Analysing the spatial contours of child health in India: Evidence from NFHS-5

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Background

- India has been identified as one of the countries among the LMIC where prevalence of malnutrition is alarmingly high.
- Eliminating malnutrition is one of the key goals set by the 2015 UN Sustainable Development Goals.
- Even though the recent evidence shows a nominal reduction in the rates in India, the goals are far to be reached.
- The geographic information system tools help provide better answers to research questions surrounding these areas. The current study explores various GIS techniques to identify pockets of low-and-high burden of malnutrition to plan calibrated steps for its elimination – whether through convergence or standalone interventions.

Objectives

- Explore the spatial heterogeneity of child undernutrition at the micro-level, across the districts of India
- To examine the spatial pattern, spatial clustering and risk factors of undernutrition among children below age 5 years across the districts

Data & Methods

- 2019-20 district-level data from the National Family Health Survey, wave 5, has been utilised, to study the spatial contours and heterogeneity of children undernourished.
- Outome variables: Children under five years stunted, wasted and underweight
- Predictor variables: Based on principal component analysis, four variables were chosen: Children who received postnatal care within two days of delivery, Women whose Body Mass Index is below normal, women having early pregnancies and households using improved drinking water.
- Various spatial econometrics models were applied to study the spatial pattern and clustering of undernutrition and its risk factors.
- Geospatial techniques like Moran's I statistics, and Univariate and Bivariate LISA were applied to understand the spatial dependence across the districts. Spatial regression models, namely spatial lag and error models, and geographically weighted regression, were used to examine the correlates of malnutrition at the micro-level.

Results

(1) Univariate Local Moran's I

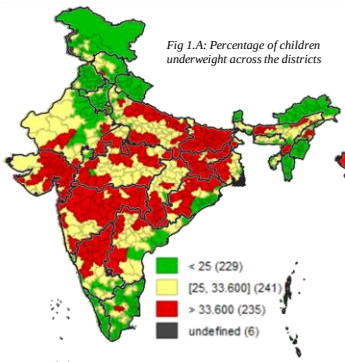


Fig 1.A: Percentage of children underweight across the districts

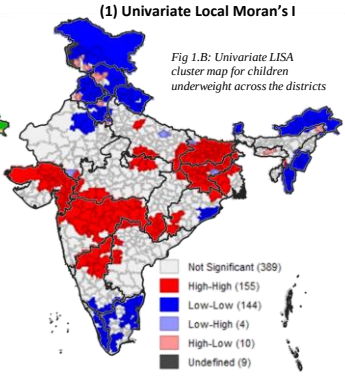


Fig 1.B: Univariate LISA cluster map for children underweight across the districts

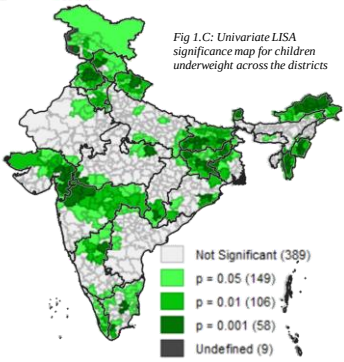
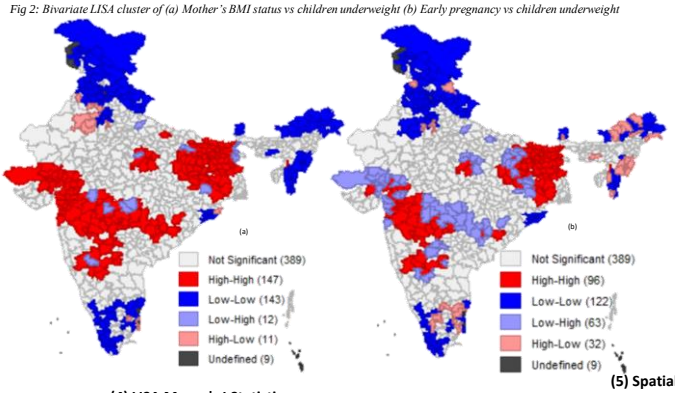


Fig 1.C: Univariate LISA significance map for children underweight across the districts

(2) Bi-variate Local Moran's I- Children undernourished with its correlates

Fig 2: Bivariate LISA cluster of (a) Mother's BMI status vs children underweight (b) Early pregnancy vs children underweight



(3) GWR Model Results

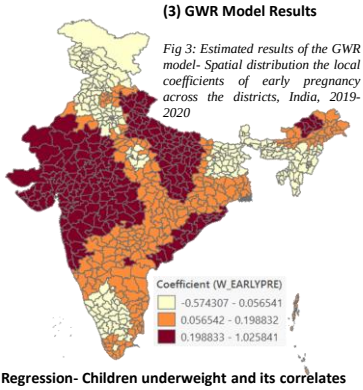


Fig 3: Estimated results of the GWR model- Spatial distribution the local coefficients of early pregnancy across the districts, India, 2019-2020

(4) LISA Moran's I Statistics

Table 1 Bivariate LISA Moran's I Statistics showing the spatial dependence for the district level prevalence of child malnutrition against its correlates

District- level variables	Underweight	
	Bivariate LISA	p value
Percent Households using improved drinking water	-0.005	0.42
Percent Women whose Body Mass Index (BMI) is below normal (BMI < 18.5 kg/m2	0.63	0.001
Percent Women having early pregnancies	0.24	0.001
Percent Children who received postnatal care within two days of delivery	-0.015	0.20

(5) Spatial Regression- Children underweight and its correlates

Table 2 Results- Spatial regression models: to assess the association of child underweight and its correlates, across districts, 2019-20

District- level correlates	OLS	Spatial Lag Model	Spatial Error Model
Percent Households using improved drinking water	-0.01	-0.01	-0.03
Percent Women whose Body Mass Index (BMI) is below normal (BMI < 18.5 kg/m2	0.94***	0.52***	0.67***
Percent Women having early pregnancies	0.16***	0.07*	0.11*
Percent Children who received postnatal care within two days of delivery	-0.04***	-0.02**	-0.03
R- squared value	0.57	0.70	0.68
Lambda Value (Lag Coefficient)			0.63
Rho Value (Lag coefficient)		0.53	
Log likelihood	-2306	-2201	-2224
AIC value	4622	4415	4459
No. of regions	705	705	705

Findings

- More than 20% of the districts showed high-high spatial association of children underweight, also showing the strongest geographical clustering with a Moran's I value of 0.68 (p<0.001), followed by children stunted (0.52, p<0.001) and children wasted (0.47, p<0.001).
- Pockets of low and high levels of malnutrition were identified, which can be used to plan calibrated steps for its elimination and to develop a customized action plan for rapid reduction in malnutrition.
- The regression results confirmed that the immediate and underlying determinants of malnutrition, namely, mother's age at first pregnancy, mother's nutritional status and children receiving postnatal care within two days of delivery, were the critical and statistically significant determinants of child nutrition.
- The GWR results suggested that the magnitude of association of children underweight with its correlates varied spatially because of the strong location specific behavior across space.

Conclusion

- These results from the analysis facilitates the identification of hotpots of low and high prevalence, and hence it can be used to allocate resources effectively to reduce health inequities between and within districts.
- Health resource allocations and child health specific interventions need to be implemented in the geographical hotspots of higher undernutrition prevalence.
- The evidence gathered from this study can be used by decision-makers for developing better strategies at the micro-level and long-term planning to find solutions to mitigate the problem of undernutrition