ABSTRACT

Background:

Malnutrition is a serious public health concern. It is one of the direct reasons of mortality of children at younger age specifically in low-income and developing countries. The geographical variation of malnutrition and its chronic form are not yet explored in Pakistan. This research is designed to serve the purpose of filling this gap.

Methods:

The study utilized Pakistan Demographic and Health Survey (PDHS) data conducted in 2017-18. After data cleaning, the final dataset included 4141 children (i.e., under the age of five years old) whose malnutrition status was kept as main interest variable. Spatial autocorrelation at global level was determined using Global Moran's I Index whereas Local Moran's I Index was applied to further identify clusters and outliers at local level in ArcGIS Pro. Furthermore, Getis-Ord Gi* statistic was utilized to provide z-score and p-score estimates highlighting the intensity of malnutrition cases in Pakistan by showing hotspots and cold spots of malnutrition. The model fitting was done using ordinary least square regression as well as geographically weighted regression method. Ordinary least square method gave significant predictors of malnutrition and severe malnutrition. Whereas, Geographically Weighted Regression provided improved estimates of malnutrition and severe malnutrition on local level. Both results were compared by using Adjusted *R*-squared values.

Findings:

Malnutrition in children were found spatially clustered at district level in Pakistan. In terms of stunting, high-risk districts were identified in Baluchistan including Kalat, Kachhi, Jhal Magsi, Lehri, Dera Bugti, Nasirabad, Jaffarabad, and Sohbatpur and in Sindh were Badin, Mirpur Khas, Sanghar, Shaheed Benazir Abad, Naushahro Feroze, Dadu, Sukkur, Kashmore, Shkarpur, Larkana, Kambar Shahdad Kot, and Jacobabad. For wasting, hotspots were found in the Baluchistan region (Kharan, Washuk, Kech, and Gwadar). For Underweight, regions with high risk included parts of the Baluchistan region (Washuk, Khuzdar, Kalat, Kachhi, Sibi, Kohlu, Dera Bugti, Lehri, Nasirabad, Sohbatpur, Jaffarabad, Jhal Magsi, and Khuzdar), and areas of Sindh including Tharparkur, Umer kot, Mirpur khas, Badin, Sanghar, Tando Allayar, Matiari (Ctrl)

Shaheed Banezir Abad, Naushahro Feroze, Dadu, Kambar Shahdad Kot, Larkana, Shkarpur, Jacobabad, Kashmore, and Sukkur. For Severe Stunting, hotspot areas were indicated in Baluchistan region (including Sibi, Kachhi, Kalat, Lehri, Nasirabad, Jhal Magsi, Jaffarabad), in Sindh (Kambar Shahdad Kot, Shikarpur, and Jacobabad), in Punjab (Gujrat, Sialkot, Narowal, Gujranwala, Hafizabad, Sheikhupura, Lahore, Nankana Sahib, Faisalabad, Kasur, and Okara), and in Azad Kashmir (Bhimber).

In GWR analysis, age of children in months, household size, child having diseases, father's secondary educational level, unimproved drinking source, and unimproved toilet facility were found as significant predictors of stunting. Similarly, for wasting, significant predictors were child having diseases, primary education of father, unimproved toilet facility, and delivery at home. In case of underweight, significant predictors were household size, age of child in months, father's secondary educational level, and unimproved drinking source. For severe stunting, the significant predictors were found to be household size, rural area of residency, unimproved drinking, and delivery at private sector. It was also concluded that GWR method provide improved estimates than OLS method.

Conclusion:

Our research indicated a spatial pattern of malnutrition and severe malnutrition clustered at district level along with highlighting high risk areas of malnutrition. Predictors of malnutrition and severe malnutrition were identified from socioeconomic and demographic variables covered in PDHS. The future policies focusing on only hot spot areas (especially highlighted areas in Baluchistan and Sindh) could help reduce the burden of malnutrition at different locations in Pakistan. The interventions should be done to improve the drinking water source, sanitation facilities, parental educational attainment, child diseases, and delivery facilities.

Key words: Malnutrition, Severe Malnutrition, Stunting, Wasting, Underweight, PDHS2017-18, Spatial Analysis, ArcGIS Pro, Hotspot Analysis, Moran's Index, Ordinary Least Square Regression, Geographically Weighted Regression.

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