery is higher in case of multiple births. Interestingly, women having exposure to media are more likely to undergo C-section than those having no exposure to media. Among social groups, the chance of C-section delivery is higher if the woman belongs to Non-SC/ST/OBC categories; the relationship was not statistically significant till 2005-06. On the other hand, ST and OBC women are less likely to undergo C-section than SC and Non-SC/ST/OBC women. The probability of C-section delivery is lower for rural women than urban counterparts. As odds ratios indicate the chance of undergoing C-section delivery is lower among women with low BMI as compared to normal and overweight women. The odds ratio for overweight women is highest and increased over time. Keeping other factors constant, the chance of women going for C-section delivery is highest in South India followed by northeast, east, north, west and central. Most importantly, the effect of place of delivery (public/private) is robust; the chance of women undergoing C-section is at least more than 4.453 times higher than in public hospitals. The increasing odds ratio from 2.88 in NFHS III to 4.453 in NFHS IV indicates about the rapidly increasing role of private sectors in rising C-section deliveries.

Caesarean Section Delivery in India: Public and Private Dichotomy

Table 6: Odds Ratio showing the effect of background variables on the caesarean section delivery in three years preceding the survey, NFHS I-IV: Results from Logistic Regression Analysis

Background Characteristics	NFHS I			NFHS II			NFHS III			NFHS IV		
	Public	Private	Total	Public	Private	Total	Public	Private	Total	Public	Private	Total
Place of delivery												
Public®												
Private			2.539***			2.942***			2.881***			4.453***
Age of mother at birth												
<20®												
20-29	2.084***	1.467**	1.769***	1.681***	1.400***	1.531***	1.740***	1.297***	1.478***	1.501***	1.364***	1.449***
30+	4.870***	2.953***	3.930***	2.627***	2.242***	2.467***	3.264***	2.425***	2.886***	2.825***	2.031***	2.465***
Birth Order												
1®												
2	0.485***	0.719***	0.584***	0.488***	0.642***	0.548***	0.578***	0.658***	0.610***	0.649***	0.784***	0.701***
3+	0.159***	0.320***	0.212***	0.225***	0.377***	0.271***	0.217***	0.334***	0.254***	0.248***	0.437***	0.316***
Multiple Births												
Single												
Multiple	3.306***	1.542	2.559***	2.939***	2.581***	2.937***	2.275***	3.056***	2.906***	2.716***	2.231***	2.509***
Educational Level												
Illiterate®												
Primary	1.772***	1.245	1.789***	1.671***	0.998	1.469***	1.515***	1.412**	1.471***	1.226***	1.169***	1.202***
Secondary	2.348***	1.641***	2.349***	1.778***	1.039	1.540***	1.816***	1.320**	1.616***	1.514***	1.244***	1.434***
Higher	4.193***	2.140***	3.261***	2.092***	1.275*	1.713***	2.437***	1.568***	1.829***	1.674***	1.282***	1.459***
Exposure to Mass Media												
Not Exposed®												
Exposed	1.494***	0.903	1.321***	1.294**	1.217	1.335***	1.456***	1.313*	1.459***	1.578***	1.252***	1.418***
Caste												
SC®												
ST	0.925	0.481*	0.726	0.73*	0.957	0.788*	0.737**	0.644**	0.621***	0.791***	0.830***	0.768***
OBC				1.081	1.232*	1.134	0.889	0.831*	0.862**	0.887***	0.859***	0.861***
Others	1.121	0.831	1.031	1.057	1.254*	1.132	1.274***	0.9	1.046	1.306***	1.107**	1.199***
Religion												
Hindu®												
Muslim	1.008	1.002	0.979	1.248**	0.878	1.038	0.911	0.929	0.887**	1.312***	0.825***	1.086***
Christian	1.176	1.299*	1.174	1.188	1.004	1.07	0.639***	1.133	0.831**	0.688***	0.590***	0.647***
Others	0.98	1.302	1.16	1.233	1.042	1.168	1.012	1.041	1.035	1.119**	1.039	1.033
Work Status of women												
Not working®												
Working	0.751**	0.99	0.833**	1.027	1.116	1.065	0.973	1.023	0.987			
Wealth Index												
Poorest®												
Poorer	1.325	1.092	1.417	0.867	0.791	0.95	1.258	0.985	1.332**	1.291***	1.009	1.310***
Middle	1.806**	0.9	1.905***	1.047	0.925	1.217	2.115***	0.991	1.990***	1.748***	1.166***	1.748***
Richer	1.710**	0.783	1.802***	1.635***	1.04	1.740***	2.771***	1.145	2.593***	1.920***	1.225***	1.869***
Richest	2.584***	0.809	2.164***	2.505***	1.174	2.147***	3.613***	1.231	2.816***	2.137***	1.303***	1.857***
Residence												
Urban®												
Rural	0.891	0.927	0.872*	0.558***	1.044	0.724***	0.688***	0.991	0.810***	0.772***	0.969	0.873***
Region												
North®												
Central	0.437***	0.427***	0.419	0.545***	1.385**	0.800**	0.533***	1.253**	0.872*	0.491***	1.331***	0.757***
East	1.127	1.103	1.093	1.726***	1.715***	1.681***	1.273**	1.387***	1.279***	0.834***	2.065***	1.183***
Northeast	0.976	1.223	1.016	1.444***	1.321	1.352***	1.213*	1.037	1.119	1.052	2.240***	1.333***
West	1.459**	1.153	1.325***	1.117	1.08	1.041	1.354***	1.001	1.094	1.056	0.937	0.816***
South	2.543***	1.363**	1.928***	2.707***	1.818***	2.156***	2.700***	1.742***	2.029***	2.258***	2.513***	2.169***
BMI of Mother												
Thin ®												
Normal	NA	NA	NA	1.108	1.445***	1.220***	1.391***	1.309***	1.348***	1.266***	1.150***	1.224***
Overweight	NA	NA	NA	1.795***	2.427***	1.988***	2.986***	1.987***	2.303***	2.678***	2.046***	2.423***
Not Available	NA	NA	NA	0.848	1.328*	1.014	1.412**	1.777***	1.603***	0.894	1.498***	1.205*
Constant	0.005***	0.125***	0.007***	0.021***	0.092***	0.018***	0.011***	0.140***	0.016***	0.029***	0.188***	0.030***

Note: ®: Reference Category; ***, **, * : <1%, 5% and 10% level of significance

An attempt was also made to analyse the differentials in C-section delivery in public and private health facilities separately with an intention to see if the determinants vary by place of delivery. A careful examination of odds ratios leads to the conclusion that with the

exception of wealth index, the patterns of effects of all other determinants are nearly similar. Analysis of the results from all four rounds of NFHS reveals the statistically significant role of wealth index of the household among those who had undergone for delivery in public health facilities. The direction of the gradient is clear, the chance of undergoing C-section delivery in public health facilities increases with the increasing household wealth. However, the wealth index did not play a significant role in C-section delivery in private health facilities till 2005-06; it emerged as a significant predictor in 2015-16. This unprecedented result hints towards the dramatic rise of private sector health institutions and the health expenditure leading to significant differentials in by economic conditions of the household. Earlier researches also indicated towards rising in health expenditure in India, particularly in private sectors. (Pandey *et al.*, 2018; Tripathy *et al.*, 2017).

Conclusion

India has experienced an increasing trend of C-section delivery in the last two and half a decade with a spectacular rise after 2005. States with marked demographic transition as well as high institutionalised births have an inflated rate of C-section deliveries. Irrespective of place (public/private), the likelihood of caesarean deliveries is associated with mothers aged more than 20 years, women having multiple births, women residing in south India, women belonging to the richest class, Non-SC/ST/OBC women, women with higher education, women with high BMI, women residing in an urban place, and women having exposure to mass media. Similar to the prior evidence, findings indicate a higher incidence of C-section delivery in private hospitals compared to public hospitals. The results substantiate the hypothesis that increased C-section deliveries may be driven in part by the private sector. Further, in the majority of the cases, the decision to go for C-section delivery was taken before the onset of labour, particularly in private health facilities. This implies that many C-section procedures are not being dictated by necessity, rather non-medical factors like financial gain to private hospitals as well as practitioners are the driving force behind the decision to undergo C-section even before the onset of labour. The higher likelihood of richer household opting for C-section deliveries in the private sector health institutions in recent years speaks about the inability of poor households to afford the cost incurred for C-section deliveries. At the same time, increasing C-section deliveries in public sector facilities points towards the role of other factors such as changing socioeconomic conditions, demographic aspirations, health situations and perceptions of people regarding C-section. One could argue that over-all economic prosperity along with aspirations of experiencing a pain-free delivery coupled with increased accessibility to the improved technology of delivery, to some extent, have contributed to increasing C-section deliveries. This may also be possible that individual-level and provider-level factors interact in driving C-section rates higher. People need to realise the fact that C-section delivery is not the only solution to pregnancy complications and associated mortality and morbidity. For example, ‘a lot of the maternal and perinatal morbidity and mortality in rural areas could be prevented by the provision of good maternity care’ (Pai, 2000: 2760). Given the sky-rocketing rise in C-section delivery and its adverse effects on women’s health, there is a need to ensure more regulated private sector, active management of labour, adherence to medical ethics, proper health care for women, and change in people’s perception of medical intervention to go away with medically unnecessary cases.

References

Amjad, A., Amjad, U., Zakar, R., Usman, A., Zakar., M.Z., and Fischer, F., 2018, Factors associated with caesarean deliveries among child-bearing women in Pakistan:

- secondary analysis of data from the Demographic and Health Survey, 2012–13. *BMC Pregnancy and Childbirth*, 18:113.
- Australian Institute of Health and Welfare, 2016, National Maternity Data Development Project: Indications for caesarean section. Research brief no. 5. Cat. no. PER 79, Canberra, AIHW.
- Betrán, A.P., Ye, J., Moller, A.B., Zhang, J., Gülmezoglu, A.M., and Torloni, M.R., 2016, The Increasing Trend in Caesarean Section Rates: Global, Regional and National Estimates: 1990-2014. *PLoS ONE*, 11:2, e0148343. <http://doi.org/10.1371/journal.pone.0148343>.
- Desai, G., Anand, A., Modi, D., Shah, S., Shah, K., Shah, A., Desai, S., and Shah, P., 2017, Rates, indications, and outcomes of caesarean section deliveries: A comparison of tribal and non-tribal women in Gujarat, India. *PLoS ONE*, 12:12. e0189260. <https://doi.org/10.1371/journal.pone.0189260>
- Ghosh, S., and James, K.S., 2010, Levels and Trends in Caesarean Births: Cause for Concern? *Economic and Political Weekly* 45(5): 19-22.
- Mehta, A., Apers, L., Verstraelen, H., and Temmerman, M., 2001, Trends in caesarean section rates at a maternity hospital in Mumbai, India. *Journal of Health Population and Nutrition*, 19(4): 306-12.
- Mishra, U.S. and Ramanathan, M., 2002, Delivery-related related complications and determinants of caesarean section rates in India. *Health Policy and Planning*, 17(1): 90-98
- Molina, G., Weiser, T.G., Lipsitz, S.R., Esquivel, M.M., Uribe-Leitz, T., Azad, T., Shah, N., Semrau, K., Berry, W.R., Gawande, AA, and Haynes, A.B., 2015, Relationship Between Cesarean Delivery Rate and Maternal and Neonatal Mortality. *JAMA*, 314(21): 2263-2270.
- Padmadas, S.S.; Kumar, S.; Nair, S.B. and Kumari, A., 2000, Caesarean section delivery in Kerala, India: evidence from a National Family Health Survey. *Social Science & Medicine*, 51(4):511-21.
- Pai, M., 2000, Unnecessary Medical Interventions: Caesarean Sections as a Case Study. *Economic and Political Weekly*, 35 (31): 2755-2761.
- Pandey, A., Ploubidis, G.B., Clarke, L., and Dandona, L., 2018, Trends in catastrophic health expenditure in India: 1993 to 2014. *Bulletin of the World Health Organization*, 96,18-28.
- Singh, P., Gulfam, H., and Swain, P.K., 2018, High prevalence of cesarean section births in private sector health facilities- analysis of district level household survey-4 (DLHS-4) of India. *BMC Public Health*, 18, 613.
- Tripathy, J.P., Shewade, H.D., Mishra, S., Kumar, A.M.V. and Harries, A.D., 2017, Cost of hospitalization for childbirth in India: how equitable it is in the post-NRHM. era? *BMC Res Notes*, 10, 409.
- World Health Organization, 2015, WHO Statement on Caesarean Section Rates, WHO reference number: WHO/RHR/15.02. Geneva: World Health Organization.
- Ye, J., Zhang, J., Mikolajczyk, R., Torloni, M.R., Gulmezoglu, A.M., and Betran, A.P., 2016, Association between rates of caesarean section and maternal and neonatal mortality in the 21st century: a worldwide population-based ecological study with longitudinal data. *British Journal of Obstetrics and Gynaecology*, 125(5):745–753.