

AN ANALYSIS OF REPRODUCTIVE AND MATERNAL HEALTH IN BIHAR: PROGRESS, PERSISTENT DISPARITIES, AND SYSTEMIC CHALLENGES

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Abstract

Introduction: Bihar, one of India's most populous and socio-economically challenged states, continues to face significant hurdles in ensuring the reproductive and maternal health of its women. Despite national health missions, indicators like the Maternal Mortality Ratio (MMR) remain alarmingly high. This paper seeks to analyze the state of maternal health in Bihar by comparing key indicators over time.

Methods: This study employs a descriptive and comparative analysis of secondary data. The primary data sources are the state-level fact sheets for Bihar from the National Family Health Survey (NFHS-4, 2015-16) and NFHS-5 (2019-21). Key indicators analyzed include Antenatal Care (ANC) coverage, institutional delivery rates, Postnatal Care (PNC), and the prevalence of anemia among women.

Results: The analysis reveals a mixed landscape. There has been significant progress in service utilization, with institutional deliveries increasing from 63.8% (NFHS-4) to 76.2% (NFHS-5). Similarly, postnatal care for mothers within two days of delivery rose from 40.9% to 64.6%. However, the quality and comprehensiveness of care remain concerns. Full ANC coverage is critically low, and the prevalence of anemia among women aged 15-49 has worsened, increasing from 60.3% to 63.5% over the same period.

Discussion: The progress in institutional deliveries can be attributed to government incentive schemes like the Janani Suraksha Yojana (JSY). However, the persistent poor outcomes in anemia and full ANC point to deeper systemic issues. These include socio-cultural barriers limiting female autonomy, deep-rooted nutritional deficiencies, and significant gaps in healthcare infrastructure, quality of care, and last-mile service delivery. The findings underscore that while access to facilities has improved, the quality of care and the underlying social determinants of health remain major obstacles. The paper concludes with targeted recommendations for policy and practice.

Keywords: Maternal Health, Bihar, NFHS, Anemia, Institutional Delivery, Antenatal Care, Health Disparities, Public Health System.

1. Introduction

The reproductive and maternal health of women is a cornerstone of public health and a critical indicator of a nation's development. In India, while significant strides have been made in reducing maternal mortality, vast regional disparities persist. The state of Bihar, with a population exceeding 125 million, consistently lags behind national averages on most health and development indices. The maternal health landscape in Bihar is particularly concerning, characterized by a high burden of maternal mortality and morbidity. As per the Sample Registration System (SRS), Bihar's Maternal Mortality Ratio (Ministry of Home Affairs, 2022)

was 118 per 100,000 live births in 2018-20, which, while an improvement, is still higher than the national average of 97.

Previous research has highlighted the multi-faceted nature of this problem. Studies like Sivasankari (2020) have pointed to significant gaps in antenatal care utilization and a high prevalence of home deliveries attended by untrained personnel, leading to preventable complications. Furthermore, while government programs such as the National Health Mission (NHM) and Janani Suraksha Yojana (JSY) have been implemented, their effectiveness is often hampered by systemic weaknesses. A Planning Commission report (Government of India, 2013 and later analyses by Tiwari et al. (2019) have identified weak health infrastructure, shortage of skilled healthcare workers, and implementation gaps as significant barriers to achieving desired health outcomes.

This paper aims to provide a current and comprehensive analysis of the situation by leveraging the most recent large-scale survey data.

Objectives of the Study:

1. To document and analyze the status of key reproductive and maternal health indicators in Bihar as per the latest NFHS-5 data.
2. To conduct a comparative analysis of these indicators between NFHS-4 (2015-16) and NFHS-5 (2019-21) to assess the extent of progress or stagnation.
3. To identify and discuss the likely socio-cultural, economic, and systemic reasons contributing to the poor reproductive health outcomes observed in the state.

Research Questions:

1. What is the current state of maternal health service utilization in Bihar, including antenatal care, institutional delivery, and postnatal care?
2. Has there been a significant improvement in these indicators between 2015-16 and 2019-21?
3. What are the primary underlying factors that continue to challenge the improvement of women's reproductive health in Bihar?

2. Methods

This study employed a descriptive and comparative secondary data analysis to evaluate the trends in key maternal health indicators in Bihar over a five-year period. The methodological approach is detailed below.

Study Design

A non-experimental, longitudinal comparative design was used. The study compares cross-sectional data from two distinct time points to identify trends, progress, and persistent challenges in maternal health service delivery and outcomes within the state of Bihar.

Data Source

The secondary data sources are the official state-level fact sheets for Bihar from two rounds of the **National Family Health Survey (NFHS)**:

- **NFHS-4**, conducted in 2015-16.

- **NFHS-5**, conducted in 2019-21.

The NFHS is a large-scale, multi-round survey conducted by the International Institute for Population Sciences (IIPS), Mumbai, under the stewardship of the Ministry of Health and Family Welfare, Government of India. "(IIPS & ICF, 2017)" and "(IIPS & ICF, 2021)". It is a highly credible and nationally representative source, providing reliable data on population, health, and nutrition for India and each of its states. Its standardized methodology allows for robust comparisons over time.

Selection and Definition of Indicators

Key maternal health indicators were selected based on their established importance within the World Health Organization's (WHO) 'continuum of care' model and their direct impact on maternal and neonatal outcomes. The selected indicators are defined as follows, consistent with NFHS definitions:

- **Antenatal Care (ANC):** The percentage of mothers of live births in the five years preceding the survey who received at least four ANC visits. This indicator reflects the quality and consistency of care during pregnancy.
- **Institutional Births:** The percentage of live births in the five years preceding the survey that were delivered in a health facility (either public or private). This is a critical process indicator for reducing delivery-related complications.
- **Postnatal Care (PNC):** The percentage of mothers who received a postnatal check-up from a skilled health professional (doctor/nurse/LHV/ANM/midwife/other health personnel) within two days of delivery. This is crucial for identifying and managing postpartum complications.
- **Maternal Anemia:** The percentage of women aged 15-49 years who are anemic, defined as having a hemoglobin level of less than 12.0 g/dl. This is a key outcome indicator reflecting the overall nutritional and health status of women.

A comparative assessment was performed by calculating the percentage point change between the two survey periods to quantify the direction and magnitude of change. The interpretation of these quantitative findings is contextualized with existing literature and expert knowledge of Bihar's health system and socio-cultural environment.

Model Specification

Let

$$Y_i = 1 \quad Y_i = 1$$

if the woman had **institutional delivery**

$$Y_i = 0 \quad Y_i = 0$$

otherwise.

The logistic regression model is:

$$\log(P/(1-P)) = \beta_0 + \beta_1 \text{EDU} + \beta_2 \text{WEALTH} + \beta_3 \text{RES} + \beta_4 \text{ANC} + \beta_5 \text{AGE} + \beta_6 \text{MEDIA}$$

$$\log(1-P) = \beta_0 + \beta_1 \text{EDU} + \beta_2 \text{WEALTH} + \beta_3 \text{RES} + \beta_4 \text{ANC} + \beta_5 \text{AGE} + \beta_6 \text{MEDIA}$$

Where,

P = Probability of institutional delivery

Independent variables:

Variable Description

EDU	Woman's education level
WEALTH	Household wealth index
RES	Rural/urban residence
ANC	Number of ANC visits
AGE	Age of mother
MEDIA	Exposure to health information

Data Analysis

The analysis was conducted in two stages:

1. Quantitative Comparison: Data for the selected indicators were extracted from the NFHS-4 and NFHS-5 Bihar fact sheets. The primary analytical method was the calculation of the absolute change in percentage points between the two survey periods. This simple but powerful method was used to quantify the magnitude and direction of change (i.e., progress, stagnation, or regression) for each indicator.
2. Contextual Interpretation: The quantitative findings were not analyzed in a vacuum. They were interpreted and contextualized by reviewing existing academic literature, government reports (e.g., from the Planning Commission, now NITI Aayog), and policy documents related to maternal health programs in India and Bihar, such as the Janani Suraksha Yojana (JSY) and the National Health Mission (NHM). This step allowed for a deeper discussion of the likely drivers behind the observed trends.

Comparative descriptive model combined with a binary logistic regression framework to examine determinants of maternal healthcare utilization and anaemia.

1. Comparative Descriptive Model

The inter-survey comparison is expressed as:

$$\Delta Y = Y_{\text{NFHS-5}} - Y_{\text{NFHS-4}}$$

Where:

- YYY = Selected maternal health indicator (Institutional Delivery, Full ANC, PNC, Anaemia)
- ΔY Delta Y ΔY = Absolute change between survey rounds

$$\% \Delta Y = \frac{Y_{NFHS-5} - Y_{NFHS-4}}{Y_{NFHS-4}} \times 100$$

This model quantifies progress or declines across survey rounds.

2. Binary Logistic Regression Model (Analytical Extension)

To examine determinants of maternal health outcomes, the following logistic model may be specified:

$$\text{logit}(P_i) = \ln \frac{P_i}{1 - P_i} = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \epsilon_i$$

Where:

- P_i = Probability of outcome (e.g., institutional delivery / anaemia / full ANC)
- X_1 = Age of woman
- X_2 = Education level
- X_3 = Wealth index
- X_4 = Place of residence (rural/urban)
- X_5 = Birth order / parity
- β_0 = Intercept
- $\beta_1 \dots \beta_5$ = Regression coefficients
- ϵ_i = Error term

3. Outcome Variable Specification

Separate models may be estimated for each outcome:

Model A: Institutional Delivery

- Dependent Variable: 1 = Institutional delivery, 0 = Home delivery

Model B: Full Antenatal Care

- Dependent Variable: 1 = Full ANC received, 0 = Otherwise

Model C: Postnatal Care

- Dependent Variable: 1 = PNC within 48 hours, 0 = Otherwise

Model D: Anaemia Status

- Dependent Variable: 1 = Anaemic (Hb < 12 g/dl), 0 = Non-anaemic

Comparative Model Output (Bihar)

Indicator	NFHS-4 (%)	NFHS-5 (%)	Absolute Change (ΔY)	Percentage Change (%)	Interpretation
Institutional Delivery	63.8	76.2	+12.4	+19.4	Substantial improvement in facility-based childbirth
Postnatal Care (within 2 days)	40.9	64.6	+23.7	+58.0	Major improvement in immediate maternal care
Anaemia (Women 15–49)	60.3	63.5	+3.2	+5.3	Deterioration in nutritional health
Full ANC	Low	Low	Marginal change	Minimal	Coverage remains inadequate

Interpretation of Model Results

- Service Utilization Improvement**
The positive change in institutional deliveries (+12.4 percentage points) indicates enhanced access to maternal health facilities. This aligns with expansion of demand-side incentives and outreach mechanisms.
- Postnatal Care Expansion**
The largest relative gain (+58.0%) is observed in early postnatal care, suggesting improved continuity of care after childbirth.
- Nutritional Outcome Deterioration**
Despite improved service utilization, anaemia prevalence increased by 3.2 percentage points, highlighting a disconnect between healthcare access and nutritional outcomes.
- Full Antenatal Care Gap**
The model confirms that full ANC coverage remains structurally low, indicating limitations in quality and completeness of antenatal services.

Overall Model Conclusion

The comparative model demonstrates a **dual pattern**:

- Significant improvement in **healthcare utilization indicators**
- Simultaneous deterioration or stagnation in **health outcome indicators**, particularly anaemia and comprehensive antenatal care

This suggests that increased institutional contact alone has not translated into improved maternal nutritional status or comprehensive care delivery, pointing to systemic gaps in service quality and social determinants of health.

3.Results:

The comparative analysis of NFHS-4 and NFHS-5 data for Bihar reveals a pattern of significant progress in some areas of service delivery, contrasted with stagnation or worsening outcomes in others, particularly related to women's nutritional status.

Table 1: Comparative Maternal Health Indicators for Bihar (NFHS-4 vs. NFHS-5)

Indicator	NFHS-4 (2015-16)	NFHS-5 (2019-21)	Change (Percentage Points)	National Average (NFHS-5)
Mothers with at least 4 ANC visits	33.5%	41.0%	+7.5	58.1%
Institutional Births	63.8%	76.2%	+12.4	88.6%
Postnatal care for mothers within 2 days	40.9%	64.6%	+23.7	78.0%
Women (15-49 yrs) who are anemic	60.3%	63.5%	+3.2 (Worsened)	57.0%

Source: NFHS-4 & NFHS-5 Bihar Fact Sheets (IIPS & ICF, 2017; 2021)

Key Findings from the Data:

1. **Remarkable Leap in Facility-Based Care:** The most significant gains were observed in indicators linked to facility-based services. Institutional births surged by **12.4 percentage points** from 63.8% to 76.2%. Even more dramatically, postnatal care (PNC) for mothers within two days of delivery saw a **23.7 percentage point** increase, rising from 40.9% to 64.6%. This suggests that programmatic pushes to bring women to facilities for childbirth and immediate follow-up have been highly effective.
2. **Modest Improvement but Persistent Gaps in Continuous Care:** While the percentage of mothers receiving at least 4 ANC visits increased by 7.5 points to 41.0%, this figure remains critically low. Bihar still lags far behind the national average of 58.1%, indicating a **17.1 percentage point gap**. This highlights a major challenge in providing continuous, comprehensive care throughout pregnancy, as opposed to a single, event-based service like delivery.
3. **Alarming Regression in Nutritional Status:** The most concerning finding is the worsening prevalence of anemia. The percentage of anemic women (15-49 years) increased from an already high 60.3% to 63.5%. Not only does this surpass the national average of 57.0%, but the **gap between Bihar and the national average has widened**. This indicates a deepening public health crisis that directly contributes to maternal morbidity, mortality, and poor birth outcomes, undermining the gains made in service delivery.

4. Discussion:

The results present a paradox: Bihar has succeeded in improving *access* to and utilization of specific event-based services (delivery, immediate PNC) but has failed to improve the *overall health and well-being* of women. This section discusses the likely reasons for this dichotomy.

Likely Reasons for Poor Reproductive Health in Bihar

The results present a stark paradox: Bihar has succeeded in improving the utilization of specific, event-based services (delivery, immediate PNC) but has failed to improve, and in some cases has worsened, the overall health and well-being of women. This dichotomy suggests that while demand-side incentives for institutional delivery have worked, the health system's capacity to provide comprehensive, quality care and address the social determinants of health remains weak. This section discusses the likely reasons for this dissonance.

1. The Success of Targeted Incentives vs. The Failure of Comprehensive Care:

The remarkable increase in institutional deliveries and PNC is directly attributable to the financial incentives provided under the **Janani Suraksha Yojana (JSY)**. This scheme effectively reduces the economic barriers for a one-time event—childbirth. However, this success has not translated to full ANC coverage, which requires multiple, sustained interactions with the health system. The **+7.5-point** increase in ANC is minor compared to the **+23.7-point** leap in PNC. This is because ANC visits incur repeated opportunity costs (lost wages, travel) and depend on a functioning primary healthcare system (PHCs), which, as noted, suffers from a shortage of human resources and poor quality of care. Women are willing to travel for a critical event like delivery but are deterred from routine check-ups by overcrowded and understaffed facilities.

2. The Deepening Nutritional Crisis:

The worsening anemia prevalence (**+3.2 percentage points**) is a powerful indictment of systemic failures beyond just the health department.

- **Systemic Gaps:** This trend points directly to a breakdown in the **supply chain and last-mile delivery of Iron-Folic Acid (IFA) tablets**. More importantly, it signals a failure in counseling. Without effective counseling from ASHA workers on managing side effects and the importance of adherence, the tablets often go unused.
- **Socio-Cultural Factors:** The issue is compounded by deep-rooted nutritional deficiencies tied to poverty and gender inequality. In many households, women eat last and least, and diets are cereal-dominant. The patriarchal norms that limit women's autonomy also limit their access to nutritious food, making anemia an intergenerational crisis where malnourished adolescent girls become anemic mothers who give birth to low-birth-weight babies.

3. Socio-Cultural and Economic Barriers:

- **Patriarchy and Low Female Autonomy:** Deep-seated patriarchal norms often restrict women's mobility and their ability to make independent decisions about their own health. Decisions to seek care, especially for non-emergency situations like ANC visits, often require permission from a husband or mother-in-law.
- **Early Marriage and Childbearing:** Bihar has one of the highest rates of child marriage in India. Early pregnancies in adolescent girls, who are often physically and nutritionally unprepared, lead to a higher risk of complications like eclampsia and obstructed labor.
- **Poverty and Opportunity Costs:** Extreme poverty prevents families from affording transport to distant health facilities, private consultations, or nutritious food. The opportunity cost of a woman or a family member losing a day's wage to attend an ANC visit is a significant deterrent.

4. Systemic and Health Infrastructure Gaps:

- **Shortage of Human Resources:** There is a severe shortage of skilled healthcare workers, especially specialists like gynecologists and anesthetists, at the district and sub-district levels. Primary Health Centres (PHCs) are often run by a single doctor or are managed by paramedical staff.
- **Quality of Care:** Even when women reach a facility, the quality of care can be suboptimal. Overcrowding, lack of privacy, disrespectful treatment, and inadequate counseling are common complaints. This deters women from seeking care for subsequent pregnancies. Full ANC coverage is low because it requires multiple, high-quality interactions, which the strained system struggles to provide.
- **Weak Supply Chain and Last-Mile Delivery:** The worsening anemia crisis points to a failure in the supply and distribution of Iron-Folic Acid (IFA) tablets and, more importantly, a lack of effective counseling on their importance and management of side effects. The Bihar State Nutrition Mission, while well-intentioned, struggles with consistent implementation at the grassroots level.

4. Deep-Rooted Nutritional Deficiencies:

- The high prevalence of anemia is not merely a medical issue but a reflection of chronic malnutrition. Diets in rural Bihar are often cereal-based with low consumption of iron-rich foods like green leafy vegetables, fruits, and animal products.
- Poor sanitation and hygiene contribute to parasitic infections, which further exacerbate anemia by preventing iron absorption. The issue is intergenerational, with anemic mothers giving birth to low-birth-weight babies, perpetuating a cycle of poor health.

5. Conclusion and Recommendations:

While Bihar has made commendable progress in increasing institutional deliveries, this success masks deep-seated failures in providing comprehensive, quality maternal care. The state is at a critical juncture where the focus must shift from mere quantity of services to the quality and holistic nature of care.

Limitations of the Study

- **Ecological Fallacy:** As the analysis uses state-level aggregate data, it cannot be used to make inferences about individuals or specific sub-groups within the state. Significant intra-state and district-level disparities are masked by the state average.
- **Causality:** This descriptive study identifies trends and associations but cannot establish causality. For instance, while the rise in institutional births coincides with JSY, this study cannot statistically prove the program's causal impact.
- **Data Lag:** The NFHS-5 data was collected between 2019 and 2021. The findings may not fully reflect the impact of policy changes or health system developments that have occurred since then.

Recommendations:

1. **Strengthen Comprehensive Antenatal Care:** Shift focus from incentivizing just delivery to ensuring a full package of high-quality ANC. This requires strengthening PHCs, ensuring the availability of diagnostic tests, and training ASHA workers in effective counseling.
2. **Tackle Anemia on a War Footing:** Integrate nutrition with maternal health services. This includes ensuring a robust IFA supply chain, promoting dietary diversity through

- kitchen gardens, and intensifying deworming programs. Engaging men and community leaders is crucial to prioritizing women's nutrition within the household.
3. **Invest in Human Resources and Infrastructure:** Address the shortage of specialist doctors and skilled nurses in rural areas through targeted recruitment, financial incentives, and improved living conditions.
 4. **Focus on Adolescent Girls:** To break the intergenerational cycle of malnutrition and poor health, targeted interventions focusing on the health, nutrition, and education of adolescent girls are essential.

Addressing the challenge of maternal health in Bihar requires a multi-sectoral approach that goes beyond the health department to tackle the underlying social determinants of health—poverty, gender inequality, and education. "**Three Delays Model**", which is a classic framework in maternal health is discussed as follows:

- **Delay 1: Delay in deciding to seek care** (low female autonomy, patriarchy, and not perceiving ANC as essential).
- **Delay 2: Delay in reaching a health facility** (poverty, opportunity costs, and poor infrastructure).
- **Delay 3: Delay in receiving adequate care at the facility** (shortage of human resources and poor quality of care).

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