



Role of Antenatal Care (ANC) Services on Safe Delivery among the Indian Women: An Investigation from the Nationally Representative Survey

Bikash Barman¹, Pradip Chouhan²

¹Assistant Professor, Department of Geography, Malda Women's College, Malda, West Bengal, India; ²Professor, Department of Geography, University of Gour Banga, Malda, West Bengal, India.

ABSTRACT

Introduction: Maternal mortality and infant mortality is now act as a danger issue all over the world and the whole world trying to combat these problems by improving the treatment-seeking behaviour at the time of pregnancy as well as improving the facility for delivery at an institution which is comparatively safe than the home delivery.

Aim/Objective: The present study gives more attention to the role of antenatal care (treatment-seeking behaviour during pregnancy) on safe delivery (institutional delivery by the skilled birth attendant (SBA) among Indian mothers aged 15-49 years.

Methodology: The entire study depends on secondary data collected from the National Family Health Survey (NFHS)-4 in the year 2015-16 in India which was conducted on 1,89,898 women having the age group of 15-49 years. For the proper depiction of the result, bivariate (Pearson's Chi-square) and multivariate (BLR model) has been conducted.

Results: The bivariate and multivariate analysis stated that there were significant variations in the likelihood of being delivered at an institution by the SBA and BLR model showing that there was a significant role of antenatal care in the safe delivery in India though there were also other determinants for safe delivery, the antenatal care was a key indicator for the safe delivery for both mother and newborn baby.

Conclusion: This study concluded that the proper utilization of antenatal care services should be given more importance because ANC services is necessary for safe delivery among the women which helps to reduce delivery complications and risk of new born health vulnerability.

Key Words: Antenatal care (ANC), Safe delivery, Institutional delivery, Skilled birth attendant (SBA), BLR model, NFHS, India

INTRODUCTION

Maternal mortality is a vital issue now a days over the world which is the primary indicator of the failure of the proper utilization of maternal health care services.^{1,2} Antenatal and postnatal care of every woman is the primary benchmark of a healthy baby and maternal health.^{3,5} WHO pointed out that at least four antenatal visits or consultations during pregnancy for every woman are necessary for a normal situation, which may help reduce delivery complications and maternal mortality.^{2,4} The place of delivery is an important determinant that helps to reduce the risk of maternal and infant death. Choosing a place of delivery has been considered an important, complicated and midcult decision-making process.^{1,3,5} The chances of safe

delivery are greater when the births take place in an institution than at home and increasing the facilities of institutional delivery is very important to reduce maternal deaths due to pregnancy complications.^{4,6} According to the World Health Organization every minute, at least one woman dies from complications during childbirth – that means 529 000 women per year.^{7,8,9} Nearly all of these deaths (99%) occur in developing countries and less than 1% occur in the more developed countries of the world.⁹ India is one of the countries experiencing high maternal (167/100,000 live births) and infant mortality rates (37/1000 live births); still 27% of the women in India deliver at home with or without the assistance of a skilled birth attendant (SBA).^{6,7,9} A few studies examined that there is a positive association between the

Corresponding Author:

Bikash Barman, Assistant Professor, Department of Geography, Malda Women's College, Malda, West Bengal, India.
Mobile: 9641972629; Email: barmanbikash2013@gmail.com

ISSN: 2231-2196 (Print)

ISSN: 0975-5241 (Online)

Received: 28.02.2023

Revised: 13.03.2023

Accepted: 25.03.2023

Published: 11.04.2023

frequency/quality of ANC services and the use of skilled birth attendants during delivery.^{10,11} ANC is an opportunity to promote the use of skilled attendance at birth and to decide the place of delivery i.e. institutional or home delivery. It also promotes healthy behaviours such as breastfeeding, early postnatal care, and planning for optimal pregnancy spacing.^{11,12,13} The benefits of delivering births in an institution are related to the life-saving equipment and hygienic conditions that help to reduce the risk of complications due to childbirth that may result in death or illness for the mother or child.¹⁴ According to NFHS-3, 61% of births in India take place at home; about 46.6% of the deliveries are conducted by a skilled birth attendant and 35% by TBAs, 85.7% of births in Jammu and Kashmir were institutional.⁹ In tribal areas of India as well as in Kashmir, home delivery by traditional birth attendants (TBAs/Dais) is a cultural norm, where skilled attendants are mostly absent. There is a negative relationship between institutional delivery and maternal mortality. It was observed that the states where mothers prefer to deliver births in an institution had a lower rate of maternal mortality.^{12,15} Southern states such as Kerala and Tamil Nadu had more than 95% of deliveries in health facilities and had maternal mortality ratios of only 66 and 90 maternal deaths per 100,000 live births, respectively, in 2012. On the other hand, the Central and Northern regions had only 25% to 45% institutional deliveries. In Uttar Pradesh and Rajasthan, the maternal mortality ratios were 292 and 255 per 100,000 live births, respectively, in 2012.^{6,9,21} Utilization of institutional delivery in Southern and western regions was higher than in Central and Northern parts of India because Southern and Western regions have a better provision of services in the form of safe and affordable methods.^{16,21} In Uttar Pradesh, around 90% of women were delivered at home and nearly half of the deliveries were assisted by family members or relatives.¹⁷ This can be dangerous for both the mother and the newborn. An extensive literature review shows that the women who had at least one antenatal visit had a higher chance of survival compared to those who had not received any visit.^{18,19} However, the present study represents the role of ANC services on safe delivery among pregnant women aged 15-49 years in India.

Wide variations exist in the access and the utilization of antenatal care services among literate and illiterate women, between the poor and rich women, between the rural and urban women in India; there are many socio-demographic correlates which affect the wide differences in the utilization of antenatal care services.^{17,22,23} A majority of Indian women still illiterate, lived in remote areas who had no proper knowledge about the utilization of antenatal care services and about the importance of antenatal care on safe delivery.^{17,24} The present study represents the role of ANC services on safe delivery among Indian women aged 15-49 years.

Data

The present work has been completed with the assistance of secondary data composed from the National Family Health Survey-4 in India which has been conducted in 2015-16 over 601509 households, 699686 women aged 15-49 years with a response rate of 97%, and 112122 men aged 15-54 years with a response rate of 92%.^{5,7,24} The present study extracted relevant data from the Demographic Health Surveys (DHS) program into STATA version 12.1. The data were weighted using the sample weights of each sample.^{24,25} The variables with multiple categories were re-coded into different groups. In the present study, we have used the data on 190898 ever-married women aged 15-49 years who had at least one live birth in the last 5 years preceding the survey.^{6,8,25}

VARIABLES

Outcome variable

Place of delivery and skilled birth attendant during delivery is very important for the safe delivery of the newborn baby and also for the maternal mortality due to maternity cause. A skilled birth attendant may reduce the risk of delivery complications. According to NFHS, skilled birth attendants are called doctors and nurses.⁷ Place of delivery and skilled birth attendant during delivery has been considered as outcome variables where the place of delivery has been categorized as an institution either public or private and home. Skilled birth attendant during delivery has been categorized as if present SBA during delivery then 'yes' and if not present then 'no' has been coded. All the dependent variables have been taken as dichotomous i.e. 1= yes and 0= no.

Explanatory variable

Different antenatal care services mean the treatment-seeking behaviour of the women during pregnancy i.e. either received any kind of ANC visits or not, either received an adequate number of ANC visits or not, proper timing of 1st ANC visits, an adequate number of tetanus toxoid injections (two or more), the adequate number of iron and folic acid tablets (at least 100 tablets) have been a consideration for the present study. According to WHO guidelines for receiving antenatal care, at least 4 ANC visits, two or more TT injections and 100 or more IFA tablets are mandatory for all pregnant women for healthy and safe delivery and newborn baby.

Study co-variates

Different socio-demographic and economic variables have been considered as covariates in the present study to show the determining effect on safe delivery except for antenatal care services i.e. age of the respondents which has been categorized into three categories i.e. 15-24 years, 25-34 years and 35-49 years, age at marriage (<18 years and 18 or >18

years), birth order (1, 2, 3 and 4 or 4+), caste (SC, ST, OBC & Others), religion (Hindu, Muslim, Christian and Others), women's education (illiterate, primary, secondary and higher), place of residence (urban & rural), wealth index (poorest, poorer, middle, richer and richest), women autonomy (low, medium and high) and media exposure (no exposure, partial exposure and full exposure) has been considered to show the adjusted odds ratio (controlled for maternal age, age at marriage, birth order, caste, religion, education, wealth index, place of residence) between antenatal care services and safe delivery among Indian mothers (15-49 years).^{6,7, 24, 25}

Method

For the proper depiction of the results, we have used Chi-square as bivariate analysis and binary (1, 0) logistic regression as multivariate analysis to show the exact association between antenatal care services and safe delivery among Indian mothers.⁷ Binary logistic (0, 1) regression also has been done where dependent variables (ANC indicators) have been coded '0' (No) and '1' (Yes) to find the unadjusted odds ratio (UOR) which tells us the role of a particular independent variable on the particular dependent variable and adjusted odds ratio (AOR) (where other independent variables were controlled) which tell us the combined effect of all the independent variables (explanatory variables and study covariates) on the particular dependent variable (outcome variables).^{6,7,24}

RESULTS

Table 1 showed the percentage (weighted % & n) distribution of the respondent's antenatal care-seeking behaviour (received antenatal care, frequent use of antenatal care, the timing of antenatal visits and provider for antenatal care), individual characteristics (maternal age, age at marriage, birth order, education, caste, religion, wealth index, place of residence) and empowerment factors (women autonomy and mass media exposure) of Indian women aged 15-49 years who had at least one live birth preceding 5 years of the survey (2015-16) where most (46.9%) of the respondent's education were secondary level and 27.6% were illiterate, 55.9% respondents have belonged from the age group 25-34 years and 37.6% were being married at <18 years old. Most of the respondents (45.3%) were from the Other Backward Classes group and about 45% of respondents belonged to poor families who inhabited rural areas (70.2%). Only 23.62% (6952) and 7.7% (14614) of women had full autonomy and full exposure to mass media (listening to the radio, watching television and reading newspaper) respectively. It was found that 83.37% (155402) women received antenatal care, 51.65% (89438) took 4 or more ANC visits, 70.33% (110103) took ANC within 1st trimester of pregnancy and 79.28% (148305) took antenatal care from the skilled health provider. In the

case of TT injection, 82.48% of women received two or more TT injections whereas only 36.90% of women received 100 or more IFA tablets which were not so satisfactory.

Table 1: Percentage (weighted % & n) distribution of the women aged 15-49 years who had at least one live birth preceding the survey in India, 2015-16

Independent variables	Weighted % (n)
Antenatal care variables	
Received antenatal care	
No	16.63(33642)
Yes	83.37(155402)
Frequent use of ANC	
No ANC	16.63 (33642)
Less than 4 ANC	31.72(65964)
4 or more	51.65(89438)
Timing of 1st ANC visit	
Within 1st trimester	70.33(110103)
After	29.67(46652)
Health provider for ANC	
Non-Skilled	20.72(42593)
Skilled	79.28(148305)
Number of TT injection	
Less than two	17.52(33221)
Two or more than two	82.48(156345)
Number of IFA tablets	
Less than 100	63.10(90316)
100 or more than 100	36.90(52816)
Individual characteristics	
Maternal age	
15-24 years	34.7(62082)
25-34 years	55.9(107500)
35-49 years	9.4(21316)
Age at marriage	
<18 years	37.3(66425)
18 or 18+ years	62.7(121205)
Birth Order	
1	33.6(61807)
2	34.5(62484)
3	16.6(33064)
4 or 4+	15.3(33543)
Women's education	
Illiterate	27.6(55165)
Primary	13.5(26712)
Secondary	46.9(88871)
Higher	12(20150)

Table 1: (Continued)

Independent variables	Weighted % (n)
Caste	
SC	21.99(35170)
ST	10.7(37889)
OBC	45.3(74060)
Others	22(35888)
Religion	
Hindu	79.4(138343)
Muslim	16.2(29309)
Christian	2.1(15202)
Others	2.3(5650)
Wealth Index	
Poorest	23.4(46782)
Poorer	21.2(43739)
Middle	19.9(38393)
Richer	19(33312)
Richest	16.6(28772)
Place of residence	
Urban	29.72(47833)
Rural	70.2(143065)
Empowerment factors	
Women autonomy	
Low	54.94(19201)
Medium	21.44(6613)
Higher	23.62(6952)
Mass media exposure	
No exposure	24.6 (49374)
Partial exposure	67.7 (126910)
Full exposure	7.7 (14614)

Source: Calculated by the researcher from NFHS-4 data

Table 2 depicted the percentage distribution of women who took full ANC, delivered at an institution and delivered by SBA in India among the women aged 15-49 years who had at least one live birth preceding 5 years at the time of the survey. Full ANC indicated the women who received at least 4 ANC visits, who received at least two TT injections and at least 100 IFA tablets according to the WHO guidelines. Antenatal care as well as full ANC played a vital role, not for the women's health but also directly affects newborn health; it increased the awareness of the different required treatment-seeking behaviour through the conversation with doctors, nurses and ASHA workers during their regular check-ups and it increased the mental strength among the pregnant women to deliver at an institution by the inspiring from the health workers information about the different facilities of

institutional delivery as well as safe delivery where most of the deliveries occurred by the skilled birth attendant. Place of delivery and skilled birth attendant during delivery is very important because they are directly related to the question of survival of the mother as well as the newborn baby. From Table 2, it was found that the percentage of women who received full ANC in India was very low i.e., 25.81% which was very shocking though in some states the percentage of women who received full ANC was high i.e. Goa (63.58%), Kerala (74.09%), Lakshadweep (80.61%) and Andaman & Nicobar Islands (55.69%). It was found that there was a positive linear relationship (Figure 1 & 2) between the full ANC and institutional delivery and skilled birth attendant during delivery in Indian states; the institutional delivery and SBA during delivery were more among those states [Goa (98.30% & 97.50%), Kerala (99.90% & 99.90%), Lakshadweep (99.20% & 100%) and Andaman & Nicobar Island (96.40% & 97.40%)] where the full percentage of women received full ANC was high compared to the other states; though it not only depends on the antenatal care but also many other factors which play a vital role for the place of delivery and the person who will deliver during delivery.

Table 2: Spatial distribution of percentage (weighted % & n) distribution of the women aged 15-49 years who had received full ANC and delivered at institution by skilled birth attendant (SBA) in India, 2015-16

States & Territory	Full ANC	Safe Delivery	
		Institutional Delivery	SBA during delivery
Andaman and Nicobar	55.69	96.40	97.40
Andhra Pradesh	48.21	92.50	92.40
Arunachal Pradesh	6.02	55.50	56.60
Assam	21.67	73.20	75.20
Bihar	5.65	66.20	70.60
Chandigarh	38.88	92.70	93.70
Chhattisgarh	22.85	72.80	78.80
Dadra and Nagar Haveli	40.89	89.40	89.70
Daman and Diu	47.19	91.50	78.20
Goa	63.58	98.30	97.50
Gujarat	38.67	89.90	88.20
Haryana	22.67	83.50	87.00
Himachal Pradesh	33.79	78.20	79.90
Jammu and Kashmir	34.82	87.10	88.60
Jharkhand	11.32	64.10	70.70
Karnataka	36.70	94.60	93.70
Kerala	74.09	99.90	99.90

Table 2: (Continued)

States & Territory	Full ANC	Safe Delivery	
		Institutional Delivery	SBA during delivery
Lakshadweep	80.61	99.20	100.0
Madhya Pradesh	13.44	82.30	78.70
Maharashtra	35.04	91.60	91.70
Manipur	39.80	72.80	80.20
Meghalaya	25.68	54.80	56.20
Mizoram	41.11	81.70	84.40
Nagaland	5.51	35.80	43.40
Delhi	41.21	87.00	88.80
Odisha	25.31	86.60	86.20
Puducherry	55.19	99.90	100.0
Punjab	33.11	92.10	94.80
Rajasthan	14.28	85.80	87.90
Sikkim	41.44	95.00	97.50
Tamil Nadu	43.44	99.20	99.20
Tripura	9.03	82.60	83.40
Uttar Pradesh	9.25	69.90	71.80
Uttarakhand	14.34	72.00	73.50
West Bengal	22.76	77.60	83.10
Telangana	44.63	92.40	91.00
India	25.81	81.12	82.69
Mean	33.27	82.89	84.16
SD	18.86	14.64	13.23

Source: National Family Health Survey-4 (2015-16), India

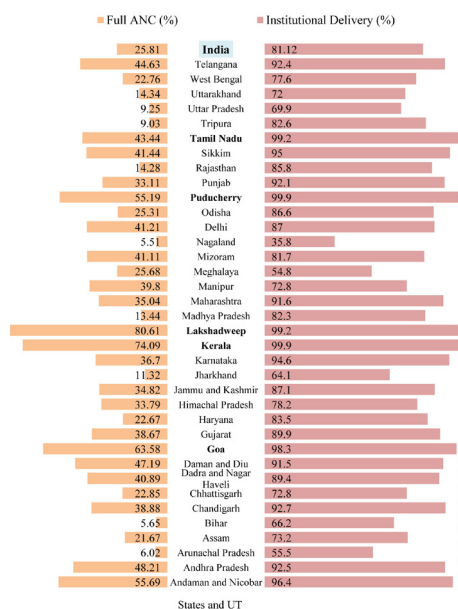
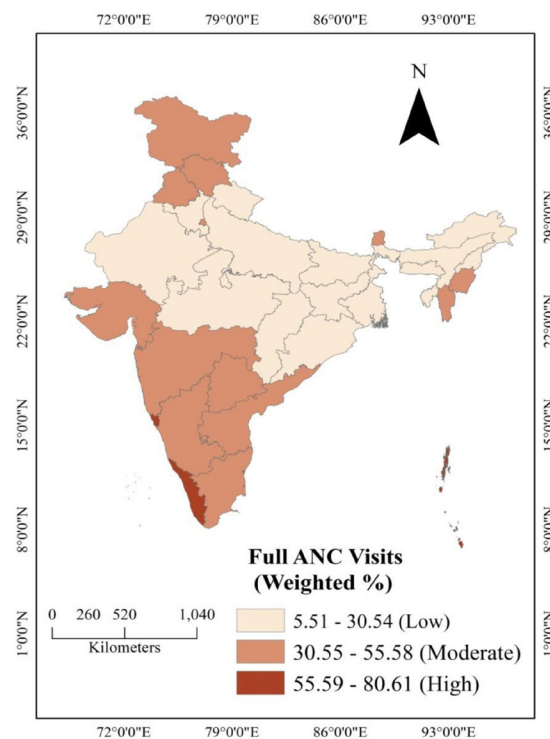


Figure 1: Percentage distribution of full ANC and institutional delivery in India, 2015-16.



Map 1: State-wise distribution of women received Full ANC in India.

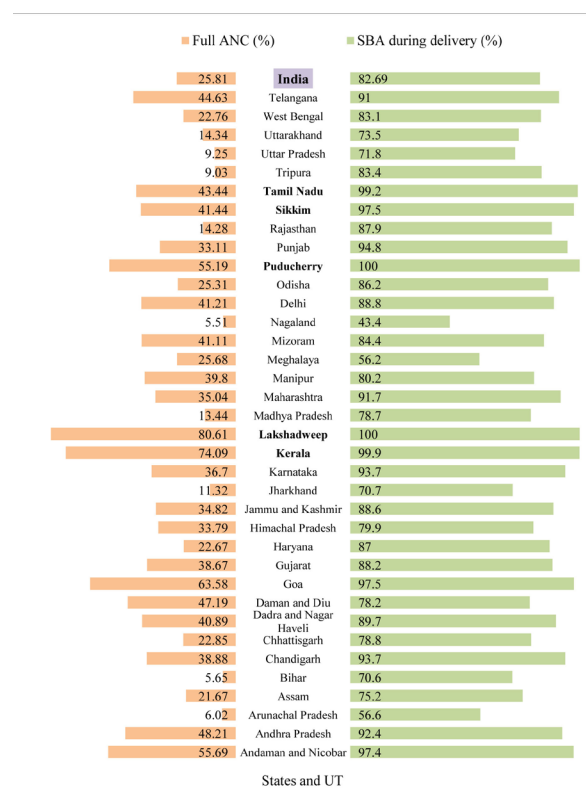
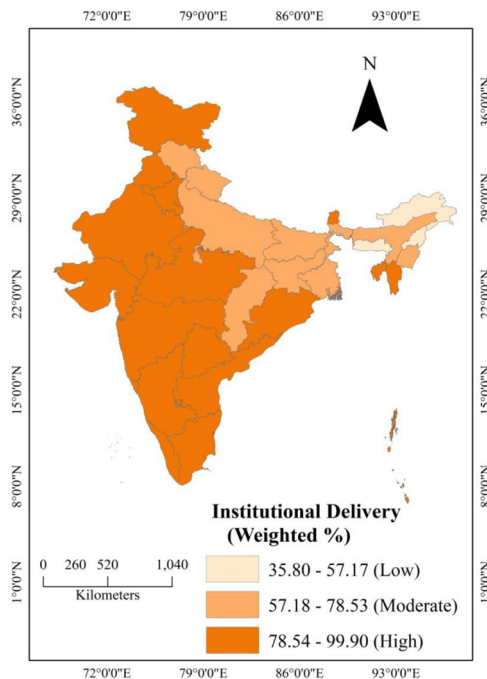
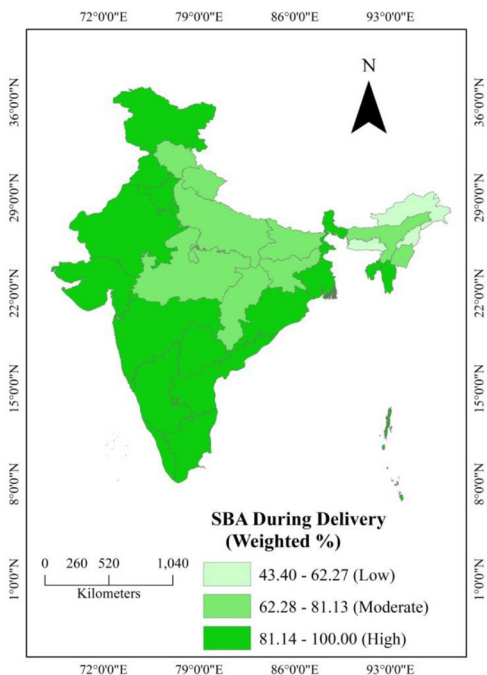


Figure 2: Percentage distribution of full ANC and SBA during delivery in India, 2015-16.



Map 2: State-wise distribution of Institutional Delivery in India.



Map 3: State-wise distribution of women delivered by SBA in India.

Table 3 showed the bivariate association between a safe delivery and the different background characteristics among the women aged 15-49 years who had at least one live birth preceding the survey in India, 2015-16 where it was found that there is a significant association between all the expla-

tory variables and outcome variables. The institutional delivery and delivered by SBA was more among those women who were received at least 4 ANC visits [(2.2e+04; 0.000), (2.3e+04; 0.000)], ANC visit within 1st trimester of pregnancy [(1.9e+04; 0.000), (1.8e+04; 0.000)], ANC from SHP [(1.9e+04; 0.000), (2.0e+04; 0.000)], two or more TT injections [(5.6e+03; 0.000), (5.8e+03; 0.000)] and 100 or more IFA tablets [(2.5e+03; 0.000), (2.6e+03; 0.000)] compare to those women who were not received all these mandatory treatment-seeking behaviour respectively.

Table 3: Bivariate association between the safe delivery and the different background characteristics among the women aged 15-49 years who had at least one live birth preceding the survey in India, 2015-16

Explanatory variables	Safe delivery			
	Place of delivery		Delivered by	
	Home	Institutional	Non-SBA	SBA
Antenatal care variables				
Received antenatal care				
No	42.71	56.67	41.16	58.84
Yes	13.83	85.95	12.57	87.43
Chi-square; p-value	1.7e+04; 0.000		1.8e+04; 0.000	
Frequent use of ANC				
No ANC	42.71	56.67	41.16	58.84
Less than 4 ANC	22.29	77.43	20.52	79.48
4 or more	8.63	91.17	7.69	92.31
Chi-square; p-value	2.2e+04; 0.000		2.3e+04; 0.000	
Timing of 1st ANC visit				
Within 1st trimester	11.75	88.01	10.75	89.25
After	18.66	81.13	16.92	83.08
Chi-square; p-value	1.9e+04; 0.000		1.8e+04; 0.000	
Skilled health provider for ANC				
No	41.30	58.12	40.06	59.94
Yes	12.65	87.13	11.37	88.63
Chi-square; p-value	1.9e+04; 0.000		2.0e+04; 0.000	
Number of TT injections				
Less than two	29.02	70.98	27.21	72.79

Table 3: (Continued)

	Safe delivery			
Explanatory variables	Place of delivery		Delivered by	
	Home	Institutional	Non-SBA	SBA
Two or more than two	16.65	83.35	15.34	84.66
Chi-square; p-value	5.6e+03; 0.000		5.8e+03; 0.000	
Number of IFA tablets				
Less than 100	17.85	82.15	16.66	83.84
100 or more than 100	8.11	91.89	7.41	92.59
Chi-square; p-value	2.5e+03; 0.000		2.6e+03; 0.000	
Individual characteristics				
Maternal age				
15-24	15.50	84.30	14.41	85.59
25-34	18.47	81.25	17.20	82.80
35-49	30.69	68.55	28.72	71.28
Chi-square; p-value	2.3e+03; 0.000		2.0e+03; 0.000	
Age at marriage				
<18 yrs	25.52	74.11	23.41	76.59
18 or 18+	13.77	85.99	13.08	86.92
Chi-square; p-value	4.0e+03; 0.000		3.7e+03; 0.000	
Birth order				
1	8.87	90.98	8.88	91.12
2	15.10	84.60	14.04	85.96
3	25.80	73.87	23.15	76.85
4 or 4+	39.89	59.54	36.85	63.15
Chi-square ; p-value	1.4e+04; 0.000		1.2e+04; 0.000	
Women's education				
Illiterate	36.16	63.44	33.33	66.67
Primary	24.31	75.34	21.99	78.01
Secondary	10.59	89.16	10.06	89.94
Higher	2.95	96.86	3.55	96.45
Chi-square; p-value	1.6e+04; 0.000		1.5e+04; 0.000	
Caste				
SC	19.33	80.32	18.18	81.82
ST	29.65	69.96	27.65	72.35
OBC	17.61	82.15	16.51	83.49

Table 3: (Continued)

Explanatory variables	Safe delivery			
	Place of delivery		Delivered by	
	Home	Institutional	Non-SBA	SBA
Others	14.19	85.49	12.88	87.12
Chi-square ; p-value	5.3e+03; 0.000		4.5e+03; 0.000	
Religion				
Hindu	16.81	82.88	15.96	84.04
Muslim	27.84	71.91	24.80	75.20
Christian	18.49	81.10	17.45	82.55
Others	7.30	92.55	5.81	94.19
Chi-square ; p-value	4.9e+03; 0.000		3.7e+03; 0.000	
Wealth Index				
Poorest	38.49	61.08	35.58	64.42
Poorer	22.84	76.83	20.93	79.07
Middle	13.10	86.61	12.31	87.69
Richer	8.05	91.73	7.65	92.35
Richest	3.75	96.07	4.03	95.97
Chi-square ; p-value	1.8e+04; 0.000		1.7e+04; 0.000	
Place of residence				
Urban	9.53	90.28	8.95	91.05
Rural	22.41	77.25	20.85	79.15
Chi-square; p-value	4.2e+03; 0.000		4.0e+03; 0.000	
Empowerment factors				
Women autonomy				
Low	20.92	78.60	20.15	79.85
Medium	17.35	82.47	16.17	83.83
High	14.36	85.17	13.51	86.49
Chi-square; p-value	78.20; 0.000		89.49; 0.000	
Mass media exposure				
No exposure	37.07	62.52	34.16	65.84
Partial exposure	13.18	86.56	12.38	87.62
Full exposure	6.93	92.86	6.73	93.27
Chi-square; p-value	1.2e+04; 0.000		1.2e+04; 0.000	

Source: Calculated by the researcher from NFHS-4 data; e+03=100; e+04=1000; ANC= Antenatal care, SBA= Skilled birth attendant, SC= Scheduled Caste, ST= Scheduled Tribes, OBC= Other Backward Class.

Table 4 depicted the results of binary logistic regression (Unadjusted model) for the association between the different antenatal care services and safe delivery (place of delivery and skilled birth attendant) where all other controlling variables were excluded in the model. The results showed that the women who received ANC visits were nearly 5 times more likely to deliver at an institution [UOR 4.831, 95% CI 4.711 - 4.954, $p = 0.000$] than the women who did not receive ANC visits. Similarly, the women who received 4 or 4+ ANC visits were 8 times more likely to deliver at an institution [UOR 8.556, 95% CI 8.298 - 8.822, $p = 0.000$] than the women who did not receive any ANC visit. The preference for institutional delivery was less among the women who received ANC visit after 1st trimester [UOR 0.592, 95% CI 0.576 - 0.609, $p = 0.000$] than the women who received ANC visit within 1st trimester. And the likelihood of institutional delivery was almost 5 times more among the women who received ANC from SHP [UOR 4.830, 95% CI 4.716 - 4.947, $p = 0.000$] than the women who were not received ANC from SHP. The likelihood of delivery at the institution was more among the women who took two or more TT injections [UOR: 2.607, 95% CI: 2.541-2.674, $p=0.000$] and who took 100 or more IFA tablets [UOR: 3.674, 95% CI: 3.172-3.946, $p=0.000$].

Another important indicator of safe delivery is skilled birth attendants during delivery which was directly associated with the proper utilization of antenatal care services. It was found that the women who received ANC visits were 5 times more likely to deliver by SBA [UOR 5.086, 95% CI 4.957 - 5.217, $p = 0.000$] than the women who did not receive ANC visits. Similarly, the women who received 4 or 4+ ANC visits were 9 times more likely to deliver by SBA [UOR 9.150, 95% CI 8.867 - 9.443, $p = 0.000$] than the women who did not receive any ANC visit. The preference for SBA for delivery was less among the women who received ANC visit after 1st trimester [UOR 0.5786, 95% CI 0.562 - 0.596, $p = 0.000$] than the women who received ANC visit within 1st trimester. And the likelihood of delivery by SBA was almost 5 times more among the women who took ANC from skilled health personnel [UOR 5.231, 95% CI 5.105 - 5.359, $p = 0.000$] than the women who did not take ANC from skilled health personnel. The likelihood of being delivered by the SBA was more among those women who took two or more TT injections [UOR: 3.681, 95% CI: 3.271-3.963, $p=0.000$] and who took 100 or more IFA tablets [UOR: 3.325, 95% CI: 3.179-3.628, $p=0.000$].

Table 4: Results of binary logistic regression model for the association (Unadjusted odds ratio) between a safe delivery and the antenatal care among the women aged 15-49 years who had at least one live birth 5 years preceding the survey in India, 2015-16

Place of delivery ((1=institutional, 0=home)				
Independent variables	UOR	p value	95% CI	
			Lower	Upper
Received ANC_No [®]	1.00			
Yes	4.831	0.000	4.711	4.954
Frequent use of ANC visit_No ANC [®]	1.00			
Less than 4 ANC visit	2.824	0.000	2.746	2.903
4 or 4+ ANC visit	8.556	0.000	8.298	8.822
Timing of ANC visit_Within 1st trimester [®]	1.00			
After 1st trimester	0.592	0.000	0.576	0.609
Health care provider for ANC_Non SHP [®]	1.00			
Skilled Health Provider	4.830	0.000	4.716	4.947
TT injection_less than two [®]	1.00			
Two or more than two	2.607	0.000	2.541	2.674
IFA tablets_less than 100 [®]	1.00			
100 or above	3.674	0.000	3.172	3.946
Delivered by (1=skilled birth attendant, 0=non-skilled birth attendant)				
Received ANC_No [®]	1.00			
Yes	5.086	0.000	4.957	5.217
Frequent use of ANC visit_No ANC [®]	1.00			
Less than 4 ANC visit	2.969	0.000	2.887	3.054
4 or 4+ ANC visit	9.150	0.000	8.867	9.443
Timing of ANC visit_Within 1st trimester [®]	1.00			
After 1st trimester	0.578	0.000	0.562	0.596
Health care provider for ANC_Non SHP [®]	1.00			
Skilled Health Provider	5.231	0.000	5.105	5.359
TT injection_less than two [®]	1.00			
Two or more than two	3.681	0.000	3.271	3.963
IFA tablets_less than 100 [®]	1.00			
100 or above	3.325	0.000	3.179	3.628

Source: Calculated by the researcher from NFHS-4 data; [®]=Reference category, CI=Confidence Interval, AOR=Adjusted odds ratio, ANC= Antenatal Care, SHP= Skilled Health Provider, TT= Tetanus Toxoid, IFA= Iron and Folic Acid

Table 5 shows the result of binary logistic regression (Adjusted model) for the association between safe delivery (place of delivery and skilled birth attendant during delivery) and different antenatal care services where the effect of other controlling variables i.e. maternal age, age at marriage, birth order, women's education, caste, religion, wealth index, place of residence and mass media also included. The adjusted model depicts that though there was a significant contribution of other controlling variables, the impact of antenatal care on safe delivery (institutional delivery and skilled birth attendant during delivery) is significant. The table shows that there was a high likelihood of being delivered to a health facility by a skilled birth attendant among those women who were taken at least 4 or more ANC visits [AOR: 1.969, 95% CI: 1.906-2.034, $p=0.000$], who took their ANC visit within the first trimester of pregnancy, who took antenatal care from SHP [AOR: 1.918, 95% CI: 1.821-2.021, $p=0.000$], who took two or more TT injections [AOR: 1.973, 95% CI: 1.890-2.137, $p=0.000$] and who took 100 or more IFA tablets [AOR: 1.894, 95% CI: 1.764-2.318, $p=0.000$]. In same way the delivery by SBA was more among those women who were took at least 4 or more ANC visits [AOR: 1.984, 95% CI: 1.918-2.052 & $p=0.000$], who were took their ANC visit within first trimester of pregnancy, who took antenatal care from SHP [AOR: 2.230, 95% CI: 2.117-2.348, $p=0.000$], who took two or more TT injections [AOR: 1.908, 95% CI: 1.739-2.207, $p=0.000$] and who took 100 or more IFA tablets [AOR: 1.991, 95% CI: 1.694-2.348, $p=0.000$].

Table 5: Results of binary logistic regression model for the association (adjusted odds ratio) between a safe delivery and the antenatal care among the women aged 15-49 years who had at least one live birth 5 years preceding the survey in India, 2015-16

Place of delivery ((1=institutional, 0=home)				
Independent variables	AOR	p value	95% CI	
			Lower	Upper
Frequent use of ANC visit_No ANC [®]	1.00			
4 or 4+ ANC visit	1.969	0.000	1.906	2.034
Timing of ANC visit_ Within 1st trimester [®]	1.00			
After 1st trimester	0.914	0.000	0.885	0.944
Health care provider for ANC_Non SHP [®]	1.00			
Skilled Health Provider	1.918	0.000	1.821	2.021
TT injection_less than two [®]	1.00			
Two or more than two	1.973	0.000	1.890	2.137
IFA tablets_less than 100 [®]	1.00			
100 or above	1.894	0.000	1.764	2.318

Table 5: (Continued)

Place of delivery ((1=institutional, 0=home)				
Independent variables	AOR	p value	95% CI	
			Lower	Upper
Delivered by (1=skilled birth attendant, 0=non-skilled birth attendant)				
Frequent use of ANC visit_No ANC [®]	1.00			
4 or 4+ ANC visit	1.984	0.000	1.918	2.052
Timing of ANC visit_ Within 1st trimester [®]	1.00			
After 1st trimester	0.887	0.000	.858	0.917
Health care provider for ANC_Non SHP [®]	1.00			
SHP	2.230	0.000	2.117	2.348
TT injection_less than two [®]	1.00			
Two or more than two	1.908	0.000	1.739	2.207
IFA tablets_less than 100 [®]	1.00			
100 or above	1.991	0.000	1.694	2.348

Source: Calculated by the researcher from NFHS-4 data; [®]=Reference category, CI=Confidence Interval, AOR=Adjusted odds ratio, ANC= Antenatal Care, SHP= Skilled Health Provider, TT= Tetanus Toxoid, IFA= Iron and Folic Acid, #In adjusted model controlled variables were maternal age, age at marriage, birth order, women's education, caste, religion, wealth index, place of residence and mass media.

DISCUSSION

The present study has examined the role of antenatal care services for safe delivery among Indian mothers using the latest round of data from the National Representative Survey. Our study also provides the association between the respondent's safe delivery and utilization of antenatal care services (received ANC, frequent use of ANC, the timing of 1st ANC visit and skilled health provider for ANC) & different background characteristics (such as age, age at marriage, birth order, women's education, caste, religion, wealth index, place of residence, women autonomy and mass media exposure). According to NFHS-4 (2015-16) in India, 84% of women (aged 15-49) received ANC, 79% received ANC from a skilled provider, and 59% of women had their first ANC visit during the first trimester of pregnancy and 51% had four or more ANC visits.^{6,7,24,25} As in other previous studies, this study also reveals a positive effect on the frequency and the content/quality of antenatal visits on the use of skilled attendant during delivery.^{26,27,28} The propensity of choosing an institution for delivery is high among women who have received antenatal services.^{29,30} Those mothers who had four or more antenatal care visits were almost two times more

likely to deliver through skilled birth attendants than those mothers who had less than four antenatal care services.^{28,30,31} This is because frequently visits to skilled health providers enhance the knowledge regarding pregnancy and delivery-related complications, newborn health, postnatal care etc.^{25,27,30} Bivariate analyses show that women's current age plays an important role in the utilization of medical services. The younger women (18-20 age group) are more likely to utilize full ANC services than the older ones, as a result, the likelihood of institutional delivery or chances of safe delivery is also high among them.^{26,31,32,33} Our findings show a significant association between birth order and the likelihood of institutional delivery. Generally, mothers with high levels of fertility are less energetic and apathetic regarding the utilization of safe delivery and have a more preference for home delivery, maybe it can happen due to increase confidence from a previous pregnancy and childbirth experience.^{29,33,36} There is an immense difference between rural and urban places regarding the utilization of antenatal care services and urban women had a higher knowledge about ANC services than their rural counterparts.^{20,24,28} Poverty is one of the factors that hinder the utilization of antenatal care services.²⁴ Increased income has a positive effect on the utilization of modern health care services and low income and the cost of services are important constraints on service utilization.^{29,37} Economic status influences peoples' choice between private and public health services. Wealthy women were more likely to go for institutional deliveries.^{6,24,38} While differences in education levels of mothers affect ANC usage, high utilization of antenatal care facilities is associated with a high literacy rate. It is well recognized that a woman's educational level has a positive impact on health care utilization by increasing female decision-making power and increasing awareness about health services.^{5,6,36} Another important covariate is mass media exposure which increases awareness about institutional delivery. Exposure to mass media or listening to the radio/reading newspapers and magazines affects the use of safe delivery services positively.⁷ The proportion of institutional delivery was more among the women who were fully exposed to mass media than the women who were never exposed to mass media and our study found the same result. Women of high autonomy or who have high decision-making power are more likely to be assisted by a skilled birth attendant at childbirth.^{7,39,40} Cultural beliefs and ideas about pregnancy also had an influence on pregnant women regarding ANC use which may lead to attending ANC visits late or not attending at all.^{6,7,24}

CONCLUSION

So it is to be said that different socio-demographic factors affect the utilization of antenatal care services. The main reasons for the non-utilization of antenatal care services are

lack of education and finances. Empowering women through education should be one of the most fundamental strategies to promote both maternal and newborn health. Community engagement and social awareness also play a very crucial role to enhance maternal health. So Government should take initiatives and effective policies regarding maternal health care services and some investments are also required to educate and empower poor women to improve maternal and child health.

ACKNOWLEDGEMENT

The authors want to acknowledge the contribution of NFHS-4 data conducted by IIPS, Mumbai.

Conflict of interest: The authors declare that they have no competing interest.

Author's contribution: I declare that it is an original research work which was carried out under the guidance of Professor Pradip Chouhan. He fully suggested me for do the necessary correction, helped me to writing the manuscript and then he proof read the manuscript.

Source of Funding: The authors declare that no funding has been required.

REFERENCES

1. Adewemimo AW, Msuya SE, Olaniyan CT, Adegoke AA. Utilisation of skilled birth attendance in Northern Nigeria: a cross-sectional survey. *Midwifery*. 2014 Jan 1;30(1):e7-13.
2. Agus Y, Horiuchi S. Factors influencing the use of antenatal care in rural West Sumatra, Indonesia. *BMC pregnancy and childbirth*. 2012 Dec;12(1):1-8.
3. Alemayehu M, Mekonnen W. The prevalence of skilled birth attendant utilization and its correlates in North West Ethiopia. *BioMed research international*. 2015 Oct 4;2015.
4. Amano A, Gebeyehu A, Birhanu Z. Institutional delivery service utilization in Munisa Woreda, South East Ethiopia: a community based cross-sectional study. *BMC pregnancy and childbirth*. 2012 Dec;12(1):1-6.
5. Barman B, Saha J, Chouhan P. Impact of education on the utilization of maternal health care services: An investigation from National Family Health Survey (2015–16) in India. *Children and Youth Services Review*. 2020 Jan 1;108:104642.
6. Barman B, Roy A, Zaveri A, Saha J, Chouhan P. Determining factors of institutional delivery in India: A study from National Family Health Survey-4 (2015–16). *Clinical Epidemiology and Global Health (CEGH)*. 2020 Dec 1;8(4):1335-40.
7. Barman B, Mallick R, Chouhan P, Majumder K. Does Media Exposure Affect the Utilization of Maternal Health Care Services? A Query from a Nationally Representative Survey of India. *J. Geogr. Sci*. 2021 5(2), 65-78.
8. Barber S. Does the quality of prenatal care matter in promoting skilled institutional delivery? A study in rural Mexico. *JMCH*. 2006 Sep;10(5):419-25.
9. Bloom SS, Lippeveld T, Wypij D. Does antenatal care make a difference to safe delivery? A study in urban Uttar Pradesh, India. *Health policy and planning*. 1999 Jan 1;14(1):38-48.

10. Celik Y, Hotchkiss DR. The socio-economic determinants of maternal health care utilization in Turkey. *Soc. Sci. Med.* 2000 Jun 1;50(12):1797-806.
11. Costello MA, Lleno LC, Jensen ER. Determinants of two major early-childhood diseases and their treatment in the Philippines: Findings from the 1993 National Demographic Survey. East-West Center, Program on Population; 1996 Aug 1.
12. Cumber SN, Diale DC, Stanly EM, Monju N. Importance of antenatal care services to pregnant women at the Buea regional hospital Cameroon. *J Fam Med Health Care.* 2016 Nov 2;2(4):23-9.
13. De Allegri M, Ridde V, Louis VR, Sarker M, Tiendrebéogo J, Yé M, et al. Determinants of utilisation of maternal care services after the reduction of user fees: a case study from rural Burkina Faso. *Health policy.* 2011 Mar 1;99(3):210-8.
14. Doctor HV. Intergenerational differences in antenatal care and supervised deliveries in Nigeria. *Health & place.* 2011 Mar 1;17(2):480-9.
15. Feyissa TR, Genemo GA. Determinants of institutional delivery among childbearing age women in Western Ethiopia, 2013: unmatched case control study. *PloS one.* 2014 May 8;9(5):e97194.
16. Fosu GB. Childhood morbidity and health services utilization: cross-national comparisons of user-related factors from DHS data. Nigeria. *Health & place.* 1994 May 1;38(9):1209-20.
17. Salam A, Siddiqui SA. Socioeconomic inequalities in use of delivery care services in India. *J Obstet Gynecol India.* 2006 Mar;56(2):123-7.
18. Gage AJ. Barriers to the utilization of maternal health care in rural Mali. *Soc. Sci. Med.* 2007 Oct 1;65(8):1666-82.
19. Guliani H, Sepehri A, Serieux J. What impact does contact with the prenatal care system have on women's use of facility delivery? Evidence from low-income countries. *Soc. Sci. Med.* 2012 Jun 1;74(12):1882-90.
20. Hagos S, Shaweno D, Assegid M, Mekonnen A, Afework MF, Ahmed S. Utilization of institutional delivery service at Wukro and Butajera districts in the Northern and South Central Ethiopia. *BMC pregnancy and childbirth.* 2014 Dec;14(1):1-1.
21. Houweling TA, Ronsmans C, Campbell OM, Kunst AE. Huge poor-rich inequalities in maternity care: an international comparative study of maternity and child care in developing countries. *Bull. World Health Organ.* 2007 Oct;85(10):745-54.
22. Kaul S, You W, Boyle KJ. Delivery at home versus delivery at a health care facility—a case study of Bihar, India. 2012.
23. Pallikadavath S, Foss M, Stones RW. Antenatal care: provision and inequality in rural north India. *Soc. Sci. Med.* 2004 Sep 1;59(6):1147-58.
24. Paul P. Effects of education and poverty on the prevalence of girl child marriage in India: A district-level analysis. *Child. Youth Serv. Rev.* 2019 May 1;100:16-21.
25. Paul P, Chouhan P. Socio-demographic factors influencing utilization of maternal health care services in India. *Clinical Epidemiology and Global Health (CEGH).* 2020 Sep 1;8(3):666-70.
26. Kishk NA. Knowledge, attitudes and practices of women towards antenatal care: rural-urban comparison. *J Egypt Public Health Assoc.* 2002 Jan 1;77(5-6):479-98.
27. Letamo G, Majelantle R. Factors influencing low birth weight and prematurity in Botswana. *J. Biosoc. Sci.* 2001 Jul;33(3):391-403.
28. Ansariadi A, Manderson L. Antenatal care and women's birthing decisions in an Indonesian setting: does location matter? Rural and remote health. 2015 Jun 1;15(2):45-61.
29. Asmeret MM. Levels and determinants of use of institutional delivery care services among women of childbearing age in Ethiopia: analysis of EDHS 2000 and 2005 data. Demographic and health surveys. USAID. 2013.
30. Mohammed BH, Johnston JM, Harwell JI, Yi H, Tsang KW, Haidar JA. Intimate partner violence and utilization of maternal health care services in Addis Ababa, Ethiopia. *BMC health services research.* 2017 Dec;17(1):1-0.
31. Mrisho M, Obrist B, Schellenberg JA, Haws RA, Mushi AK, Mshinda H, et al. The use of antenatal and postnatal care: perspectives and experiences of women and health care providers in rural southern Tanzania. *BMC pregnancy and childbirth.* 2009 Dec;9(1):1-2.
32. Nielsen BB, Liljestrand J, Thilsted SH, Joseph A, Hedegaard M. Characteristics of antenatal care attenders in a rural population in Tamil Nadu, South India: a community-based cross-sectional study. *Health Soc Care Community.* 2001 Nov;9(6):327-33.
33. Nikiéma B, Beninguise G, Haggerty JL. Providing information on pregnancy complications during antenatal visits: unmet educational needs in sub-Saharan Africa. *Health policy and planning.* 2009 Sep 1;24(5):367-76.
34. Rai RK, Singh PK, Singh L. Utilization of maternal health care services among married adolescent women: insights from the Nigeria Demographic and Health Survey, 2008. *Women's Health Issues.* 2012 Jul 1;22(4):e407-14.
35. Rockers PC, Wilson ML, Mbaruku G, Kruk ME. Source of antenatal care influences facility delivery in rural Tanzania: a population-based study. *JMCH.* 2009 Nov;13(6):879-85.
36. Smith ME, Tawiah EO, Badasu DM. Why some women deliver in health institutions and others do not: A cross sectional study of married women in Ghana, 2008. *Afr. J. Reprod. Health.* 2012 Sep 1;16(3):35-46.
37. Stanton C, Blanc AK, Croft T, Choi Y. Skilled care at birth in the developing world: progress to date and strategies for expanding coverage. *J. Biosoc. Sci.* 2007 Jan;39(1):109-20.
38. Stephenson R, Baschieri A, Clements S, Hennink M, Madise N. Contextual influences on the use of health facilities for childbirth in Africa. *Am. J. Public Health.* 2006 Jan;96(1):84-93.
39. Unicef. Trends in maternal mortality: 1990 to 2013. Geneva: World Health Organization; 2014.
40. Wilunda C, Quaglio G, Putoto G, Takahashi R, Calia F, Abebe D, et al. Determinants of utilisation of antenatal care and skilled birth attendant at delivery in South West Shoa Zone, Ethiopia: A cross sectional study. *Reprod. Health.* 2015 Dec;12(1):1-2.