International Journal of Community Medicine and Public Health
Yadav G et al. Int J Community Med Public Health. 2026 Feb;13(2):855-864
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20260316

Original Research Article

Predictors of elective and emergency caesarean deliveries in India: evidence from large scale survey

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Received: 10 December 2025
Accepted: 19 January 2026

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ABSTRACT

Background: Emergency and elective C-sections are essential for strengthening obstetric care, particularly in low- and middle-income countries like India. This study aims to (i) estimate the prevalence of emergency and elective C-section deliveries in India, and (ii) examine sociodemographic and clinical factors associated with these two types of procedures.
Methods: Data were drawn from 230,870 individual births that occurred in the five years preceding the survey, using National Family Health Survey (NFHS-V) data. C-section deliveries were categorized into emergency and elective based on reported indications. Descriptive statistics, bivariate analysis, and multivariable logistic regression were used to assess associated factors.
Results: The overall C-section rate was 21.6%, of which 14.2% were emergency and 7.4% elective procedures. Multivariable logistic regression indicated that private facility deliveries were strongly associated with higher odds of overall (AOR=4.17), elective (AOR=2.94), and emergency (AOR=3.08) C-sections compared to public facilities. Rural residence reduced C-section likelihood, while wealthier women, especially the richest, had higher odds. Maternal age, education, and media exposure increased odds across all types. Multiple pregnancies substantially raised C-section risk, whereas higher birth order lowered it. Larger birth size increased emergency C-section likelihood. Regional variation was notable, with southern India showing the highest odds. ANC visits increased overall C-section risk but had limited impact on elective or emergency C-sections.
Conclusions: Addressing regional inequities, improving obstetric care readiness, and reducing unnecessary elective C-sections are critical for improving maternal and neonatal health outcomes.

Keywords: ANC visits, Determinants, Elective C-sections, Emergency C-sections, Prevalence

INTRODUCTION

The World Health Organization (WHO) has considered the ideal rate for caesarean deliveries to be between 10% and 15%.[1] But for the last 30 years, there has been an increase in the caesarean deliveries rate, and this rate continues to rise globally, from 7% in 1990 to 21% of all childbirths, as in 2021.[2] This number will continue increasing over the coming decade, with nearly a third (29%) of all births likely to occur by C-section by 2030.[2] The rise in caesarean deliveries rates partially because of its magnitude to these medical complications.[3,4] Still, many non-medical contributors have emerged, like fear of pain, late marriages, patient demand, and delivering the baby at a "chosen" delivery date and time that have contributed to the rise in Caesarean deliveries rates.[5,6]

Caesarean deliveries have seen a surge in recent times due to several contributing factors like advancement in operative technology, safe anaesthesia, and safe blood transfusion.[7,8] Also, a growing number of women are preferring C-section due to fear of pain from vaginal

delivery and lack of awareness about the complications associated with C-section.[8,10] C-section is perceived as an escape from labor pain, and the assumption that Caesarean deliveries is painless, safer, and healthier than vaginal delivery has become prevalent among women. Fear of vaginal delivery, personal beliefs, cultural norms and values, and social network are reported as some of the factors affecting the choice of caesarean delivery.[8] However, C-section cannot always be a safe option because of the related comorbidities that are associated with it. C-section can lead to short-term and long-term health effects for women and children, including increased risks of maternal mortality, maternal morbidity, and altered immune development.[11-13] Several studies across the globe have assessed the outcomes of pregnancies with a history of previous C-sections, majorly highlighting the risks and complications associated with repeat C-sections. Increased risk of placenta previa, pre-eclampsia/eclampsia, poor progress of labor, blood transfusion, and adverse neonatal outcomes have been observed in such studies.[14] Caesarean delivery is associated with a higher risk of developing asthma, food allergy, type1 diabetes, and obesity during infancy.[15] Moreover, birth by C-section is associated with higher frequency of dysmetabolic traits in offspring, including overweight or obesity at 20 years.[16] Additionally, it is associated with increased odds of maternal mortality and poor delivery outcomes in resource-constrained settings like sub-Saharan Africa.[17]

C-sections may be planned before the birth, this is known as an elective caesarean. This may happen if there are pregnancy complications that prevent a baby being born by vaginal birth. The rise of caesarean delivery rates has been a cause of concern worldwide and it has significantly changed health care policies and has left a deep impact on women's attitudes and perceptions of childbirth.[1,2] The prevalence of C-section deliveries in India is 22% during 2019-21, higher than the WHO-recommended 5-15% of deliveries.[18-20] With the increasing number of institutional births, the trend of C-section delivery is also increasing rapidly in the country, especially at private healthcare facilities.[21,22] However, there is considerable geographic variation in its proportion by various socioeconomic and demographic characteristics and within countries.[20]

The rising incidence of C-section deliveries has been identified as a significant factor contributing to delayed initiation of breastfeeding.[13,19,23-27] Understanding the socio-economic and demographic determinants of elective and emergency C-section deliveries is therefore crucial for designing effective policies aimed at reducing unnecessary surgical interventions. In this context, the present study aims to examine the prevalence and predictors of elective and emergency C-section deliveries in India. A total of 230,870 individual deliveries that occurred within the five years preceding the survey were included in the final analysis.

METHODS

Data source

The data for this study taken from the National Family Health Surveys, NFHS-5 (2019-21). The National Family Health Survey's major goal is to provide vital statistics on health and family welfare, as well as data on developing issues, at the national, state, and district levels. Data from NFHS rounds are useful in establishing a baseline and analysing the country's development in the health sector over time.

Statistical analysis

In this study logistic regression analysis has been used to find out probability of occurrence of elective and emergency caesarean deliveries and initiation of breastfeeding within hour of birth according to background variables. Logistic regression equation has been given below.

$$\ln (p/1-q) = \alpha+\beta x1+\beta x2+\beta x3$$

where, p: probability of occurrence of the event.

1-p: probability of non-occurrence of the event.

p/1-q: is odd ratio which is the probability of non-occurrence of the event.

x1, x2, and x3…. are predictor variable.

α: is intercept where there is no effect on any independent variable on dependent variable.

β1, β2, β3 are coefficients.

Outcome variable

In the present study, C-section deliveries were categorized into (i) emergency and (ii) elective procedures based on established obstetric literature and available survey information (Darnal and Dangal, 2020). Emergency C-section was defined as a caesarean delivery performed in response to immediate or unexpected maternal and/or fetal complications that required rapid intervention to prevent adverse health outcomes.[28,29] This includes situations such as obstructed labour, fetal distress, excessive bleeding, pregnancy-induced hypertension, or any other acute obstetric emergency.

In contrast, an elective C-section was defined as a planned caesarean delivery conducted before the onset of labour, without any immediate medical or obstetric emergency, and typically scheduled due to maternal request or known medical indications identified during antenatal care.[28,29]

To incorporate this distinction into the analysis, a binary outcome variable was created. All C-section deliveries were coded as 1, representing "C-section," while all normal vaginal deliveries were coded as 0. Within the subset of C-section cases, an additional binary classification was developed: emergency C-section was coded as 1, and others as coded 0. Similarly, for elective C-section, it was coded as 1, and others as 0. This step allowed the study to analyse overall C-section prevalence as well as differentiate between emergency and elective procedures. The classification ensured consistency with prior research and supported a more nuanced understanding of delivery practices and their determinants.

Output variable

A set of socio-demographic, maternal, and child-related independent variables was selected based on previous literature. These include place of residence (urban/rural), religion (Hindu/Muslim/Christian/other), and caste (SC/ST/OBC/other). Household wealth status was assessed using wealth quantiles (poorest/poorer/middle/ richer/ richest), while regional location was categorized as north, central, east, north-east, west, and south. Maternal characteristics included mother's education (no education/primary/secondary/higher) and mother's age at birth (<20 years/20-24/25-29/30-34/ ≥35 years). Delivery-related variables comprised place of delivery (institutional-public, institutional-private, non-institutional) and type of delivery (normal/C-section). Birth-related factors included birth order (first/second/third/fourth or higher), sex of the child (male/female), and size at birth includes small, very small, average, large/very large, don't know). The analysis has been carried out using the STATA 14 software.

RESULTS

Profile of the study population

Table 1 provides the percentage distribution of children born in India over the past five years. The majority of births occurred in rural areas (73.4%) compared to urban areas (26.7%). Hindus women represent the largest proportion (79.4%) of births, followed by Muslims (16.2%), Christians (2.1%), and other religious groups (2.3%). The highest percentage of births occurred among OBC women (45.5%), followed by SCs (24.4%), others (19.6%), and STs (10.5%). The poorest wealth quantile accounts for 25% of births, followed by poor (21.7%), middle (19.5%), rich (18.4%), and the wealthiest quantile comprises 16%. Place of delivery is a critical consideration, as institutional deliveries (both public and private) constitute the majority of births (88.7%). The type of delivery analysis distinguishes between normal deliveries (78.5%) and C-sections (21.5%).

Prevalence of emergency and elective C-section deliveries with background characteristics in India

The distribution of elective and emergency caesarean sections varied considerably across socioeconomic, demographic, and maternal health characteristics. Overall, elective C-sections accounted for a slightly higher proportion (57%) compared to emergency C-sections (43%), but the pattern differed across groups.

Place of delivery showed almost identical patterns between public and private facilities, although elective procedures were slightly more common in private settings (58%). Urban mothers had a higher proportion of elective C-sections (60%) than rural mothers (56%), indicating greater access to planned surgical deliveries in urban areas. Across religious groups, the proportion of elective C-sections was highest among Christians (62%), while Muslims had a slightly higher share of elective procedures (59%) compared to Hindus. Caste differences were moderate, with elective C-sections more common among mothers from "other" castes (60%), followed by OBC (58%). Wealth gradients showed a clear pattern: elective C-sections increased steadily with wealth, from 50% among the poorest to 61% among the richest, indicating strong socioeconomic influence on planned deliveries. Regional differences were prominent. Elective C-sections were most common in the northeast (64%) and south (62%), whereas central and east regions recorded higher proportions of emergency C-sections. Maternal education showed a positive association, with elective C-sections increasing from 54% among mothers with no education to 59% among those with higher education. Maternal age also played an important role. Elective C-sections were lowest among mothers aged less than 20 years (52%), and increased progressively, reaching 65% among mothers aged 35 and above, indicating a greater likelihood of planned surgical delivery in older mothers. Access to mass media was associated with higher elective C-sections (58%). Birth order showed an interesting pattern: while elective C-sections were lowest among first-order births (54%), the proportion increased sharply for second-order births (63%) and remained higher for higher-order births. Pregnancy duration showed only slight variation, with elective C-sections slightly more common among births before 9 months (60%). Birth spacing did not show a strong gradient. Infants categorized as large or very large at birth had a higher share of elective C-sections (60%) compared to small babies (56%). Similarly, mothers with four or more ANC visits had a higher proportion of elective procedures (59%) than those with no ANC visits.

Table 1: Percentage distribution of children born in past 5 five years by background characteristics, 2019-21.

Background characteristics		Percent	Numbers
Delivery type	Normal	78.50	181,236
	C-section	21.50	49,634
C-section type	Elective	12.35	28,512
	Emergency	9.15	21,122
Place of delivery	Health facility- public	61.91	1,42,943
	Health facility- private	26.68	61,595
	Home	11.41	26,332
Residence	Urban	26.65	61,528
	Rural	73.35	1,69,342
Religion	Hindu	79.41	1,83,338
	Muslim	16.24	37,495
	Christian	2.07	4,784
	Others	2.28	5,253
Caste	Schedule caste	24.37	53,756
	Schedule tribe	10.49	23,141
	OBC	45.52	1,00,408
	Others	19.61	43,256
Wealth quantiles	Poorest	24.59	56,771
	Poorer	21.73	50,170
	Middle	19.54	45,101
	Richer	18.41	42,505
	Richest	15.73	36,323
Regions	North	13.4	30,931
	Central	27.88	64,373
	East	26.13	60,323
	North east	3.63	8,388
	West	12.44	28,717
	South	16.52	38,139
Mother education	No education	21.36	49,306
	Primary education	12.32	28,434
	Secondary	50.69	1,17,031
	Higher	15.64	36,099
Mother's age at birth	Less Than 20	9.25	20,565
	24-24	43.21	96,018
	25-29	31.63	70,291
	30-34	11.89	26,413
	35 and above	4.03	8,945
Place of delivery	Institutional- public	62	1,42,943
	Institutional- private	26.68	61,595
	Non-institutional	11.41	26,332
Type of delivery	Normal	78.5	1,81,236
	C-Section	21.5	49,634
Birth order	First	39.12	90,326
	Second	33.61	77,589
	Third	15.3	35,321
	Fourth or higher	11.97	27,633
Sex of the child	Male	51.96	1,19,960
	Female	48.04	1,10,910
Size at birth	Small and very small	10.62	24,523
	Average	69.47	1,60,376
	Large and very large	18.71	43,193
	Don't know	1.2	2,777
Number of ANC Visits	No ANC visit	6.12	10,712
	Less than four ANC	35.38	61,901
	Four or more ANC	58.49	1,02,334
Timing of First ANC Visit	In the first trimester	70.04	1,22,534
	After the first trimester	29.96	52,413
Total		100.0	2,30,870

Table 2: Prevalence of elective and emergency C-section decision in India by background characteristics in India, 2019-21.

Household characteristics		C-section	
		Elective	Emergency
Place of delivery	Public	57.8	42.2
	Private	57.7	42.3
Residence	Urban	59.8	40.2
	Rural	56.3	43.7
Religion	Hindu	57.3	42.7
	Muslim	58.9	41.1
	Christian	62.2	37.8
	Others	58.2	41.8
Caste	Schedule Caste	56.3	43.7
	Schedule Tribe	54.3	45.7
	OBC	57.5	42.5
	Others	59.6	40.4
Wealth Quantiles	Poorest	49.5	50.5
	Poorer	54.5	45.5
	Middle	57.2	42.8
	Richer	59.3	40.8
	Richest	60.9	39.1
Regions	North	57.2	42.8
	Central	54.1	45.9
	East	54.2	45.8
	Northeast	63.7	36.3
	West	58.1	41.9
	South	61.5	38.5
Mother education	No education	53.8	46.2
	Primary education	54.1	45.9
	Secondary	58.2	41.8
	Higher	58.7	41.3
Mother's age at birth	Less than 20	52.4	47.6
	24-24	54.7	45.3
	25-29	59.2	40.8
	30-34	63.2	36.8
	35 and above	64.9	35.1
Access of mass media	No	53.3	46.7
	Yes	58.4	41.6
Birth order	First	53.6	46.4
	Second	62.8	37.2
	Third	60.5	39.5
	Fourth or higher	56.7	43.3
Pregnancy duration	Less than 9 months	60.1	39.9
	9 or more month	57.4	42.6
Birth spacing	1 year	58.0	42.0
	2 year	56.1	43.9
	3 or more years	58.5	41.5
Multiple birth	Single	57.7	42.3
	Multiple	58.8	41.2
Size at birth	Small and very small	56.2	43.8
	Average	57.2	42.8
	Large and very large	60.1	39.9
Number of ANC Visits	No ANC Visit	56.1	43.9
	Less than four ANC	56.7	43.3
	Four or more ANC	58.6	41.4
Timing of first ANC Visit	In first trimester	58.4	41.6
	After first trimester	56.6	43.4
Observations	Total C-Section n=49,634	28,512 (57.44)	21,122 (42.56)

Table 3: Result of multiple logistic regression showing association between C-section delivery and selected predictors, 2019-21.

Predictors		C-section		Emergency C-section		Elective C-section	
		AOR	95% CI (LL, UL)	AOR	95% CI (LL, UL)	AOR	95% CI (LL, UL)
Type of Facility	Public ®						
	Private	4.166***	(4.04, 4.29)	3.081***	(2.96, 3.21)	2.937***	(2.84,3.04)
Residence	Urban®						
	Rural	0.922***	(0.89, 0.95)	0.935	(0.89, 0.98)	0.955	(0.92, 0.99)
Religion	Hindu®						
	Muslim	1.116***	(1.07, 1.17)	1.059	(1, 1.12)	1.128***	(1.07, 1.19)
	Christian	0.723***	(0.67, 0.78)	0.747***	(0.68, 0.82)	0.799***	(0.73, 0.87)
	Others	1.349***	(1.26, 1.44)	1.257***	(1.15, 1.37)	1.257***	(1.16, 1.36)
Caste	Schedule caste®						
	Schedule tribe	0.701***	(0.66, 0.74)	0.819***	(0.76, 0.88)	0.673***	(0.63, 0.72)
	OBC	0.873***	(0.84, 0.91)	0.897***	(0.85, 0.94)	0.886***	(0.85, 0.93)
	Others	1.119***	(1.07, 1.17)	0.993	(0.94, 1.05)	1.15***	(1.09, 1.21)
Wealth Quantiles	Poorest®						
	Poorer	1.315***	(1.25, 1.39)	1.204***	(1.12, 1.29)	1.434***	(1.34, 1.54)
	Middle	1.578***	(1.49, 1.67)	1.37***	(1.27, 1.47)	1.721***	(1.6, 1.85)
	Richer	1.645***	(1.55, 1.74)	1.322***	(1.22, 1.43)	1.847***	(1.72, 1.99)
	Richest	1.539***	(1.44, 1.64)	1.214***	(1.11, 1.32)	1.788***	(1.65, 1.94)
Regions	North®						
	Central	0.83***	(0.79, 0.87)	0.887***	(0.83, 0.94)	0.821***	(0.78, 0.87)
	East	1.295***	(1.23, 1.36)	1.242***	(1.16, 1.33)	1.198***	(1.13, 1.27)
	North east	1.599***	(1.51, 1.7)	1.225***	(1.13, 1.33)	1.659***	(1.55, 1.78)
	West	0.802***	(0.76, 0.85)	0.878***	(0.82, 0.94)	0.834***	(0.78, 0.89)
	South	2.568***	(2.45, 2.69)	1.603***	(1.51, 1.7)	2.282***	(2.17, 2.4)
Mother Education	No education®						
	Primary education	1.067	(1, 1.14)	1.089	(1, 1.19)	1.033	(0.95, 1.12)
	Secondary	1.298***	(1.23, 1.37)	1.262***	(1.18, 1.35)	1.246***	(1.17, 1.33)
	Higher	1.354***	(1.28, 1.44)	1.328***	(1.23, 1.44)	1.222***	(1.14, 1.31)
Mother's Age at Birth	Less than 20®						
	24-24	1.208***	(1.14, 1.28)	1.089	(1.01, 1.18)	1.242***	(1.15, 1.34)
	25-29	1.659***	(1.56, 1.77)	1.251***	(1.15, 1.36)	1.717***	(1.59, 1.86)
	30-34	2.202***	(2.05, 2.36)	1.4***	(1.28, 1.53)	2.249***	(2.07, 2.45)
	35 and above	2.893***	(2.65, 3.16)	1.58***	(1.41, 1.77)	2.861***	(2.58, 3.17)
Access of Mass Media	No®						
	Yes	1.186***	(1.14, 1.24)	1.146***	(1.08, 1.21)	1.182***	(1.12, 1.25)
Birth Order	First®						
	Second	0.736***	(0.71, 0.76)	0.621***	(0.6, 0.65)	0.969	(0.93, 1.01)
	Third	0.399***	(0.38, 0.42)	0.409***	(0.38, 0.44)	0.564***	(0.53, 0.6)
	Fourth or higher	0.21***	(0.2, 0.22)	0.252***	(0.23, 0.28)	0.308***	(0.28, 0.34)
Duration Pregnancy	Less than 9 months®						
	9 or more month	1.008	(0.97, 1.05)	1.111***	(1.05, 1.18)	0.939	(0.89, 0.99)
Multiple Pregnancy	Single®						
	Multiple	3.284***	(2.86, 3.77)	2.057***	(1.76, 2.4)	2.32***	(2.01, 2.68)
Size at Birth	Small and very small®						
	Average	0.891***	(0.85, 0.94)	0.872***	(0.82, 0.93)	0.952	(0.9, 1.01)
	Large and very large	1.055	(1, 1.11)	0.96	(0.89, 1.03)	1.107	(1.04, 1.18)
	Don't know	1.582	(0.98, 2.56)	1.425	(0.76, 2.65)	1.476	(0.83, 2.63)
Weight at Birth (in KG)	Less than 2.5®						
	2.5-2.9	0.885***	(0.85, 0.92)	0.972	(0.92, 1.03)	0.861***	(0.82, 0.91)
	3.0-3.49	0.916***	(0.88, 0.96)	0.968	(0.91, 1.03)	0.906***	(0.86, 0.95)
	3.5 or more	1.121***	(1.07, 1.18)	1.242***	(1.16, 1.33)	0.981	(0.92, 1.04)
	Not measured	0.856	(0.77, 0.95)	0.98	(0.86, 1.12)	0.826	(0.73, 0.93)
Number of ANC Visits	No ANC Visit®						
	Less than four ANC	1.024	(0.94, 1.11)	1.066	(0.96, 1.19)	0.989	(0.89, 1.09)
	Four or more ANC	1.245***	(1.15, 1.35)	1.198	(1.07, 1.34)	1.189	(1.08, 1.31)
Timing of First ANC Visit	In first Trimester ®						
	After first Trimester	0.998	(0.96, 1.03)	1.018	(0.97, 1.07)	0.987	(0.95, 1.03)
Pseudo R2		0.1803		0.0900		0.1330	
Number of observations		1,40,054		1,40,054		1,40,054	

Note: ®Reference category; Level of Significant- ***p<0.001, **p<0.01, *p<0.05.

Determinants of C-section deliveries in India

Table 3 shows the results of three models of multiple logistic regression analysis to examine the determinants of C-section, emergency and elective C-section deliveries. The results from model 1 shows that the type of facility emerged as a significant predictor, revealing that mothers accessing private facilities for delivery had 4.2 times higher odds of undergoing a C-section compared to those in public facilities. Additionally, residence played a crucial role, with rural residents exhibiting 0.92 times lower odds of C-section compared to urban counterparts. Muslim mothers exhibited 1.12 times higher odds of undergoing a C-section compared to Hindus. ST and OBC women had lower odds of C-section delivery, with odds ratios of 0.70 and 0.87, respectively. However, mothers from other castes displayed 1.2 times higher chance of C-section than SCs.

The study found that mothers in poorer, middle, richer, and richest wealth quantiles exhibited progressively higher odds ratios, underscoring the socio-economic dimensions influencing the choice of delivery method. Regional disparities were evident, with mothers in the South region exhibiting 2.6 times higher odds of C-section compared to the north. Mothers aged 35 and above had 2.9 times higher odds compared to those less than 20 years old ($p<0.01$).

Mothers with secondary education displayed 1.3 times higher odds of undergoing a C-section compared to those with no education. Similarly, mothers with higher education had higher odds, with an odds ratio of 1.3. Older mothers exhibited higher odds of undergoing a C-section, with the odds increasing steadily with age. Mothers with access to mass media exhibited 1.19 times higher odds of C-section delivery compared to those without such access. Second-born children had 0.74 times lower odds of C-section, while third-born and higher-order births exhibited even lower odds. The presence of twins significantly increased the likelihood of C-section. Mothers with multiple births exhibited 3.28 times higher odds of C-section compared to single birth. While the odds ratios for different size categories were not statistically significant, there were trends suggesting that larger babies may be associated with higher odds of C-section; however, average birth size children were less likely to deliver through C-section mode. The number of ANC visits demonstrated a significant association with C-section rates. Mothers with four or more ANC had 1.25 times higher odds of C-section compared to those with no ANC visits. Similarly, the timing of the first ANC did not exhibit statistical significance in predicting C-section rates.

Determinants of emergency C-section deliveries in India

Table 3 shed light on the determinants of emergency C-section deliveries. The mothers accessing private facilities had 3.1 times higher odds of undergoing an Emergency C-section compared to those in public facilities. Christian mothers had lower and other religion had higher chance of emergency C-section than Hindus. While ST and OBC mothers' lower odds for emergency C-section. Results show that mothers in poorer, middle, richer, and richest wealth quantiles exhibited 20% to 37% higher likelihood for emergency C-section. Regional variations persisted, with the south region, east and north east having the higher odds of emergency C-section compared to the North region. Mothers with secondary or higher education displayed 1.3 times higher odds of undergoing an emergency C-section compared to those with no education. Similarly, mothers having exposer of mass media had 15% higher chance of emergency C-section than their counterparts. Maternal age remained a significant predictor, with older mothers having higher odds of emergency C-section.

Higher birth order continued to be associated with lower odds of emergency C-section. Second-born children had 38%, third-born exhibited 59%, and fourth or higher-order births had 75% less likely of emergency C-section. Moreover, the full-term pregnancy significantly increased the likelihood of emergency C-section, and mothers with multiple births exhibited 2.1 times higher chance of emergency C-section compared to single birth. Average size of babies at the time birth had 13% less likely of emergency C-section than small and very small babies. Similarly, babies weighing 3.5 KG or more had 24% higher chance of emergency C-section. ANC visits and the timing of the first ANC visit did not exhibit statistical significance in predicting emergency C-section rates.

Determinants of elective C-section deliveries in India

Table 3 shows the determinants of elective C-section deliveries, where the type of facility remained a significant predictor. Mothers accessing private facilities had higher odds of undergoing an elective C-section compared to those in public facilities. Likewise, STs were 33% and OBCs were 11% less likely to undergoing for elective C-section; and other caste women were 15% more likely to go for elective C-section than SCs. Mothers in poorer, middle, richer, and richest wealth quantiles exhibited 43% to 85% higher likelihood for elective C-section than women of poorest wealth quantile. South region exhibiting the highest odds of elective C-section, followed by northeast and east region (1.198) compared to the north region.

However, women in central and western region were less likely of undergoing an elective C-section. Maternal education and age remained a significant predictor, with more educated and older mothers having higher odds of elective C-section. Similarly, mothers having exposer of mass media had 18% higher chance of elective C-section. Third-born children had 44%, four or higher birth order children exhibited 69% less likely of elective C-section. Mothers with multiple births exhibited 2.32 times higher chance of elective C-section compared to single birth

DISCUSSION

Using nationally representative data from NFHS-5, the present study examined the prevalence and determinants of overall, elective, and emergency C-section deliveries in India. The findings clearly demonstrate that medical, socio-demographic, and health-system factors jointly influence the rising burden of C-section deliveries, with distinct predictors shaping emergency and elective procedures.

Our study indicates that women delivering in private facilities had significantly higher odds of undergoing C-section, whether overall, emergency, or elective, compared to those using public facilities. This aligns with earlier studies indicating potential overuse of C-sections in the private sector due to financial incentives, convenience, and differences in clinical decision-making practices.[21] The magnitude of association was strongest for elective C-sections, highlighting the increasing role of non-medical and provider-driven factors in scheduling deliveries in private settings. The socio-economic status emerged as a powerful determinant, with wealthier women demonstrating progressively higher odds of both emergency and elective C-sections. While higher wealth may enhance access to facility-based obstetric care and the ability to pay for surgical services, it may also reflect a cultural shift toward viewing C-section as a safer or more convenient option among affluent populations. In contrast, women from scheduled tribes and other backward classes consistently exhibited lower odds of all forms of C-section, indicating persistent social inequities in access to maternal health services and potential underutilization among historically marginalized groups.

The regional disparities were prominent in our present study. The southern region consistently reporting the highest odds of C-sections. This pattern has been widely documented in previous literature and may reflect better access to institutional care, differences in clinical protocols, and socio-cultural preferences.[20]

The northeast and eastern regions also showed elevated odds for emergency and elective C-sections, underscoring the complexity of region-specific health system dynamics. The influence of maternal age and education was also evident for C-section delivery. Older mothers (≥35 years) and those with secondary or higher education were more likely to undergo both emergency and elective C-sections. Biologically, advanced maternal age is associated with pregnancy complications that may necessitate surgical delivery.[20,21] Higher educational attainment is often linked with increased health awareness, stronger decision-making autonomy, and greater willingness to opt for C-section when medically advised or even for perceived safety and convenience. Higher-order births were associated with significantly lower odds of both emergency and elective C-sections, consistent with obstetric norms that first births carry higher risks warranting surgical intervention. Conversely, multiple births substantially increased the likelihood of all types of C-sections due to elevated risks such as malpresentation, fetal distress, and preterm delivery. The study also found that babies with larger birth size or weight ≥3.5 kg had higher odds of emergency C-section, reflecting clinical concerns around obstructed labor and birth complications. The role of ANC was mixed across the models. While four or more ANC visits increased the odds of overall C-section, ANC was not a significant predictor for emergency or elective C-sections independently. This may suggest that ANC enhances institutional delivery uptake in general, but clinical decisions leading to emergency or elective surgery depend more on complications identified at the time of delivery rather than on ANC utilization alone. Exposure to mass media also showed a positive association with higher odds of both emergency and elective C-sections, indicating the growing influence of information access on healthcare-seeking behaviour. Media exposure may shape perceptions of C-section as a modern, safer delivery method and encourage women to seek services from private facilities that more readily perform surgical deliveries.

Overall, the study highlights that the rising trend of C-section deliveries in India is shaped by a complex interplay of healthcare system characteristics, socio-economic inequalities, maternal demographic factors, and clinical needs. The stark contrast between private and public facilities, along with strong socio-economic gradients, suggests that non-medical factors may be contributing to unnecessary C-sections in certain populations while others may not be receiving the surgical care they need.

Findings highlight the need for stronger regulation and monitoring of C-section practices, especially in private facilities where rates are disproportionately high. Policies should focus on improving the quality of antenatal and intrapartum care, ensuring early identification and referral of high-risk pregnancies. Targeted strategies are required to reduce socio-economic and regional disparities by strengthening public sector obstetric services in underserved areas. Public awareness campaigns should promote informed decision-making regarding delivery methods, emphasizing the risks of unnecessary C-sections while ensuring timely access to emergency obstetric care when medically required.

The present study has some limitations. Firstly, this study is based on cross-sectional NFHS-5 data, which limits the ability to establish causal relationships. The analysis relies on self-reported information, which may be subject to recall bias, especially for delivery-related variables. Clinical factors such as maternal comorbidities, fetal complications, or provider-level decision-making key determinants of C-section were not available in the dataset, potentially leading to residual confounding. Additionally, distinctions between medically justified and non-medically indicated C-sections could not be assessed.

CONCLUSION

This study, based on nationally representative NFHS-5 data, demonstrates that C-section deliveries in India, both elective and emergency, are shaped by a complex mix of socio-economic, demographic, clinical, and health-system factors. Private health facilities, higher wealth status, older maternal age, higher education, mass media exposure, and multiple births were strong predictors of C-section use, while disadvantaged caste groups and higher birth orders were less likely to receive surgical deliveries. Regional variations, particularly the substantially higher likelihood of C-sections in southern India, further highlight disparities in obstetric practices across the country. The findings suggest that while some C-sections are clinically necessary, a considerable proportion may be driven by non-medical influences, particularly in private facilities and among wealthier or more educated women. Addressing these imbalances will require strengthened clinical oversight, improved quality of maternal care, and targeted interventions to ensure that C-sections are performed based solely on medical necessity. Ensuring equitable access to safe delivery care remains essential for reducing preventable maternal and neonatal risks in India.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Yadav G, Ghosh K, Shekhar P, Pandya S. Predictors of elective and emergency caesarean deliveries in India: evidence from large scale survey. Int J Community Med Public Health 2026;13:855-64.