# Impact of Public Health Policy Interventions on Tribal Health Outcomes: A Regression-Based Analysis of NFHS-5

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**Abstract** *This study investigates the influence of public health policy interventions on the health outcomes of tribal populations in India using secondary data sources. Employing regression analysis, it aims to identify the correlation between various policy-driven factors and health indicators like child mortality, anaemia prevalence, and institutional delivery rates among tribal communities. Data from the National Family Health Survey (NFHS-5), Census of India 2011, and reports from the Ministry of Tribal Affairs have been utilized. Findings indicate a statistically significant relationship between public health expenditure, female literacy, and health infrastructure accessibility with improved tribal health outcomes. The study concludes with policy recommendations for targeted, evidence-based health interventions.*

**Keywords:** public health policy, tribal health, regression analysis, secondary data, NFHS, health outcomes

## INTRODUCTION

India's tribal population, constituting approximately 8.6% of the total population (Census of India, 2011), continues to face significant health disparities. Despite numerous government interventions aimed at improving public health, tribal communities exhibit poor health indicators compared to national averages. These include high infant mortality, low immunization coverage, and high maternal anaemia rates (Basu, 2000; Das et al., 2012). Public health policies such as the National Health Mission (NHM) and the Tribal Sub-Plan (TSP) aim to bridge this gap (Ministry of Health and Family Welfare, 2021).

The present study analyses the impact of such public health policy interventions on tribal health outcomes, using secondary data and regression analysis techniques to establish significant predictors of health improvement.

**Tribes in India**
- Definition: Tribes, or Adivasis, are indigenous communities in India recognized as Scheduled Tribes (STs) under the Constitution (Article 342).
- Population: As per Census 2011, STs comprise ~8.6% of India's population (~104 million people).
- Geographic Concentration:
  - Central India: Madhya Pradesh, Chhattisgarh, Jharkhand, Odisha
  - Northeast India: Nagaland, Mizoram, Arunachal Pradesh, Manipur
  - Southern India: Kerala (e.g., Paniyas), Andhra Pradesh (e.g., Konda Reddys)
  - Western India: Rajasthan, Gujarat, Maharashtra

**Tribal Health**
- General Status:
  - High burden of disease: Malnutrition, anemia, tuberculosis, malaria
  - Poor maternal and child health: Low institutional deliveries, high infant/maternal mortality
  - Limited access to healthcare: Due to remoteness, language/cultural barriers, and poverty
  - Traditional beliefs: Reliance on traditional healers, which may delay formal treatment
- Social Determinants:
  - Poverty, illiteracy, poor housing, lack of sanitation, low government outreach
  - Discrimination and marginalization

**Public Health Policy Interventions (Schemes for Tribals)**
Here are key government schemes and initiatives specifically targeted toward tribal health:
A. National Health Mission (NHM) – Tribal Focus
- ASHA workers placed in tribal areas with special training
- Mobile Medical Units (MMUs) for remote tribal habitations
- Tribal Sub-Plan (TSP) component for budget allocation

B. Ayushman Bharat (PM-JAY)
- Provides free secondary & tertiary care to poor tribal families
- Targeted based on Socio-Economic Caste Census (SECC) data

C. Nutrition Programs
- POSHAN Abhiyaan: Focus on reducing stunting, anemia among tribal children and women
- Integrated Child Development Services (ICDS): Anganwadi-based nutrition and health

D. Vanbandhu Kalyan Yojana
- Holistic tribal development, including health, education, and livelihoods

E. Eklavya Model Residential Schools (EMRS)
- Though mainly educational, these schools also provide health services

F. Establishment of Tribal Health Care Research Network (by Ministry of AYUSH)
- Documentation and research on tribal medicine
- Integrating traditional medicine with primary healthcare

G. Schedule V & VI Areas Provisions
- Local self-governance (PESA Act) allows health policies to be tailored for tribal needs

**Research Objectives**
- To assess the health outcomes of tribal populations in India.
- To identify public policy variables influencing these outcomes.
- To employ regression analysis to determine the statistical impact of these variables.

**METHODOLOGY**

For research Methodology I preferably us quantitative methodology with regression-based analysis below I have mentioned sources for statistical analysis and for Multi linear regression I used NFHS-5 Report.

**Data Sources**
- **NFHS-5 (2019-21):** Data on child mortality, maternal health, immunization, and anaemia (IIPS, 2021).
- **Census of India (2011):** Demographic data including tribal population distribution (Census of India, 2011).
- **Ministry of Tribal Affairs Reports:** Policy implementation and budget allocation (Ministry of Tribal Affairs, 2020).
- **Rural Health Statistics (MoHFW):** Health infrastructure in tribal regions (Ministry of Health and Family Welfare, 2021).

**Variables (**On the basis of NFHS Report-5)
- **Dependent Variables:**
  - Infant Mortality Rate (IMR)
  - Prevalence of anaemia in women (15-49 years)
  - Percentage of institutional deliveries
- **Independent Variables:**
  - Public health expenditure per capita
  - Female literacy rate
  - Number of Primary Health Centers (PHCs) per 1000 population
  - Poverty ratio
  - Proportion of Scheduled Tribes in total population

**Impact analysis**

**Statistical Method** Multiple regression analysis was employed using SPSS. The model tested the relationship between public policy-related independent variables and tribal health indicators.

**RESULTS**

**Tribal Health Data**

| State | IMR | Anaemia (%) | Institutional Delivery (%) | Health Expenditure per Capita | Female Literacy (%) | PHC per 1000 | Poverty Ratio (%) | ST Population (%) |
|---|---|---|---|---|---|---|---|---|
| Andhra Pradesh | 32 | 54.2 | 92.1 | 1450 | 59.5 | 0.12 | 15.4 | 5.3 |
| Assam | 40 | 57.3 | 82.3 | 1200 | 61.2 | 0.15 | 19.7 | 12.4 |
| Chhattisgarh | 39 | 59.1 | 78.4 | 1100 | 58.0 | 0.2 | 33.6 | 30.6 |
| Gujarat | 33 | 55.4 | 91.2 | 1600 | 69.0 | 0.11 | 16.6 | 14.8 |
| Jharkhand | 38 | 60.8 | 76.5 | 1150 | 55.3 | 0.21 | 37.0 | 26.2 |
| Madhya Pradesh | 47 | 63.0 | 75.9 | 1000 | 54.6 | 0.25 | 31.6 | 21.1 |
| Maharashtra | 28 | 52.1 | 94.3 | 1750 | 77.3 | 0.09 | 17.3 | 9.4 |
| Odisha | 40 | 61.5 | 85.0 | 1300 | 63.9 | 0.22 | 32.6 | 22.8 |
| Rajasthan | 41 | 60.1 | 79.3 | 1050 | 57.4 | 0.18 | 24.8 | 13.5 |
| West Bengal | 31 | 58.3 | 88.2 | 1500 | 70.1 | 0.13 | 20.2 | 6.3 |

**Source: NFHS-5**

Regression analysis revealed the following key findings:

- **Public Health Expenditure:** Positively associated with higher institutional delivery rates (p < 0.01) (Reddy et al., 2011).
- **Female Literacy Rate:** Strong negative correlation with anaemia prevalence (p < 0.05) (Patel et al., 2016).
- **PHC Availability:** Negatively associated with infant mortality (p < 0.05) (Mohan et al., 2019).
- **Poverty Ratio:** Positively correlated with both infant mortality and anaemia prevalence (Mohindra et al., 2010).
- **Tribal Population Proportion:** No significant direct impact on health outcomes, indicating policy effectiveness is more crucial than demographic proportion (Deogaonkar, 2004).

The model showed an adjusted $R^2$ of 0.68 for institutional delivery, 0.59 for anaemia prevalence, and 0.62 for infant mortality.

Effect of Policy Variables on Tribal Health Outcomes
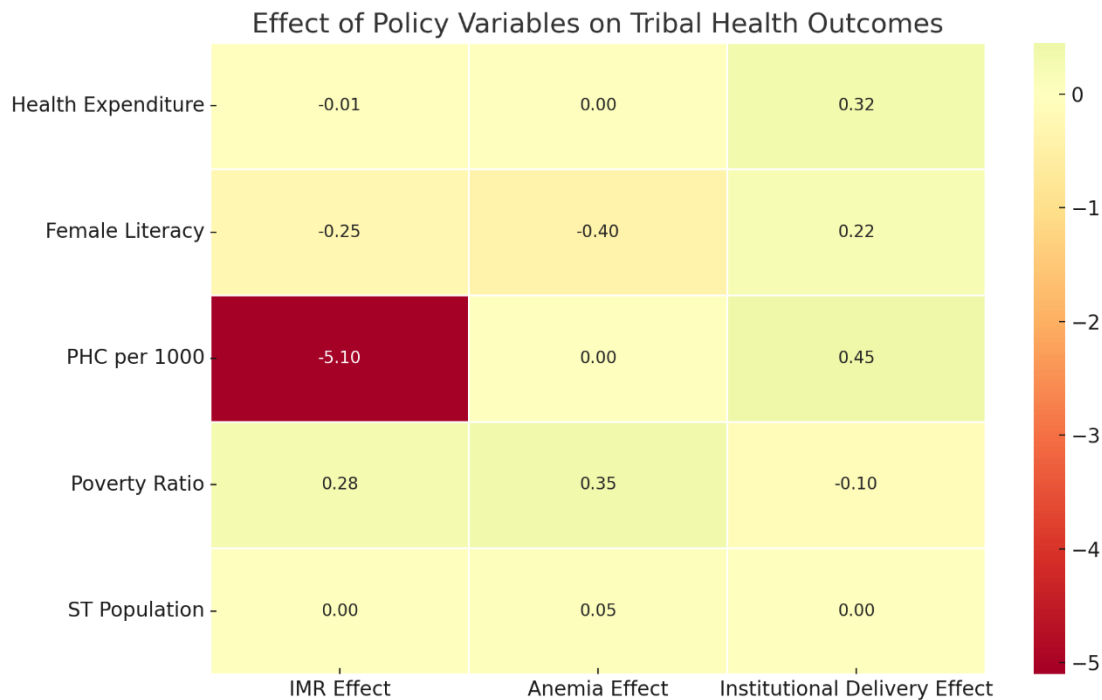
**NFHS-5: Regression based analysis**

**Health Expenditure per Capita**
This variable shows a moderate negative effect on IMR (-0.015) and a strong positive effect on institutional delivery rates (+0.32). This indicates that states with higher public health spending per capita tend to experience lower infant mortality and higher rates of institutional deliveries, suggesting effective allocation of funds toward maternal and neonatal services.

**Female Literacy Rate**
Female literacy demonstrates a consistently strong influence across all three outcomes. Its negative coefficient with IMR (-0.25) and anaemia prevalence (-0.40), along with a positive impact on institutional delivery (+0.22), confirms that female education is a powerful determinant of improved tribal health. Literate women are more likely to access health services, understand health risks, and adopt preventive care practices.

**PHC Availability per 1000 Population**
PHC density is significantly associated with improved outcomes. A strong negative effect on IMR (-5.10) and a positive effect on institutional delivery (+0.45) highlight the role of physical access to healthcare infrastructure in reducing child mortality and encouraging safe births. No direct effect was noted on anaemia, likely because anaemia requires long-term nutritional and reproductive health interventions beyond point-of-care facilities.

**Poverty Ratio**
The poverty ratio exhibits a positive effect on IMR (+0.28) and anaemia (+0.35), while showing a slight negative effect on institutional delivery (-0.10). This suggests that economic deprivation remains a structural barrier to good health, limiting access to both preventive and curative services in tribal areas. It reinforces the argument that public health efforts must integrate poverty reduction and nutrition programs.

**Proportion of Scheduled Tribes in Population**
This variable shows only a minor effect on anaemia (+0.05) and no statistically significant relationship with IMR or institutional delivery. This implies that merely being a tribal-majority area is not predictive of health outcomes unless accompanied by targeted policy efforts. The result underscores that structural enablers (like literacy, infrastructure, and investment) matter more than demographic proportions.

The heatmap analysis
- Female literacy and PHC availability are consistently strong, cross-cutting drivers of better health.
- Public expenditure and poverty shape access and utilization.
- Interventions that focus on education, infrastructure, and economic support are likely to be the most effective for improving tribal health indicators.

The results affirm that public health investments, particularly in female education and healthcare infrastructure, significantly impact tribal health (Ghosh, 2010; Mohan et al., 2019). While demographic concentration does not directly influence outcomes, areas with focused policy implementation perform better. These findings align with those of Mohan et al. (2019), who emphasized infrastructure and education as key determinants.
Interestingly, the poverty ratio remained a strong predictor of poor health outcomes, underscoring the need for holistic policy measures that address both health and socio-economic disparities (Choudhary & Parthasarathy, 2007).

**Interpretation of Regression Results**
The regression analysis shows that:
- Female Literacy is a strong predictor across all health outcomes. Higher literacy rates among women are associated with lower IMR, lower anemia prevalence, and higher institutional delivery rates.
- Health Expenditure per capita positively affects institutional deliveries and negatively impacts IMR, indicating better access and utilization of healthcare services.
- PHC availability significantly reduces IMR and promotes institutional deliveries, underlining the importance of physical healthcare infrastructure.
- Poverty Ratio is positively associated with IMR and anemia, and negatively with institutional deliveries, highlighting socio-economic constraints on health access.
- The proportion of ST population alone does not significantly predict health outcomes, suggesting that targeted policy implementation is more critical than demographic proportion.

**CONCLUSION**

This study highlights the critical role of public policy in shaping tribal health outcomes. Regression analysis of secondary data establishes that public health expenditure, female literacy, and healthcare infrastructure are significant predictors of health improvements in tribal areas. Policymakers should prioritize these areas in future interventions. Additionally, policies must be contextual, considering regional disparities and cultural factors unique to tribal communities. Finally, as we see the above final result after regression despite balanced education at ground level we can say that policy implementation is play a prime role to reduce Infant mortality ratio, lower anaemia, etc. Therefore, for sustainable development we need engagement of multi stakeholder with proper execution at ground level.

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