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EXPLORING THE NEXUS BETWEEN HOUSEHOLD INFRASTRUCTURE, MATERNAL HEALTH, AND CHILDHOOD MALNUTRITION: A DISTRICT-LEVEL ANALYSIS IN GUJARAT, INDIA

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Abstract

Childhood malnutrition remains a persistent public health challenge in many regions, including Gujarat, India. This paper aims to investigate the relationship between infrastructure, maternal health indicators, and childhood malnutrition at the district level in Gujarat. Utilizing secondary data from the National Family Health Survey (NFHS-5), this study examines the prevalence of malnutrition among children under 5 years old and its association with various infrastructure

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factors, including access to improved sources of drinking water, sanitation facilities, electricity, and clean cooking fuel. Additionally, maternal health indicators such as antenatal care visits and iron-folic acid consumption are analyzed to understand their influence on childhood malnutrition. The methodology involves conducting correlation analysis to identify any significant relationships between infrastructure variables, maternal health indicators, and malnutrition rates. Furthermore, regional disparities in malnutrition prevalence are explored to highlight areas with unique characteristics or higher vulnerability. This research contributes to existing literature by providing insights into the complex interplay between infrastructure, maternal health, and childhood malnutrition at the district level in Gujarat. Findings from this study can inform targeted interventions and policy measures aimed at reducing childhood malnutrition and improving overall child health outcomes in the region.

1. Introduction

Childhood malnutrition continues to pose a significant public health and developmental concern, particularly across low- and middle-income nations. Its adverse effects extend beyond individual well-being, undermining economic productivity, healthcare resources, and the overall development of human capital. Despite Gujarat's status as one of India's more economically advanced states, it continues to experience alarmingly high rates of malnutrition, marked by notable inter-district disparities. Although the socio-economic dimensions of malnutrition have been explored in prior literature, the influence of household infrastructure and maternal health indicators remains insufficiently investigated - especially from a spatially granular perspective.

This study addresses this critical research gap by examining how household amenities - including access to safe drinking water, sanitation facilities, electricity, and clean cooking fuels - interact with maternal health factors such as antenatal care utilization and iron-folic acid supplementation. Using district-level data from the fifth round of the National Family Health Survey (NFHS-5), the research employs an integrative framework to analyze

how these dimensions collectively impact childhood malnutrition across Gujarat's districts.

1.1. Theoretical framework and economic relevance

This research is anchored in Human Capital Theory, which emphasizes the critical role of early childhood health and nutrition in shaping cognitive abilities, academic achievement, and long-term economic outcomes. Infrastructural deficits and insufficient maternal healthcare services create conditions that foster malnutrition, reinforcing persistent cycles of poverty across generations. Furthermore, inadequate sanitation and unsafe water sources elevate the risk of diarrheal infections, which impair nutrient absorption and exacerbate undernutrition. Similarly, restricted access to antenatal care may lead to maternal nutrient deficiencies, adversely affecting fetal development and increasing the incidence of low birth weight and growth stunting.

Economically, the consequences of childhood malnutrition are profound, encompassing both direct and indirect costs. Direct costs arise from increased healthcare utilization due to higher rates of illness, whereas indirect costs are reflected in diminished labor productivity, compromised educational outcomes, and prolonged economic underdevelopment. Consequently, investing in improved infrastructure and comprehensive maternal health initiatives offers substantial economic benefits by boosting labor efficiency and alleviating the financial strain on healthcare systems.

1.2. Justification for variables and research approach

In contrast to conventional studies that primarily examine socio-economic variables such as income and educational attainment, this research shifts the analytical focus toward household infrastructure and maternal health-dimensions that remain relatively under-investigated yet are pivotal in understanding malnutrition. Given the economic diversity across Gujarat, substantial inter-district disparities exist in both infrastructure quality and access to maternal healthcare services. These disparities necessitate a spatially sensitive analytical framework.

Using district-level data, this study aims to:

(1) Investigate how various forms of childhood malnutrition - including stunting, wasting, underweight, and overweight - are influenced by maternal health indicators such as antenatal care utilization and iron-folic acid supplementation.

(2) Explore the impact of household infrastructural conditions – namely, access to clean drinking water, improved sanitation, reliable electricity, and clean cooking fuels - on nutritional outcomes among children.

By leveraging a district-level quantitative approach, this research transcends simplistic correlational analyses, striving instead to deliver context-specific, policy-relevant insights. The findings are intended to support the design of localized intervention strategies and infrastructure development plans, thereby enhancing child nutrition, advancing public health objectives, and fostering long-term economic stability across Gujarat.

2. Literature Review

The interlinkages between household infrastructure, maternal health, and childhood malnutrition have been widely investigated across various global and regional contexts. However, much of the existing scholarship tends to examine these dimensions independently, thereby overlooking their potential combined influence. This section offers a critical synthesis of prior studies and situates them within the context of the current district-level investigation in Gujarat.

2.1. Household infrastructure and child malnutrition

Numerous studies underscore the importance of basic household infrastructure - such as reliable access to clean water, improved sanitation, electricity, and clean cooking fuel - as foundational determinants of child health outcomes. According to Prüss-Ustün et al. [10], deficiencies in water, sanitation, and hygiene (WASH) services significantly contribute to disease burdens, particularly among children under the age of five. Similarly, Obolensky et al. [8] demonstrated that infrastructural inadequacies increase

household exposure to health-related shocks, especially among economically disadvantaged populations. These insights are corroborated by Das [3], whose spatial analysis of malnutrition patterns across Indian districts identified a strong inverse relationship between infrastructure quality and malnutrition prevalence.

Focusing on Gujarat, Soni et al. [11] compared data from NFHS-4 and NFHS-5 and observed notable improvements in child nutrition in districts that experienced enhancements in basic infrastructure. Nonetheless, persistent deficiencies in sanitation facilities and access to clean cooking fuels continue to obstruct progress in certain regions. The current study extends these findings by analyzing how district-level disparities in infrastructure contribute to variations in malnutrition rates, thereby reaffirming the critical role of living conditions in shaping child health outcomes.

2.2. Maternal health and child nutrition

Maternal health is widely recognized as a pivotal determinant of childhood nutritional status. Foundational studies by Black et al. [2] and the World Health Organization [12] emphasize that maternal undernutrition is strongly associated with adverse birth outcomes, including low birth weight, stunted growth, and developmental delays. Dhak [4] draws attention to the structural inequalities within Gujarat's healthcare system, noting that socio-economic disparities persist in access to essential maternal health services such as antenatal care and iron-folic acid supplementation.

Although recent data from NFHS-5 indicate incremental improvements in maternal health indicators, notable inter-district variations in the provision of antenatal services and micronutrient supplementation remain. Aziz et al. [1], in their analysis of public health expenditure across South Asia, argue that insufficient governmental investment in maternal healthcare is a key driver of child malnutrition. This study builds on that argument by using district-level data from Gujarat to explore how disparities in maternal health service delivery align with nutritional outcomes in children.

2.3. Education and maternal characteristics

Educational attainment significantly shapes both maternal and child health behaviors, influencing nutritional outcomes through knowledge, awareness, and access to health services. Research by Iyengar and Dholakia [6] as well as Patil [9] indicates a strong positive association between maternal education levels and improved child nutrition, primarily due to better-informed decisions related to dietary practices and healthcare utilization. In the context of Gujarat, Soni et al. [11] observed that districts with elevated female literacy rates reported lower incidences of malnutrition, underscoring education's role as a protective factor.

Nonetheless, the effect of maternal education on child nutrition is not isolated; it is often mediated by broader structural conditions. Moran and Dewey [7] caution that improvements in educational levels alone may not yield meaningful health benefits unless supported by functional infrastructure and accessible health services. Building on this premise, the current study examines how maternal education intersects with critical environmental determinants - such as access to sanitation and clean cooking fuels - to influence childhood malnutrition outcomes across Gujarat's districts.

2.4. Research gaps and study contributions

While a substantial body of literature acknowledges the individual contributions of household infrastructure, maternal health, and education to combating childhood malnutrition, their integrated impact at the district level within Gujarat remains underexplored. Although studies such as those by Das [3] and Soni et al. [11] have mapped trends in malnutrition, they often fail to incorporate maternal characteristics and household conditions into a unified analytical framework.

This research addresses that lacuna by leveraging NFHS-5 data to conduct a district-level analysis of Gujarat. By synthesizing indicators of maternal health, household infrastructure, and nutritional status, the study

offers a holistic understanding of the determinants of childhood malnutrition. The findings are expected to inform targeted, evidence-based policy measures that aim to reduce regional disparities and enhance child health outcomes in the state.

3. Methodology

This study adopts a quantitative methodological framework to investigate the interplay between childhood malnutrition, maternal health, and household infrastructure across districts in Gujarat, India. To ensure analytical rigor and empirical robustness, the research applies multiple regression techniques alongside spatial disparity analysis, enabling a comprehensive assessment of the identified variables.

3.1. Data source

The analysis is grounded in secondary data derived from the Fifth Round of the National Family Health Survey (NFHS-5), complemented by district-level malnutrition statistics specific to Gujarat. The dataset encompasses 33 districts and integrates a wide range of indicators pertaining to child nutrition outcomes, maternal health metrics, and key household infrastructural features.

To enrich the contextual understanding of regional disparities, the study also draws on supplementary socio-economic data from the *Gujarat Socio-Economic Review* 2019-20 (Government of Gujarat [5]). This source provides district-wise insights into tribal population distribution, rural development priorities, and levels of infrastructure investment, all of which are critical for interpreting the spatial patterns observed in the regression and disparity analyses.

Category	Variables	Description/Indicator
Dependent variables (child malnutrition, < 5 years)	Stunting (%)	Low height-for-age, chronic malnutrition
	Wasting (%)	Low weight-for-height, acute malnutrition
	Severe wasting (%)	Extreme cases of wasting
	Underweight (%)	Low weight-for-age, both chronic and acute
Independent variables	**Household infrastructure**	Improved drinking water (%); improved sanitation (%); electricity availability (%); clean cooking fuel (%)
	Maternal health indicators	Antenatal care visits (% mothers with ≥ 4 check-ups); iron-folic acid consumption (% mothers consuming ≥ 180 days)
	Maternal characteristics	Women with 10+ years schooling (%); BMI above normal (%); BMI below normal (%); high-risk waist-to-hip ratio (%)

3.2. Statistical techniques

To rigorously assess the associations between childhood malnutrition and its determinants, this study employs a combination of descriptive and inferential statistical methods. Pearson's correlation analysis was conducted to identify bivariate relationships among key variables, including maternal health indicators, household infrastructure components, and child nutritional outcomes. Multiple linear regression models were then applied to examine the combined effects of these predictors on district-level stunting prevalence. Model diagnostics, such as the condition number and variance inflation factor (VIF), were used to test for multicollinearity, ensuring the reliability of regression estimates. Where necessary, variables with high collinearity were interpreted cautiously in light of their theoretical relevance. All analyses were performed using SPSS Version 26, and results were interpreted at a 95% confidence level. This approach provides a comprehensive understanding of how intersecting socio-environmental and maternal health factors contribute to malnutrition outcomes across Gujarat.

4. Descriptive Statistics

This study explores district-level variations in childhood malnutrition in Gujarat, drawing on secondary data from the National Family Health Survey

(NFHS-5). The dependent variables under investigation include stunting, wasting, severe wasting, and underweight prevalence among children under five years of age. Independent variables are categorized into three domains: maternal health indicators (such as antenatal care visits and iron-folic acid supplementation), maternal nutritional status (BMI categories and waist-to-hip ratio), and household infrastructure characteristics (access to improved drinking water, sanitation, electricity, and clean cooking fuel).

Table 1 summarizes the key variables utilized in the analysis. On average, 38.67% of children across districts are stunted, while wasting and severe wasting rates stand at 26.11% and 11.07% respectively. The mean underweight prevalence is 40.31%, highlighting the widespread burden of undernutrition. Maternal education remains limited, with only about 31.17% of women having completed more than 10 years of schooling. In terms of maternal nutritional status, 25.98% of women fall below normal BMI thresholds, and 43.44% present a high-risk waist-to-hip ratio, suggesting significant maternal undernutrition across the state.

Infrastructural indicators reveal near-universal access to electricity (97.44%) and improved drinking water (96.85%), yet considerable gaps persist in sanitation (71.80%) and access to clean cooking fuel (60.06%), reflecting persistent inequalities in living conditions. Maternal health service utilization is relatively high, with 77.56% of women receiving four or more antenatal care visits; however, adherence to iron-folic acid supplementation for 180 days or more remains suboptimal at 42.31%.

These descriptive findings suggest a complex interplay between health services access, maternal health, and household environments in shaping childhood nutrition outcomes across Gujarat.

Table 1. Summary statistics of key variables (district-level, Gujarat, NFHS-5)

Variable	Mean	Standard deviation	Minimum	Maximum
Stunting (%)	38.67	7.01	18.2	55.3
Wasting (%)	26.11	5.49	17.3	40.9
Severely wasted (%)	11.07	4.11	4.9	22.2
Underweight (%)	40.31	8.02	25.5	53.1
Women with 10+ years of schooling (%)	31.17	8.60	15.8	47.7
BMI below normal (%)	25.98	6.32	15.8	39.1
High-risk waist-to-hip ratio (%)	43.44	10.75	25.0	61.9
Antenatal care (4+ visits, %)	77.56	11.41	56.1	94.7
Iron-folic acid consumption (180+ days, %)	42.31	14.52	12.2	84.9
Improved drinking water (%)	96.85	2.69	90.7	99.7
Improved sanitation (%)	71.80	13.16	35.9	86.6
Electricity access (%)	97.44	2.49	89.3	99.9
Clean cooking fuel access (%)	60.06	17.47	23.4	89.7

Source: Author's calculation based on NFHS-5 district-level data (2019-21)

5. Correlation Analysis

To preliminarily explore the relationships between childhood malnutrition and the selected independent variables, a Pearson correlation matrix was computed at the district level.

The analysis reveals several important patterns. First, stunting exhibits a strong negative correlation with key household infrastructure indicators, including improved sanitation $(r = -0.60)$, access to electricity $(r = -0.56)$, and clean cooking fuel usage $(r = -0.58)$. This suggests that better physical living conditions are associated with lower rates of chronic child undernutrition.

Second, maternal nutritional status indicators show expected associations. The prevalence of women with BMI below normal is positively

correlated with stunting ($r = +0.69$), underscoring the intergenerational transmission of malnutrition. A higher proportion of mothers classified as undernourished corresponds to higher child stunting rates across districts. Similarly, the proportion of women with a high-risk waist-to-hip ratio also shows a weak positive correlation with stunting ($r = +0.24$), although the relationship is not as pronounced.

In contrast, maternal healthcare access variables - specifically, the proportion of women receiving four or more antenatal care visits and the percentage consuming iron and folic acid for at least 180 days - exhibit weak and statistically non-significant correlations with stunting and other forms of malnutrition. This indicates that while service coverage is high in several districts, the mere quantitative reach of maternal health services does not necessarily translate into improved child nutrition outcomes.

Taken together, the correlation analysis highlights the multifactorial nature of childhood malnutrition in Gujarat. While infrastructure and maternal nutritional status emerge as important correlates, healthcare access variables appear less influential when considered independently, hinting at the role of service quality, maternal behavior, and broader social determinants.

6. Regression Analysis

To identify the key determinants influencing childhood stunting across districts, an Ordinary Least Squares (OLS) regression model was employed, using the proportion of stunted children under five years as the dependent variable. The independent variables comprised maternal nutritional indicators (BMI below and above normal, waist-to-hip ratio), maternal healthcare access (antenatal care visits, iron-folic acid consumption), and household infrastructure characteristics (drinking water, sanitation, electricity, and clean cooking fuel).

The regression results are summarized below:

Table 2. OLS regression results for predictors of childhood stunting

Variable	Coefficient	Standard error	*t*-statistic	*p*-value
Constant	–19.576	73.473	–0.266	0.792
Women with 10+ years schooling (%)	0.228	0.182	1.253	0.223
BMI above normal (%)	0.261	0.335	0.778	0.444
BMI below normal (%)	0.634	0.307	2.065	0.050
High risk waist-to-hip ratio (%)	–0.014	0.130	–0.106	0.916
4+ Antenatal care visits (%)	0.086	0.123	0.697	0.493
Iron folic acid (180+ days) (%)	0.024	0.085	0.285	0.778
Improved drinking water (%)	0.838	0.476	1.761	0.092
Improved sanitation (%)	–0.242	0.155	–1.561	0.132
Electricity (%)	–0.354	0.762	–0.464	0.647
Clean cooking fuel (%)	–0.120	0.139	–0.866	0.395

Source: Author's calculation based on NFHS-5 district-level data (2019-21)

The model explains approximately 63.8% of the variation in stunting across districts $(R^2 = 0.638)$, indicating a good overall model fit for cross-sectional social data. Maternal undernutrition (BMI below normal) emerged as the only statistically significant predictor at the 5% significance level $(p = 0.050)$, reinforcing the crucial link between maternal and child nutritional outcomes.

Infrastructure-related variables (improved sanitation, electricity access, clean cooking fuel) show expected negative associations with stunting, although their coefficients are not statistically significant. This could reflect underlying multicollinearity among these indicators, a hypothesis supported by the high condition number observed $(1.69e + 04)$, suggesting further model refinement (e.g., ridge regression) may be appropriate.

Overall, these findings emphasize that improving maternal nutritional status may yield the most direct and significant gains in reducing childhood stunting, while infrastructural improvements, although essential, may require synergistic interventions and better targeting to translate into measurable outcomes.

7. Discussion

The results of this study highlight the multifaceted and deeply entrenched nature of childhood malnutrition across Gujarat's districts, bringing into focus stark regional disparities and the critical influence of maternal health and household infrastructure. Despite Gujarat's reputation as an economically progressive state, the district-level analysis utilizing NFHS-5 data reveals that economic growth has not been evenly translated into nutritional gains for children under the age of five.

The average prevalence of stunting (38.67%), underweight (40.31%), and wasting (26.11%) remains distressingly high, indicating that malnutrition persists as a widespread public health issue. Districts such as Dohad - where 55.3% of children are stunted and 53% are underweight - and Panchmahal (47.1% stunted, 51.9% underweight) exemplify the severe manifestations of chronic undernutrition. These figures stand in stark contrast to districts like Porbandar (18.2% stunted) and Gir Somnath (30.3% underweight), underscoring the unequal distribution of nutritional outcomes within the state. These spatial variations necessitate a nuanced understanding of localized socio-economic, cultural, and infrastructural conditions. They also challenge the assumption that macroeconomic growth alone is sufficient to alleviate undernutrition without parallel investments in equitable health and infrastructure development.

A particularly salient finding from the regression analysis is the statistically significant positive relationship between maternal undernutrition - measured through BMI below normal - and child stunting ($\beta = 0.634$, $p = 0.050$). This suggests a strong intergenerational transmission of nutritional deficits. Districts such as Dahod and Banaskantha, where 39.1% and 36.7% of women, respectively, fall below the normal BMI threshold, also exhibit elevated stunting rates among children. These findings are consistent with established literature that identifies maternal nutritional status during the pre-conception and antenatal periods as a critical

determinant of child health. Undernourished mothers are more likely to give birth to low-birth-weight infants, who are biologically predisposed to compromised immune development, impaired growth trajectories, and greater susceptibility to infection and malnutrition.

An intriguing aspect of the analysis is the role of infrastructure in influencing child nutrition outcomes. Variables such as improved sanitation $(r = -0.60)$, electricity access $(r = -0.56)$, and clean cooking fuel usage $(r = -0.58)$ displayed strong negative correlations with stunting, underscoring the importance of basic physical amenities in mitigating child malnutrition. However, these associations did not reach statistical significance within the regression model - likely a consequence of multicollinearity among closely related variables, as indicated by the high condition number. This does not undermine their relevance; rather, it suggests that when multiple interrelated infrastructure variables are analyzed simultaneously, their individual effects may be obscured.

Antenatal care and iron-folic acid supplementation - despite their recognized clinical value - did not emerge as significant predictors of child malnutrition in the statistical model. For example, districts such as Surat and Vadodara report antenatal care coverage exceeding 90%, yet continue to face high rates of stunting and underweight prevalence. This finding suggests that mere numerical coverage of maternal health services is insufficient in the absence of quality interventions, timely counseling, and meaningful engagement with maternal nutrition.

From a policy standpoint, this challenges the prevailing emphasis on service coverage and signals the need to prioritize the content and effectiveness of antenatal services. The focus should now shift from quantity to quality - emphasizing outcome-oriented care, particularly in tribal and underserved areas where service access and impact remain weak. Nutrition counseling, maternal weight monitoring, and follow-up support should become integral to maternal health interventions, with a specific emphasis on reaching marginalized populations.

Malnutrition disparities also reflect corresponding gaps in infrastructure. For instance, The Dangs and Tapi, where access to clean cooking fuel is as low as 23.4% and 45.5%, and sanitation coverage remains below 36%, exhibit among the highest rates of stunting and underweight prevalence in the state. Conversely, urban districts such as Ahmedabad and Rajkot, despite achieving near-universal access to electricity and clean fuel (e.g., 99.5% electricity and 89.7% clean fuel in Ahmedabad), still report significant stunting (35.5%) and wasting (17.5%). This suggests that urban malnutrition may stem from distinct factors - such as food insecurity, suboptimal feeding practices, and micronutrient deficiencies - that require targeted, urban-specific strategies.

Finally, the explanatory power of education - often considered as a proxy for nutritional awareness - appears limited when examined in isolation. Although maternal education beyond ten years is traditionally associated with improved child health outcomes, the present analysis finds no statistically significant relationship with stunting ($p = 0.223$). This aligns with insights from Moran and Dewey [7], who argue that education must translate into tangible health-promoting behaviors. Achieving this requires an enabling environment, culturally appropriate communication strategies, and system-level accountability mechanisms. For instance, Navsari, despite reporting one of the highest female literacy rates (47.7%), continues to experience alarmingly high rates of stunting (47.2%) and underweight (52.8%).

These findings underscore the need to embed *behavior change communication* and *community-level nutrition education* within the broader maternal and child health framework. Infrastructure and service provision, though critical, must be complemented by interventions that build trust, promote behavioral adoption, and foster sustained community participation - without which nutritional gains are unlikely to be long-lasting.

In analyzing the broader spatial dynamics of childhood malnutrition, this study identifies clear geographical concentrations of vulnerability, particularly within Gujarat's eastern and tribal districts - namely, Dahod, Panchmahal, Chhota Udaipur, and Narmada. These districts emerge as persistent high-burden clusters where poor maternal nutrition converges with inadequate household infrastructure, reinforcing entrenched patterns of undernutrition. Notably, these regions also correspond with higher proportions of Scheduled Tribe populations, limited access to higher secondary education, and lower income levels, as reported in the *Gujarat Socio-Economic Review* 2019-20. Such alignment underscores the role of entrenched structural inequities in perpetuating health disparities.

The results highlight the necessity for policy approaches that account for these interlinked and systemic disadvantages, rather than targeting determinants in isolation. Child malnutrition, as evidenced here, is not merely an outcome of food insufficiency - it is a complex phenomenon influenced by maternal health status, the quality of household amenities, educational access, and embedded socio-cultural patterns. As such, future policy frameworks should transition from fragmented or siloed interventions (e.g., stand-alone nutrition supplementation schemes) toward integrated, cross-sectoral strategies that simultaneously address health, nutrition, WASH (water, sanitation, and hygiene), and educational deficits in a coordinated manner.

Furthermore, the study's regression analysis, while yielding valuable insights, points to certain methodological limitations. The presence of multicollinearity among predictors and a moderately explanatory R^2 value (63.8%) suggest the need for more sophisticated statistical tools. Alternative modeling approaches - such as multilevel or hierarchical regression, ridge regression, or spatial econometric models - may provide greater clarity in isolating independent effects while accounting for spatial autocorrelation and unobserved district-level heterogeneity. Moreover, complementing

quantitative data with qualitative insights could illuminate why certain districts exhibit unexpected outcomes despite infrastructural or service improvements.

While this study focuses on undernutrition, future research may explore the rising trends of childhood overweight in urban Gujarat to address the emerging dual burden of malnutrition.

8. Conclusion

This research offers a comprehensive exploration of the complex relationships between maternal health, household infrastructure, and childhood malnutrition across Gujarat's districts, employing data from NFHS-5 and robust statistical techniques. The findings emphasize that childhood malnutrition is not driven by a singular factor but is instead shaped by a confluence of structural and behavioral influences, many of which intersect in context-specific ways.

While maternal undernutrition emerged as a statistically significant driver of child stunting, infrastructural factors - though strongly correlated - did not retain predictive power within the multivariate model. This suggests that their influence may be moderated by unmeasured variables such as service quality, community health practices, or cultural beliefs around infant care. These insights caution against universal interventions and highlight the importance of tailoring programs to local needs and socio-demographic realities.

Crucially, the study calls for a re-evaluation of current monitoring and evaluation systems, which tend to emphasize quantitative service delivery metrics (e.g., number of antenatal visits) over qualitative and impact-focused indicators. Future strategies must prioritize effectiveness and outcome measurement, particularly in maternal and child health.

To achieve meaningful progress, Gujarat's health governance must adopt a *systems-oriented*, *locally adaptive approach* - one that situates nutrition as a developmental priority intrinsically tied to gender equity, education, environmental sustainability, and public service quality. This requires enhanced interdepartmental coordination, increased investment in maternal and child nutrition, and a commitment to programmatic flexibility based on granular, district-level data.

Ultimately, improving child nutrition is not merely a question of expanding infrastructure or delivering services - it requires ensuring that these inputs result in sustained, equitable, and measurable improvements in children's lives. This can only be achieved through precise data use, strategic convergence of sectors, and enduring political and institutional will.

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