Dissertation Training

at

Wadhwani Institute for Artificial Intelligence

(A Unit of National Entrepreneurship Network)

Role of males in the utilization of maternal healthcare services among EAG states in India, 2019-21

by

Ishita Maji

PG/21/039

Under the guidance of

Dr. Pijush Kanti Khan

PGDM (Hospital & Health Management) 2021-23

International Institute of Health Management Research New Delhi

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ABSTRACT

Background: Maternal mortality is a critical health indicator. By 2022, MMR decreased to 97/100,000 live births (SRS). Efforts to enhance maternal and newborn care have prioritised antenatal care, pregnant women's nutrition, and promoting a dignified delivery experience. The Government of India has actively implemented various national health programs and schemes to address these objectives and reduce maternal mortality. Engaging partners in using maternal health services continues to be a significant public concern in developing countries. Involving men in maternal healthcare is an essential and proven intervention to reduce maternal and newborn mortality by ensuring safe delivery and minimizing childbirth complications. **Aim:** The study aims to gather data on the impact of attitudes and male involvement in availing or fully utilizing maternal healthcare services, incredibly complete ANC and institutional deliveries, from all EAG states. **Methodology:** This study utilized data from the NFHS-5 conducted in 2019-20, which collected information at the individual level. The survey covered men (15 to 59 years) and women (15 to 49 years) and focused on the EAG states. **Results:** The findings indicate that 49.16% of women attended at least four ANC visits when their male partners were not present, while 66.00% attended at least four ANC visits when their male partners were present. Among women whose male partners were absent during ANC visits, 84.29% chose institutional delivery. In contrast, when male partners were present during ANC visits, women opting for institutional delivery significantly increased to 92.35%. Approximately 33.31% of women whose male partners were absent during ANC visits adhered to the recommended IFA supplement intake. However, among women whose male partners were present during ANC visits, a higher percentage of approximately 47.46% complied with the recommended IFA supplement intake. **Discussion:** These results indicate that women with male partners present during ANC visits were more likely to attend at least four ANC sessions than women whose partners were not present. Partners during ANC visits are associated with a higher likelihood of women opting for institutional delivery. The involvement and support of male partners

seem to play a positive role in influencing women's decision-making and choices regarding delivery options, favouring institutional settings for childbirth. Better utilization of maternal healthcare services in the Non-EAG states, with more women receiving adequate antenatal care during their pregnancies. Addressing barriers to ANC utilization and promoting awareness about the importance of regular antenatal visits could help bridge this gap and enhance maternal and child health outcomes in the EAG states. **Conclusion:** Overall, the study offers insightful information about how men's participation in maternal healthcare services in EAG states affects such services. By utilizing this data, decision-makers and healthcare professionals may develop focused interventions that will enhance maternal health outcomes and achieve the SDGs for maternity care by 2030. In India, improving mother and child health and lowering maternal mortality can be accomplished by highlighting the value of male partners in maternal healthcare.

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5-May-2023

To Whomsoever It May Concern

This is to certify that Ishita Maji was associated with Artificial Intelligence Unit of National Entrepreneurship Network (hereon referred to as NEN-AI), Mumbai office from 6-February-2023 to 5-May-2023.

She was designated as a Program Intern, during her relieving. We wish her all the best in her future endeavors.

Best Regards,

Shekar Sivasubramanian
Chief Executive Officer

Ishita Maji

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TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Ishita Maji** student of PGDM (Hospital & Health Management) from International Institute of Health Management Research, New Delhi has undergone internship training at **Wadhwani AI** from **6th February 2023** to **5th May 2023**.

The Candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish her all success in all her future endeavors.

Dr. Sumesh Kumar

Associate Dean, Academic and Student Affairs

IIHMR, New Delhi

Dr. Pijush Kanti Khan

Assistant Professor

IIHMR, New Delhi

Certificate of Approval

The following dissertation titled **"ROLE OF MALES IN THE UTILIZATION OF MATERNAL HEALTHCARE SERVICES AMONG EAG STATES IN INDIA, 2019-21"** at **"WADHWANI INSTITUTE FOR ARTIFICIAL INTELLIGENCE"** is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of **PGDM (Hospital & Health Management)** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation.

Name	Signature
PRAVEEN KUMAR	
VIBEY	
SUKESH BHARDWAJ	

Certificate from Dissertation Advisory Committee

This is to certify that **Ms. Ishita Maji**, a graduate student of the **PGDM (Hospital & Health Management)** has worked under our guidance and supervision. ~~He/~~ She is submitting this dissertation titled "**ROLE OF MALES IN THE UTILIZATION OF MATERNAL HEALTHCARE SERVICES AMONG EAG STATES IN INDIA, 2019-21**" at "**WADHWANI INSTITUTE FOR ARTIFICAL INTELLIGENCE**" in partial fulfillment of the requirements for the award of the **PGDM (Hospital & Health Management).**

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

Dr. Pijush Kanti Khan,
Assistant Professor,
IIHMR, Delhi

Dr. Sneha Nikam
Program Manager,
Wadhwani AI

INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT RESEARCH,
NEW DELHI

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **Role of males in the utilization of maternal healthcare services among EAG states in India, 2019-21** and submitted by **Ishita Maji** Enrollment No. **PG/21/039** under the supervision of **Dr. Pijush Kanti Khan** for award of PGDM (Hospital & Health Management) of the Institute carried out during the period from 6th February 2023 to 5th May 2023 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Ishita Maji

Signature

8

FEEDBACK FORM

Name of the Student: Ishita Maji

Name of the Organization in Which Dissertation Has Been Completed: Wadhwani AI

Area of Dissertation: Maternal and Child Health

Attendance: >90%

Objectives achieved: Ensured proper programmatic management of the solution and its government outreach.

Deliverables:

1. Created Training manual for U6A – Anthropometric Measurements.
2. Drafted script for GIFs and Video capturing based on the Training manual of U6A.
3. Field visit to Bhilwara (Phase II) to explore ways to capture video to be used for ML model training.
4. Follow up with WCD office Delhi, Rajasthan, Jharkhand.
5. Field visit to WCD Ranchi and RIMS Ranchi for approvals.
6. List of partnerships required for different AI solutions in Wadhwani AI.

Strengths:

1. Ishita has good knowledge and technical expertise, compared to her limited experience.
2. She is very passionate about her work and is really prompt, hardworking and sincere in her assignments
3. She has showcased good communication skills while coordinating with our critical stakeholders
4. Overall she has an attitude to learn which will go a long way for her

Suggestions for Improvement:

1. She can improve her documentation skills, needs little guidance on it.
2. She requires more mentoring to understand the minute aspects of program implementation & research which I am sure she will gain with experience, given her inclination towards learning

Suggestions for Institute (course curriculum, industry interaction, placement, alumni):

Overall we are very happy with Ishita's performance which is an indicator that the institute has mentored & trained the students well

Signature: Dr Sneha Nikam

Date: 25.07.2023

Place: New Delhi

ACKNOWLEDGEMENT

I am incredibly thankful to **Dr. Sneha Nikam**, **Dr. Dhwani Almaula**, and **Vijayalakshmi Raghavan** for generously sharing their valuable insight and guiding me throughout, which helped me to give my best during the internship.

My learnings regarding the internship would not have been possible without the discussions with the entire MNCH team members at **Wadhwani AI (A Unit of National Entrepreneurship Network).** I would also like to express my gratitude for providing timely guidance, inspiration and unconditional support during the summer training.

Mentors in IIHMR

I am incredibly grateful to **Dr. Pijush Kanti Khan** and all the faculty members for giving me this opportunity to learn and add to my fruitful experience. Without their cooperation and guidance, conducting my study and completing my internship would not have been possible.

ABBREVIATION

MMR = Maternal Mortality Ratio

SRS = Sample Registration System

UN = United Nations

SDG = Sustainable Development Goals

WHO = World Health Organization

RMNCH = Reproductive, Maternal, Newborn, and Child Health Care

PMMVY = Pradhan Mantri Matru Vandana Yojana

SUMAN = Surakshit Matritva Anushasan

LaQshya = Labour Room & Quality Improvement Initiative

JSSK = Janani Shishu Suraksha Karyakram

JSY = Janani Suraksha Yojana

ANC = Antenatal Care

EAG = Empowered Action Group

NFHS = National Family Health Survey

CI = Confidence Interval

OR = Odds Ratio

IFA = Iron Folic Acid

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INTRODUCTION

Maternal mortality is a critical health indicator. India has been deeply concerned about maternal mortality, continuously striving to improve maternal health and lower the Maternal Mortality Ratio (MMR). The latest data from the National Sample Registration System (SRS) statistics reveal that India's MMR for 2016-18 stands at 113/100,000 live births, showing a decrease of 17 points from the previous figure of 130/100,000 live births in 2014-16. (1) By 2022, MMR decreased to 97/100,000 live births (SRS). (2)

The Indian government has aligned itself with the Sustainable Development Goals (SDGs) set by the United Nations (UN), which aim to achieve a maternal mortality ratio (MMR) of less than 70 deaths/100,000 live births by 2030 globally. (3) In 2017, approximately 24 million babies were born in India, and tragically, around 35,000 women lost their lives during or shortly after childbirth, resulting in an MMR of 145 per 100,000 live births, which accounted for about 12% of maternal deaths worldwide. On a positive note, WHO reports a significant global decrease in MMR, from 342 in 2000 to 211 in 2017, leading to a decline in maternal mortality from 451,000 to 295,000 during this period. Notably, India's efforts to reduce maternal deaths contributed to about 40% of this decline. (4)

Pregnancy-related complications are the primary cause of mortality among women aged 15-49, particularly for those aged 15-19. Serious complications account for nearly two-thirds of all maternal deaths, encompassing conditions such as severe postpartum bleeding, infections, high blood pressure during pregnancy leading to pre-eclampsia and eclampsia, unsafe abortions, and difficulties during childbirth. (1)

Enhancing the continuum of reproductive, maternal, newborn, and child health care (RMNCH)

services is a crucial step, as the WHO recommends, to leverage government-led initiatives to reduce maternal and child mortality. Antenatal care (ANC) plays a pivotal role in this process by providing pregnant women with valuable knowledge about safe pregnancy practices from qualified medical professionals, facilitating a deeper understanding of pregnancy and childbirth warning signs, and offering essential social, emotional, and psychological support when required. ANC also offers vital services, including tetanus vaccinations, hypertension management to prevent eclampsia, vitamin supplementation, and other necessary medical care during pregnancy. Additionally, ANC includes services such as HIV testing and interventions to prevent mother-to-child transmission of the virus. (5)

Efforts to enhance maternal and newborn care have prioritized antenatal care, pregnant women's nutrition, and promoting a dignified delivery experience. The Government of India has actively implemented various national health programs and schemes to address these objectives and reduce maternal mortality.

For example, the Pradhan Mantri Surakshit Matritva Abhiyan focuses on providing comprehensive and high-quality antenatal care at no cost while improving the accessibility and quality of diagnostic and counselling services. The government's flagship initiative to improve nutritional outcomes, POSHAN Abhiyaan, has been launched. Additionally, the Pradhan Mantri Matru Vandana Yojana (PMMVY) program offers financial assistance to pregnant women, ensuring they can meet their increased nutritional needs and partially compensate for any wage loss during pregnancy. These initiatives aim to alleviate financial burdens and support pregnant women throughout their pregnancy journey. (6)

Ensuring a positive childbirth experience for pregnant women has become a critical focus through initiatives such as the Surakshit Matritva Anushasan (SUMAN) and the Labour Room & Quality

Improvement Initiative (LaQshya). The primary goal of SUMAN is to eliminate all preventable maternal and newborn deaths and complications by providing guaranteed, dignified, and respectful delivery of high-quality healthcare services at no cost, with zero tolerance for service rejection, to all women and newborns seeking care at public health institutions. The success of previous programs like Janani Shishu Suraksha Karyakram (JSSK) and Janani Suraksha Yojana (JSY) has laid the groundwork for these initiatives aimed at improving maternal health. (6)

Engaging partners in using maternal health services continues to be a significant public concern in developing countries. Involving men in maternal healthcare is an essential and proven intervention to reduce maternal and newborn mortality by ensuring safe delivery and minimizing childbirth complications. Additionally, husbands' involvement during pregnancy helps their wives make timely decisions and prevent delays in accessing maternal care. (6)

Both increased husband involvement in maternal healthcare and improved female autonomy are effective strategies to enhance the use of maternal healthcare. (7) Recently, the Indian government has actively involved men in maternal health care. WHO also recommends measures to promote men's engagement during pregnancy, labour, and the postnatal period. (8) In 2008, more than 358,000 women lost their lives due to pregnancy and childbirth-related causes, with a majority of these deaths occurring in South Asia and Sub-Saharan Africa, contributing to about 83% of the total. Limited research from Nepal and southwest Ethiopia has indicated that the support and participation of husbands in ANC have shown positive effects on ANC utilization. Studies have demonstrated that husbands' involvement during pregnancy was associated with improved maternal health outcomes, particularly in rural Nepalese women. (6), (9)

India is predominantly composed of patriarchal societies, wherein the decisions made by male household members influence women's needs and well-being. The knowledge and awareness of pregnancy-related issues among husbands positively influence women's proper utilization of

maternal health care services. A study conducted in the rural Gadchiroli district of Maharashtra found that men who knew about pregnancies, childbirth, and postpartum challenges were more inclined to encourage and support their wives in utilizing all available maternal health services. (10)

In a community-based observational cross-sectional study conducted on husbands of expectant women at an urban health centre in Mumbai's Malvani slum community, it was found that a significant proportion of husbands, 67.4%, exhibited a positive attitude towards involvement in ANC. In comparison, 32.6% had a negative attitude. The husbands' knowledge of specific aspects of ANC, such as tetanus toxoid, routine blood tests, early pregnancy registration, and increased dietary needs, was reported at 35%, 45%, 51%, and 65%, respectively. The husband's attitude towards participating in their wife's ANC is influenced by factors such as their level of education, occupation, distance from the healthcare facility, time spent there, and the attitude of the healthcare professionals. (11)

Spouses who possess an awareness of pregnancy and birthing issues are more likely to utilize maternal health care services provided by the government. Therefore, educating and empowering men with knowledge about pregnancy complications becomes crucial in reducing maternal and newborn mortality. Improving the husband's understanding and attitude towards ANC is vital for early detection and prompt referral of pregnancy-related problems.

Given the current state of maternal health in India, particularly in EAG states (Empowered Action Group), enhancing performance and involving men in maternal health-related activities is paramount. In order to achieve the maternal health SDGs by 2030, the active engagement of males is essential. Educating spouses about maternal care and encouraging their presence during antenatal visits could improve maternal health outcomes in India. Strengthening the agenda of husband involvement in maternal health care is crucial to attaining the SDGs for maternal care.

The study aims to gather data on the impact of attitudes and male involvement in availing or fully utilizing maternal healthcare services, incredibly complete ANC and institutional deliveries, from all EAG states. This data will contribute to observing the effectiveness of involving men in maternal health services and its implications on maternal and child health outcomes.

METHODOLOGY

Data

This study utilized data from the NFHS-5 conducted in 2019-20, which collected information at the individual level. The survey covered men (15 to 59 years) and women (15 to 49 years) and focused on the EAG states. The data on men's involvement in maternal care was obtained from the survey's kid's file.

Key variables

The main variables of interest in the study were the frequency of ANC visits, institutional delivery, place of delivery, and the usage of iron-folic acid (IFA) tablets for 100 days. ANC visits were categorized into two groups: less than four contacts and four or more contacts. The key independent variables were male partner attendance during ANC visits and the classification of states under the EAG.

The study aimed to explore the relationship between male partner attendance during ANC visits and the utilization of maternal health services. Those responding affirmatively about being present with their partners during ANC visits were assigned a value of 1, while those responding negatively to the question were assigned a value of 0.

After controlling for various factors such as women's socio-demographic characteristics (age, age at

marriage, caste, education, religion), male partners' socio-demographic factors (education and age), and household factors (place of residence, household wealth index, EAG state), the study identified a significant association between male partner attendance during ANC visits and maternal health service utilization.

Statistical analyses

The study employed descriptive data and multivariable logistic regression analysis to understand the relationship between male partners attending ANC and using maternal health services. The OR and 95% CI were used to present the findings. The statistical software Stata SE version 14.2 was used for data analysis. Since the sample design is complex, survey weights were applied to generate representative estimates.

RESULTS

The data presents the percentage of women who attended at least four ANC visits based on whether their male partner was present during these visits. The findings indicate that 49.16% of women attended at least four ANC visits when their male partners were not present, while 66.00% attended at least four ANC visits when their male partners were present (**Fig. 1**).

The presence of male partners during ANC visits appears to be positively associated with higher utilization of antenatal care services, potentially leading to improved maternal and child health outcomes.

Fig. 1. Male partner's attendance for women with at least 4 ANC visits (%)

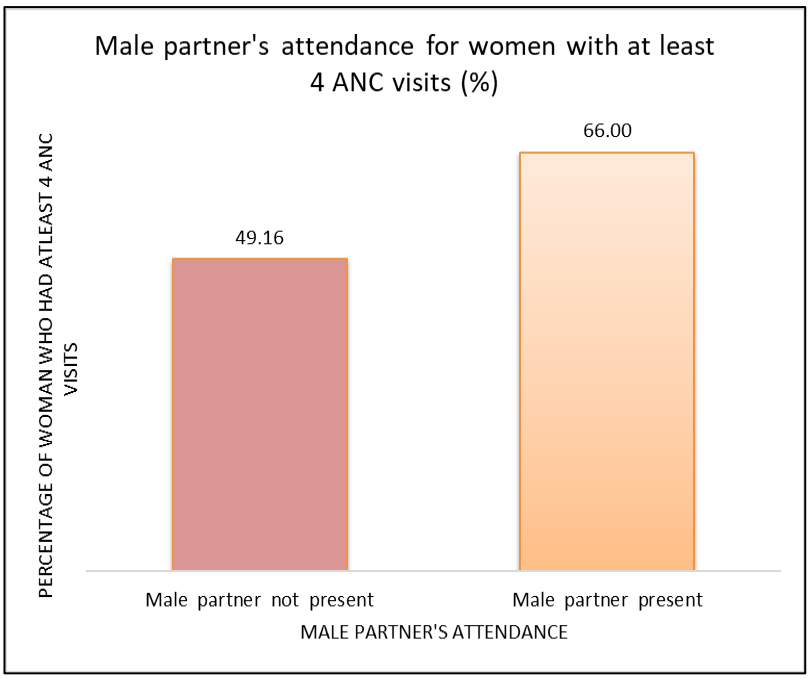


Fig. 2 illustrates a clear correlation between male partner attendance during ANC visits and the percentage of women opting for institutional delivery. Among women whose male partners were absent during ANC visits, 84.29% chose institutional delivery. In contrast, when male partners were present during ANC visits, women opting for institutional delivery significantly increased to 92.35%.

Fig. 2. Male partner's attendance for women who had institutional delivery (%)

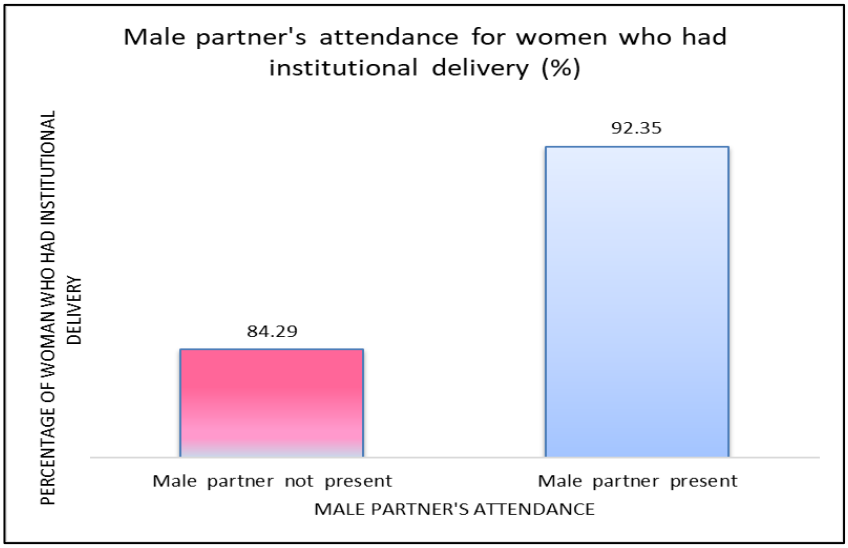


Fig. 3 demonstrates a relationship between male partner attendance during ANC visits and the percentage of women who consumed Iron and Folic Acid (IFA) supplements for 100 days. Approximately 33.31% of women whose male partners were absent during ANC visits adhered to the recommended IFA supplement intake. However, among women whose male partners were present during ANC visits, a higher percentage of approximately 47.46% complied with the recommended IFA supplement intake. This result suggests a positive link between male partner attendance during ANC visits and women's adherence to IFA supplements.

Fig. 3. Male partner's attendance for women who had taken IFA tablets for 100 days (%)

The graph in **Fig. 4** reveals a significant disparity in the percentage of women who completed at least four ANC visits between EAG states and Non-EAG states in India. Only 45.93% of women in EAG states completed at least four ANC visits during their pregnancies. In contrast, the data shows a notably higher percentage in Non-EAG states, where 76.45% of women completed at least four ANC visits.

Fig. 4. State type of the women who had at least 4 ANC visits (%)

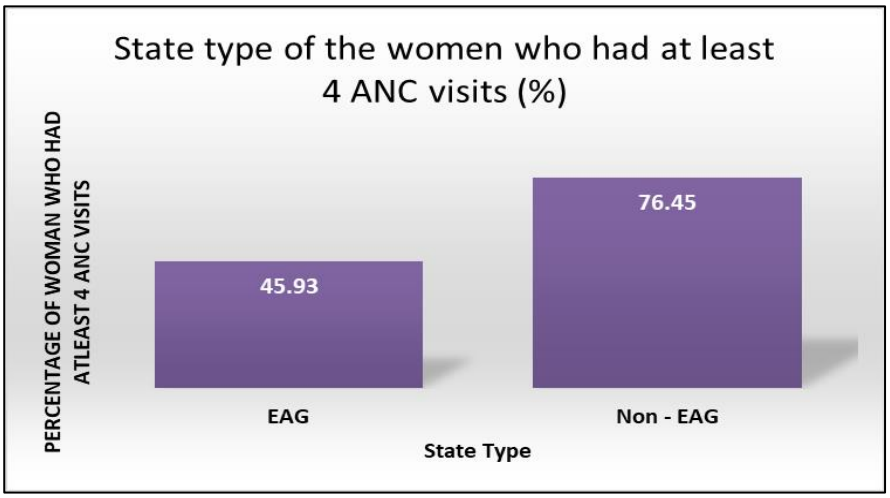


Fig. 5 compares two types of states in India: EAG states and Non-EAG states, based on the percentage of women who had institutional delivery. Approximately 83.99% of women in EAG states opted for institutional delivery, while approximately 94.69% had institutional delivery in Non-EAG states.

Fig. 5. State type of the women who had institutional delivery (%)

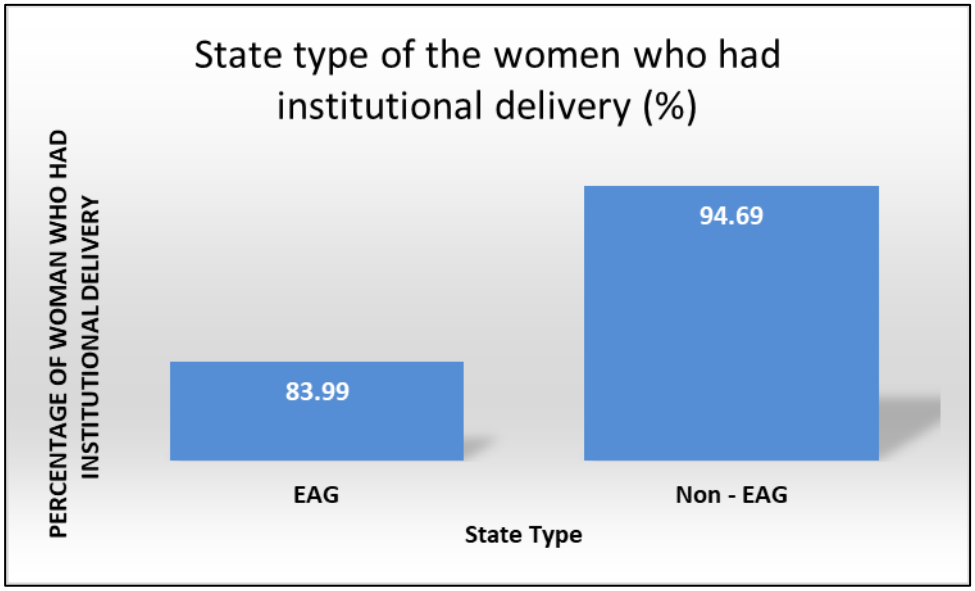
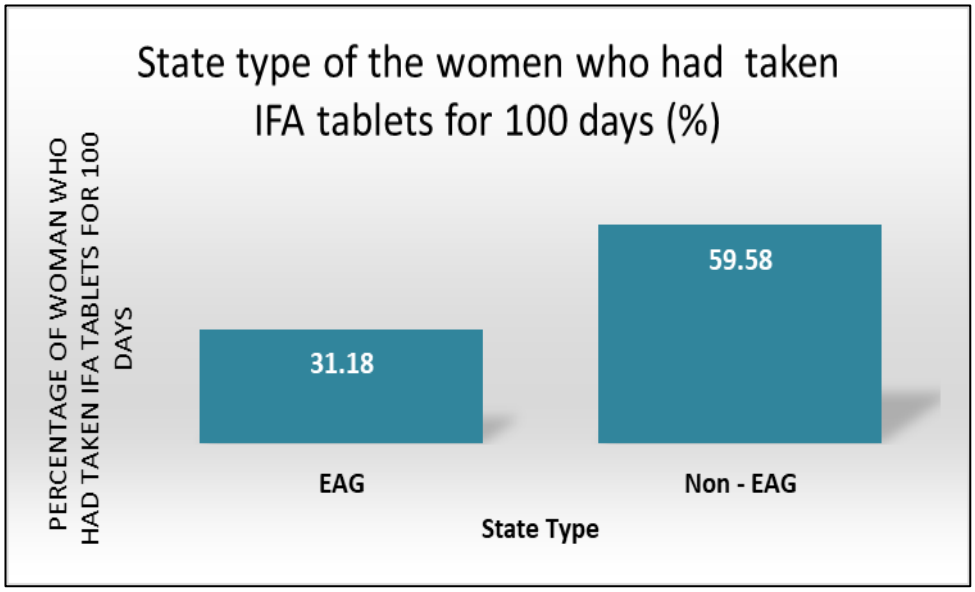


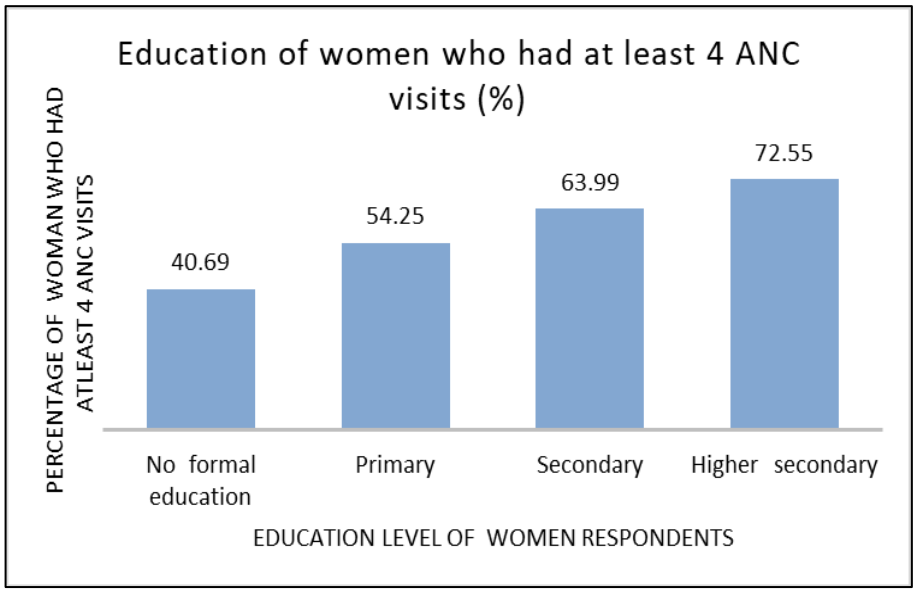
Fig.6. shows that in EAG states, only 31.18% of women had taken IFA supplementation for 100 days. On the other hand, in the Non-EAG states, a considerably higher percentage of women, approximately 59.58%, had taken IFA supplementation for the recommended 100 days.

Fig. 6. State type of the women who had taken IFA tablets for 100 days (%)



The graph (**Fig. 7**) depicts a clear trend showing the percentage of women who received at least four ANC services increasing with their level of education. Among women without formal education, the lowest percentage of ANC utilization was observed, with only 40.69% having at least four ANC visits during their pregnancy. In contrast, among women with primary education, the percentage of those having at least four ANC visits increased to 54.25%, indicating a higher utilization rate than women without formal education. There was a further increase in ANC utilization for women with secondary education, with 63.99% having at least four ANC visits. The highest percentage of ANC utilization was among women with higher secondary education, with 72.55% having at least four ANC visits during pregnancy.

Fig. 7. Education of women who had at least 4 ANC visits (%)



The data provide strong evidence of a positive correlation between the level of education and the utilization of ANC services. In **Fig. 8**, it is evident that as the education level of women increases, there is an upward trend in the percentage of women opting for institutional delivery. Among women with no formal education, 74.78% chose institutional delivery, while for those with primary education, the percentage increased to 84.27%. Women with secondary education substantially improved, with 92.61% choosing institutional delivery. The highest percentage of institutional delivery, 97.85%, was observed among women with higher secondary education.

Fig. 8. Education of women who had institutional delivery (%)

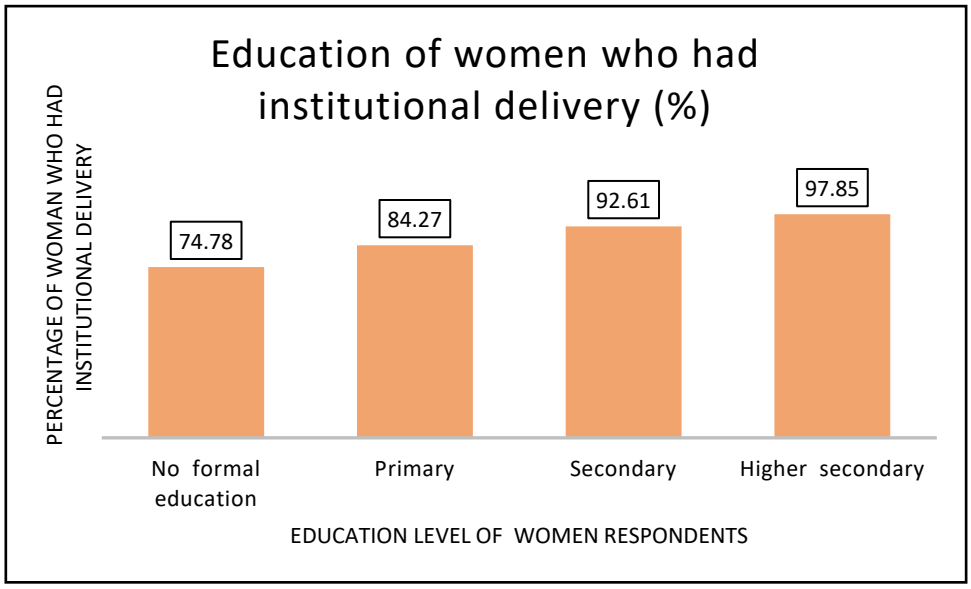
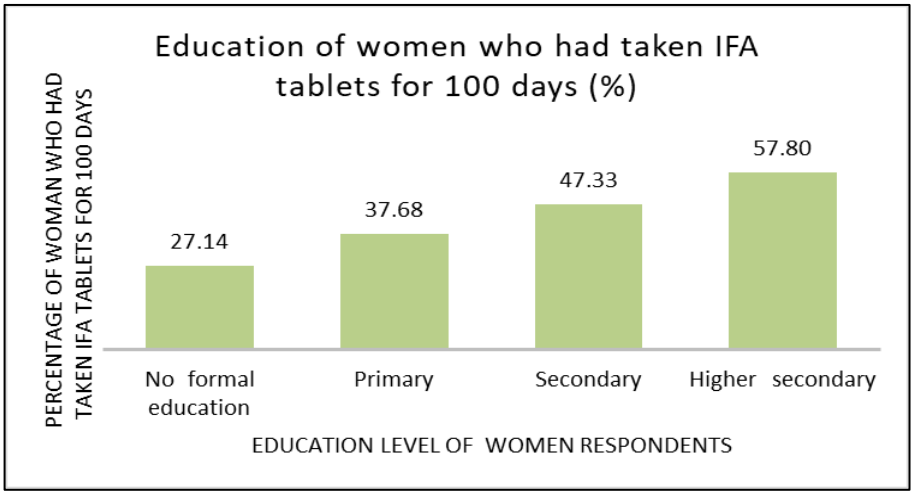


Fig. 9 shows a similar positive association between women's education level and the percentage of women who have taken IFA supplements for 100 days. As the education level of women rises, the proportion of women adhering to the recommended IFA supplement intake also increases. Among women with no formal education, only 27.14% took IFA supplements for the recommended duration, whereas for those with primary education, the percentage rose to 37.68%. The trend continued with further improvements for women with secondary education (47.33%) and the highest increase observed among women with higher secondary education (57.80%).

Fig. 9. Education of women who had taken IFA tablets for 100 days (%)



In **Fig. 10**, the husband's education level is positively associated with the percentage of women who underwent at least 4 ANC visits during their pregnancies. As the husband's education level increases, there is a noticeable increase in the proportion of women who receive the recommended ANC visits. For women whose husbands had no formal education, the percentage was 41.40%, rising to 56.04% for husbands with completed primary education. Further increases were observed for husbands with secondary education (63.04%) and higher secondary education (68.10%). Interestingly, the % of husbands whose education status was unknown falls between those with no formal education and those with primary education, at 45.52%.

Fig. 10. Husband's education for women with at least 4 ANC visits (%)

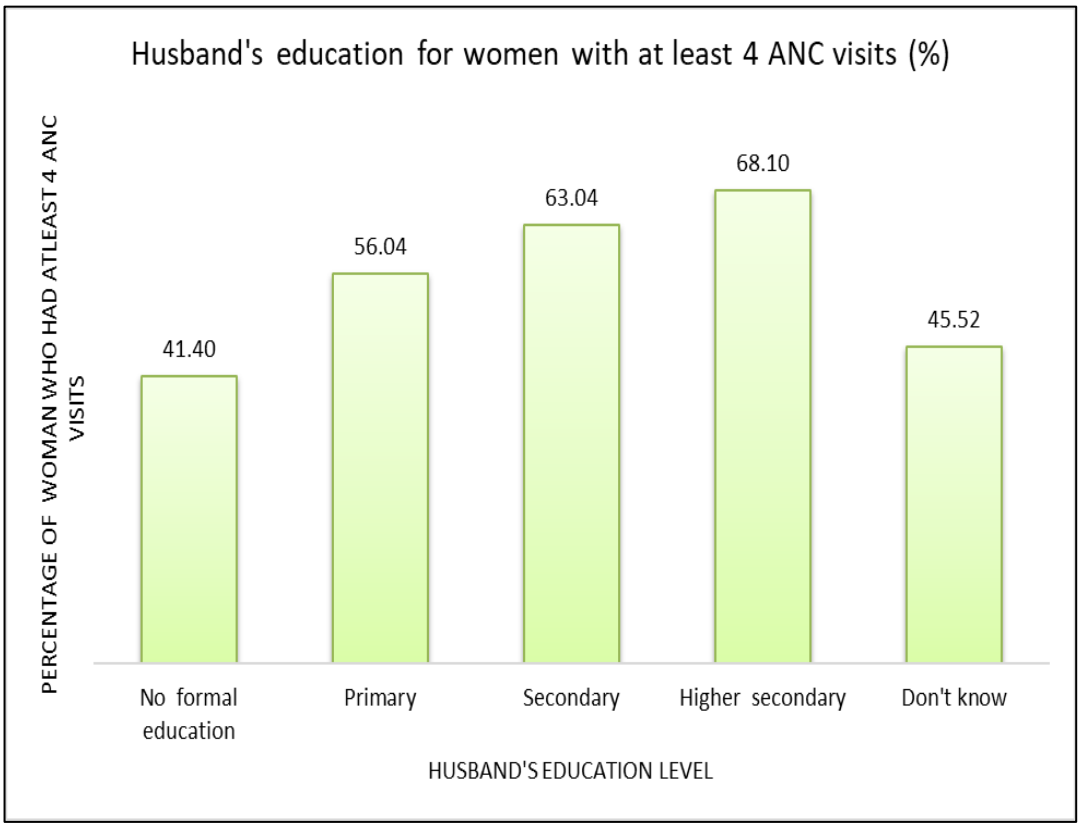
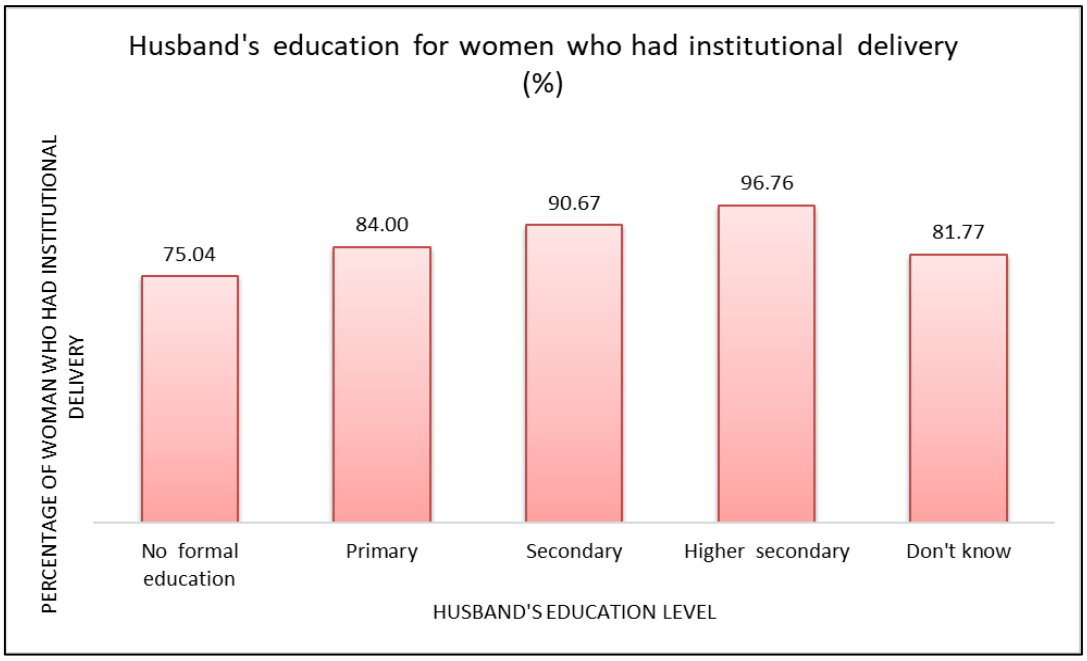


Fig. 11 illustrates a positive relationship between the husband's education level and the percentage of women opting for institutional deliveries. As the husband's education level increases, there is a corresponding increase in the percentage of women choosing institutional deliveries. For women whose husbands had no formal education, the percentage of institutional deliveries was 75.04%, while for those with husbands who completed primary education, the percentage increased to 84.00%. Further increases were observed for husbands with secondary education (90.67%) and higher secondary education (96.76%). Women whose husbands' education level was categorized as "Do not know" had 81.77% opting for institutional deliveries.

Fig. 11. Husband's education for women who had institutional delivery (%)

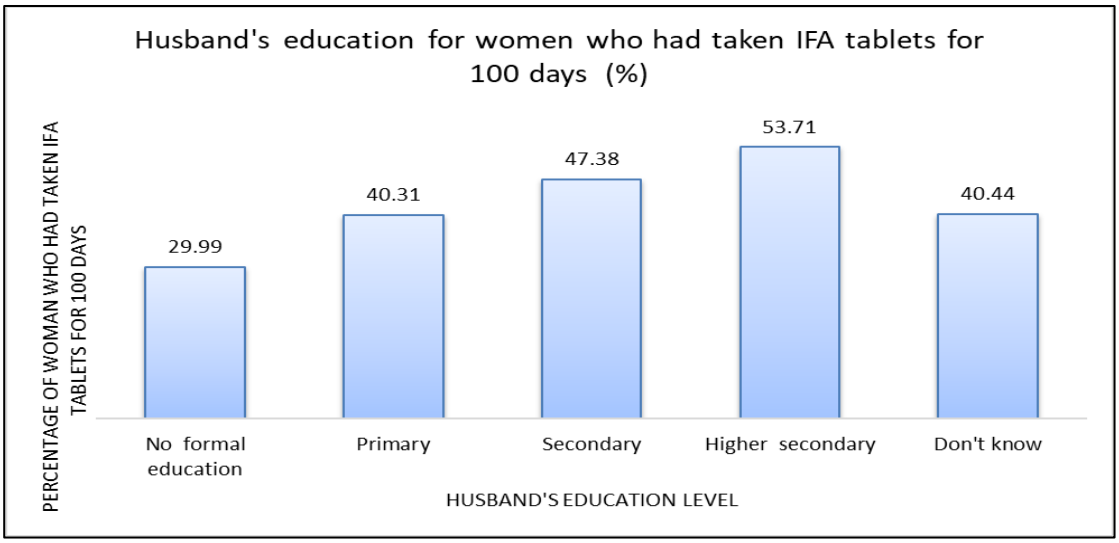


"Husband's Education" and the corresponding "Percentage of women who had taken IFA (Iron and Folic Acid) for 100 days" **(Fig.12.)**. Percentage of women who had taken IFA for 100 days whose husbands had no formal education is 29.99%. The % of women who had taken IFA for 100 days whose husbands had only primary education is 40.31%. The % of women who had taken IFA for 100 days whose husbands had only secondary education is 47.38%. The % of women who had taken IFA for 100 days whose husbands had only higher secondary education is 53.71%. The percentage of women who had taken IFA for 100 days whose husband's education is not known is 40.44%

The data indicates a positive trend in the percentage of women who had taken IFA for 100 days as their husband's education level increased. Women whose husbands have higher levels of education (higher secondary) show the highest percentage (53.71%) of adherence to the IFA intake for the

recommended duration. On the other hand, women whose husbands have no formal education show the lowest percentage (29.99%) of compliance with the IFA regimen.

Fig. 12. Husband's education for women who had taken IFA tablets for 100 days (%)



The data in **Fig.13.** shows significant variations in the percentage of women receiving at least 4 ANC visits across different states and union territories. States like Lakshadweep (95.13%), Goa (93.31%), Tamil Nadu (91.07%), Puducherry (88.06%), and Kerala (90.82%) have higher percentages, indicating better maternal healthcare utilization. On the other hand, states like Nagaland (22.2%), Bihar (25.72%), and Jharkhand (38.79) have lower percentages, suggesting a need for targeted efforts to improve ANC utilization in those regions.

Fig. 13. Percentage of women who had 4 ANC visits in different states of India (%)

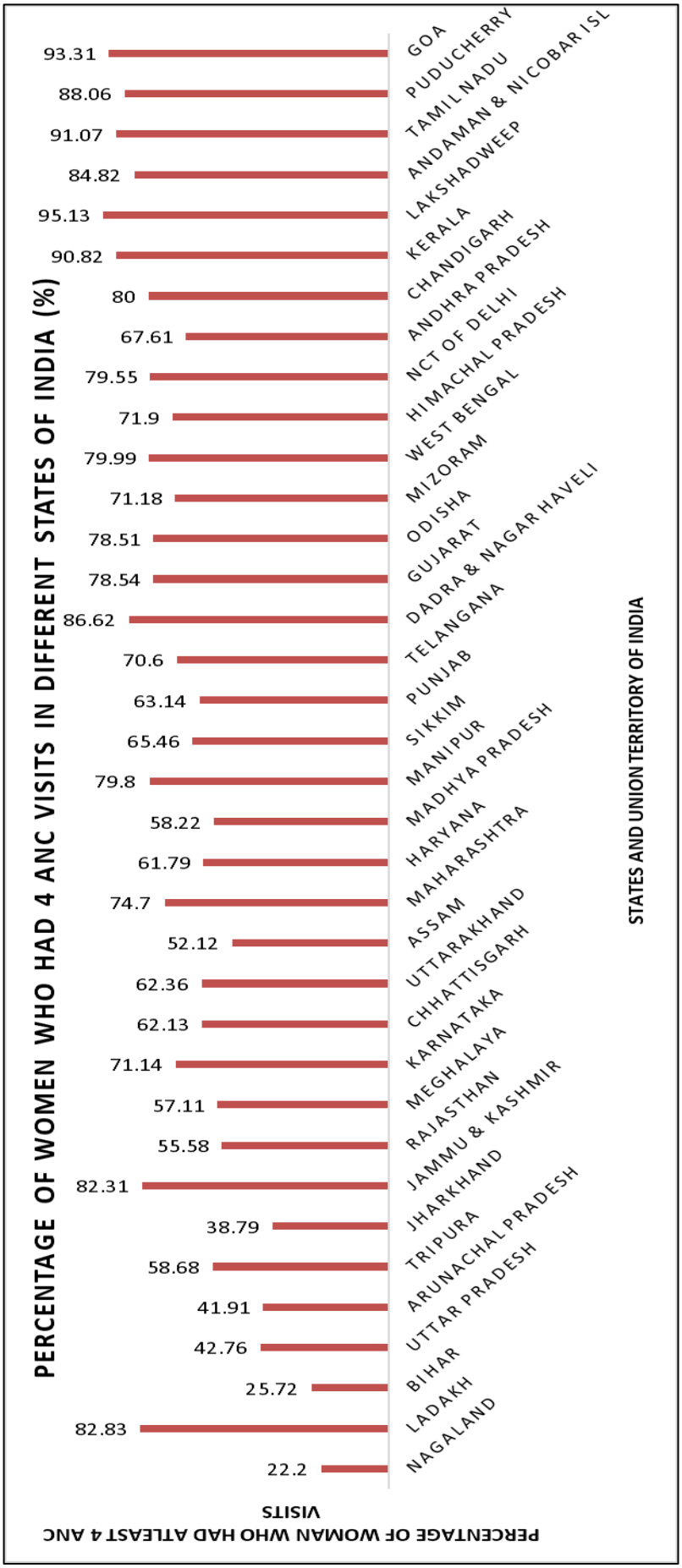
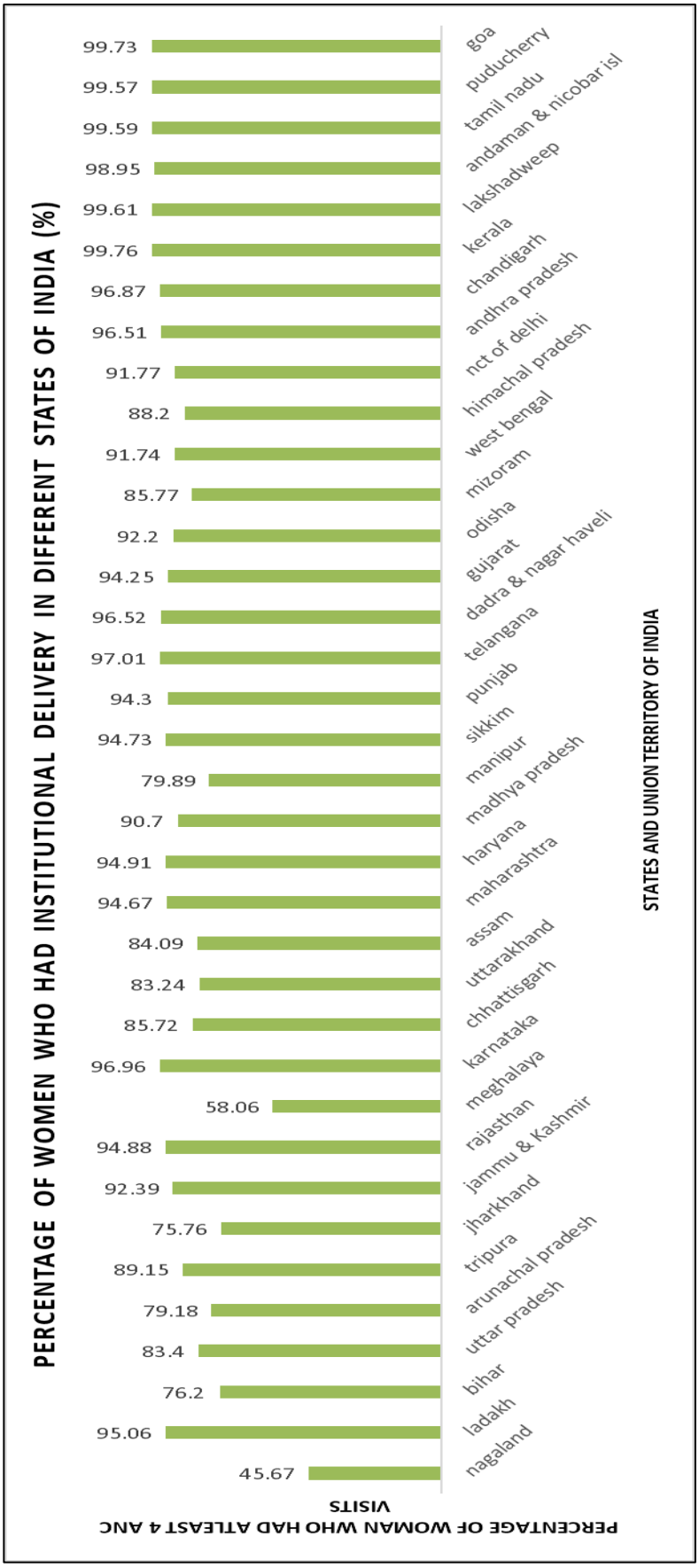


Fig. 14. indicate the percentage of institutional deliveries (childbirths that occur in healthcare facilities, such as hospitals or maternity centres) in each state and union territory. States like Kerala (99.76%), Tamil Nadu (99.59%), and Puducherry (99.57%) have exceptionally high institutional delivery rates, while states like Nagaland (45.67%) and Meghalaya (58.06%) have relatively lower rates. High institutional delivery rates are generally associated with better access to healthcare facilities and improved maternal and neonatal care, which is essential for reducing maternal and infant mortality.

Fig. 14. Percentage of women who had institutional delivery in different states of India (%)



The data is shown in **Fig.15.** shows the variation in the percentage of women who have taken the 100 days IFA tablet during pregnancy across different regions in India. Higher percentages indicate better adherence to the recommended IFA supplementation during pregnancy, which is essential for ensuring the health and well-being of both mothers and their babies, which can be seen in Lakshadweep (80.11%), Andaman & Nicobar Islands (80.94%), Tamil Nadu (82.47%), Puducherry (84.09%) and Goa (87.49%). States and union territories with lower percentages may require targeted interventions and awareness campaigns to improve the uptake of IFA tablets among pregnant women.

Fig. 15. Percentage of women who had taken 100 days of IFA tablet in different states of India (%)

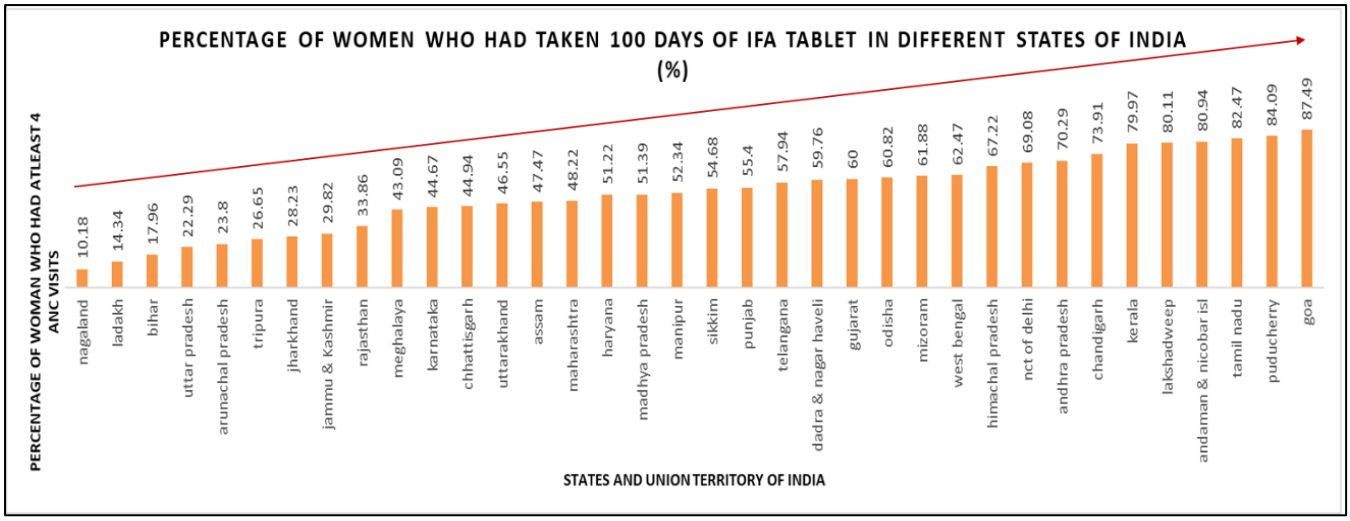


Table. 1. Percentage of women with data on ANC visits, place of delivery and consumption of IFA tablets for 100 days and socio-demographic factors

	Women with data on Women with data on antenatal care visit N = 176,843				Women with data on place of delivery N = 232,920				Women with data on taking 100 days of IFA tablets N = 176,843		
	At least 4 ANC visits	(%)	p value		Institutional delivery	(%)	p value		Taken IFA for 100 days	(%)	p value
Male partner attendance	**1,03,795**	**63.68**			**18,059**	**91.25**			**73,016**	**45.51**	
Male partner not present	12,000	49.16	**0.000**		4,800	84.29	**0.000**		8,269	33.31	**0.000**
Male partner present	91,795	66.00			13,259	92.35			64,747	47.46	
Husband's education	**15,914**	**60.01**			**4,945**	**88.39**			**11,768**	**45.20**	
No formal education	1,702	41.40	**0.000**		1,591	75.04	**0.000**		1,179	29.99	**0.000**
Primary	1,772	56.04			914	84.00			1,295	40.31	
Secondary	9,311	63.04			2,179	90.67			6,881	47.38	
Higher secondary	3,070	68.10			232	96.76			2,367	53.71	
Don't know	59	45.52			29	81.77			46	40.44	
Respondent's education	**1,03,795**	**59.78**			**32,126**	**88.59**			**75,254**	**44.07**	
No formal education	15,748	40.69	**0.000**		13,519	74.78	**0.000**		10,202	27.14	**0.000**
Primary	11,450	54.25			6,090	84.27			8,108	37.68	
Secondary	57,695	63.99			11,625	92.61			41,990	47.33	
Higher secondary	18,902	72.55			892	97.85			14,954	57.80	
Respondent's caste	**98,408**	**59.40**			**30,614**	**88.57**			**71,397**	**43.65**	
Scheduled caste (SC)	19,603	56.40	**0.000**		6,088	87.26	**0.000**		14,234	41.11	**0.000**
Scheduled tribe (ST)	19,601	58.97			11,897	82.25			14,435	45.10	
Other Backward Classes (OBC)	39,278	58.06			9,203	89.52			28,521	42.57	
General	19,290	66.27			3,172	91.68			13,783	48.71	
Don't know	636	61.11			254	85.73			424	38.85	
Sex of the child	**1,03,795**	**59.78**			**32,126**	**88.59**			**75,254**	**44.07**	
Male	55,797	59.83	**0.356**		16,267	88.82	**0.000**		40,169	43.59	**0.037**
Female	47,998	59.71			15,859	88.35			35,085	44.62	
Age of mother	**1,03,795**	**59.78**			**32,126**	**88.59**			**75,254**	**44.07**	
Less than 18 years	9,221	51.91	**0.000**		5,727	80.71	**0.000**		6,477	37.28	**0.000**
18-35 years	94,037	60.71			26,307	89.61			68,365	44.86	
36-49 years	537	76.91			92	94.92			412	61.40	
Respondent's religion	**1,03,795**	**59.78**			**32,126**	**88.59**			**75,254**	**44.07**	
Hindu	77,372	59.63	**0.000**		18,846	89.52	**0.000**		56,772	43.92	**0.000**
Muslim	14,794	58.78			5,268	84.29			9,523	41.70	
Others	11,629	65.93			8,012	87.77			8,959	54.95	
Wealth quintile	**1,03,795**	**59.78**			**32,126**	**88.59**			**75,254**	**44.07**	
Poorest	19,741	42.99	**0.000**		17,363	76.17	**0.000**		14,131	30.82	**0.000**
Poorer	22,002	54.70			8,173	87.19			15,277	37.97	
Middle	21,779	63.76			3,838	92.28			15,387	45.57	
Richer	21,361	68.92			1,926	95.37			15,599	51.97	
Richest	18,912	73.32			826	97.44			14,860	58.38	
Place of residence	**1,03,795**	**59.78**			**32,126**	**88.59**			**75,254**	**44.07**	
Urban	26,287	70.07	**0.000**		3,122	93.79	**0.000**		19,885	54.00	**0.000**
Rural	77,508	55.74			29,004	86.71			55,369	40.17	
Type of state	**1,03,795**	**59.78**			**32,126**	**88.59**			**75,254**	**44.07**	
EAG	46,515	45.93	**0.000**		12,097	83.99	**0.000**		33,086	31.18	**0.000**
Non - EAG	57,280	76.45			20,029	94.69			42,168	59.58	

In **Table 2.**, a dataset comprising 26,179 observations served as the foundation for the logistic regression model. The independent variables in the model collectively demonstrated a significant impact on the dependent variable, as indicated by the statistically significant chi-squared test results for the overall model fit (LR chi2(13) = 2370.02, $p < 0.001$). The Pseudo R2 value (0.0676) suggests that the independent variables in the model account for approximately 6.76% of the variance in the dependent variable.

The log-likelihood value (-16346.589) represents how well the model fits the observed data, with a lower value indicating a better fit. The odds ratios, standard errors, and p-values for the independent variables are presented below:

1. Male partner attendance (yes): When the male partner attends antenatal care, the odds of having at least 4 ANC visits are 1.66 times higher ($p < 0.001$).

2. Wealth quintile:

- Poorer: The odds of having at least 4 ANC visits among poorer individuals are 1.14 times higher ($p < 0.001$).
- Middle: Among middle-income individuals, the odds of having at least 4 ANC visits are 1.35 times higher ($p < 0.001$).
- Richer: Among richer individuals, the odds of having at least 4 ANC visits are 1.49 times higher ($p < 0.001$).
- Richest: Among the richest individuals, the odds of having at least 4 ANC visits are 1.71 times higher ($p < 0.001$).

3. EAG state: Individuals residing in EAG states have 0.39 times lower odds of having at least 4 ANC visits ($p < 0.001$) than those in other states.

4. Place of residence:

- Rural: Individuals residing in rural areas have 0.92 times lower odds of having at least 4 ANC visits ($p = 0.02$) than those in urban areas.

5. Husband's education:

- Primary: When the husband has a primary education, the odds of having at least 4 ANC visits are 1.19 times higher ($p < 0.001$).
- Secondary: When the husband has a secondary education, the odds of having at least 4 ANC visits are 1.36 times higher ($p < 0.001$).
- Higher: When the husband has higher education, the odds of having at least 4 ANC visits are 1.37 times higher ($p < 0.001$).
- Do not know: The odds ratio for the husband's education labelled as "do not know" is 1.30, but the corresponding p-value is not provided.

6. Age of mother:

- 18-35: No statistically significant effect of the age group 18-35 on having at least 4 ANC visits ($p = 0.20$).
- 36-49: In the age group 36-49, the odds of having at least 4 ANC visits are 1.94 times higher ($p = 0.01$).

Table. 2. The odds ratios, standard errors, and p-values for at least 4 ANC Visits

Logistic regression	Number of obs = 26,179	Prob > chi2 = 0	
	LR chi2(13) = 2370.02	Psuedo R2 = 0.0676	
Log likelihood = -16346.589			
At least 4 ANC Visits	Odds Ratio	Std. Err.	P>|z|
Male partner attendance			
yes	1.66	0.06	0.00
Wealth quintile			
poorer	1.14	0.04	0.00
middle	1.35	0.06	0.00
richer	1.49	0.07	0.00
richest	1.71	0.09	0.00
EAG state	0.39	0.01	0.00
Place of residence			
rural	0.92	0.03	0.02
Husband's education			
primary	1.19	0.06	0.00
secondary	1.36	0.06	0.00
higher	1.37	0.07	0.00
don't know		1.30	1.25
Age of mother			
18-35	1.06	0.05	0.20
36-49	1.94	0.50	0.01
_cons	1.09	0.08	0.22

In **Table 3.**, a dataset consisting of 26,179 observations was utilized for the logistic regression analysis. The statistically significant chi-square value of 2075.32 (p = 0.000) obtained from the likelihood ratio chi-square test with 13 degrees of freedom indicates that the model is significant. The independent variables in the model may account for 11.58% of the variance in the dependent variable, as reflected by the Psuedo R-squared value of 0.1158.

The model's log-likelihood is -7920.949, suggesting a good fit of the model to the data. The logistic regression analysis for each independent variable (predictor) gives the following results:

1. Male partner attendance (yes): The odds ratio is 1.41, with a standard error of 0.05 and a p-value of 0.00, indicating a significant positive association between male partner attendance during maternal healthcare and the likelihood of taking IFA tablets for 100 days.

2. Wealth quintile:

- Poorer: Odds ratio 1.10, standard error 0.04, p-value 0.01
- Middle: Odds ratio 1.28, standard error 0.05, p-value 0.00
- Richer: Odds ratio 1.44, standard error 0.07, p-value 0.00
- Richest: Odds ratio 1.75, standard error 0.09, p-value 0.00

These results indicate that as the wealth quintile increases, there is a significant positive association with the likelihood of taking IFA tablets for 100 days.

3. EAG state: The odds ratio is 0.56, with a standard error of 0.01 and a p-value of 0.00, indicating that being in an EAG state is significantly associated with a decrease in the likelihood of taking IFA tablets for 100 days.

4. Place of residence (rural): The odds ratio is 0.85, with a standard error of 0.03 and a p-value of 0.00, suggesting that residing in a rural area is significantly associated with a decrease in the likelihood of taking IFA tablets for 100 days.

5. Husband's education:

- Primary: Odds ratio 1.26, standard error 0.07, p-value 0.00
- Secondary: Odds ratio 1.36, standard error 0.06, p-value 0.00
- Higher: Odds ratio 1.40, standard error 0.07, p-value 0.00
- Do not know: Odds ratio 1.34, standard error 0.28, p-value 0.16

These results suggest that as the husband's education level increases, there is a significant positive association with the likelihood of taking IFA tablets for 100 days, except for the "do not know" category, which is not statistically significant.

6. Age of mother:

- 18-35: Odds ratio 1.14, standard error 0.05, p-value 0.00
- 36-49: Odds ratio 1.69, standard error 0.35, p-value 0.01

These results indicate that mothers aged 36-49 have significantly higher odds of taking IFA tablets for 100 days than mothers aged 18-35.

Table. 3. The odds ratios, standard errors, and p-values for women who have taken IFA for 100 days

Logistic regression	Number of obs = 26,179	Prob > chi2 = 0.000	
	LR chi2(13) = 2075.32	Psuedo R2 = 0.1158	
Log likelihood = -7920.949			
Taken IFA tablets for 100 days	Odds Ratio	Std. Err.	P>|z|
Male partner attendance			
yes	1.41	0.05	0.00
Wealth quintile			
poorer	1.10	0.04	0.01
middle	1.28	0.05	0.00
richer	1.44	0.07	0.00
richest	1.75	0.09	0.00
EAG state	0.56	0.01	0.00
Place of residence			
rural	0.85	0.03	0.00
Husband's education			
primary	1.26	0.07	0.00
secondary	1.36	0.06	0.00
higher	1.40	0.07	0.00
don't know	1.34	0.28	0.16
Age of mother			
18-35	1.14	0.05	0.00
36-49	1.69	0.35	0.01
_cons	0.48	0.03	0.00

Table 4. represents the results of logistic regression analysis conducted on a dataset with 26,179 observations to examine the factors influencing institutional delivery in the target population. The model fit was determined using the likelihood ratio (LR) chi-square test, which yielded a highly significant result (LR chi2(13) = 2075.32, $p < 0.001$). The Psuedo R2 value of 0.1158 indicates that the included variables may account for approximately 11.58% of the variance in institutional delivery.

The odds ratios and corresponding statistical significance of the predictor variables concerning institutional delivery are as follows:

1. Male partner attendance (yes): Women whose male partners attend antenatal care have approximately 1.84 times higher odds of choosing institutional delivery ($p < 0.001$).

2. Wealth quintile:

- Poorer: Women in the poorer wealth quintile have approximately 1.90 times higher odds of institutional delivery ($p < 0.001$).
- Middle: Women in the middle wealth quintile have nearly 2.98 times higher odds of institutional delivery ($p < 0.001$).
- Richer: Women in the richer wealth quintile have approximately 4.42 times higher odds of institutional delivery ($p < 0.001$).
- Richest: Women in the richest wealth quintile have the highest odds of institutional delivery, approximately 7.46 times higher ($p < 0.001$).

3. EAG states: The variable for the EAG states is not statistically significant ($p = 0.11$), indicating no significant association between being in an EAG state and institutional delivery.

4. Place of residence:

- Rural: Women residing in rural areas have approximately 0.82 times lower odds of choosing institutional delivery ($p = 0.01$) than women in urban areas.

5. Husband's education:

- Primary: Women whose husbands have a primary education have 1.32 times higher odds of institutional delivery ($p < 0.001$).

- Secondary: Women whose husbands have secondary education have approximately 1.88 times higher odds of institutional delivery ($p < 0.001$).

- Higher: Women whose husbands have a higher education have approximately 2.85 times higher odds of institutional delivery ($p < 0.001$).

- Don't know: Husbands' education level is not statistically significant ($p = 0.56$), indicating no significant association with institutional delivery.

6. Age of mother:

- 18-35: Women aged 18 to 35 have 1.43 times higher odds of institutional delivery ($p < 0.001$).

- 36-49: The odds of institutional delivery for women aged 36 to 49 are not statistically significant ($p = 0.87$), suggesting no significant association.

The constant term (_cons) also represents the baseline odds of institutional delivery when all other predictor variables are zero. It has an odds ratio of approximately 1.37 ($p < 0.001$).

Table. 4. The odds ratios, standard errors, and p-values for women who had institutional delivery

Logistic regression	**Number of obs = 26,179**	**Prob > chi2 = 0.000**	
Log likelihood = -7920.949	**LR chi2(13) = 2075.32**	**Psuedo R2 = 0.1158**	
Institutional Delivery	**Odds Ratio**	**Std. Err.**	**P>|z|**
Male partner attendance			
yes	1.84	0.09	0.00
Wealth quintile			
poorer	1.90	0.10	0.00
middle	2.98	0.20	0.00
richer	4.42	0.39	0.00
richest	7.46	0.95	0.00
EAG state	0.93	0.04	0.11
Place of residence			
rural	0.82	0.06	0.01
Husband's education			
primary	1.32	0.08	0.00
secondary	1.88	0.10	0.00
higher	2.85	0.28	0.00
don't know	1.17	0.32	0.56
Age of mother			
18-35	1.43	0.08	0.00
36-49	1.06	0.39	0.87
_cons	1.37	0.14	0.00

DISCUSSION

These results indicate that women with male partners present during ANC visits were more likely to attend at least four ANC sessions than women whose partners were not present. Partners during ANC visits are associated with a higher likelihood of women opting for institutional delivery. The involvement and support of male partners seem to play a positive role in influencing women's decision-making and choices regarding delivery options, favouring institutional settings for childbirth. By encouraging and assisting women in sticking to the necessary IFA supplementation, which is crucial for the health of both the mother and the growing fetus, having male partners present at ANC visits can improve maternal health outcomes. However, it is essential to consider other factors that may also influence IFA consumption, and further research may be needed to explore the underlying reasons for this observed association.

In the EAG states, a lower percentage suggests that many women are not accessing the recommended number of ANC visits, which is essential for monitoring maternal and fetal health, detecting and managing complications, and providing necessary interventions to ensure safe pregnancies and deliveries.

Better utilization of maternal healthcare services in the Non-EAG states, with more women receiving adequate antenatal care during their pregnancies. The difference in ANC utilization between the two state types is striking and highlights the need for targeted interventions in EAG states to improve maternal healthcare access and utilization. Addressing barriers to ANC utilization and promoting awareness about the importance of regular antenatal visits could help bridge this gap and enhance maternal and child health outcomes in the EAG states. Overall, the data underscores

the significance of ensuring access to quality maternal healthcare services, particularly ANC, to decrease maternal mortality and improve health as well as well-being of pregnant women and their infants, regardless of their state. A more significant proportion of women in these Non - EAG states received the entire course of IFA, which can positively impact maternal and fetal health.

Efforts should be made to raise awareness about the importance of IFA supplementation, improve healthcare facilities, and ensure consistent availability of IFA supplements in the EAG states. Addressing these issues makes it possible to increase the percentage of women receiving IFA for 100 days, ultimately contributing to better maternal and child health in these regions.

Higher levels of education appear to be linked to a greater likelihood of women seeking and attending the recommended number of ANC visits, which is essential for ensuring safe and healthy pregnancies and reducing maternal and newborn complications. These results emphasize the importance of promoting education and awareness about maternal healthcare services to improve maternal and child health outcomes.

The percentage of women choosing institutional deliveries increases among higher education levels, indicating that higher secondary education substantially impacts the preference for institutional delivery.

Overall, the data underscores the importance of education in maternal healthcare decision-making. Higher levels of education empower women to make informed choices regarding childbirth, leading to a higher preference for institutional deliveries. As the level of education increases, the percentage

of women adhering to the IFA intake also increases.

There is immense importance in the husband's education in maternal healthcare utilization. Women whose husbands have higher educational qualifications are more likely to receive at least 4 ANC visits during their pregnancies, recommended by WHO. Educated husbands may support promoting and ensuring their wives' adherence to essential maternal healthcare practices, including taking iron and folic acid supplements for the recommended period. However, it is essential to conduct further research to identify the underlying factors driving this association and to design targeted interventions to improve maternal health outcomes for the population.

The results indicate that male partner attendance during antenatal care, wealth quintile, husband's education, and place of residence significantly influence the likelihood of having at least 4 ANC visits. Additionally, residing in an EAG state and being in the age group 36-49 also significantly affects ANC utilization. These findings can provide valuable insights for policymakers and healthcare providers to develop targeted interventions to improve maternal healthcare utilization in India.

Through logistic regression analysis, it also shows that male partner attendance during maternal healthcare, higher wealth quintile, being in non-EAG states, urban residence, higher husband's education level, and being in the age group of 36-49 is significantly associated with higher odds of taking IFA tablets for 100 days. On the other hand, residing in EAG states and being in the age group of 18-35 are associated with lower odds of taking IFA tablets for 100 days.

Logistic regression analysis provides valuable insights into the factors influencing institutional delivery in the population under study. Male partner attendance, wealth quintile, place of residence,

husband's education, and age of the mother are all significant predictors of institutional delivery, while EAG state and "don't know" category for husband's education are not significantly associated with institutional delivery. These findings can inform targeted interventions and policy measures to improve maternal healthcare and promote institutional deliveries in the population.

CONCLUSION

The study focuses on the crucial role of male partners in using maternal healthcare services in India, particularly in the EAG states. The maternal mortality ratio of our country is still a significant public health for policymakers, and efforts are being made to reduce the MMR and achieve the United Nations SDG target of less than 70 deaths/100,000 live births by 2030.

The involvement of male partners in utilizing maternal healthcare is a well-established intervention for reducing maternal and newborn mortality. Their engagement during pregnancy helps them make timely decisions and avoid delays in accessing maternal care. Recent governmental initiatives in India have sought to include males in maternal health care actively, and the World Health Organization (WHO) also recommends actions to encourage men's involvement during pregnancy and childbirth.

The study emphasizes how husbands' knowledge and comprehension of pregnancy difficulties affect how often their wives use maternal health services. In patriarchal communities, where women's needs and health often depend on male decisions, educating and empowering males about pregnancy difficulties can help reduce maternal and newborn fatalities.

The results show that husbands who support their wives in receiving full ANC and institutional

deliveries are more likely to have a good attitude toward participating in ANC and better understand maternal health care. This emphasizes educating partners about maternal care and encouraging their attendance during antenatal appointments.

In order to achieve the SDGs for maternal care in India, a robust agenda for husband involvement needs to be developed and implemented. By empowering males and improving their understanding and attitude towards ANC, early detection of pregnancy-related problems and timely referrals can be ensured.

Overall, the study offers insightful information about how men's participation in maternal healthcare services in EAG states affects such services. By utilizing this data, decision-makers and healthcare professionals may develop focused interventions that will enhance maternal health outcomes and achieve the SDGs for maternity care by 2030. In India, improving mother and child health and lowering maternal mortality can be accomplished by highlighting the value of male partners in maternal healthcare.

LIMITATIONS OF THE STUDY

The study's scope was limited to analyzing survey questions specifically related to male partners' attendance in antenatal care, disregarding other potential forms of support that were not considered in the analysis. Moreover, a specific subgroup of women who did not receive antenatal care was not included in the study, resulting in the absence of information on male partner attendance for this particular group. It is reasonable to assume that these women may have had lower levels of education and belonged to socioeconomically vulnerable groups due to their lack of interaction with the healthcare system during pregnancy. Consequently, the study's findings cannot be generalized to this excluded sub-population. (13)

Additionally, variables such as the timing and frequency of prenatal care appointments or whether male partners accompanied women to multiple antenatal care sessions could not be considered due to their absence in the dataset.

ETHICAL CONSIDERATION

The study was presented before the Students Ethics Board of International Institute of Health Management Research, Delhi. The students ethics board approved the study as this is a public deidentified freely available data in the public domain (DHS site) exempted from ethical issues.

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CERTIFICATE ON PLAGIARISM CHECK

Name of Student (in block letter)	**Ms.: Ishita Maji**		
Enrolment/Roll No.	PG/21/039	**Batch Year**	2021-2023
Course Specialization (Choose one)		Health Management	
Name of Guide/Supervisor	Dr/ Prof.: Pijush Kanti Khan		
Title of the Dissertation/Summer Assignment	**Role of males in the utilization of maternal healthcare services among EAG states in India, 2019-21**		
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