Regional Variation of Child Malnutrition Indicators in Uttar Pradesh, India: Evidence from NFHS 2019-2021

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Introduction

The persistence of child malnutrition in India is rooted in complex socio-economic, political, and environmental dynamics. Theoretical frameworks such as the ecological model of health (Bronfenbrenner, 1979) suggest that malnutrition is influenced by multiple layers of factors ranging from individual-level characteristics (e.g., maternal education) to broader societal influences (e.g., income inequality and geographic deprivation). Additionally, social determinants of health theories (Marmot, 2005) highlight how socio-economic conditions such as wealth status, caste, and geographic location shape health disparities. In India, Uttar Pradesh exemplifies these dynamics, with substantial regional variation in the prevalence of child malnutrition. This study is anchored in the ecological model and examines how individual, household, and regional factors interact to shape malnutrition outcomes. In particular, the study seeks to highlight intra-state regional disparities and their implications for targeted interventions. The objective of this study is to analyse regional disparities in child malnutrition across Uttar Pradesh by examining the prevalence of stunting, wasting, and underweight children in five regions and identify the socio-economic and geographic determinants that explain these regional variations, using logistic regression analysis to assess their impact.

There are mainly two theoretical concepts used in this study- 1. The ecological model of health, 2. The concept of social inequality. The ecological model of health underpins this research by suggesting that child malnutrition is not just a function of individual factors but is also shaped by contextual elements such as socioeconomic conditions and geographic location. The concept of social inequality is particularly relevant here, as malnutrition disproportionately affects children from marginalized socio-economic groups and disadvantaged regions. Additionally, life course theory informs the study's examination of how early childhood nutrition impacts long-term health and development outcomes. According to this theory, malnutrition during critical growth periods can have enduring effects on cognitive development, school performance, and future earning potential, thereby perpetuating cycles of poverty and inequality (Barker, 1998).

Data and Methods

Data for this study were obtained from the National Family Health Survey (NFHS-5, 2019-21), a representative survey that collects data on various health and demographic indicators, including child nutrition. The key malnutrition indicators studied are:
Stunting: Height-for-age below -2 standard deviations (SD) from the WHO growth reference.
Wasting: Weight-for-height below -2 SD from the WHO median.
Underweight: Weight-for-age below -2 SD from the median.
Uttar Pradesh was divided into five major regions: Northern Upper Ganga Plain, Southern Ganga Plain, Central, Eastern, and Southern. Logistic regression models were employed to assess the impact of socioeconomic variables (such as maternal education, caste, religion, and wealth index) and geographic variables on malnutrition outcomes. The model controlled for various individual- and household-level factors, including maternal age, education, religion, caste, wealth, and contraceptive use.

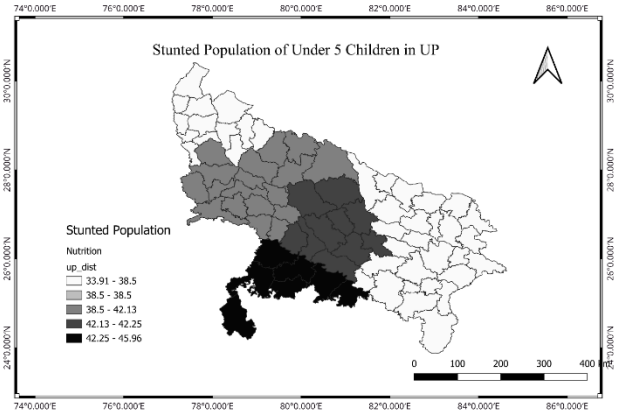
Results

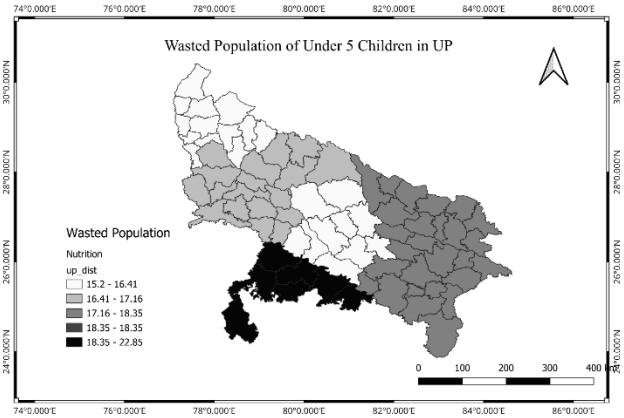
Table 1. Percentage Distribution of Stunting, Wasting, and Underweight by Region

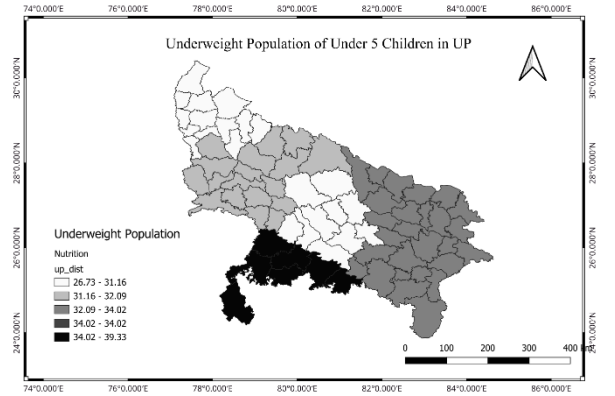
Region	Stunting	Wasting	Underweight
Northern Upper Ganga Plain	32.81	25	29.77
Southern Ganga Plain	41.58	22.72	31.44
Central	40.97	24.4	34.47
Eastern	41.49	23.41	33.03
Southern	36.58	32.86	38.67
Total	39.7	24.6	32.1

Table 1 presents the percentage distribution of stunting, wasting, and underweight children across five regions of Uttar Pradesh. The findings reveal substantial regional variation: The Northern Upper Ganga Plain has the highest rate of stunting (52.81%), followed by the Eastern (51.76%) and Central (49.92%) regions. Wasting is most prevalent in the Eastern region (31.14%), with significant levels also found in the Northern Upper Ganga Plain (28.47%). The highest proportion of underweight children is observed in the Central region (38.27%), followed by the Eastern region (32.21%). These findings indicate that while malnutrition is pervasive across all regions, the southern and eastern regions show particularly high levels, possibly due to a combination of geographical disadvantages and socio-economic deprivation. The semi-arid Bundelkhand area, located in the Southern region, is especially vulnerable to food insecurity and poor agricultural productivity, which likely contributes to the elevated malnutrition rates.

Geographical Distribution of Stunted, Wasted and Underweight Children in Regions of Uttar Pradesh, NFHS, 2019-21, India.







Source: prepared by the author following the National Sample Survey's regional classification of Uttar Pradesh, 2011 and NFHS, 2019-21, India.

The geographical distribution of stunted, wasted, and underweight children (as shown in the accompanying maps) highlights regional clusters of high malnutrition. The southern region, encompassing Bundelkhand, emerges as a hotspot for both stunting and underweight, while the Eastern region shows high levels of wasting. These geographic disparities underscore the critical role of environmental factors, such as agricultural productivity and water availability, in shaping malnutrition outcomes.

Table 2: Logistic Regression Results

	Stunting			**Wasting**			**Underweight**		
Variables	**Model I**	**Model II**	**Model III**	**Model I**	**Model II**	**Model III**	**Model I**	**Model II**	**Model III**
Place of Residence®									
Urban									
Rural	1.37***	0.92**	0.95	0.89**	0.78***	0.79***	1.22***	0.86**	0.87***
Wealth Index									
Poorest®									
Poorer		0.79***	0.83***		0.87***	0.89**		0.79***	0.8***
Middle		0.67***	0.73***		0.78***	0.83**		0.64***	0.69***
Richer		0.52***	0.58***		0.81***	0.78**		0.55***	0.61***
Richest		0.41***	0.47***		0.73***	0.83***		0.45***	0.52***
Maternal Education									
Illiterate®									
Up to Secondary		0.81***	0.80***		0.91**	0.89**		0.79***	0.77***
Higher		0.58***	0.59***		0.84**	0.79***		0.65***	0.63***
Sex of Child									
Male®									
Female			0.93**			0.90***			0.90***
Caste									
SCs/STs®									
OBCs			0.89***			1.03			0.96
Others			0.76***			0.90**			0.79***
Religion									
Hindu®									
Muslim			0.98***			0.98***			1.32
Others			0.54**			0.54**			0.52**
Source of Drinking Water									
Improved®									
Unimproved			0.81**			1.02			0.88**
Toilet Facility Type									

Toilet facility available®									
Open Defecation			1.11***			0.98			1.01
Region									
Southern Ganga Plain®									
Northern Upper Ganga Plain			1.07			1.02			1.03
Central			1.20***			0.91*			1.05
Eastern			0.94			1.16 ***			1.17***
Southern			1.26***			1.44***			1.40***

Table 2 presents the results of the logistic regression analysis, examining the socio-economic and geographic determinants of child stunting, wasting, and underweight. Stunting: Maternal education emerges as a significant protective factor against stunting, with children of educated mothers less likely to be stunted. Wealth is another significant determinant, with children from wealthier households exhibiting lower odds of stunting. Regionally, children in the Southern and Eastern regions are significantly more likely to be stunted than those in the Northern Upper Ganga Plain. Wasting: Similar to stunting, maternal education and wealth index significantly affect wasting. Children from households in lower wealth quintiles are more likely to experience wasting, while those with better maternal education are less vulnerable. Geographic variation is also evident, with the Eastern region exhibiting higher wasting rates, suggesting region-specific vulnerabilities. Underweight: Wealth and maternal education are strong determinants of underweight status, with similar trends observed across regions. The Southern and Central regions show significantly higher odds of children being underweight compared to the Northern Upper Ganga Plain, reinforcing the need for targeted interventions in these areas.

Conclusion

This study highlights substantial intra-state regional disparities in child malnutrition within Uttar Pradesh. The southern region, in particular, exhibits elevated rates of stunting and underweight, likely due to a combination of geographic disadvantages and socio-economic deprivation. Despite the relative wealth of the Northern Upper Ganga Plain, malnutrition remains a pervasive issue across all regions, particularly in the eastern and southern parts of the state. The findings underscore the importance of region-specific interventions that address malnutrition's socio-economic and geographic determinants. Policy efforts must be tailored to the distinct challenges faced by regions like Bundelkhand, where poor agricultural productivity and limited infrastructure exacerbate malnutrition. Addressing the structural inequalities that underpin regional disparities in malnutrition will be critical for achieving sustainable improvements in child health and development outcomes.

References

Almasi, A., Alireza Zangeneh, Shahram Saeidi, (2019). Study of the spatial pattern of malnutrition (stunting, wasting and overweight) in countries in the world using Geographic Information System. *Int J Pediatr*, 7 (10), 10269-10281.

Basu, A.M. (1993). How pervasive are sex differentials in childhood nutritional levels in South Asia? *Social Biology*, 40 (2), 25–37.

Borooah, V. K. (2005). Caste, inequality, and poverty in India. *Review of Development Economics*, 9(3), 399-414.

Cesare, M. D., Bhatti, Z., Soofi, S.B., Fortunato, L., Ezzati, M., and Bhutta, Z. A. (2015). Geographical and socio economic inequalities in women and children's nutritional status in Pakistan in 2011: An analysis of data from a nationally representative survey. *The lancet global health*, 3(4): e229–e239.

Coffey, D., Deshpande, A., Hammer, J., and Spears, D. (2019). Local social inequality, economic inequality, and disparities in child height in India. *Demography*, 56, 1427-1452.

Deaton, A., and Dreze, J. (2009). Food and nutrition in India: facts and interpretations. *Economic & Political Weekly*, 44 (7), 42-65.

Deshpande, A. (2000). Does caste still define disparity? A look at inequality in Kerala, India. *The American Economic* Review, 90(2), 322-325.

Hathi, P., Haque, S., Pant, L., Coffey, D., and Spears, D. (2014). Place and child health: The interaction of population density and sanitation in developing countries. *Demography*, 54,337-360.

International Institute for Population Sciences (IIPS) & ORC Macro (2007). *National Family Health Survey (NFHS-3), 2005e2006*: India, Vol. I. Mumbai: International Institute for Population Sciences.

International Institute for Population Sciences (IIPS) and ICF (2017). National Family Health Survey Report-4, 2015-16: India. Mumbai, *IIPS*.

Keshri, K. (2019). Temporary labour migration in S. Irudaya Rajan and M. Sumeetha (Ed.), *Handbook of Internal Migration in India*. *(New Delhi: SAGE India), 140-152.*

Khadilkar, V.V., Khadilkar,A.V., and Chiplonkar, S.A. (2010). Growth performance of affluent Indian preschool children: A comparison with the new WHO growth standard. *Growth and Pediatric Endocrine Research Unit, Indian Pediatrics,* 47(10), 869-72.

Lone, B., Vani,M., Lone, S., and Mayer, I.A. (2018). Geographical perspective on stunting among rural female children in district Baramulla, Jammu & Kashmir-India. *Springer Netherlands,* 84(2), 459-470.

Menon P., Kohli N., Pradhan M., Cyriac, S., and Priyadarshi, M. (2014). In the challenge of child under nutrition in Uttar Pradesh: Findings from a situation assessment. POSHAN report no. 3. *New Delhi:International Food Policy Research Institute.*

Ministry of Finance, Government of Uttar Pradesh. *Economic Survey of Uttar Pradesh*. 2019-20

Ministry of Home Affairs (2012). *Census of India*. New Delhi: Ministry of Home Affairs (MOHA), Government of India (GOI).

Mishra, R. (2017). Determinants of child malnutrition in tribal areas of Madhya Pradesh. *Economic & Political Weekly*, Vol. 52 (5), 50-57.

Menon, P., Derek, R., and Ngyun, P.H. (2018). Understanding the geographical burden of stunting in India: A regression-decomposition analysis of district- level data from 2015-16. *Maternal and Child Nutrition*, 14 (4), e12620.

Smith, L. C., Ramakrishnan, U., Ndiaye, A., Haddad, L., and Martorell, R. (2003). The importance of women's status for child nutrition in developing countries. *Food and Nutrition Bulletin,* 24(3), 287-288.

Smith, L. C., Ruel M. T., and Ndiaye A. (2005). Why is child malnutrition lower in urban area than in rural area? Evidence from 36 developing countries. *World Development*, 33(8), 1285-1305.

Spears, D. (2013). Child stunting and open defecation: How much of the South Asian height "enigma" is a toilet gap? *Ideas for India, Human Development.*

Spears, D. (2018). Exposure to open defecation can account for the Indian enigma of child height. *Journal of Development Economics*, 146, 10277.

Tarozzi, A. (2012). Some facts about boy versus girl health indicators in India: 1992–2005. *CESifo Economic Studies,* 58(2), 296-321.

Tarozzi, A., and Mahajan, A. (2007). Child nutrition in India in the nineties. *Economic Development and Cultural Change, University of Chicago Press*, 55, 441-486.

UNDP (2017). *Human development reports*. New York: United Nations Development Programme.

WHO (2006). *The WHO Child Growth Standards*. Geneva: World Health Organization.

WHO (2013). *Women's and children's health evidence of impact of human rights.* Geneva: World Health Organization WHO (2018). *Global nutrition report, 2018*. Geneva: World Health Organization.