

SHORT ARTICLE

Socio-demographic Determinants of Caesarean Section Deliveries in India: Descriptive analysis of Cross-sectional data from National Family Health Survey

Pandurang Vithal Thatkar, Mukesh Suresh Bawa, Harshal Tukaram Pandve, Atul Vilas Desale, Rahul Bhagchand Chavan

Department of Community Medicine, Postgraduate Institute, Yashwantrao Chavan Memorial Hospital, Pimpri, Pune, Maharashtra

CORRESPONDING AUTHOR

Dr. Mukesh Suresh Bawa, Department of Community Medicine, Postgraduate Institute, Yashwantrao Chavan Memorial Hospital, Pimpri, Pune- 411018

Email: mukesh.bawa257@gmail.com

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ABSTRACT

Background: Increase in global rate of Caesarean deliveries poses significant public health concerns as it is associated with high costs and risks for maternal, new born health. In India understanding determinants of Caesarean deliveries is of paramount importance in order to prevent maternal and child health morbidity and mortality. **Aims and Objective:** To investigate the socio-demographic determinants of Caesarean deliveries in India using cross-sectional data from National Family Health Survey. **Methodology:** The present study is a cross-sectional record based study using data from National Family Health Survey conducted in India between 2019 and 2021. The primary outcome variable is Caesarean delivery, while predictors are socio-demographic and obstetric factors. Frequency analysis used for socio-demographic variables and binary logistic regression was used to determine the determinants of Caesarean deliveries among women in the reproductive age group. The analysis was done using IBM SPSS Statistics 26.0 Software. **Results:** The socio-demographic and obstetric factors like maternal age, residence, education, employment, BMI, Birth order, number of Antenatal visits, place of delivery, wealth index, and media exposure are associated with Caesarean delivery. **Conclusions:** The study provides insights into the factors influencing Caesarean deliveries rates among women in India.

KEYWORDS

Caesarean delivery, Socio-demographic determinants, India, NFHS

INTRODUCTION

Caesarean deliveries have become increasingly common in cases of obstructed labor.(1,2) According to NFHS-4, caesarean delivery rate in India has increased to 17.2 % from 2.9% in

NFHS-1. Caesarean deliveries are estimated to prevent roughly 187,000 maternal and 2.9 million neonatal deaths on a global scale each year. This procedure should be reserved for situations involving complex or high-risk

pregnancies.(2,3) Unnecessary caesarean sections linked to higher rates of maternal infections, uterine haemorrhages, and infant respiratory issues and hypoglycemia.(4,5) Delayed initiation of breastfeeding is common after Caesarean delivery due to factors like mother and child separation, reduced infant suckling ability, and inadequate milk secretion, resulting in shorter breastfeeding durations.(6) Literature suggests that babies born via Caesarean section had less immediate maternal contact and were less likely to breastfeed within 24 hours after birth.(7) There is growing trend of caesarean sections not medically necessary.(8) This increase is attributed to factors like maternal anxiety about vaginal delivery, the desire for scheduled delivery (9), physician preferences, and financial incentives for higher Caesarean delivery rates in private healthcare settings.(10) Socio-cultural and religious factors also influence the choice of Caesarean deliveries in some societies. Legal consequences from adverse vaginal delivery outcomes have led clinicians to opt for Caesarean delivery as a defensive measure, contributing to the overall rise in Caesarean delivery rates.(11) Aim of present study is to investigate relationship between socio-demographic factors and caesarean section deliveries in India.

MATERIAL & METHODS

Data required for this study was retrieved from the 2019-2021 National Family Health Survey 5 in India.

Study type & study design: Descriptive record based study

Study Population: All the women in the age group between 15 to 49 years, who had at least one child, either through caesarean section or vaginal delivery.

Study duration: Year 2016 to 2020

Sample Size: A sample of 176843 women in the age group between 15 to 49 years and who had at least one child, either through caesarean section or vaginal delivery, during 2016 to 2020 is included in present the study

Strategy for data collection: Secondary data analysis of NFHS 2019-21 survey data was done using the data accessed from the Demographic

& Health Surveys program after obtaining the necessary permissions.

Data sampling design & method: NFHS survey adopted Multistage sampling design in rural area and in urban areas using a stratified cluster sample (12).

Working definition: For this study, the primary outcome variable was the caesarean deliveries in women reproductive age group and the explanatory variables were sociodemographic variables like women's age, educational level, working status, partner's education and occupation, religion, wealth index, place of residence. Also Obstetric variables like Body Mass Index (BMI), birth order, Ante Natal Care visits, place of delivery. Mass media exposure of mother was determined by the frequency of engaging with newspapers, radio and television.

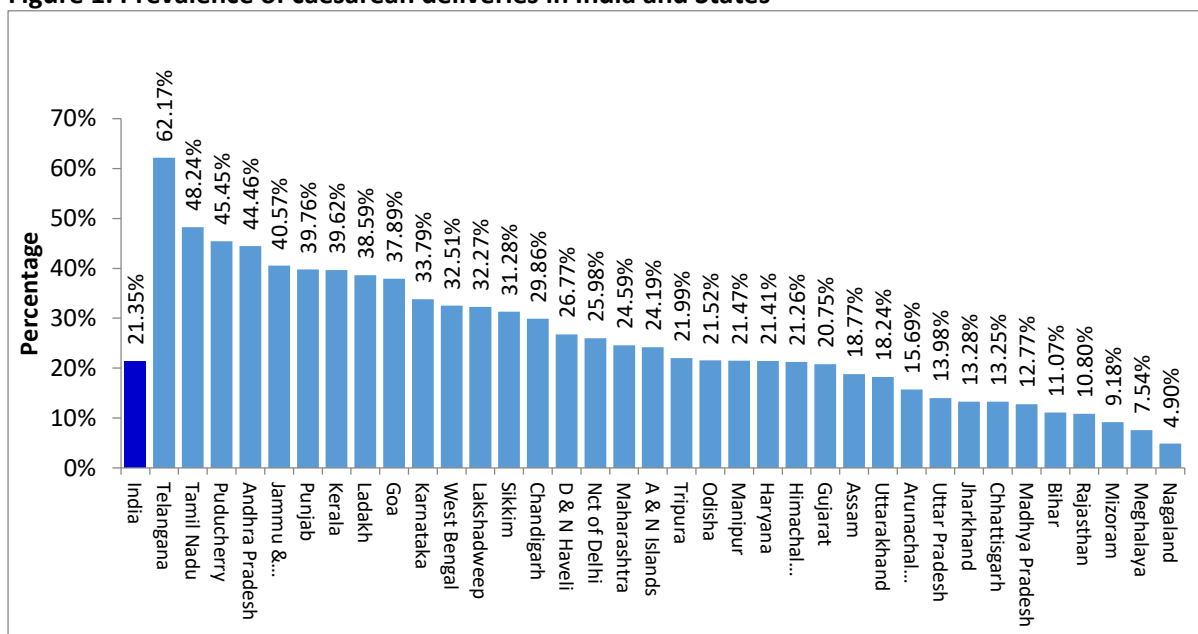
Ethical issues & informed consent: The ethical approval for NFHS surveys were obtained from the ethics review board of the International Institute for Population Sciences, Mumbai, India.

Data analysis - software: A frequency analysis was performed and results were presented as proportions. The binary logistic regression analysis was applied to determine the determinants of Caesarean deliveries among women in the reproductive age group. The analysis was done using IBM SPSS Statistics 26.0 software.

RESULTS

The prevalence of caesarean deliveries across various states in India is shown in figure 1. Nationally, caesarean sections account for 21.35% of deliveries, with 37759 cases out of a total of 176843. However, there's a noticeable variation across states. Telangana has the highest rate of Caesarean deliveries at 62.17%, while Nagaland has the lowest at 4.90%. States like Tamil Nadu, Puducherry and Andhra Pradesh have almost equal distributions between natural and Caesarean deliveries, with 48.24%, 45.45% and 44.46% Caesarean rates, respectively. On the higher end, states such as Mizoram, Meghalaya and Nagaland show a substantial skew towards normal deliveries and the lowest Caesarean delivery rates of 9.18%, 7.54% and 4.90%, respectively.

Figure 1. Prevalence of caesarean deliveries in India and States



The table 1 provides insights into sociodemographic characteristics of the study subjects. In terms of age distribution, the majority (58.8%) are aged between 25-35 years, while 10.8% are 35 years or older and 30.3% falls in the 15-24 age range. Most subjects included in the present study reside in rural areas (78.5%) compared to urban (21.5%). As per educational level, the majority have completed secondary education (52.4%), with 15.0% achieved higher education and only

20.3% having no education. Interestingly, only 3.0% of the respondents are currently working. The predominant religion is Hinduism (73.5%), and in terms of economic standing, 25.4% fall under the 'Poorest' category in the wealth index. The birth order is evenly distributed, with the highest being second-born at 35.3%. Majority of subjects (58.7%) had 4 or more ANC visits during pregnancy and 65% deliveries were conducted in Public/Government Hospitals.

Table 1. Distribution of study subjects according to background characteristics

Background characteristics	Frequency	Percentage
Age in years	15-24	53635
	25-35	104032
	≥ 35	19176
Type of place of residence	Urban	37975
	Rural	138868
Highest educational level	No education	35976
	Primary	21737
	Secondary	92624
	Higher	26506
Respondent currently working	No	171465
	Yes	5378
Religion	Hindu	129944
	Muslim	25234
	Christian	14006
	Other	7659
Wealth index combined	Poorest	44867
	Poorer	40481
	Middle	34569
	Richer	31054
	Richest	25872
Birth order	1	59620

Background characteristics		Frequency	Percentage
	2	62370	35.30%
	3 or more	54853	31.00%
Number of antenatal visits during pregnancy	No antenatal visits	11462	6.50%
	1-3 visits	61586	34.80%
	4 or more visits	103795	58.70%
Place of delivery	Home	21219	12.00%
	Public/Govt Hospital	114952	65.00%
	Private Hospital	40280	22.80%
	Other	392	0.20%
Body Mass Index	Underweight	31107	18.10%
	Normal	107261	62.30%
	Overweight/Obese	33933	19.70%
Mass Media Exposure	No	48997	27.70%
	Yes	127846	72.30%
Husband/partner's education level	No education	3840	14.30%
	Primary	3372	12.50%
	Secondary	15078	56.00%
	Higher	4547	16.90%
	Don't know	110	0.40%
Husband/partner's occupation (grouped)	Professional/technical/managerial	2156	8.00%
	Clerical	654	2.40%
	Sales	2784	10.30%
	Services/household and domestic	2498	9.30%
	Agricultural	8917	33.10%
	Skilled and unskilled manual	8422	31.30%
	Other	1516	5.60%

In terms of body mass index, 62.3% had normal weight, while 19.7% are overweight or obese. Majority of the women (72.3%) have exposure to mass media. Regarding their partners, 56% have secondary education, and the most prevalent occupation is agricultural (33.1%) followed by Skilled and unskilled manual (31.3%). Lastly, a notable 72.3% of the subjects have exposure to mass media.

Table 2 shows the prevalence of Caesarean deliveries according to sociodemographic characteristics. Age-wise, those between 25-35 years have the highest Caesarean deliveries rate at 22.6% followed by age group 35 and above (22.3%). Urban residents undergo more Caesarean deliveries at 32.9% compared to their rural counterparts at 18.2%. As education levels rise, so does the prevalence of Caesarean deliveries, those having higher education have a notable 40.1% prevalence. Working respondents have a nearly equal Caesarean delivery rate with non-working ones. The 'Other' category of religion has the highest prevalence of Caesarean delivery at 27.0%, Christians have least Caesarean delivery rate of 13.0%. Socioeconomic status

also influences Caesarean delivery rate, with the 'Richest' segment recording a 39.1% prevalence followed by richer (31.6%) and middle (24.1%).

As per Birth order, first-born children have a higher Caesarean delivery rate at 28.4% followed by the second birth order (24.5%). The frequency of antenatal visits correlates with higher Caesarean delivery rates, with those having 4 or more visits have a prevalence of 26.1%. Those women delivered in private hospitals report higher Caesarean delivery rate of 49.4%, whereas the prevalence of Caesarean delivery in Public/Government Hospitals was 15.5%. The overweight or obese women had a 37.2% of Caesarean delivery rate, significantly higher than normal (18.3%) and underweight (13.9%). Those respondents having exposure to mass media show a 25.7% Caesarean delivery prevalence. Partners' education level plays a role, with those having higher education witnessing a 35.7% Caesarean delivery rate. When considering the husband's occupation, professionals show the highest rate at 37.5%.

Table 2. Prevalence of caesarean birth among reproductive age women in India by Socio demographic and Obstetric characteristics

Background characteristics		C-Section	Prevalence	95% CI for prevalence	
				Lower	Upper
Age in years	15-24	9945	18.50%	18.20%	18.90%
	25-35	23542	22.60%	22.40%	22.90%
	≥ 35	4272	22.30%	21.70%	22.90%
Type of place of residence	Urban	12506	32.90%	32.50%	33.40%
	Rural	25253	18.20%	18.00%	18.40%
Highest educational level	No education	3232	9.00%	8.70%	9.30%
	Primary	2658	12.20%	11.80%	12.70%
	Secondary	21234	22.90%	22.70%	23.20%
	Higher	10635	40.10%	39.50%	40.70%
Respondent currently working	No	4702	21.80%	21.20%	22.30%
	Yes	1125	20.90%	19.80%	22.00%
Religion	Hindu	28351	21.80%	21.60%	22.00%
	Muslim	5521	21.90%	21.40%	22.40%
	Christian	1819	13.00%	12.40%	13.50%
	Other	2068	27.00%	26.00%	28.00%
Wealth index combined	Poorest	3361	7.50%	7.20%	7.70%
	Poorer	6139	15.20%	14.80%	15.50%
	Middle	8337	24.10%	23.70%	24.60%
	Richer	9811	31.60%	31.10%	32.10%
	Richest	10111	39.10%	38.50%	39.70%
Birth order	One	16910	28.40%	28.00%	28.70%
	Two	15263	24.50%	24.10%	24.80%
	3 or more	5586	10.20%	9.90%	10.40%
Number of antenatal visits during pregnancy	No antenatal visits	1194	10.40%	9.90%	11.00%
	1-3 visits	9515	15.40%	15.20%	15.70%
	4 or more visits	27050	26.10%	25.90%	26.40%
Place of delivery	Public/Govt Hospital	17850	15.50%	15.30%	15.70%
	Private Hospital	19909	49.40%	48.90%	49.90%
Body Mass Index	Underweight	4310	13.90%	13.50%	14.20%
	Normal	19654	18.30%	18.10%	18.60%
	Overweight/Obese	12611	37.20%	36.70%	37.70%
Mass Media Exposure	No	4946	10.10%	9.80%	10.40%
	Yes	32813	25.70%	25.40%	25.90%
Partner's education level	No education	404	10.50%	9.60%	11.50%
	Primary	473	14.00%	12.90%	15.20%
	Secondary	3308	21.90%	21.30%	22.60%
	Higher	1624	35.70%	34.30%	37.10%
	Don't know	16	14.50%	8.00%	21.10%
Husband/partner's occupation (grouped)	Professional / technical	809	37.50%	35.50%	39.60%
	Clerical	198	30.30%	26.80%	33.80%
	Sales	750	26.90%	25.30%	28.60%
	Services / domestic	654	26.20%	24.50%	27.90%
	Agricultural	1393	15.60%	14.90%	16.40%
	Skilled and unskilled	1657	19.70%	18.80%	20.50%
	Other	364	24.00%	21.90%	26.20%

Table 3 presents the odds ratio of caesarean births among reproductive age women in India, using binary logistic regression to identify the association of various factors with

the choice of caesarean section. This analysis excluded factors such as the education and occupation of the partner due to the

substantial amount of missing data in these variables.

Odds of undergoing a Caesarean delivery in women aged 25-34 and >35 years are significantly higher than in those aged 15-24 years, with odds ratios of 1.371 (95% CI: 1.328-1.416) and 1.997 (95% CI: 1.895-2.106), respectively. Rural residents are less likely than urban residents to undergo caesarean births, with an odds ratio of 0.898 (95% CI: 0.869-0.927). Women with Higher educational levels have higher odds of a Caesarean delivery. Women with primary (OR = 1.070, 95% CI = 1.008-1.137), secondary (OR = 1.361, 95% CI = 1.298-1.426), and higher education (OR = 1.481, 95% CI = 1.401-1.566) have increased odds compared to those with no formal education. Also currently working women have increased odds of having Caesarean delivery (OR = 1.179, 95% CI = 1.092-1.273).

Regarding religion, Muslims and 'Others' have higher odds than Hindus, while Christians have lower odds. Wealth also influences the likelihood of undergoing a Caesarean delivery. Compared to the poorest category, women in the poorer, middle, richer, and richest categories have increased odds ratios of 1.340 (95% CI = 1.276-1.406), 1.630 (95% CI = 1.552-

1.713), 1.616 (95% CI = 1.534-1.703), and 1.340 (95% CI = 1.264-1.420), respectively. A higher birth order is associated with a decreased likelihood of a Caesarean delivery.

Higher number of antenatal visits are associated with higher odds of a Caesarean delivery, those with 4 or more visits have significantly higher odds (OR = 1.364, 95% CI = 1.270-1.465). Women unsure about their antenatal visits also have increased odds (OR = 1.231, 95% CI = 1.079-1.405). Deliveries in private hospitals are associated with a higher likelihood of Caesarean delivery (OR = 4.049, 95% CI = 3.936-4.164) compared to public/government hospitals. Body Mass Index (BMI) also plays a role; overweight/obese women have increased chances of a Caesarean delivery, with odds ratios of 2.141 (95% CI = 2.048-2.238), respectively, compared to underweight women.

Finally, exposure to mass media is associated with increased odds of caesarean births. Women exposed to mass media have an increased odds ratio of 1.274 (95% CI = 1.225-1.325), indicating a higher likelihood of undergoing a C-section compared to those without such exposure.

Table 3. Odds ratio of Caesarean delivery among reproductive age women in India by Socio demographic and Obstetric characteristics, NFHS-2019-2021

		B	S.E.	Exp(B)	95% C.I. for EXP(B)	Lower	Upper	p-value
Age in years	15-24			Ref				<.001
	25-35	0.316	0.016	1.371	1.328	1.416		<.001
	≥ 35	0.692	0.027	1.997	1.895	2.106		<.001
Place of residence	Urban			Ref				
	Rural	-0.108	0.017	0.898	0.869	0.927		<.001
Highest educational level	No education			Ref				<.001
	Primary	0.068	0.031	1.07	1.008	1.137		0.026
	Secondary	0.308	0.024	1.361	1.298	1.426		<.001
	Higher	0.393	0.028	1.481	1.401	1.566		<.001
Respondent currently working	No			Ref				
	Yes	0.165	0.039	1.179	1.092	1.273		<.001
Religion	Hindu			Ref				<.001
	Muslim	0.15	0.019	1.162	1.118	1.207		<.001
	Christian	-0.247	0.03	0.781	0.737	0.829		<.001
	Other	0.209	0.031	1.232	1.159	1.309		<.001
Wealth index combined	Poorest			Ref				<.001
	Poorer	0.292	0.025	1.34	1.276	1.406		<.001
	Middle	0.489	0.025	1.63	1.552	1.713		<.001
	Richer	0.48	0.027	1.616	1.534	1.703		<.001
	Richest	0.293	0.03	1.34	1.264	1.42		<.001
Birth order	One			Ref				<.001

	B	S.E.	Exp(B)	95% EXP(B) Lower	C.I. for Upper	p- value	
Number of antenatal visits during pregnancy	Two	-0.219	0.015	0.804	0.78	0.828	<.001
	3 or more	-0.979	0.021	0.376	0.361	0.392	<.001
	No antenatal visits			<i>Ref</i>			<.001
	1-3 visits	0.032	0.037	1.032	0.959	1.111	0.397
	4 or more visits	0.311	0.036	1.364	1.27	1.465	<.001
Place of delivery	Don't know	0.208	0.067	1.231	1.079	1.405	<.001
	Public/Govt Hospital			<i>Ref</i>			
	Private Hospital	1.398	0.014	4.049	3.936	4.164	<.001
Body Mass Index	Underweight			<i>Ref</i>			<.001
	Normal	0.167	0.02	1.181	1.136	1.229	<.001
	Overweight/Obese	0.761	0.023	2.141	2.048	2.238	<.001
Mass Media Exposure	No			<i>Ref</i>			
	Yes	0.242	0.02	1.274	1.225	1.325	<.001
Constant	-2.787	0.049	0.062				<.001

DISCUSSION

In the current study, we examined the prevalence of Caesarean deliveries and its determinants among reproductive age women in India. The research indicated that roughly 21.35% of women in India underwent a Caesarean delivery, significantly exceeding the WHO's recommended upper threshold of 15% for any nation. (8) In India, the rate of caesarean deliveries has risen sharply from a mere 3% in 1992-93 to 17% in 2015-16, and further to 21.5% in 2019-21. (13) Prior research from India has highlighted advancements in female literacy and healthcare services in smaller towns and villages as one of the factor that attributed in the rise of C-section deliveries..(14) Studies done by Christilaw JE (2006), Main EK et al (2012) and Boerma T et al (2018) attributed the increase in Caesarean delivery to variables like maternal anxiety about vaginal delivery, the desire for scheduled delivery, physician preferences, and financial incentives for higher Caesarean delivery rates in private healthcare settings. Moreover, concerns about legal consequences and litigation stemming from adverse vaginal delivery outcomes have led clinicians to opt for Caesarean delivery as a defensive measure, contributing to the overall rise in Caesarean delivery rates.(9–11) The current study demonstrated that in India, that factors such as age, place of residence, education, employment status, BMI, Birth order, frequency of ANC visits, place of delivery,

Religion, Wealth Index, and exposure to mass media are important determinants of caesarean deliveries. Similar results were reported by in Ghana 15–17. In these studies, conducted at Ghana where the prevalence of Caesarean delivery was 14.6%, concluded that factors like wealth index, education, marital status, ANC visits, place of delivery are significantly associated with a higher likelihood of Caesarean delivery. Another study conducted in India by Reddy B V et al. concluded that place of residence, education of female and partner, frequency of ANC visits are associated with the higher rate of Caesarean delivery.(15)

Roy et al. (2021) explores the prevalence and determinants of Caesarean deliveries in two Indian states, Bihar and Tamil Nadu. The study identified that socioeconomic factors, including a mother's education and wealth, influenced the chances of Caesarean deliveries. Wealthy and highly educated Women were likely to undergo C-sections. The choice of health facility played a role, with women in private urban healthcare facilities having a higher likelihood of Caesarean deliveries, indicating a preference for Caesarean delivery in such settings. In Bihar, where public healthcare facilities are more commonly used, women had a lower likelihood of Caesarean deliveries compared to Tamil Nadu, where private healthcare facilities were more frequently utilized. These findings are similar to the findings of the current study. (16)

In a cross-sectional study conducted by Sreevidya S et al (2003) in Madras, India, it was determined that regions with a higher prevalence of Caesarean deliveries showed a favourable educational trend, irrespective of wealth as measured by household assets. Additionally, the research revealed an interactive association between education and the selection of healthcare facilities, suggesting that highly educated women were more inclined to have Caesarean deliveries in private urban healthcare facilities. (17)

Das Pranta et al (2021) conducted study to, assess the prevalence of Caesarean delivery and the factors associated with it using data from the Nepal Demographic and Health Survey. Their findings align with the findings of the this study, indicating that caesarean deliveries were more likely to occur among mothers aged 30 years or older, individuals with higher incomes, those who were overweight or obese, individuals with exposure to media, and those who had received antenatal care (ANC) visits.(18)

Manyeh et al. (2018) investigated the determinants of caesarean deliveries in Southern Ghana. The study highlighted the influence of socioeconomic factors, maternal age, parity, geographic location, and the type of health facility on the prevalence of Caesarean deliveries in Southern Ghana. These findings are consistent with the findings of the current study.(19)

CONCLUSION

The socio-demographic factors like maternal age, education level, marital status, and wealth, Place of delivery, as well as obstetric factors such as the Obesity, frequency of antenatal care visits, parity, and gestational age, were determinants of caesarean deliveries.

RECOMMENDATION

Based on findings of the current study, further exploratory studies are recommended to gain in depth knowledge about Caesarean section practice and it's determinants in India. Maternal child health programmes in India should also include guidelines for indications of

Caesarean section deliveries for both private and government institutions.

LIMITATION OF THE STUDY

The study is cross sectional, which limits it's ability to establish causation or capture temporal trends. The data source is susceptible to recall bias and lacks comprehensive variables, such as medical indications or healthcare infrastructure.

RELEVANCE OF THE STUDY

The study provides insights into the current trend of Caesarean section in India and it's sociodemographic determinants. It will enable policy makers to prepare appropriate policy to promote mother centric maternal child care services in the country.

AUTHORS CONTRIBUTION

All authors have contributed equally

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Nil

CONFLICT OF INTEREST

There are no conflicts of interest.

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DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors have not used any generative AI and/or AI Assisted technologies in the writing process.

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