

Dissertation Training

at

Piramal Swasthya Management and Research Institute

Study Title:

**Examining the Changes and Determinants of Antenatal Care Visits and Birth Preparedness
Among Rural Women in Bihar: A Comparative Analysis of 2024 and 2025**

By

Shivam Kumar Sharma

PG/23/110

Under the guidance of

DR. Preetha Gs

PGDM (Hospital and Health Management)

2023-2025



International Institute of Health Management Research, New Delhi

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**International Institute of Health Management Research
New Delhi**

(Completion of Dissertation from respective organization)

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Name: Shivam Kumar Sharma

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Among Rural Women in Bihar: A Comparative Analysis of 2024 and 2025

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Antenatal Care Visits and Birth Preparedness Among Rural Women in Bihar: A Comparative
Analysis of 2024 and 2025

Date: 03/06/2025

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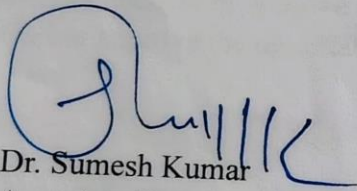


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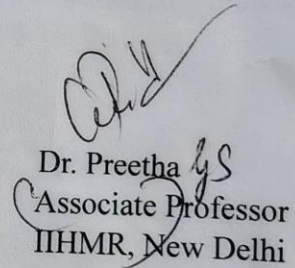
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The Candidate has successfully carried out the study designated to him during dissertation training and his/her approach to the study has been sincere, scientific and analytical.

The dissertation is in fulfilment of the course requirements. I wish him all success in all his/her future endeavours.



Dr. Sumesh Kumar
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The following dissertation titled **"Examining the Changes and Determinants of Antenatal Care Visits and Birth Preparedness Among Rural Women in Bihar: A Comparative Analysis of 2024 and 2025"** at Piramal Swasthya 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.

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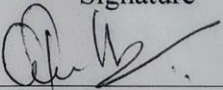
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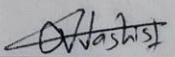
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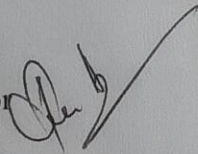


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This is to certify that **Mr. Shivam Kumar Sharma**, a graduate student of the **PGDM (Hospital & Health Management)** has worked under our guidance and supervision. He/ She is submitting this dissertation titled “**Examining the Changes and Determinants of Antenatal Care Visits and Birth Preparedness Among Rural Women in Bihar: A Comparative Analysis of 2024 and 2025**” at “Piramal Swasthya” in partial fulfilment of the requirements for the award of the **Post Graduate Diploma in Health and Hospital Management Equivalent to MBA (PGDM) from International Institute of Health Management Research, New Delhi, India.**

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.

Institute Mentor
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INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT RESEARCH,
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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled “Examining the Changes and Determinants of **Antenatal Care Visits** and **Birth Preparedness** Among Rural Women in Bihar: A Comparative Analysis of 2024 and 2025” and submitted by Mr. Shivam Sharma Enrolment No: PG/23/110 under the supervision of Dr. Preetha for award of PGDM (Hospital & Health Management) of the Institute carried out during the period from 3rd March to 3rd June 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.

Signature

Shivam Kumar Sharma

FEEDBACK FORM

Name of the Student: Shivam Kumar Sharma

Dissertation Organization: Piramal Swasthya Management and Research Institute

Area of Dissertation: Public Health with a special focus on Maternal and Child Health

Attendance: Perfect adherence to internship norms.

Objectives met: Learnt Literature Review, Evidence Table Generation, Indicator Matrix Generation, Reference Management, Tool Development, Epidemiological concepts, Digital Data Management & Quality control, Data Collection, Data Management, Basic Quantitative Analysis and Thematic Extraction of Information from Qualitative Data.

Deliverables:

- Carried out detailed review of literature on "antenatal care and birth-preparedness among women of rural Bihar".
- Prepared evidence tables & well-structured indicator matrix.
- Engaged in data-collection in household surveys.
- Carried out data-analysis using SAS on some key maternal and child health indicators.
- Engaged in CFA (composite facility assessment) training along with household training.
- Engaged in health expansion project and carried out detailed situation analysis of various health indicators of different states.
- Made some ppts and involved in Bihar story ppt.
- Prepared a detailed report on changes and determinants of antenatal care and birth-preparedness.
- Developed the basic concepts of data cleaning, data management and research methodology.

Strengths:

Data management, analysis, synthesizing, diligence, engagement, proactiveness, learning spree, eye for detail, analytical and other software skills, teamwork and self-management.

Suggestions for Improvement:

Programmatic knowledge, leadership competencies, stakeholder management & communication.



Director Data & Learning; Core Team Member, Research and MLE

Signature of the Officer-in-Charge (Internship)



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CERTIFICATE ON PLAGIARISM CHECK

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Name of Guide/Supervisor	Dr./Prof.: Preetha GS		
Title of the Summer Training/ Dissertation	Examining the changes and determinants of antenatal care visits and birth preparedness among rural women in Bihar: A comparative analysis of 2014 and 20		
Plagiarism detect software used	"TURNITIN"		
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I received a fantastic opportunity to learn and advance my career during my internship with the **Piramal Swasthya** Foundation in Bihar. I consider myself really lucky to have been involved, and I am appreciative of the opportunity to interact with so many amazing individuals and experts that helped me during my internship.

In addition to providing the resources I needed to complete my project successfully, I would like to sincerely thank **Dr. Tanmay Mahapatra** (Director, Data and Learning, Piramal Swasthya Management and Research Institute), **Dr. Devashish Singh** (Senior RMLE leader), and **Dr. Shuchi Sree Akhouri** (Senior RMLE leader) for their invaluable advice, support, and input. I sincerely appreciate what they have contributed.

I want to sincerely thank my mentor, **Dr. Preetha** (Assistant Professor, IIHMR Delhi), **Dr. Sutapa Bandyopadhyay Neogi** (Director, IIHMR Delhi), and **Dr. Sumesh Kumar** (Associate Dean Academics and Student Affairs, IIHMR Delhi) for their invaluable advice, which was crucial to both the theoretical and practical aspects of my study.

I see this as a major turning point in my professional growth. I'm determined to make the most of the abilities and information I've acquired, and I'll keep trying to get better in order to meet my professional goals. I'm excited to work with each and every one of you in the future.

Sincerely,

Shivam Kumar Sharma

ACRONYMS/ABBREVIATIONS

BPCR-birth preparedness and complication readiness.

ANC-antenatal care.

ASHA- Accredited Social Health activist.

MCP- Mother Child protection card

NFHS- National Family Health Survey

NHM- National Health Mission

MMR-maternal mortality rate

SBA-skilled birth attendant.

PNC-post natal care.

THR- Take Home Ration.

WASH- Water and sanitation hygiene.

OBSERVATIONAL LEARNINGS

ORGANIZATION PROFILE:

Piramal Foundation creates creative answers to problems that stand in the way of India's economic potential being fully realized. India has started the process of guaranteeing universal health coverage, and Piramal Swasthya is helping with that by using its experience and knowledge of creating ground-breaking solutions that have a big impact. The goal of Piramal Swasthya is to close the gaps in public healthcare by supporting and enhancing the Government of India's plan to achieve universal health coverage. One of the biggest non-profits in India's primary public healthcare sector, Piramal Swasthya focuses on non-communicable diseases, maternal health, and child and adolescent health.

With more than ten years of expertise, Piramal Swasthya has managed a number of healthcare innovations at scale that are meeting the primary healthcare requirements of the majority of India's underprivileged and marginalized communities. Through 35 creative public healthcare delivery schemes, Piramal Swasthya operates in 21 Indian states and has provided services to over 112 million beneficiaries to date. Over 2500 workers, including more than 250 physicians, are employed by Piramal Swasthya and collaborate with Seva Bhav. The Group's key values—Knowledge, Action, Care, and Impact—direct the organization as it fulfils its social obligations.

DISSERTATION JOURNEY

During my two-month internship I gained practical knowledge in data collection and research methodologies. This experience encompassed several key areas, each contributing to a comprehensive understanding of the field.

Data collection and questionnaire design: I was introduced to the practical aspects of data collection for research studies. This included exposure to different types of questionnaires and learning how to conduct in-depth interviews. These skills are essential for gathering accurate and relevant data from study participants.

SAS Software: I learned the basics of SAS software, focusing on SAS syntax, recoding, and data analysis. This included practical exercises that helped me understand how to manipulate and analyze data using SAS, a critical tool for any data analyst.

Microsoft excel: My training in Microsoft Excel covered data management techniques, including the use of pivot tables, conditional formatting, VLOOKUP, HLOOKUP, and data validation. These skills are crucial for organizing and analyzing large datasets efficiently.

Epidemiology and Research Methodology: I gained knowledge in epidemiology and various research methodologies. This required learning about a variety of study designs, such as case-control, cohort, and cross-sectional studies. I also learned about key epidemiological concepts like relative risk, incidence, and prevalence. Understanding these methodologies is fundamental for conducting robust and credible research.

Field visit: I participated in field visits that provided practical insights into conducting research studies in real-world settings. These visits included a trip to the sub-divisional hospital in Danapur, where I gained a brief yet informative understanding of hospital operations. Observing how a hospital functions helped contextualize the data collection process within healthcare settings.

FACILITY VISIT: SUB-DIVISIONAL HOSPITAL DANAPUR

Date: May 15, 2025

Location: Sub-Divisional Hospital, Danapur.

Facilitator: Prashant sir

This report is the details of my field visit to the Sub-Divisional Hospital in Danapur, where I had the opportunity to learn about the functioning of a government hospital in Bihar. Seema Ma'am, the hospital manager, graciously provided insights into the various services offered and the daily operations of the facility.

Understanding of Hospital Departments:

- **OPD (Outpatient Department):** This is the first point of contact for patients seeking medical consultation for non-emergency conditions.
- **IPD (Inpatient Department):** This department is for patients who require hospitalization for treatment or surgery.
- **Labor Room:** This specialized unit is equipped for childbirth and deliveries. It provides a sterile and well-equipped environment for mothers and newborns.
- **C-Section Room:** This dedicated room is designed for conducting caesarean sections, a surgical procedure for childbirth.
- **Immunization Room:** This department focuses on preventive healthcare by administering vaccines to children and adults according to recommended schedules.
- **Vaccine Storage Room:** This temperature-controlled room ensures proper storage and preservation of vaccines to maintain their effectiveness.

Family Planning and Antenatal Care:

The hospital offers family planning services to help individuals and couples make informed choices about their reproductive health. I learned about various family planning methods available like condoms, vasectomy, tubectomy, Antara etc.

I also gained valuable insights into antenatal care, the crucial care provided to pregnant women throughout their pregnancy. This includes regular checkups, monitoring foetal development, and ensuring the well-being of both mother and baby. During these checkups, various measurements are taken, such as:

- Fundal height (distance between the pubic bone and the top of the uterus)
- Blood pressure
- Weight
- Foetal heart rate

Interaction with Staff and Nurses:

- The hospital staff and nurses played a vital role in my learning experience. They generously elaborated on their specific roles and responsibilities within their respective departments. Their explanations provided a deeper understanding of the daily operations and the dedication required to serve patients effectively.

HOUSEHOLD SURVEY

Date: May 24, 2025

Location: Sahnaura, Barh District, (Patna)

Facilitator: Prashant sir

On a recent visit to Sahnaura village in Barh district, Patna, I had the opportunity to learn about the process of conducting a household survey with the guidance of an Anganwadi worker. The primary focus was on understanding how to create a comprehensive survey chart and the methodology for gathering accurate data. During this visit, I observed the usage of three different questionnaires tailored for infants aged 0-5 months, 6-11 months, and 12-23 months. . The interviews were conducted with mothers of children aged 0-23 months.

- 1) **0-5 months old:** Focused primarily on breastfeeding practices and postnatal care.
- 2) **6-11 months old:** Included questions about the introduction of complementary foods in addition to breastfeeding.

- 3) **12-23 months old:** Covered a broader range of topics including continued breastfeeding, family planning, variety in complementary foods, and growth monitoring.

What we learn ?

- How to make a complete survey chart
- understand the structure and sections of the questionnaire for different age groups of infants.
- observe the data collection process and interview techniques.

The survey is designed to gather comprehensive information about the health and well-being of infants in different age groups. The questionnaire is divided into several sections, each targeting specific aspects of maternal and child health. These sections include:

1) socio-demographic information

- This section collects basic information about the family, such as the parent's age, education, occupation, and household composition. This data helps in understanding the socio-economic context of the family.

2) Antenatal care and birth preparedness

- Questions in this section focus on the care received by the mother during pregnancy, including antenatal visits, vaccinations, and preparations made for the birth. This helps in assessing quality and accessibility of maternal health services.

3) Birth history of youngest child

- This part records details about the youngest child's birth, such as the place of birth, type of delivery, and any complications during birth. It provides insight into the birthing practices and outcomes in the community.

4) Post-natal care and breast feeding

- The postnatal care section includes questions about the care received by both mother and child after birth, while the breastfeeding section focuses on the initiation and exclusivity of breastfeeding.

5) complementary feeding practices

- This section gathers information on the introduction of complementary foods to infants, including the types of foods given, the frequency of feeding, and any difficulties faced by the caregivers. It helps in assessing the nutritional status of infants

6) Family planning

Questions in this section address the family's knowledge and use of family planning methods, which is important for understanding reproductive health practices in the community.

At last, I want to conclude that the household survey visit to Sahnaura village provided a comprehensive understanding of how to conduct a detailed survey on maternal and child health. Learning to create a full survey chart, understanding the structure of the questionnaire, and observing the data collection process were invaluable experiences. The systematic approach to gathering information ensures that the data collected is reliable and useful for improving health interventions in the community.

SESSIONS LEARNINGS DURING INTERNSHIP PERIOD

Month 1:

- **Introduction to SAS Installation:** Learned how to install and set up SAS software.
- **Introduction to Data Cleaning and Management:** Covered basic techniques for cleaning and managing data.
- **Lecture on Literature Review:** Explored how to conduct a literature review of research papers.
- **Research Methodology Class:** Attended a session on prevalence, incidence rate, and risk ratio.
- **SAS Interface:** Detailed lecture on SAS interface, including log, result, and code windows; learned to create libraries and import data.
- **Data Cleaning in SAS:** Learned to clean and manage raw data; calculated BMI.
- **Research Methodology Class:** Continued learning about risk ratio, incidence proportion, exposed and unexposed groups, and population at risk.
- **Literature Review Class:** Learned to create Mesh terms related to our topics.

Month 2:

- **Excel Pivot Tables:** Created pivot tables and various charts.
- **SAS Functions:** Learned basic SAS functions such as PROC SORT, PROC FREQ, and PROC MEAN.
- **Questionnaire Design:** Understood the format of questionnaires and reviewed a toolkit for maternal and child health questionnaires.
- **Excel Conditional Formatting:** Applied conditional formatting in Excel.
- **Recoding in SAS:** Learned recoding techniques in SAS.
- **Study Designs:** Gained an understanding of various study designs, including cohort, case-control, cross-sectional, and ecological studies.
- **Data Validation in Excel:** Learned data validation techniques.
- **Sociodemographic Indicators:** Identified indicators from maternal and child health questionnaires.

- **Study Designs:** Continued discussions on different study designs.
- **Excel Functions:** Used SUBTOTAL, SUM, MAX, MIN, and AVG functions.
- **Recoding in SAS:** Recoded sociodemographic indicators and calculated frequencies.
- **Qualitative and Quantitative Studies:** Detailed lecture on these study types and their application in research.

Month 3:

- **VLOOKUP and HLOOKUP:** Learned these lookup functions in Excel.
- **Indicator Matrix:** Understood how to find variables and definitions for various indicators in maternal and child health questionnaires.
- **Incidence Rate and Confounding Factors:** Continued learning about these topics.
- **Mentor Meeting:** Discussed how to find indicators for various research topics.
- **Excel Functions:** Learned COUNTIF, SUMIF, and IF functions.
- **Research Methodology:** Covered topics like ecological fallacy, differential recall bias, data validity, precision, incubation period, latency period, and temporal ambiguity.
- **Descriptive Analysis in SAS:** Conducted descriptive analysis of various indicators using SAS software.

LIMITATIONS:

Within the two-month internship period, it is challenging to finish a research project on time. Even though we have access to the data collection needed for our research topic, doing proper analysis in a short amount of time is challenging. As part of our observational learning, we conducted home surveys at a rural community and an institutional delivery location. Accordingly, we have been working with the questionnaire instrument for a certain age group, although we are unaware of its development. Some limitations were noted during the study in relation to my research project on maternal health, namely the antenatal care and birth preparedness, among infants aged 0 to 5 months.

KEY FINDINGS FROM LITERATURE REVIEW:

1. The study identifies a number of important factors that influence Indian women's use of prenatal care (ANC). Increased ANC utilization was found to be associated with higher household wealth status, parental education, membership in specific tribes or castes, women's autonomy in healthcare decision-making, living in Southern India, media exposure, contraceptive use, and a woman's desire for pregnancy. On the other hand, ANC usage that was suitable was hindered by domicile in Eastern and

Central India, lesser household affluence, and a lack of autonomy for women. Addressing these determinants—which include bolstering basic healthcare in marginalized areas, lowering financial barriers, encouraging education, empowering women, improving family planning services, and extending health promotion campaigns—should be the main goal of efforts to increase ANC uptake.

2. The study discovered that although most women attended their first antenatal appointment within the first 12 weeks of pregnancy, the percentage of women who completed the recommended four or more visits was lower in some areas than intended but equivalent to national statistics overall. The use of professional delivery services was, nevertheless, greater than the national average. Key danger indications during pregnancy, labour/birth, postpartum, and neonatal periods were not well known, despite greater healthcare service consumption. Just roughly half of pregnant women knew where they would give birth in advance, and very few made arrangements to donate blood. One important factor that was found to influence both the awareness and practices of complications readiness and birth preparedness was education. In general, more community capacity building and more awareness campaigns are required to improve birth preparedness and complication readiness.
3. The results of our study demonstrate how many data sources interact dynamically to alter our perception of Telangana's antenatal care (ANC) quality. This substantially broadens the body of knowledge already available on assessing ANC quality. Similar to other research, our results demonstrate a broad range of quality in ANC service across multiple dimensions. Our ability to identify quality gaps is improved when many data streams are integrated. For instance, a study carried out in rural Tanzania found a discrepancy between the high satisfaction levels reported by expectant mothers in their departure interviews and the deficiencies in ANC consultations that were found by facility audits and observational data. A common explanation for these gaps was pharmaceutical and screening test stockouts.
4. Consistent with results from a study conducted in Karnataka, women in the current study who had information about danger indications associated with pregnancy, delivery, and newborns were better equipped to handle emergencies. Similar to findings from another study, about 57.5% of respondents saved money for childbirth-related expenses. Additionally, as demonstrated by studies from Karnataka as well as this study, awareness of government financial support corresponded with improved readiness.
5. The study discovered that improved Birth Preparedness, Complications Readiness (BCPR) practices depend on an understanding of danger indications during pregnancy. It is essential to teach families and moms about warning indicators. Poverty and a desire for public healthcare were associated with lower BPCR in rural locations. A lot of women were not aware of government programs that could assist with the cost of childbirth. Increasing knowledge about these initiatives may increase their use. Finding a matched blood donor in advance is crucial for emergencies, particularly in regions where blood is scarce. During prenatal care, conversations regarding pregnancy and BPCR should involve spouses and families. This is particularly crucial for young, underprivileged women. The usage of

healthcare can also be impacted by cultural variables. On these community and cultural factors, more research is required. In general, the emphasis should focus on enhancing understanding, dialogue, and use of current resources to enhance maternal health results.

6. According to the study, taking 100 or more Iron and Folic Acid (IFA) tablets before becoming pregnant is associated with a decreased risk of maternal and infant death, which is consistent with national guidelines. It also draws attention to the growing frequency of needless caesarean section deliveries and the urgent need for improved monitoring and treatment of anaemia in pregnant women. Enhancing prenatal and delivery care services and guaranteeing the availability of qualified medical personnel are essential for raising mother and child survival rates in rural India. Even though the study emphasizes the value of sufficient prenatal care (ANC) and delivery coverage, it also identifies several shortcomings, including a dearth of specific data on blood types and pregnancy problems, and calls for more research in these areas. Additionally, it highlights the significance of closely monitoring caesarean section deliveries and putting the best possible iron supplementation plans into place in order to significantly lower newborn and mother mortality.
7. The results of the study show that birth preparedness and complication readiness (BPCR) practices are similar in different locations, with methodological differences and sociodemographic factors perhaps accounting for differences. Although older age groups seem to be more likely to engage in BPCR practices, preparation for BPCR is greatly influenced by educational attainment and past antenatal care follow-up. Notably, a history of live births and deliveries at medical facilities enhances the chance of BPCR practice, indicating the importance of healthcare access and education in fostering readiness. These results highlight the significance of focused healthcare and education initiatives to promote BPCR practices and, eventually, mother and child health outcomes.
8. A study on Tanzania urban women's birth preparedness and complication readiness (BPCR) reveals significant findings. The degree to which women are free to choose where they were born has a big impact on family support. Unexpectedly, single status has a positive correlation with BPCR preparedness, maybe as a result of more autonomy in making decisions. Working has a detrimental effect on readiness, probably because of time constraints. Better preparedness is correlated with preference for family or traditional birth attendants over trained attendants, underscoring the importance of known assistance. Losing a baby has a detrimental impact on one's knowledge and preferences for a professional birth attendant, which suggests that specific help is required. The importance of healthcare accessibility is shown by the fact that living far from a medical institution reduces preparedness. mHealth technologies, such as smartphone apps, have the potential to be extremely important in improving pregnant experiences and spreading knowledge, especially for urban populations.
9. According to a study, men's involvement in maternal health care is largely to blame for the large gaps in knowledge regarding obstetric and neonatal danger indications that exist among expectant mothers and their partners. Although vaginal bleeding was acknowledged, there was a lack of general

knowledge, which delayed receiving medical attention in an emergency. Negative memory for postpartum and neonatal warning indicators indicates a serious knowledge deficit. Preparing birthing supplies and saving money were normal, but knowing where to give birth and setting up labor support were less typical. While partners' knowledge was mostly influenced by their educational position, women's knowledge was predicted by age, ethnic group, and level of health facility. Improving birth preparedness and complication readiness requires immediate action, particularly in rural regions with limited access to maternal health information.

10. The results of the study highlight two important ramifications for the Reproductive and Maternal Newborn Child Health Programme in India. First off, even in affluent states like Delhi, where ANC visits are likely to be appropriate, vulnerable pregnant women may still not have their needs met, calling for immediate legislative changes to close the healthcare gap. Second, ANC penetration was much higher in previously underserved areas, such as villages and urban resettlement colonies, probably as a result of easier access to primary care facilities. This emphasizes the significance of governmental initiatives meant to improve primary healthcare, as seen in comparable contexts in earlier research.

ABSTRACT

Introduction

In developing countries, maternal mortality remains a significant public health issue, particularly due to avoidable issues during pregnancy and childbirth. Over 287,000 maternal deaths occurred globally in 2020, with low- and lower-middle-income nations accounting for 95% of these deaths. Even though India's maternal mortality ratio (MMR) dropped from 130 in 2014–16 to 97 in 2018–20, places like Bihar still report alarmingly high MMRs. This study's primary goal is to investigate the variables affecting ANC visits and birth readiness among rural Bihar women.

Methodology

This is a secondary data analysis of a community-based cross-sectional study conducted in rural areas of Bihar during 2024 and 2025. Data were collected from a total of 2,250 women from 13 districts of Bihar randomly, who had 0-5 months old child.

Result

Between 2024 and 2025, ANC use rose from 43.40% to 50.70%. Additionally, the proportion of women who started ANC during the first trimester increased marginally from 52.8% to 54.3%. Factors that were substantially ($P < 0.05$) associated with four or more ANC visits in both years were maternal age, caste, family type, wealth index, mother and father's education, gravida, parity, and early ANC beginning. In both years, there was a high correlation between overall birth preparedness and parental education, father's occupation, and wealth.

Discussion

Despite national efforts to enhance maternal health, Bihar continues to have low levels of birth preparation and low utilization of ANC services. The study highlights the need for specific policy measures to address the socioeconomic and institutional barriers that women face when trying to get high-quality healthcare. Improving knowledge, financial security, and service accessibility is essential to reducing maternal mortality in Bihar and achieving national and international health goals.

SECONDARY DATA ANALYSIS

INTRODUCTION

In developing countries, promoting women's reproductive health and reducing maternal and infant mortality rates are significant public health issues⁽¹⁾. The majority of maternal mortality is caused by problems related to pregnancy and childbirth⁽²⁾. The rate of maternal death is very high, In 2020, 287,000 women lost their lives both during and after becoming pregnant and giving delivery. In 2020, low- and lower-middle-income countries accounted for about 95% of all maternal deaths, the majority of which could have been avoided. High maternal mortality rates in some regions reflect disparities in access to quality healthcare, highlighting wealth inequality. In 2020, the MMR in low-income countries was 430 per 100,000 live births, whereas in high-income countries it was 13 per 100,000 live births. The United Nations has set a Sustainable Development Goal (SDG) 3.1 goal to reduce the global maternal mortality ratio to less than 70 per 100,000 live births⁽³⁾.

India's maternal mortality ratio declined from (130) in 2014–2016 to (97) in 2018–20, with a rate of (103) in 2017–19. There is a very high variation in MMR that can be seen among different states of India from (215) in Assam to (43) in Kerala per lakh live births (4). MMR per 100,000 live births was (197) in Uttar Pradesh, (173) in Madhya Pradesh, (164) in Rajasthan, (150) in Odisha, (159) in Chhattisgarh, and (149) in Bihar. The majority of these high MMR states are included in the (EAG) eight empowered action group states (Jharkhand, Bihar, Uttarakhand, Madhya Pradesh, Chhattisgarh, Orissa, and Rajasthan), which together with Assam make up approximately 48% of India's total population. These states are highly focused due to their comparatively low socioeconomic indicators as well as higher indicators of fertility and mortality⁽⁴⁾.

According to the World Health Organization (2018), the MMR in these states is similarly equivalent to the maternal mortality rates per 100,000 live births in a few low- and middle-income countries, including Bangladesh (186), Nepal (258), Cambodia (161), South Africa (138), and Zambia (224). Furthermore, many developing countries' other socioeconomic indices and determinants exhibit the same traits as India's EAG states⁽¹⁾.

To reduce maternal and neonatal mortality, birth preparedness and complication readiness are the two primary areas of involvement and by encouraging health-seeking behaviour and the utilization of suitably qualified individuals and healthcare facilities for delivery⁽⁵⁾.

Preparation for a standard birth and readiness for any emergencies is known as Birth Preparedness and Complication Readiness, or BPCR. It involves proactive planning and decision-making to ensure a pregnant woman can access professional obstetric health services during labor. These actions collectively contribute to improving maternal health and reducing maternal mortality⁽⁶⁾.

There are three types of delays in seeking care for obstetric complications: (A) delaying making the decision to seek care; (B) delaying going to a health facility; and (C) delaying obtaining care while at the facility. The Johns Hopkins Program for International Education in Gynecology and Obstetrics (JHIEGO) maternal and newborn health program developed the birth preparation and complication readiness matrix to address these three delays: (5).

A birth plan should identify the following components: Knowledge of warning signs, the intended birth location, the preferred birth attendant, the closest appropriate care facility, finances for birth-related and emergency expenses, a birth companion, assistance in caring for the home and children while the woman is away, transportation to a medical facility for the birth, transportation in the event of an obstetric emergency, and the identification of compatible blood donors in case of emergency(7).

Antenatal care (ANC) is important for pregnant women, their families, and the community. It helps prevent illness, promote health, and screen for any issues. Using ANC services properly can reduce maternal deaths and improve the health of mothers and babies(8).

The World Health Organization (WHO) updated ANC guidelines in 2016. They emphasized personalized care and health, suggesting an increase in ANC appointments from four to eight or more. They also acknowledged the challenges of delivering and overseeing high-quality ANC in various health systems(9).

Significant progress has been made in the past few decades to expand access to perinatal and maternal health care services in low- and middle-income countries (LMICs). Prenatal care (ANC) coverage has increased significantly, as indicated by the number of ANC visits a woman received. This, along with the coverage of skilled birth attendants, is a commonly used measure to assess the impact of maternal health programs(10).

In India, the National Family Health Survey 2019-21 showed that 58.1 % of women had a minimum of four ANC visits. This involved care provided by qualified medical professionals, timely registration of pregnancy, the first ANC visit during the first trimester, four or more ANC visits, and appropriate information(11).

There are various factors which influence maternal health, such as increased household wealth, parental education, belonging to other tribes or castes, a woman's ability to access a health facility, media exposure, and desire for pregnancy. These factors need to be addressed in order to improve maternal health(8).

Maternal mortality rates in developing countries are largely caused by underutilization of maternal healthcare services. Pregnant women who take four or more Antenatal Care visits (ANC4+), use skilled birth attendants (SBA), and receive postnatal care (PNC) can avoid these deaths (1).

The National Family Health Survey–5 reveals the current utilization of maternal health services in the BIMARU states (Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh). Maternal service usage rates are as follows: 25.2% ANC4+ in Bihar, 57.5% ANC4+ in Madhya Pradesh, 55.3% ANC4+ in Rajasthan, and 42.4% ANC4+ in Uttar Pradesh(12–15). It is evident that Bihar has the lowest utilization while Madhya Pradesh has the highest among the BIMARU states.

Limited research exists on the factors that affects the utilization of maternal healthcare services in these states. This study aim to understand the factors associated with antenatal care and birth preparedness among rural pregnant women of bihar.

RATIONALE OF THE STUDY

Limited research exists on the factors that affects the utilization of maternal healthcare services in Rural Bihar. This study aims to understand the trends and factors associated with antenatal care and birth preparedness among rural pregnant women of Bihar.

RESEARCH OBJECTIVES

1. To Examine the changes In Antenatal Care Visits and Birth Preparedness Among Women of Rural Bihar.
2. To Examine the Factors Influencing the Antenatal Care Visits and Birth Preparedness.

METHODOLOGY

This Study Is Based on Secondary Data Which Is Collected In 2024 And Again In 2025 In Rural Bihar.

STUDY AREA: 13 districts of Bihar selected randomly from 9 Commissionerate

TARGET POPULATION: Mothers of 0-5 months old children

SAMPLE SIZE: 2,250 mothers

STUDY DESIGN: A community based cross-sectional study

DATA ANALYSIS TOOL: SAS SOFTWARE

RESULT

TABLE 1: - DESCRIPTIVE ANALYSIS

Variables	2024				2025			
	N	n	%	[LCL-UCL]	N	n	%	[LCL-UCL]
Age of respondent								
15-24	2250	1426	63.4	[61.4, 65.4]	2250	1372	61	[59 , 63]
25-34		770	34.2	[32.3, 36.2]		806	35.8	[33.8 , 37.8]
>=35		54	2.4	[1.8, 3]		72	3.2	[2.5 , 3.9]
Caste								
marginalised	2250	685	30.4	[28.5, 32.3]	2250	666	29.6	[27.7 , 31.5]
non-marginalised		1565	69.6	[67.7, 71.5]		1584	70.4	[68.5 , 72.3]
Religion								
hindu	2250	1930	85.8	[84.3 , 87.2]	2250	1932	85.9	[84.4 , 87.3]
non-hindu		320	14.2	[12.8 , 15.7]		318	14.1	[12.7 , 15.6]
Type of family								
Nuclear	2250	883	39.2	[37.2 , 41.3]	2250	1387	61.6	[59.6 , 63.7]
Joint		1367	60.8	[58.7 , 62.8]		863	38.4	[36.3 , 40.4]
Wealth index								
low	2250	750	33.3	[31.4 , 35.3]	2250	750	33.3	[31.4 , 35.3]
middle		750	33.3	[31.4 , 35.3]		750	33.3	[31.4 , 35.3]

high		750	33.3	[31.4 , 35.3]		750	33.3	[31.4 , 35.3]
Mother's Education								
Illiterate		782	34.8	[32.8 , 36.7]		709	31.5	[29.6 , 33.4]
upto class 8th	2250	510	22.7	[20.9 , 24.4]	2250	570	25.3	[23.5 , 27.1]
above class 8th		958	42.6	[40.5 , 44.6]		971	43.2	[41.1 , 45.2]
Father's Education								
Illiterate		687	33.2	[31.1 , 35.2]		624	29.9	[27.9 , 31.8]
upto class 8th	2072	487	23.5	[21.7 , 25.3]	2090	494	23.6	[21.8 , 25.5]
above class 8th		898	43.3	[41.2 , 45.5]		972	46.5	[44.4 , 48.6]
Mother's Occupation								
Unemployed		2140	95.1	[94.2 , 96]		2166	96.3	[95.5 , 97.1]
Agriculture		23	1	[0.6 , 1.4]		21	0.9	[0.5 , 1.3]
Non-agriculture	2250	38	1.7	[1.2 , 2.2]	2250	17	0.8	[0.4 , 1.1]
Business		22	1	[0.6 , 1.4]		24	1.1	[0.6 , 1.5]
Salaried		27	1.2	[0.7 , 1.7]		22	1	[0.6 , 1.4]
Father's Occupation								
Unemployed		79	3.5	[2.8 , 4.3]		70	3.1	[2.4 , 3.8]
Agriculture		189	8.5	[7.3 , 9.6]		244	10.9	[9.6 , 12.1]
Non-agriculture	2233	1063	47.6	[45.5 , 49.7]	2247	962	42.8	[40.8 , 44.9]
Business		308	13.8	[12.4 , 15.2]		280	12.5	[11.1 , 13.8]
Salaried		594	26.6	[24.8 , 28.4]		691	30.8	[28.8 , 32.7]
Gravida								
1 gravida		669	29.7	[27.8 , 31.6]		682	30.3	[28.4 , 32.2]
2 gravida	2250	600	26.7	[24.8 , 28.5]	2250	594	26.4	[24.6 , 28.2]
3 gravida		464	20.6	[18.9 , 22.3]		464	20.6	[18.9 , 22.3]
4 and more gravida		517	23	[21.2 , 24.7]		510	22.7	[20.9 , 24.4]
Parity								
1 parity		713	31.7	[29.8 , 33.6]		732	32.5	[30.6 , 34.5]
2 parity	2250	639	28.4	[26.5 , 30.3]	2250	635	28.2	[26.4 , 30.1]
3 and above parity		898	39.9	[37.9 , 41.9]		883	39.2	[37.2 , 41.3]
History of still birth								
no	2250	2178	96.8	[96.1 , 97.5]	2250	2176	96.7	[96 , 97.4]
yes		72	3.2	[2.5 , 3.9]		74	3.3	[2.6 , 4]

Advice on ANC checkups									
no	244	220	90.2	[86.4 , 93.9]	333	311	93.4	[90.7 , 96.1]	
yes		24	9.8	[6.1 , 13.6]		22	6.6	[3.9 , 9.3]	
4 or more ANC visits									
no	2221	1257	56.6	[54.5 , 58.7]	2215	1093	49.3	[47.3 , 51.4]	
yes		964	43.4	[41.3 , 45.5]		1122	50.7	[48.6 , 52.7]	
First ANC visit									
1st trimester		1128	52.8	[50.7 , 54.9]		1212	56.4	[54.3 , 58.5]	
2nd-3rd trimester	2137	884	41.4	[39.3 , 43.5]	2149	820	38.2	[36.1 , 40.2]	
4th and above		125	5.8	[4.9 , 6.8]		117	5.4	[4.5 , 6.4]	
Advice on danger sign									
no	244	233	95.5	[92.9 , 98.1]	333	322	96.7	[94.8 , 98.6]	
yes		11	4.5	[1.9 , 7.1]		11	3.3	[1.4 , 5.2]	
Pregnancy Danger Sign Risk Level									
Low risk		551	24.5	[22.7 , 26.3]		525	23.3	[21.6 , 25.1]	
moderate risk	2250	500	22.2	[20.5 , 23.9]	2250	487	21.6	[19.9 , 23.3]	
high risk		1199	53.3	[51.2 , 55.4]		1238	55	[53 , 57.1]	

OUTCOME VARIABLE

Overall BP practice									
Poor		671	29.8	[27.9 , 31.7]		673	29.9	[28 , 31.8]	
Average	2250	682	30.3	[28.4 , 32.2]	2250	746	33.2	[31.2 , 35.1]	
Good		897	39.9	[37.8 , 41.9]		831	36.9	[34.9 , 38.9]	
4 or more ANC visits									
no	2221	1257	56.6	[54.5 , 58.7]	2215	1093	49.3	[47.3 , 51.4]	
yes		964	43.4	[41.3 , 45.5]		1122	50.7	[48.6 , 52.7]	

A total of 2,250 women of reproductive age (15 to 49 years) participated in the study conducted across both years, 2024 and 2025. The proportion of respondents aged 15-24 slightly decreased from 64.1% in 2024 to 61.9% in 2025, while the 25-44 age group modestly increased from 34.2% to 35.8%. Illiteracy among mothers decreased from 34.8% in 2024 to 31.5% in 2025, with corresponding increases in educational attainment up to Class 8th (22.6% to 25.3%) and above Class 8th (42.2% to 43.1%). A similar decrease was observed in illiterate fathers (30.4% to 27.9%). Father's employment saw a notable shift, with agricultural employment significantly dropping from 8.4% in 2024 to 0.4% in 2025. The

proportion of unemployed mothers remained high at 96.5% in 2025. Caste distribution remained stable in 2025 (29.8% Scheduled Caste, 70.4% non-marginalized), as did religion (85.9% Hindu). The wealth index categories (Poor, Middle, Rich) maintained an even distribution of 33.3% each in 2025. A slight shift towards nuclear families was observed in 2025 (39.6% nuclear, 60.4% joint). The number of ANC visits increased from 41.3% in 2024 to 48.6% in 2025, and the timing of the first ANC visit improved (52.8% in 2024 vs. 54.3% in 2025 visiting in the 1st trimester). The distribution of gravida remained the same in 2025, and the proportion of respondents with a history of stillbirth remained low at 3.3%. Advice on danger signs decreased from 4.5% to 3.3%, and high-risk level pregnancy increased in pregnant women from 53.3% in 2024 to 55% in 2025.

Overall Birth Preparedness Measure

- Overall birth preparedness was assessed using a composite index derived from five key components of birth preparedness: (1) identification of place of delivery, (2) identification of a birth companion, (3) identification of a blood donor, (4) arrangement of transport, and (5) saving money for delivery-related expenses. Each component was assigned a score of 1 if the respondent had made the respective preparation and 0 otherwise. The total score ranged from 0 to 5 for each respondent. To calculate this a tertile-based method is used where Respondents were grouped into three categories based on their total score which are [**Poor preparedness** (score = 0), **Average preparedness** (score = 1–2), and **Good preparedness** (score = 3–5)]

Components of Birth-Preparedness

Variables	2024				2025			
	N	n	%	[LCL-UCL]	N	n	%	[LCL-UCL]
Identified place of delivery yes	2250	1579	70.2	[68.3 , 72.1]	2250	1577	70.1	[68.2 , 72]
Identified skilled provider yes	2250	976	40.5	[38.3 , 42.8]	2250	936	37.7	[35.5 , 39.9]
saved money yes	2250	996	41.8	[39.5 , 44.1]	2250	976	40.4	[38.1 , 42.6]
Identified transport yes	2250	657	27.6	[25.6 , 29.7]	2250	562	22.4	[20.5 , 24.2]
Identified blood donor yes	2250	160	6.8	[5.7 , 8]	2250	138	5.3	[4.3 , 6.2]

The table presents a comparison of birth preparedness indicators among rural women in Bihar for the years 2024 and 2025. The proportion of women who identified a place of

delivery remained almost the same in both years—70.2% in 2024 and 70.1% in 2025—indicating consistent awareness regarding delivery planning. However, the percentage of women who identified a skilled birth provider decreased slightly from 40.5% in 2024 to 37.7% in 2025, suggesting a minor decline in planning for skilled assistance during childbirth.

Similarly, the proportion of women who saved money for delivery dropped from 41.8% in 2024 to 40.4% in 2025, indicating a small reduction in financial preparedness. A more noticeable decline was observed in the identification of transport, which decreased from 27.6% to 22.4%, pointing to possible challenges in planning for access to health facilities. Additionally, the percentage of women who identified a potential blood donor declined from 6.8% in 2024 to 5.3% in 2025, highlighting a gap in emergency preparedness. Overall, while the identification of the place of delivery remained stable, the other indicators showed a downward trend, indicating the need to strengthen birth preparedness efforts, particularly in emergency planning and financial readiness.

TABLE 2: - STRATIFIED ANALYSIS FOR 4 OR MORE ANC VISITS

Variables	2024					2025				
	4 or more ANC VISITS					4 or more ANC VISITS				
	N	YES				N	YES			
		n	%	LCL-UCL	P value		n	%	LCL-UCL	P value
Age of respondent										
15-24	1412	647	45.8	[43.2 , 48.4]	0.0068	1359	729	53.6	[51 , 56.3]	0.0016
25-34	758	300	39.6	[36.1 , 43.1]		786	363	46.2	[42.7 , 49.7]	
>=35	51	17	33.3	[20.4 , 46.3]		70	30	42.9	[31.3 , 54.5]	
Caste										
marginalised	669	228	34.1	[30.5 , 37.7]	<.0001	650	277	42.6	[38.8 , 46.4]	<.0001
non-marginalised	1552	736	47.4	[44.9 , 49.9]		1565	845	54	[51.5 , 56.5]	
Religion										
hindu	1904	806	42.3	[40.1 , 44.6]	0.0125	1904	959	50.4	[48.1 , 52.6]	0.5039
non-hindu	317	158	49.8	[44.3 , 55.4]		311	163	52.4	[46.9 , 58]	
Type of family										
nuclear	1351	651	48.2	[45.5 , 50.9]	<.0001	1371	765	55.8	[53.2 , 58.4]	<.0001
joint	870	313	36	[32.8 , 39.2]		844	357	42.3	[39 , 45.6]	
Wealth index										
low	729	225	30.9	[27.5 , 34.2]	<.0001	730	298	40.8	[37.3 , 44.4]	<.0001
middle	745	322	43.2	[39.7 , 46.8]		738	375	50.8	[47.2 , 54.4]	

[illegible]

1st trimester	1124	563	50.1	[47.2 , 53]		1206	695	57.6	[54.8 , 60.4]	
2nd-3rd trimester	880	328	37.3	[34.1 , 40.5]	<.0001	810	361	44.6	[41.1 , 48]	<.0001
4th and above	121	32	26.4	[18.6 , 34.3]		115	31	27	[18.8 , 35.1]	

This table describes the factors affecting ANC 4 visits among pregnant women. It was found that the mother's age, caste, religion, type of family, Wealth Index, mother's education, father's education, father's occupation, gravida, parity, and first ANC visits were significantly linked to (ANC 4 visits) ($P < 0.05$) for both the years. But mother's occupation shows significant association to ANC 4 visits only in year 2025. However factors like mother's occupation, history of stillbirth, and advice on ANC checkup did not show a significant association with ANC 4 visits for both the years.

The comparison between 2024 and 2025 shows an overall improvement in the percentage of rural pregnant women in Bihar receiving four or more antenatal care (ANC) visits. Notable increases were observed in several key groups. Among women aged 15–24, the coverage increased from 45.8% in 2024 to 53.6% in 2025. Similarly, among women from marginalised castes, the percentage rose from 34.1% to 42.6%. Women living in nuclear families also showed an improvement from 48.2% to 55.8%. ANC coverage among women in the low wealth group increased from 30.9% to 40.8%, while those in the high wealth group reached 60.1% in 2025.

Parental education was also associated with ANC visits. Mothers with education above class 8 had higher coverage (52.6% in 2024 to 60.3% in 2025), same with fathers with similar education levels (53.1% to 58.9%). The timing of the first ANC visit remained a strong factor; women who had their first visit in the first trimester reported higher coverage, increasing from 50.1% to 57.6% across the two years.

The role of religion was significant in 2024 with higher percentage in non-hindu both the year (49.8% in 2024 to 52% in 2025) but don not show significant association in 2025. First-time mothers (1 gravida and 1 parity) had the highest percentage of 4 or more ANC visits,(60.7% and 62.3% in 2024 respectively for 1 gravida and 1 parity to 68% for both in 2025). The father's occupation also showed a pattern—women whose husbands were in salaried or business jobs had higher ANC coverage compared to those in agriculture or informal work.

TABLE 3: - STRATIFIED ANALYSIS FOR BIRTH PREPAREDENESS

Variables	2024										2025									
	Overall Preparedness										Overall Preparedness									
	poor (0)			average (1-2)			good (3-5)			p-value	poor (0)			average (1-2)			good (3-5)			p-value
	N	n	%	LCL	-	n	%	LCL	-		N	n	%	LCL	-	n	%	LCL	-	

				UC L			UC L			UC L					UC L			UC L			UC L		
Age of respondent																							
15-24	1		2					4				1		3		3		3					
	4	4	9		4		[27.6	5	0	[37.8		3	4	0	[28.3	4	2	[30.3	5	6			
	2	2	.	[27.3	2	3	,	7	.	,		7	2	.	,	5	.	,	0	.	[33.9		
	6	3	7	,32]	8	0	32.4]	5	3	42.9]		2	2	8	33.2]	0	8	35.3]	0	4	,39]		
25-34			3								0.9	8	2	7		2	3	[30.2	3	8	[35.2	0.2	
	7	2	0		2	0		3		[35.5	73	0	2	.	[24.8	7	.		1	.	,	95	
	7	3	.	[27,	3	.	[27.5	0	3	,	3	6	5	9	,31]	0	5	36.8]	1	6	41.9]		
	0	3	3	33.5]	7	8	,34]	0	9	42.4]													
>=35			2					4															
	7		7	[15.8		1	[19.1		0	[27.6													
	5	1	.	,	1	.	,	2	.	,		7	2	.	[25,	2	.	[25,	2	.	,		
	4	5	8	39.7]	7	5	43.9]	2	7	53.9]		2	6	1	47.2]	6	1	47.2]	0	8	38.1]		
Caste																							
marginalised non-marginalised			3					3			0.3	6	2		[29.5	2	2		2	4			
	6	2	0	[26.9	2		[28.5	2	7			6	2	3	,	1	.	[29,	2	.	[30.8	0.0	
	8	0	.	,	1	3	,	5	.	[34,		6	2	3	,	6		36.1]	9	4	,38]		
	5	8	4	33.8]	9	2	35.5]	8	7	41.3]		6	0	3	36.6]	7	3						
marginalised	1		2					4			5	5	4	8	[26.4	5	3	[31.1	6		[35.6		
	6	6	.	,	6	.	,	3	.	,		8	5	.	,	2	.	,	0	3	,		
	5	3	6	31.8]	3	6	31.8]	9	8	43.3]		4	3	6	30.8]	9	4	35.7]	2	8	40.4]		
Religion																							
hindu	1		2			3		4			0.9	1		3		3		3					
	9	5	9	[27.6	5	0	[28.2	7	0	[37.9		9	5	0	[28.1	6	1	[29.1	7	8	[36.4		
	3	7	.	,	8	.	,	7	.	,		3	8	.	,	0	.	,	4	.	,	<0	
	0	3	7	31.7]	4	3	32.3]	3	1	42.2]	00	2	3	2	32.2]	3	2	33.3]	6	6	40.8]		
non-hindu			3					3			6	3		2					2			00	
	3		0	[25.6		0	[25.6	1	8	[33.4		3		8	[23.3	1		[39.5		6	[21.9	1	
	2	9	.	,	9	.	,	2	.	,		1	9	.	,	4	4	,	8	.	,		
	0	8	6	35.7]	8	6	35.7]	4	8	44.1]		8	0	3	33.3]	3	5	50.4]	5	7	31.6]		
Type of family																							
nuclear	1		2			3		4			0.0	1		2		3		3					
	3	3	7	[25.1	4	0	[27.8	5	2			3	3	8	[25.8	4	2	[30.2	5	9	[36.6		
	6	7	.	,	1	.	,	7	.	[39.7		8	9	.	,	5	.	,	4	.	,	0.0	
	7	5	4	29.8]	3	2	32.6]	9	4	,45]	02	7	0	1	30.5]	3	7	35.1]	4	2	41.8]		
joint			3								4			3					3			0.0	
	8	2	3	[30.4	2	0	[27.4	3		[32.8		8	2	2	[29.7	2		[30.8	2	3	[30.1	7	
	8	9	.	,	6	.	,	1	3	,		6	8	.	,	9	3	,	8	.	,		
	3	6	5	36.6]	9	5	33.5]	8	6	39.2]		3	3	8	35.9]	3	4	37.1]	7	3	36.4]		
Wealth index																							
low			3			3		3			0.0			3		3		3					
	7	2	0	[27.1	2	3	[30.5	2	5	[32.3		7	2	2	[29.2	2	6	[33.2	2	0	[27.5		
	5	2	.	,	5	.	,	6	.	,		5	4	.	,	7	.	,	3	.	,		
	0	8	4	33.7]	4	9	37.3]	8	7	39.2]		0	4	5	35.9]	5	7	40.1]	1	8	34.1]		
middle			3					3			0.0			3		3					<0		
	7	2	1	[28.1	2	0	[26.8	2	8	[34.9	01	7	2	0	[27.5	2	3	[29.8	2		[32.6	00	
	5	3	.	,	2	.	,	8	.	,	6	5	3	.	,	4	.	,	7	3	,	1	
	0	6	5	34.8]	6	1	33.4]	8	4	41.9]		0	1	8	34.1]	9	2	36.6]	0	6	39.4]		
high			2					4						2									
	7	2	7	[24.4	2	6	[23.8	3	5			7	1	6	[23.2	2	9	[26.3	3		[40.4		
	5	0	.	,	0	.	,	4	.	[41.9		5	9	.	,	2	.	,	3	4	,		
	0	7	6	30.8]	2	9	30.1]	1	5	,49]		0	8	4	29.6]	2	6	32.9]	0	4	47.6]		
Mother's Education																							
illiterate			3			3		3			<0			3		3		3			<0		
	7	2	3	[29.9	2	3	[30.6	2	2	[29.6	00	7	2	3	[29.8	2	5	[31.6	2	1		00	
	8	6	.	,	6	.	,	5	.	,	1	0	3	.	,	4	.	,	2	.	[28.2		
	2	0	2	36.6]	5	9	37.2]	7	9	36.2]		9	6	3	36.8]	9	1	38.6]	4	6	,35]	1	

Father's Education	upto class 8th above	5	1	3		1		1	3	[32.7	5	1	3	[27.8	1	3	[30.5	1		[30.1			
		1	6	.	[29 ,	5	3	[26 ,	8	.	7	8	.	9	.		[30.5	9	3				
		0	9	1	37.2]	3	0	34]	8	9	41.1]	0	0	6	35.4]	6	4	38.3]	4	4			
				2			2			4			2						4				
		9	2	5		2	7	[24.7	4	7		9	2	6	[23.7	3		[28.1	4	2			
	class 8th	5	4	.	[22.5	6	.	,	5	.	[44 ,	7	5	.	,	0	3	,	1	.	,		
		8	2	3	, 28]	4	6	30.4]	2	2	50.3]	1	7	5	29.2]	1	1	33.9]	3	5			
	illiterate	6	2	2	[28.7	2	3	[29.8	2	4	[30.9	6	2		[30.3	2	5		1	0			
		8	2	.	,	2	.	,	3	.	,	2	1	3	,	2	.	[32 ,	8	.	,		
ate	7	1	2	35.7]	9	3	36.9]	7	5	38.1]	4	2	4	37.7]	3	7	39.5]	9	3				
Mother's Occupation						3				4					3			3					
	upto class 8th above	4	1			1	0	[26.5	1	0	[36.1	4	1	9	[25.3	1	6	[32.6	1	3			
		8	4	2	[24.9	4	.	,	9	.	,	9	4	.	,	8	.	,	6	.			
		7	1	9	, 33]	9	6	34.7]	7	5	44.8]	4	5	4	33.4]	2	8	41.1]	7	8			
				2			2			4						2			4				
		8	2	6	[23.9	2	7	[24.8	4	5	[42.2	9	2		[23.3	2	9	[26.9	4	4			
	class 8th	9	4	.	,	4	.	,	0	.	,	7	5	2	,	8	.	,	3	.	,		
		8	1	8	29.7]	9	7	30.7]	8	4	48.7]	2	3	6	28.8]	9	7	32.6]	0	2			
	Unemployed	2		2			3					2		3					3				
	1	6	9	[27.6	6	0	[28.6	8			1	6	0	[28.3	7			7	6				
	4	3	.	,	5	.	,	5	4	[37.9	6	5	.	,	1	3	[31 ,	9	.	,			
	0	2	5	31.5]	3	5	32.5]	5	0	, 42]	6	5	2	32.2]	5	3	35]	6	7				
Father's Occupation						3				3					3			3					
	Agriculture			4	[15.3		0	[11.6		4	[15.3			8		8	[17.3		3				
		2		.	,		.	,		.	,	2		.	[9.2 ,		.	,		.	,		
	Non-agriculture	3	8	8	54.3]	7	4	49.3]	8	8	54.3]	1	6	6	47.9]	8	1	58.9]	7	3			
				5			2			2				2		4			3				
				2	[36.7		1			6	[12.3			3		1	[17.8		5				
		3	2	.	,		.	[8.1 ,	1	.	,	7	4	.	[3.4 ,		.	,		.	,		
		8	0	6	68.5]	8	1	34]	0	3	40.3]	1		5	43.7]	7	2	64.6]	6	3			
				1			3			5				2		4			3				
				3			1	[12.3		4	[33.7			0		5	[25.9		3				
Mother's Occupation	Business	2		.	[0 ,		.	,	1	.	,	2		.	[4.6 ,	1	.	,		.	,		
		2	3	6	28]	7	8	51.3]	2	5	75.4]	4	5	8	37.1]	1	8	65.8]	8	3			
				2			2			4				1		2			6				
				9	[12.4		5			4	[25.7			3		2			3				
	Salaried	2		.	,		.	[9.4 ,	1	.	,	2		.	[0 ,		.	[5.2 ,	1	.	,		
		7	8	6	46.9]	7	9	42.5]	2	4	63.2]	2	3	6	28]	5	7	40.3]	4	6			
	Unemployed			3			2							3		4			2				
				0	[20.2		6	[16.8				7		1	[20.5		2	[31.3		5			
		7	2	.	,	2	.	,	3	4	[32.1	7	2	.	,	3	.	,	1	.			
	9	4	4	40.5]	1	6	36.3]	4	3	, 54]	0	2	4	42.3]	0	9	54.5]	8	7				
Father's Occupation										3					3			3					
	Agriculture	1		3	[26.6			[20.7		9	[32.7	2		0	[24.6		0	[24.6		9			
		8	6	.	,	5	2	,	7	.	,	4	7	.	,	7	.	,	9	.			
	Non-agriculture	1	3	3	40.1]	1	7	33.3]	5	7	46.7]	4	4	3	36.1]	4	3	36.1]	6	3			
							3			3				3		3			3				
		0	3		[28.3	3	2	[29.8	3	6	[33.4	9	3	3	[30.5	3	3	[30.8	3	2			
		6	3	3	,	4	.	,	8	.	,	6	2	.	,	2	.	,	1	.			
		3	0	1	33.8]	7	6	35.5]	6	3	39.2]	2	2	5	36.5]	5	8	36.8]	5	7			
					[22.6			[23.2	1		[38.6				[24.6				1				
	Business	0	8	2	,	8	2	,	3	4	,	8	8	3	,	8	2	[24 ,	1	4			
	8	5	7	32.6]	7	8	33.3]	6	4	49.7]	0	4	0	35.4]	2	9	34.6]	4	0				

Salary	5	1	7	[23.7	1	9	[25.5	2	3	[39.6	0.6
	9	6	.	, 30.9]	7	.	, 32.8]	5	.	, 47.6]	
gravid	4	2	3		3	1		9	6		
1	6	2	1	[28.2	1		[25.6	2	9		0.4
	6	1	.	, 35.2]	9	2	, 32.4]	6	.	[35.6	
gravid	9	2	7		4	9		3	3	, 43]	
2	6	1	9	[26.2	1		[25.4	2	1	[37.2	0.6
	0	7	.	, 33.5]	7	2	, 32.6]	4	.	, 45.1]	
gravid	0	9	8		4	9		7	2		12
3	4	1	6	[22.9	1	2	[28.1	1	0	[36.3	9
	6	2	.	, 31]	5	.	, 36.6]	8	.	, 45.2]	
gravid	4	5	9		0	3		9	7		
4											
and						3			3		
more	5	1			1	1	[27.7	1	8	[34.1	
gravid	1	5	3	[26,	6	.	, 35.7]	9	.	, 42.5]	
Parity	7	5	0	33.9]	4	7		8	3		
1	7	2	1	[28.3	2	8	[25.4	2	9		0.4
	1	2	.	, 35.1]	0	.	, 32.1]	8	.	[36,	
parit	3	6	7		5	8		2	6	43.1]	
y											
2	6	1	9	[25.9	1	9	[25.9	6	1	[37.3	82
	3	8	.	, 33]	8	.	, 33]	3	.	, 45]	
parit	9	8	4		8	4		3	2		
y											
3											
and											
abov			2			3			3		
parit	8	2	8	[25.7	2	2	[29.1	3	9		
y	9	5	.	, 31.6]	8	.	, 35.2]	5	.	[36,	
History of still birth	8	7	6		9	2		2	2	42.4]	
no	2	6	9	[28,	6	.	, 32.3]	6	.	, 41.8]	0.8
	7	5	.	, 31.8]	1	3		6	8		
yes	7	2	.	, 38.1]	2	.	, 39.7]	3	.	, 54.5]	49
	2	0	8		1	2		1	1		
4 or more ANC visits											
no	1	3		[26.4	3	0	[27.8	5	0	[37.9	0.7
	5	6	2	, 31.5]	8	.	, 32.9]	1	.	, 43.4]	
yes	9	2	0	[27.6	2	0	[27.2	8	.	, 42.5]	18
	6	9	.	, 33.4]	9	.	, 33]	0	4		
First ANC visit	4	4	5		0	1		0	4		
6	1	4	3	[21.4	2	3	[30.3	2	1	[37.9	0.3
	9	7	.	, 27.8]	3	.	, 37.4]	8	.	, 45.2]	
8	2	3	2	[28.5	2	9	[26.5	2	8	[34.5	0.1
	8	1	3	, 35.5]	0	9	, 33.4]	6	.	, 41.8]	
9	5	1	7	[24,	2	3	[29.9	2	8	[34.8	0.3
	9	6	.	, 31.2]	0	7	, 37.5]	3	.	, 42.6]	
4	4	1	9	[25.6	1	5	[31,	1	4	[30.6	0.09
	6	3	.	, 33.9]	6	.	, 39.7]	6	.	, 39.3]	
5	1	5	3	[26,	7	4	[30.8	7	1	[31,	0.1
	0	3	0	, 34]	8	9	, 39]	9	1	, 39.2]	
7	2	3	2	[27.7	2	0	[27.5	2	8	[34.6	0.1
	3	2	3	, 34.4]	2	.	, 34.2]	7	.	, 41.6]	
6-7	1	7	2	[29.7	2	3	[29.7	2	9	[35.3	0.1
	5	6	.	, 31]	2	4	, 37.1]	4	.	, 42.9]	
8	2	0	3	[27.6	3	4	[31.7	3	4	[31.3	0.1
	8	7	.	, 33.7]	0	.	, 38]	0	.	, 37.6]	
3	1	3	2	[28.2	1	3	[30.8	8	7	[35.1	0.03
	6	5	1	, 32]	3	8	, 34.7]	8	1	, 39.2]	
7	1	4	4	[14.5	3	4	[33.3	1	1	[20.5	9
	4	8	3	, 34.1]	3	6	, 55.9]	3	1	, 41.6]	
0	3	0	3	[27.9	3	4	[32,	3	4	[31.7	0.0
	9	3	.	, 33.4]	1	9	, 37.7]	7	5	, 37.3]	
1	3	3	1	[26.3	3	1	[29,	4	9	[36.4	0.0
	2	2	2	, 31.6]	5	7	, 34.5]	1	3	, 42.2]	

	1	2	3	4		1	2	3	3	
1st	1	3	7	[25.3	3	0	4	1	[38.9	
trime	2	1	.	,	4	.	[27.6	7	.	,
ster	8	5	9	30.5]	2	3	, 33]	1	8	44.6]
2nd-			3			2		3		
3rd	8	2	1	[28.7	2	9	[26.7	3	8	[35.3
trime	8	8	.	,	6	.	,	4	.	,
ster	4	1	8	34.9]	3	8	32.8]	0	5	41.7]
4th			2			3		3		
and	1		4	[17.2		7	[29.1		7	[29.1
abov	2	3	.	,	4	.	,	4	.	,
e	5	1	8	32.4]	7	6	46.1]	7	6	46.1]
Advice on danger sign										
		2			2			4		
	2	7	[22.1		7	[22.1	1	4	[37.8	
no	3	6	.	,	6	.	,	0	.	,
	3	5	9	33.7]	5	9	33.7]	3	2	50.6]
		4				4		4		
		5	[15.8		9			5	[15.8	
yes	1	.	,		.	[0,		.	,	
	1	5	5	75.1]	1	1	26.2]	5	5	75.1]
Pregnancy Danger Sign Risk Level										
Low		2			3			4		
risk	5	1	8	[24.4	1	0		2	1	[37.6
	5	5	.	,	6	.	[26.3	3	.	,
	1	5	1	31.9]	6	1	, 34]	0	7	45.9]
mod		2						4		
erate	5	1	8	[24.4	1			2	1	[37.3
risk	0	4	.	,	5	3	[26,	0	.	,
	0	2	4	32.4]	0	0	34]	8	6	45.9]
	1	3			3			3		
high	1	3	1	[28.6	3	0	[27.9	4	8	
risk	9	7	.	,	6	.	,	5	.	[35.5
	9	4	2	33.8]	6	5	33.1]	9	3	, 41]

This table describes the factors affecting overall birth-preparedness among pregnant women. It was found that the type of family, wealth index, mother's education, father's education was significantly linked to overall birth-preparedness at ($P < 0.05$) for both the years (2024 and 2025). Religion, father's occupation and pregnancy danger sign risk level shows significant association with overall birth preparedness only in 2025. Age, Caste, mother's occupation, gravida, parity, history of still birth, 4 or more anc visits, first anc, advice on danger signs did not show a significant association with overall birth-preparedness for both the years. wealth index is significantly associated with overall preparedness in both the years 2024 and 2025 ($p < 0.001$). In both years, the "high" wealth index group exhibited the highest percentage of "good" preparedness (45.5% and 44% in 2024 and 2025 respectively), while the "low" wealth index group had the highest percentage of "poor" preparedness (2024: 30.4%; 2025: 32.5%).

Mother's education is significantly associated with overall preparedness in both years ($p < 0.001$). In both years, mothers with "above class 8th" education reported the highest percentage of "good" preparedness (2024: 47.2%; 2025: 42.5%), while "illiterate" mothers reported the highest "poor" preparedness (2024: 33.2%; 2025: 33.3%).

Father's education also shows a significant association with overall preparedness in both years (2024: $p = 0.0007$; 2025: $p < 0.001$). In both years, "above class 8th" education was associated with the highest "good" preparedness (2024: 45.4%; 2025: 44.2%), and "illiterate" fathers with the highest "poor" preparedness (2024: 32.2%; 2025: 34%).

Father's occupation was significantly associated with overall preparedness in 2025 ($p < 0.001$), but not in 2024 ($p = 0.0856$). In 2025, "salaried" fathers had the highest percentage of "good" preparedness (41.5%), while "unemployed" fathers had the highest percentage of "poor" preparedness (31.4%).

In 2025, a statistically significant association was found between pregnancy danger sign risk level and overall preparedness ($p = 0.0184$). This association was not significant in 2024 ($p = 0.5119$). In 2025, the "moderate risk" group had the highest percentage of "good" preparedness (42.7%), while the "high risk" group had the highest percentage of "poor" preparedness (31.9%).

A significant association between religion and overall preparedness was observed in 2025 ($p < 0.001$), but not in 2024 ($p = 0.9006$). In 2025, "Hindu" respondents showed a higher percentage of "good" preparedness (38.6%) compared to "non-Hindu" respondents (26.7%). "Non-Hindu" respondents, however, showed a much higher percentage of "average" preparedness (45%).

A statistically significant association exists between the type of family and overall preparedness in both 2024 ($p = 0.0024$) and 2025 ($p = 0.0097$). In both years, "nuclear" families consistently showed a higher percentage of "good" preparedness (2024: 42.4%; 2025: 39.2%) compared to "joint" families (2024: 36%; 2025: 33.3%). Conversely, "joint" families had a higher percentage of "poor" preparedness.

TABLE 4: - REGRESSION FOR 4 OR MORE ANC VISITS

	2024	2025
Variables	ANC 4 VISITS (REF=NO)	ANC 4 VISITS (REF=NO)

	YES			YES		
	AOR	LCL-UCL	P-VALUE	AOR	LCL-UCL	P-VALUE
Age of respondent (ref=15-24)						
25-34	0.786	[0.653 , 0.945]	0.0105	0.753	[0.629 , 0.901]	0.002
>=35	0.625	[0.341 , 1.145]	0.1283	0.735	[0.449 , 1.204]	0.2215
Caste (ref=marginalised)						
marginalised	1.401	[1.144 , 1.716]	0.0011	1.387	[1.141 , 1.687]	0.001
Religion(ref=hindu)						
non-hindu	1.208	[0.939 , 1.554]	0.1408	0.993	[0.772 , 1.277]	0.956
Type of family (ref=nuclear)						
joint	0.732	[0.607 , 0.883]	0.0011	0.67	[0.558 , 0.805]	<.0001
Wealth index(ref=low)						
middle	1.556	[1.251 , 1.936]	<.0001	1.431	[1.161 , 1.763]	0.0008
high	2.515	[2.017 , 3.136]	<.0001	2.004	[1.619 , 2.481]	<.0001
Mother's Education (ref=illiterate)						
upto class 8th	1.469	[1.157 , 1.865]	0.0016	1.353	[1.075 , 1.701]	0.0099
above class 8th	1.791	[1.438 , 2.231]	<.0001	1.923	[1.544 , 2.396]	<.0001
Mother's Occupation (ref=Unemployed)						
Agriculture	1.155	[0.486 , 2.746]	0.7438	0.784	[0.315 , 1.95]	0.6008
Non-agriculture	1.416	[0.709 , 2.827]	0.3242	0.443	[0.142 , 1.385]	0.1615
Business	1.122	[0.472 , 2.667]	0.7937	2.473	[1.007 , 6.07]	0.0482
Salaried	1.29	[0.59 , 2.82]	0.5234	1.584	[0.653 , 3.842]	0.3089
Father's Education (ref=illiterate)						
upto class 8th	1.215	[0.945 , 1.561]	0.1281	1.223	[0.954 , 1.566]	0.1119
above class 8th	1.718	[1.357 , 2.175]	<.0001	1.594	[1.265 , 2.008]	<.0001
Father's Occupation(ref=Unemployed)						
Agriculture	1.076	[0.622 , 1.862]	0.7923	0.607	[0.347 , 1.062]	0.0801
Non-agriculture	1.116	[0.692 , 1.799]	0.6525	0.607	[0.361 , 1.019]	0.0588
Business	1.025	[0.616 , 1.706]	0.9228	0.713	[0.41 , 1.237]	0.2286
Salaried	1.424	[0.877 , 2.311]	0.1529	0.805	[0.479 , 1.352]	0.4116
gravida(ref=1 gravida)						
2 gravida	0.489	[0.388 , 0.617]	<.0001	0.363	[0.287 , 0.46]	<.0001
3 gravida	0.265	[0.201 , 0.348]	<.0001	0.385	[0.295 , 0.503]	<.0001
4 and more gravida	0.267	[0.196 , 0.363]	<.0001	0.329	[0.246 , 0.442]	<.0001

Parity (ref=1 parity)						
2 parity	0.408	[0.325 , 0.512]	<.0001	0.357	[0.284 , 0.448]	<.0001
3 and above parity	0.212	[0.163 , 0.275]	<.0001	0.311	[0.242 , 0.4]	<.0001
History of still birth (ref=no)						
yes	0.981	[0.592 , 1.628]	0.942	1.487	[0.922 , 2.399]	0.1041
Advice on ANC checkups(ref=no)						
yes	0.803	[0.332 , 1.943]	0.626	2.789	[1.025 , 7.59]	0.0446
First ANC visit (ref=1st trimester)						
2nd-3rd trimester	0.604	[0.502 , 0.727]	<.0001	0.592	[0.493 , 0.711]	<.0001
4th and above	0.383	[0.249 , 0.59]	<.0001	0.303	[0.196 , 0.469]	<.0001

This table describes the Adjusted Odds Ratio (AOR) of 4 or more ANC visits among pregnant women. It was found that the age, caste, type of family, wealth index, mother's education, father's education, gravida, parity, first ANC was significantly linked to 4 or more ANC visits at ($P < 0.05$) for both the years (2024 and 2025). Advice on ANC visits significantly linked with 4 or more ANC visits only in 2025 but did not show significant association with 4 or more ANC visits. factors like religion, mother's occupation, father's occupation and history of still birth did not show significant association with 4 or more ANC visits.

women aged 25–34 had significantly lower odds of completing four ANC visits than those aged 15–24 in both years. In 2024, the AOR was 0.786 ($p=0.0105$), indicating a 21.4% lower likelihood, and in 2025, the AOR was 0.753 ($p=0.002$), suggesting a 24.7% reduction in the odds. For women aged ≥ 35 , the association was not statistically significant in either year. women from non-marginalised groups had a higher odds of receiving four ANC visits. The AOR was 1.401 in 2024 ($p=0.0011$), meaning a 40.1% higher chance, and 1.387 in 2025 ($p=0.001$), translating to a 38.7% increase in odds compared to marginalised caste women. Women from joint families were significantly less likely to attend 4 or more ANC visits. The AORs were 0.732 in 2024 ($p=0.0011$) and 0.67 in 2025 ($p<0.0001$), indicating 26.8% and 33% lower odds, respectively, compared to women from nuclear families. Women from middle-income households had 1.556 times higher odds (55.6%) in 2024- and 1.431-times higher odds (43.1%) in 2025 (both $p<0.001$). Women from high-income households had even greater odds: 2.515 times in 2024 and 2.004 times in 2025, indicating they were 151.5% and 100.4% more likely, respectively, to complete 4 or more ANC visits.

Women educated up to class 8th had 46.9% higher odds in 2024 (AOR = 1.469, $p = 0.0016$) and 35.3% higher odds in 2025 (AOR = 1.353, $p = 0.0099$). Women with education above class 8th had 79.1% and 92.3% higher odds in 2024 and 2025, respectively (AOR = 1.791 and 1.923; both $p < 0.0001$). Father's education also showed a significant effect for those

educated above class 8th: [AOR=1.718, 1.594 in 2024 and 2025 respectively (both $p < 0.0001$), suggesting 71.8% and 59.4% higher odds of attending 4 or more ANC visits.

In 2024, women with 2, 3, or ≥ 4 pregnancies had [AOR= 0.489, 0.265, and 0.267 respectively] means 51.1%, 73.5%, and 73.3% lower odds of attending 4 or more ANC visits as compared to first-time pregnant women (all $p < 0.0001$). In 2025, the pattern continued [AOR=0.363, 0.385, and 0.329, $p < 0.0001$]. 63.7% lower, 61.5% lower, and 67.1% lower odds of attending 4 or more ANC visits.

In 2024, women with two and three or more children had 59.2% and 78.8% lower odds (AORs = 0.408 and 0.212, $p < 0.0001$), while in 2025, the odds were 64.3% and 68.9% lower (AORs = 0.357 and 0.311, $p < 0.0001$), respectively, compared to women with one child.

Receiving advice on ANC checkups was not significant in 2024, but in 2025 it became a strong predictor (AOR = 2.789, $p = 0.0446$), suggesting women who received advice were 178.9% more likely to complete four ANC visits. Women whose first ANC visit occurred in the 2nd–3rd trimester were significantly less likely to complete 4 visits [AOR=0.604] in 2024 and [AOR=0.592] in 2025, indicating 39.6% and 40.8% lower odds respectively (both $p < 0.0001$). Those women who initiates ANC in the 4th month or later had even lower odds: 61.7% lower in 2024 [AOR = 0.383] and 69.7% lower in 2025 [AOR = 0.303, $p < 0.0001$].

TABLE 5: - REGRESSION FOR Overall Birth-Preparedness

	2024						2025					
Variables	Overall Preparedness (REF=POOR)						Overall Preparedness (REF=POOR)					
	Average			Good			Average			Good		
	A O R	LCL- UCL	P- VA LUE	A O R	LCL- UCL	P- VA LUE	A O R	LCL- UCL	P- VA LUE	A O R	LCL- UCL	P- VA LUE
Age of respondent (ref=15-24)												
25-34	0.99	[0.795, 1.25]	0.97	0.96	[0.779, 1.195]	0.74	1.09	[0.875, 1.368]	0.42	1.22	[0.984, 1.52]	0.07
≥ 35	1.10	[0.541, 2.241]	0.78	1.13	[0.582, 2.231]	0.70	1.00	[0.516, 1.594]	0.73	1.07	[0.409, 1.362]	0.34
Caste (ref=marginalised)												
marginalised	0.98	[0.768, 1.254]	0.88	1.05	[0.838, 1.336]	0.63	1.10	[0.872, 1.407]	0.40	1.23	[0.977, 1.56]	0.07
Religion(ref=hindu)												

non-hindu Type of family (ref=nuclear)	1.003	[0.732 , 1.375]	0.9841	0.913	[0.678 , 1.229]	0.5476	1.479	[1.097 , 1.995]	0.0103	0.661	[0.477 , 0.917]	0.0131
	0.785	[0.62 , 0.981]	0.0334	0.732	[0.589 , 0.909]	0.0048	0.825	[0.659 , 1.032]	0.0925	0.816	[0.654 , 1.018]	0.0709
	0.863	[0.665 , 1.12]	0.2685	1.033	[0.803 , 1.329]	0.7999	0.924	[0.718 , 1.189]	0.5391	1.211	[0.939 , 1.562]	0.1412
joint Wealth index(ref=low)	0.882	[0.671 , 1.159]	0.3672	1.385	[1.071 , 1.79]	0.0129	0.952	[0.73 , 1.242]	0.7183	1.688	[1.303 , 2.188]	<.0001
middle Mother's Education (ref=illiterate)	0.922	[0.695 , 1.222]	0.572	1.122	[0.853 , 1.477]	0.4089	1.026	[0.78 , 1.35]	0.854	1.061	[0.803 , 1.401]	0.6776
	1.163	[0.886 , 1.526]	0.2758	1.846	[1.426 , 2.39]	<.0001	1.153	[0.881 , 1.509]	0.2985	1.398	[1.073 , 1.822]	0.0132
	1.099	[0.375 , 3.222]	0.8633	1.239	[0.41 , 3.744]	0.7045	1.099	[0.375 , 3.222]	0.8633	1.239	[0.41 , 3.744]	0.7045
Agriculture	1.652	[0.476 , 5.737]	0.4295	1.646	[0.456 , 5.939]	0.4463	1.652	[0.476 , 5.737]	0.4295	1.646	[0.456 , 5.939]	0.4463
Non-agriculture	2.02	[0.696 , 5.862]	0.1959	3.332	[0.43 , 4.119]	0.6192	2.02	[0.696 , 5.862]	0.1959	3.332	[0.43 , 4.119]	0.6192
Business	1.52	[0.361 , 6.395]	0.5679	3.363	[0.953 , 11.87]	0.0595	1.52	[0.361 , 6.395]	0.5679	3.363	[0.953 , 11.87]	0.0595
Salaried Father's Education (ref=illiterate)	1.051	[0.778 , 1.418]	0.7473	1.259	[0.944 , 1.68]	0.1166	1.051	[0.778 , 1.418]	0.7473	1.259	[0.944 , 1.68]	0.1166
upto class 8th	1.069	[0.799 , 1.43]	0.653	1.408	[1.069 , 1.854]	0.015	1.069	[0.799 , 1.43]	0.653	1.408	[1.069 , 1.854]	0.015
above class 8th Father's Occupation(ref=Unemployed)	0.684	[0.359 , 1.304]	0.2489	1.712	[0.85 , 3.451]	0.1326	0.684	[0.359 , 1.304]	0.2489	1.712	[0.85 , 3.451]	0.1326
Agriculture	0.684	[0.359 , 1.304]	0.2489	1.712	[0.85 , 3.451]	0.1326	0.684	[0.359 , 1.304]	0.2489	1.712	[0.85 , 3.451]	0.1326

Non-agriculture	0.691	[0.385, 1.242]	0.2166	1.477	[0.767, 2.843]	0.2432
	0.642	[0.34, 1.211]	0.1712	1.71	[0.858, 3.408]	0.1274
Business	0.954	[0.529, 1.719]	0.875	2.246	[1.165, 4.33]	0.0156
Salaried gravida(ref=1 gravida)	1.069	[0.801, 1.426]	0.651	1.14	[0.873, 1.49]	0.3341
	1.343	[0.97, 1.86]	0.0755	1.326	[0.975, 1.803]	0.0721
2 gravida	1.20	[0.835, 1.731]	0.3224	1.21	[0.859, 1.71]	0.273
3 gravida	1.116	[0.844, 1.478]	0.4413	1.153	[0.889, 1.496]	0.2827
	1.306	[0.965, 1.767]	0.084	1.276	[0.96, 1.696]	0.093
3 and above parity	1.01	[0.542, 1.888]	0.9719	1.229	[0.692, 2.184]	0.4808
History of still birth (ref=no)	0.858	[0.682, 1.078]	0.1878	0.82	[0.662, 1.016]	0.0693
yes First ANC visit (ref=1st trimester)	1.367	[0.845, 2.213]	0.2029	1.047	[0.649, 1.69]	0.8508
	0.962	[0.77, 1.201]	0.7304	0.863	[0.7, 1.064]	0.1667
2nd-3rd trimester	0.858	[0.682, 1.078]	0.1878	0.82	[0.662, 1.016]	0.0693
4th and above 4 or more ANC visits (ref=no)	1.025	[0.64, 1.64]	0.919	0.862	[0.649, 1.406]	0.5506
	0.962	[0.77, 1.201]	0.7304	0.863	[0.7, 1.064]	0.1667
yes Advice on danger sign(ref=no)	0.196	[0.022, 1.771]	0.1466	0.725	[0.192, 2.73]	0.6344
yes Pregnancy danger sign risk level (ref=low risk)	0.691	[0.385, 1.242]	0.2166	1.477	[0.767, 2.843]	0.2432
	0.642	[0.34, 1.211]	0.1712	1.71	[0.858, 3.408]	0.1274
Non-agriculture	0.691	[0.385, 1.242]	0.2166	1.477	[0.767, 2.843]	0.2432
	0.642	[0.34, 1.211]	0.1712	1.71	[0.858, 3.408]	0.1274
Business	0.954	[0.529, 1.719]	0.875	2.246	[1.165, 4.33]	0.0156
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	1.343	[0.97, 1.86]	0.0755	1.326	[0.975, 1.803]	0.0721
2 gravida	1.20	[0.835, 1.731]	0.3224	1.21	[0.859, 1.71]	0.273
3 gravida	1.116	[0.844, 1.478]	0.4413	1.153	[0.889, 1.496]	0.2827
	1.306	[0.965, 1.767]	0.084	1.276	[0.96, 1.696]	0.093
3 and above parity	1.01	[0.542, 1.888]	0.9719	1.229	[0.692, 2.184]	0.4808
History of still birth (ref=no)	0.858	[0.682, 1.078]	0.1878	0.82	[0.662, 1.016]	0.0693
yes First ANC visit (ref=1st trimester)	1.367	[0.845, 2.213]	0.2029	1.047	[0.649, 1.69]	0.8508
	0.962	[0.77, 1.201]	0.7304	0.863	[0.7, 1.064]	0.1667
2nd-3rd trimester	0.858	[0.682, 1.078]	0.1878	0.82	[0.662, 1.016]	0.0693
4th and above 4 or more ANC visits (ref=no)	1.025	[0.64, 1.64]	0.919	0.862	[0.649, 1.406]	0.5506
	0.962	[0.77, 1.201]	0.7304	0.863	[0.7, 1.064]	0.1667
yes Advice on danger sign(ref=no)	0.196	[0.022, 1.771]	0.1466	0.725	[0.192, 2.73]	0.6344
yes Pregnancy danger sign risk level (ref=low risk)	0.691	[0.385, 1.242]	0.2166	1.477	[0.767, 2.843]	0.2432
	0.642	[0.34, 1.211]	0.1712	1.71	[0.858, 3.408]	0.1274

	0.9870	[0.718, 1.356]	0.9358	0.9820	[0.73, 1.32]	0.9034	0.8940	[0.649, 1.233]	0.4961	1.1870	[0.871, 1.615]	0.2774
moderate risk												
	0.905	[0.694, 1.179]	0.4575	0.833	[0.65, 1.068]	0.1493	0.848	[0.654, 1.099]	0.2121	0.836	[0.646, 1.081]	0.1716
high risk												

This table describes the Adjusted Odds Ratio (AOR) of Overall Birth-Preparedness among pregnant women. It was found that wealth index, mother's education and father's education and father's occupation shows significant association with overall birth-preparedness for both the year. Type of family and religion shows significant association only in 2024 and 2025 respectively. Age, caste, mother's occupation, gravida, parity, history of still birth, first anc visits, 4 or more anc visits, advice on danger signs, and pregnancy danger sign risk level did not show significant association with overall birth-preparedness.

High-income households showed a significantly increased likelihood of good preparedness in both 2024 (AOR = 1.385, 95% CI: [1.071, 1.790], $p = 0.0129$) and 2025 (AOR = 1.688, 95% CI: [1.303, 2.188], $p < 0.0001$). The association was stronger in 2025. Middle-income households showed no significant difference in preparedness in either year.

Maternal education above class 8th was significantly associated with good preparedness in both 2024 (AOR = 1.846, 95% CI: [1.426, 2.390], $p < 0.0001$) and 2025 (AOR = 1.398, 95% CI: [1.073, 1.822], $p = 0.0132$). Education up to class 8th had no significant impact.

Paternal education above class 8th was significantly associated with good preparedness in both 2024 (AOR = 1.718, 95% CI: [1.357, 2.175], $p < 0.0001$) and 2025 (AOR = 1.701, 95% CI: [1.285, 2.252], $p = 0.0002$). It was also associated with average preparedness in 2024 (AOR = 1.511, 95% CI: [1.140, 2.003], $p = 0.0044$), but not in 2025.

Non-agricultural occupations were significantly associated with good preparedness in both 2024 (AOR = 1.362, 95% CI: [1.005, 1.845], $p = 0.0462$) and 2025 (AOR = 1.578, 95% CI: [1.147, 2.171], $p = 0.0054$). Agricultural occupations showed no significant association.

Joint families were associated with lower odds of average (AOR = 0.780, 95% CI: [0.620, 0.981], $p = 0.0334$) and good preparedness (AOR = 0.732, 95% CI: [0.589, 0.909], $p = 0.0048$). These associations were not observed in 2025. Non-Hindu women had higher odds of average preparedness (AOR = 1.479, 95% CI: [1.097, 1.995], $p = 0.0103$) but lower odds of good preparedness (AOR = 0.661, 95% CI: [0.477, 0.917], $p = 0.0131$). These associations were not observed in 2024.

DISCUSSION

This study examined the changes in antenatal care (ANC) visits among rural women in Bihar across two time periods, 2024 and 2025. The findings revealed an overall improvement in 4 or more ANC visits, with the proportion of women receiving four or more ANC visits increasing from 43.4% in 2024 to 50.7% in 2025, while the proportion initiating ANC in the

first trimester rose modestly from 52.8% to 56.4%. This positive trend reflects a growing awareness of maternal health services and the potential impact of ongoing government efforts to improve maternal healthcare access in rural areas of Bihar. Educational levels among mothers and fathers slightly improved, and a notable reduction in illiteracy was observed. There was a shift in household structure, with an increasing trend toward nuclear families in 2025. Additionally, a sharp decline in fathers engaged in agriculture.

After controlling for a number of factors, the regression results revealed that, age, caste, type of family, wealth index, mother's education, father's education, gravida, parity, first ANC was significantly linked with 4 or more ANC visits for both the years (2024 and 2025). Advice on ANC visits significantly linked with 4 or more ANC visits only in 2025 but did not show significant association in 2024.

Women aged 25–34 years were consistently less likely to complete four ANC visits compared to younger women aged 15–24 years. Education was found to be a strong determinant of ANC utilization, with both mothers and fathers educated up to or beyond the 8th standard being more likely to ensure four or more ANC visits. Additionally, higher maternal education and older age at pregnancy were associated with a reduced likelihood of utilizing inadequate ANC services. These results are consistent with previous studies conducted in neighbouring South Asian countries such as Nepal and Bangladesh, where educational status and age have been identified as key predictors of maternal healthcare utilization. (16) (17)

A study conducted in Malaysia similarly found that women with no formal education or only primary-level education were less likely to utilize adequate antenatal care services compared to those who had attained tertiary-level education. (18)(19) Education plays a crucial role in improving women's understanding of the importance of antenatal care (ANC) and the possible health risks linked to not using these services. It also supports their ability to make informed decisions and increases their confidence to seek and use healthcare during pregnancy.(20)

Higher levels of education enhance women's awareness and understanding of antenatal care (ANC) services and their potential outcomes, which positively influences their healthcare decision-making. Educated women are more likely to recognize signs of obstetric complications, which contributes to better utilization of ANC services. (21)

Compared to marginalized groups, women from non-marginalized groups were more likely to attend four or more ANC visits. Compared to women from nuclear families, joint family women were less likely to attend four or more ANC visits.

In both years, women from high-income and middle-income households were more likely to attend four or more ANC appointments. In agreement with previous research from India, living in an urban area and falling into a wealthier quintile greatly raises the likelihood of receiving high-quality ANC care.(20) Additionally, women in the wealthiest quintile in LMICs like India have more social and financial capital, which enhances care consumption

habits.

Compared to first-time pregnant women, women with 2, 3, or ≥ 4 pregnancies were less likely to attend four or more ANC visits.

Compared to women with one child, those with two or three children were less likely to complete four or more ANC visits. Women with prior pregnancies or deliveries sometimes neglect the need to seek medical assistance.(22)

In 2024, receiving advice on ANC checkups was not significant; however, in 2025, it became a robust predictor, indicating that women who received advice were more likely to complete four or more ANC visits. Compared to first trimester visits, women who had their first ANC visit in the second, third, or fourth trimester and later were less likely to attend four or more ANC visits.

This study also explored the changes and determinants of overall birth preparedness among rural women in Bihar during the years 2024 and 2025. The results indicated that the proportion of women with poor birth preparedness remained largely unchanged, with only a marginal increase from 29.8% to 29.9%. A slight improvement was observed in the proportion of women falling into the average preparedness category, which rose from 30.3% in 2024 to 33.2% in 2025. However, the proportion of women demonstrating good birth preparedness declined from 39.9% to 36.9% over the same period. These findings suggest that, while some progress has been made in improving basic levels of preparedness, the overall shift towards optimal birth preparedness remains limited.

The multivariate regression analysis further identified key socio-economic factors—such as household wealth, maternal and paternal education levels, and the father's occupation—as significant predictors of overall birth preparedness in both years. These results highlight the ongoing influence of education and economic status on maternal health behaviors in rural settings.

Women from higher-income households were more likely to have good birth preparedness in both 2024 and 2025, indicating the positive influence of economic stability on planning for childbirth. Additionally, maternal education beyond the 8th standard was significantly associated with better preparedness in both years, suggesting that higher levels of education equip women with the knowledge and confidence needed to plan effectively for delivery. In contrast, education up to the 8th standard did not show a significant association, highlighting that basic education alone may not be sufficient to influence birth preparedness behaviors..(23) father education above class 8th was significantly associated with good preparedness in both 2024 and 2025. It was also associated with average preparedness in 2024 but not in 2025.(24)

Joint families were associated with lower odds of average and good preparedness. These associations were not observed in 2025. Non-Hindu women had higher odds of average preparedness but lower odds of good preparedness. These associations were not observed in 2024.(25)

CONCLUSION

This study demonstrates a moderate improvement in antenatal care visits among rural women in Bihar between 2024 and 2025, with a significant increase in the proportion of women receiving four or more ANC visits. Key determinants—including mother's and father's education, wealth status, maternal age, family type, and timing of the first ANC visit—were significantly associated with 4 or more ANC visits in both years. Additionally, receiving advice on ANC emerged as a significant factor in 2025, highlighting the growing role of health communication in the rural Bihar.

Despite this improvement, progress in birth preparedness was limited. The proportion of women with good birth preparedness declined across the two years, suggesting that increased ANC coverage has not yet helped in improvement of overall birth-preparedness. Higher socioeconomic status and education were positively associated with birth-preparedness, whereas women from joint families and with higher parity were less likely to be well prepared for childbirth.

These findings highlight the need for more comprehensive maternal health strategies that not only promote the use of antenatal services but also improve birth preparedness. Efforts should focus on increasing health awareness, reducing social and economic barriers, and supporting women who are more vulnerable—especially those with multiple pregnancies, limited education, or lower income. Strengthening these areas can help ensure that all women are better prepared for childbirth, ultimately leading to safer pregnancies and healthier outcomes for both mothers and newborns.

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