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A REGIONAL PERSPECTIVE ON CHILD MALNUTRITION AND INFANT MORTALITY IN KARNATAKA

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ABSTRACT

Child malnutrition and infant mortality remain critical public health challenges in Karnataka, with significant disparities across its regions. This study examines the magnitude, patterns, and regional variations of child malnutrition and infant mortality, with a focus on identifying high-burden areas. Using data from the National Family Health Survey (NFHS) and HMIS dataset from 2008-09 to 2020-21. The study highlights persistent undernutrition, stunting, and wasting among children under five, particularly in economically and socially disadvantaged districts such as those in the Kalyana Karnataka region and the rest of the divisions. Infant mortality rates (IMR) also show uneven distribution, with divisions due to inadequate maternal health care, poor nutritional status, and limited access to health infrastructure. The findings addressing regional disparities is essential to achieving Sustainable Development Goals (SDG) related to health, nutrition, and child survival in Karnataka.

KEYWORDS: *Stunted, Wasted, Underweight, Malnutrition, Spatial distribution of IMR.*

INTRODUCTION

Malnutrition is a significant public health issue in India, affecting 50% of the population through protein-calorie deficits and micro-nutrient deficiencies [KCNM][1]. In the Global Hunger Index 2023 rankings, India is ranked 111 out of 125 countries with a score of 28.7 [GHI-2024]. India faces one of the world's worst rates of child malnutrition, with 60 million children underweight, 35.5% stunted, 19.3% wasted, and 32.1% of children are underweight, while, a 57% vitamin A deficient, and 75% anaemic [NFHS-5]. It is the cause of 50% of under-5 child deaths and often leads to permanent damage, impaired physical and mental development, and increased healthcare costs. The Indian government is mandated to provide health services and commodities to various population groups, with the aim of promoting healthy lives and wellbeing for all ages (SDGs), as outlined in the National Health Policy-2017, and reducing inequality within and among countries.

Health inequalities exist in overall performance across State and UTs, in India. Karnataka has of the prominent regional diversity and regional disparity. Karnataka's malnutrition and infant mortality trends show regional disparities, with the Northern divisions having the highest burden. The Sustainable Development Goals (SDGs) aims of the third and tenth for "improving child health and reducing inequality" by 2030. Karnataka reports 11% malnourished and 5% acutely malnourished children, with 35.44% stunted in preschool. The Kayana Karnataka division, and Belgavi division are the most backward region in Karnataka, according to the High-Powered Committee to Redress of Regional Imbalances (HPCRRIs). The State has attempt to reduce inequalities in health aspects. Improvement of health status and reduction of health inequalities by promoting affordable primary, secondary, and tertiary care services for every household is one of the aims of the health department of Karnataka (KHP).

[1] *Karnataka Comprehensive Nutrition Mission. Government of Karnataka*

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The Kalyana Karnataka region is facing significant malnutrition issues. Bidar district has recorded 5.02% of children with severe acute malnutrition and 7.92% with moderate acute malnutrition in 2024-25, while Kalaburagi had 3.90% SAM and 6.10% MAM and Raichur had 3.28% SAM and 8.72% MAM, respectively (TOI, Jul 15, 2025). The region is home to four of the poorest districts in Karnataka, including Yadgir, Raichur, Kalaburagi, and Koppal. In 2021, Raichur had the highest prevalence of moderately underweight children, followed by Bidar, Kalaburagi, and Yadgir. In the past four years, the region has experienced approximately 2,250 newborn deaths and 150 maternal deaths annually. District-specific breakdowns include Kalaburagi, Raichur, Ballari, Bidar, Yadgir, Vijayanagara, and Koppal, with other districts also experiencing substantial fatality counts. The study tries to attempt evaluate the malnutritional status of children under five by regions, and estimate the infant mortality rate by divisions using the HMIS dataset.

REVIEW OF LITERATURE

Malnutrition remains a significant issue among children in Karnataka, India. Studies have reported high prevalence rates of underweight (44%), stunting (35%), and wasting (28-31%) in the state [9, 10]. Factors contributing to malnutrition include inadequate intake of protective foods rich in proteins, vitamins, and minerals [11]. The nutritional status of children can be assessed using various anthropometric indicators, with weight-for-age and height-for-age being commonly used measures [10]. Recent research has employed machine learning techniques to analyze factors influencing child nutrition, identifying Height for Age Z-score (HAZ) as a key predictor [8]. Despite challenges, improvements in healthcare and nutrition programs, such as the Integrated Child Development Scheme, have contributed to a decline in infant mortality rates in Karnataka [11]. However, continued efforts are needed to address malnutrition and its consequences on child health in the region.

Infant mortality in Karnataka has shown a declining trend over the years, with rates lower than the national average [13]. However, significant spatial disparities persist across districts, with Dharwad, Gadag, Davangere, and Chitradurga identified as high-burden areas [12]. Several factors influence infant mortality rates, including parental literacy, socio-economic status, and maternal age [14, 15]. Higher parental education, especially maternal education, and better economic status are associated with lower infant mortality. Additionally, factors such as birth order, previous stillbirths, and the type of birth attendant impact infant survival rates [15]. To address these disparities, geographically targeted strategies and improvements in healthcare infrastructure for children are necessary [12,13]. Continued efforts in maternal and child health initiatives are crucial for further reducing infant mortality in Karnataka.

The inter-regional differences exist in the distribution of poverty in the state, and the Hyderabad Karnataka (HK) region (renamed as Kalyana Karnataka) has the highest incidence of poverty [1]. The Kalyana Karnataka region comprises Ballari, Bidar, Kalaburagi, Koppal, Raichur, and Yadgir districts. These six districts were recognized as an underdeveloped region in various aspects such as agriculture, trade, economic and social infrastructure as compared to the rest of the state [1]. And these are in the bottom position in health index, income index, education index, human development index, this region most backward as compared to the rest of the state [2]. The Kalyana Karnataka districts have exhibits lower health performance than the rest of the state. The regional inequalities in health outcome are crucially dependent on social and economic factors. After controlling for these socio-economic factors affecting infant mortality and significant differences exist between two regions of the state [16].

DATA AND METHOD

The study uses cross-sectional dataset was obtained from the National Family Health Survey (NFHS) reports NFHS-4 (2015-16) & NFHS-5 (2019-20), accredited by IIPS, with a total of 60 observations were recorded in the dataset. To assess the magnitude of malnutritional child such as stunted, wasted, and underweight between the State's Kalyana Karnataka region and the rest of the regions were quantified using descriptive statistics. The study also, uses data on live-births, and infant deaths was the official vital statistics published by the Health Management Information System [HMIS] accredited by the Ministry of Health and Family Welfare (MoHFW) from 2008-09 to 2020-21, a total of 360 observations were recorded. To estimating infant mortality rate and examine spatial disparity for child health status in Karnataka. Three alternative ways of calculating adjusted infant mortality rates method proposed by McGhee. The method follows:

Conventional method: $IMR\ (n) = \frac{D(0,n)}{B(n)} \times 1000$

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In this case, D (0, n) indicates the number of infant deaths, while B(n) denotes the number of live births throughout the year.

Adjusted method: the conventional infant mortality rate may provide a distorted view of the level and trend of infant mortality, necessitating adjustments to account for actual risk populations.

Separation factor (f' *and* f''):

$$f' = \frac{D'_y}{D'_y + D''_y} \quad \text{..... (1)}$$

$$f'' = 1 - f'$$

$$AdjIMR = \frac{D_y}{f' B_y + f'' B_{y-1}} \quad \text{..... (2)}$$

Where, $\boldsymbol{D'_y}$ is the portion occurring to births in year and $\boldsymbol{D''_y}$ represents the portion occurring to births of the previous year. The $\boldsymbol{B_y}$ is represents the cohort of birth in the year. The relationship among births conceptions in three successive years (y - 1, y, and y + 1). The adjusted infant mortality rate is estimated using alternative method which above equations 1 and 2.

RESULT AND DISCUSSION

***Table 1*: Children's malnutritional status of Bengaluru Division**

	Particular	Stunted Children (height-for-age)			Wasted Children (weight-for-height)			Underweight (weight-for-age)		
Sl. No.	Districts	NFHS_4	NFHS-5	Change	NFHS_4	NFHS-5	Change	NFHS_4	NFHS-5	Change
1	Bengaluru Rural	28.7	36.6	7.9	22.8	16.2	-6.6	26.5	23.8	-2.7
2	Bengaluru Urban	28.1	31.3	3.2	28.9	19.2	-9.7	26.8	28.1	1.3
3	Chamarajanagara	30.5	32.2	1.7	19.1	18	-1.1	31.1	28.7	-2.4
4	Chikkaballapura	37.7	31.3	-6.4	17.2	16.1	-1.1	28.5	25.2	-3.3
5	Chitradurga	28.6	36	7.4	31.8	17.9	-13.9	29.9	32.4	2.5
6	Davanagere	46.4	38.4	-8	22.4	18.8	-3.6	41.9	32.8	-9.1
7	Kolar	32	31.1	-0.9	18.4	15.5	-2.9	27.7	15.7	-12
8	Ramnagara	22	15.6	-6.4	20.3	20	-0.3	22.9	19.8	-3.1
9	Shimoga	35.3	29	-6.3	14.3	23.2	8.9	30.6	34.4	3.8
10	Tumakuru	28.6	40.3	11.7	26.2	10.9	-15.3	26	26.7	0.7
	Mean	**31.79**	**32.18**		**22.14**	**17.58**		**29.19**	**26.76**	
	Minimum	**22**	**15.6**		**14.3**	**10.9**		**22.9**	**15.7**	
	Maximum	**46.4**	**40.3**		**31.8**	**23.2**		**41.9**	**34.4**	
	Std	**6.68**	**6.88**		**5.46**	**3.25**		**5.09**	**5.91**	

Source: NFHS-4 (2015-16) and NFHS-5 (2019-20)

Table 1 represent comparative analysis of child malnutrition indicators across Bangalore division across districts using two rounds of the National Family Health Survey (NFHS-4 and NFHS-5). The study observed that the mean change of Stunted (height-for-age) Children slight increase from 31.79% to 32.18% (↑ 0.39%). A highest stunting (NFHS-5) recorded in Tumakuru district (40.3%) and a lowest stunting (NFHS-5) in Ramnagara district (15.6%). The increase prevalence of stunting observed in Bengaluru Rural (↑ 7.9%), Bengaluru Urban, Chamarajanagara, Davanagere, Ramnagara, and Tumakuru districts. As well as, decreased prevalence of stunting in Chikkaballapura (↓ 6.4%), Chitradurga, Kolar, and Shivamogga districts. Which indicating long-term nutrition and health issues remain unresolved. The mean change of the Wasted Children (weight-for-height) decrease from 22.14% to 17.58% (↓ 4.56%) and significant reduction in all districts. The highest wasting (NFHS-5) recorded in Chamarajanagara district (18%) and lowest wasting (NFHS-5) in Tumakuru district (10.9%). As well as, the largest improvement in the Tumakuru (↓ 15.3%) and Chitradurga (↓ 13.9%) districts and least improvement in Chamarajanagara district (↓ 1.1%). The mean change of Underweight Children (weight-for-age) decreased from

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29.19% to 26.76% (↓ 2.43%). As of the NFHS-5, the Highest underweight recoded in Davanagere district (32.4%) and the lowest in Ramnagara district (15.7%). Most of districts of Bengaluru Division have improved, except the Bengaluru Urban (↑ 1.3%) and Kolar (↑ 1.2%) districts, which highlighting emerging concerns in urban settings. The Largest improvement recorded in Davanagere district (↓ 9.1%), but still has the highest underweight prevalence. The study found that high variability in stunting and underweight across districts of Bengaluru Division (std > 5), while wasting shows less variability (std ≈ 3.25), indicating more uniform improvements.

***Table 2*: Children's malnutritional status of Belgaum Division**

	Particular	Stunted Children (height-for-age)			Wasted Children (weight-for-height)			Underweight (weight-for-age)		
Sl. No.	Districts	NFHS_4	NFHS-5	Change	NFHS_4	NFHS-5	Change	NFHS_4	NFHS-5	Change
1	Bagalkot	47.3	48.3	1	24.6	16.9	-7.7	44.6	42.3	-2.3
2	Belgaum	36.7	32.8	-3.9	31.7	23.6	-8.1	38.5	36.9	-1.6
3	Bijapur	44.9	45.9	1	29.1	15	-14.1	38.9	39	0.1
4	Dharwad	37.4	45.2	7.8	33.8	16.5	-17.3	41.1	40.4	-0.7
5	Gadag	34.8	45.2	10.4	43.1	18.2	-24.9	38.1	39.8	1.7
6	Haveri	43.8	29.9	-13.9	20.4	17.7	-2.7	36.9	35	-1.9
7	Uttara Kannada	37.9	29.6	-8.3	18.3	21.9	3.6	30.1	33.3	3.2
	Mean	**40.40**	**39.56**		**28.71**	**18.54**		**38.31**	**38.10**	
	Minimum	**34.80**	**29.60**		**18.30**	**15.00**		**30.10**	**33.30**	
	Maximum	**47.30**	**48.30**		**43.10**	**23.60**		**44.60**	**42.30**	
	Std	**4.83**	**8.35**		**8.53**	**3.08**		**4.42**	**3.18**	

Source: NFHS-4 (2015-16) and NFHS-5 (2019-20)

Table 2 presents comparative children's malnutritional status from NFHS-4 (2015–16) and NFHS-5 (2019–20) surveys for 7 districts of Belgaum division in Karnataka. The Mean of **stunted children** reduced from 40.4% to 39.56% (↓ 0.84%). The minimum prevalence of stunted children recorded in Uttara Kannada district (29.6%) and a maximum in Bijapur district (45.9%). Along with significant improvement in Haveri (-13.9%) and Uttara Kannada (-8.3%) districts due to better maternal health and antenatal care, while worst deterioration in Dharwad (+8.3%) and Bijapur (+5.1%) districts, due to stagnation in maternal care, poor child feeding practices, or poor implementation of interventions. The **wasting of children** reflects short-term acute food insecurity and infections. The mean change of wasting children dropped significantly from 28.71% to 18.54% (↓ 10.17%). With a minimum prevalence of wasting in Dharwad (16.5%) and a maximum in Bijapur (23%). The Gadag (↓24.9%), Belgaum (↓8.1%), and Bagalkot (↓7.7%) districts are indicates major improvement due to the better detection and treatment of severe acute malnutrition (SAM) through nutrition rehabilitation centres (NRCs). The marginal improvement found in Bijapur (↑1%) district while no improvement in Dharwad (↓1.3%) district, which may may indicate persistent food insecurity, inadequate feeding practices, or poor access to healthcare. The **Underweight** combines both stunting and wasting and is a more composite indicator. It shows slight improvement and the mean decreased from 38.31% to 38.10% (↓ 0.21%) in the Belgaum division. The NFHS-5 report that a maximum underweight in Bagalkot (42.3%) district and a minimum underweight in Uttara Kannada (33.3%) The Gadag (-1.7%) and Haveri (-1.9%) districts are recorded highest reduction and the Uttara Kannada (+3.2%) district is actually a deterioration due to recent acute malnutrition episodes or deterioration in food intake or infections, which didn't impact height but did impact weight.

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Table 3: Children's malnutritional status of Kalyana Karnataka Division

	Particular	Stunted Children (height-for-age)			Wasted Children (weight-for-height)			Underweight (weight-for-age)		
Sl. No	Districts	NFHS_4	NFHS-5	Change	NFHS_4	NFHS-5	Change	NFHS_4	NFHS-5	Change
1	Ballari	49.5	36.1	-13.4	26.9	22.9	-4	53.3	36.5	-16.8
2	Bidar	42.8	36.8	-6	23.6	22.1	-1.5	39.4	36.1	-3.3
3	Gulbarga	52.2	34.5	-17.7	34	25	-9	56.7	36.2	-20.5
4	Koppal	55.8	49.1	-6.7	26.4	23.1	-3.3	49.9	45.8	-4.1
5	Raichur	37.2	39.8	2.6	34.9	23.2	-11.7	41.2	40.7	-0.5
6	Yadgiri	55.5	57.6	2.1	31.3	17.7	-13.6	50.3	45.2	-5.1
	Mean	**48.83**	**42.32**		**29.52**	**22.33**		**48.47**	**40.08**	
	Minimum	**37.20**	**34.50**		**23.60**	**17.70**		**39.40**	**36.10**	
	Maximum	**55.80**	**57.60**		**34.90**	**25.00**		**56.70**	**45.80**	
	Std	**7.44**	**9.12**		**4.56**	**2.46**		**6.81**	**4.54**	

Source: NFHS-4 (2015-16) and NFHS-5 (2019-20)

Table 3 represents the children's malnutritional status of Kalyana Karnataka Division, which presents district-wise child malnutrition indicators across two National Family Health Surveys -4 (2015–16) and NFHS-5 (2019–20). Stunted Children reflects chronic undernutrition, often due to long-term deprivation and poor maternal health. Mean of prevalence of Stunted Children significantly fallen from 48.83% → 42.32% (↓ 6.51%). The study observed that improvement in 4 out of 6 districts of Kalyana Karnataka and Gulbarga district showed the highest improvement (–17.7%), followed by Ballari, due to likely long-term nutritional programs, better sanitation, maternal care. While Yadgiri (+2.1%), and Raichur (+2.6%) districts are rising due to lack of maternal education and healthcare access and poor implementation of child development schemes like ICDS, mid-day meals. The Yadgiri district has the highest prevalence of stunting in NFHS-5 (57.6%), still very high and rising. Wasting reflects acute malnutrition of the division. The region accounted an average of prevalence of wasting children fell from 29.52% to 22.33% (↓ 7.19%). All districts of KK region showed improvement. The Yadgiri district had the best improvement (−13.6%) followed by Raichur. Significant drop indicates better short-term nutritional interventions such as emergency feeding programs, access to ready-to-use therapeutic food (RUTF), and Improved management of childhood illness. The Bidar district showed the least change (↓1.5%), it may be due to stagnation in outreach or health services. The Yadgiri district improved significantly in wasting but worsened in stunting, suggesting long-term malnutrition issues remain. The Standard deviation decreased (4.56 to 2.46), indicating better uniformity in improvement. The region shows substantial improvement in underweight prevalence. The mean fallen from 48.47% to 40.08% (↓ 8.39%). The improvement reflects a general uplift in nutrition, healthcare, and feeding practices. Most improved district is Gulbarga (↓20.5%) and least improved is Raichur (↓0.5%). Gulbarga again stands out for most progress and the Raichur district showed almost no improvement due to systemic issues such as food insecurity, low birth weights, anaemia. Wasting and Underweight prevalence of KK region show reduced variability, suggesting uniform progress across districts. But Stunting variability increased, indicating growing inequality in long-term nutrition outcomes.

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Table 4: Children's malnutritional status of Mysore Division

	Particular	Stunted Children (height-for-age)			Wasted Children (weight-for-height)			Underweight (weight-for-age)		
Sl. No.	Districts	NFHS_4	NFHS-5	Change	NFHS_4	NFHS-5	Change	NFHS_4	NFHS-5	Change
1	Chikmagalur	21.1	27.3	6.2	22.3	24.9	2.6	24.6	25.4	0.8
2	Dhakshin Kannada	23.9	25.1	1.2	17.1	30.5	13.4	21.7	26.4	4.7
3	Hassan	27	27.1	0.1	19.1	15.2	-3.9	26.4	23.8	-2.6
4	Kodagu	29.8	30.4	0.6	16.4	21.7	5.3	25.7	22.6	-3.1
5	Mandya	18.6	24.3	5.7	23.2	11.8	-11.4	20.3	16.7	-3.6
6	Mysore	25.1	27.5	2.4	17.3	15.6	-1.7	24.9	28.2	3.3
7	Udupi	21.1	23.1	2	20.9	17.6	-3.3	22.3	21	-1.3
	Mean	**23.80**	**26.40**		**19.47**	**19.61**		**23.70**	**23.44**	
	Minimum	18.6	23.1		16.4	11.8		20.3	16.7	
	Maximum	29.8	30.4		23.2	30.5		26.4	28.2	
	Std	3.86	2.43		2.70	6.47		2.28	3.82	

Source: NFHS-4 (2015-16) and NFHS-5 (2019-20)

Table 4 compares NFHS-4 (2015–16) and NFHS-5 (2019–20) data for seven districts of Mysore division across three nutrition indicators. The Mean of prevalence of stunting risen from 23.80% to 26.40%, which indicates worsened overall. The deterioration of chronic malnutrition, which may due to poor maternal nutrition and antenatal care and gaps in child development programs. Most increased district is Chikmagalur (+6.2%) due to migration, agricultural stress, or health service gaps. And least increased district is Hassan (+0.1%), which due to a major concern for policy. The Mean of Wasted Children slightly increased from 19.47% to 19.61%. the Dhakshina Kannada district recorded sharp rise (↑13.4%) could reflect recent outbreaks e.g., diarrhoea and infections, and Poor feeding during illness. The Mandya recorded major improvement (↓11.4%) due to possibly better short-term interventions. Wide variation (Std Dev increased from 2.70 to 6.47) suggests inconsistent results across districts. The Mean of Underweight Children indicates slightly dropped from 23.70% to 23.44%. the prevalence of underweight significantly increased for the Mysore (3.3%), and Dhakshina Kannada (4.7%) districts. While the Mandya, Kodagu, and Hassan districts are shown significantly decline.

Table 5: Division wise malnutritional status of Karnataka.

Particluars	Stunted Children (height-for-age)		Wasted Children (weight-for-height)		Underweight (weight-for-age)	
Districts	**NFHS_4**	**NFHS-5**	**NFHS_4**	**NFHS-5**	**NFHS_4**	**NFHS-5**
Bengaluru Division	31.79	32.18	22.14	17.58	29.19	26.76
Belgaum Division	40.40	39.56	28.71	18.54	38.31	38.10
Kalaburagi Division	48.83	42.32	29.52	22.33	48.47	40.08
Mysuru Division	23.80	26.40	19.47	19.61	23.70	23.44

Source: Author's Calculation

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Figure 1: Division wise Child Health status of Karnataka

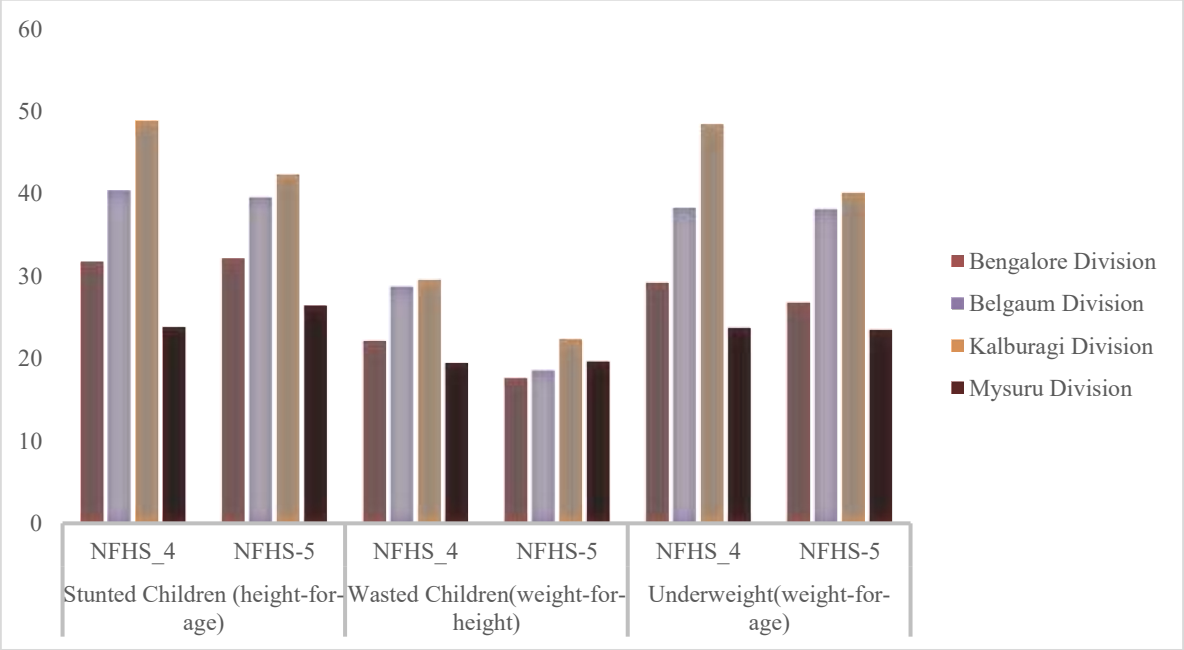


Table 5 and figure 1 provides a summary comparison of child malnutrition across four divisions of Karnataka based on data from NFHS-4 (2015–16) and NFHS-5 (2019–20). Kalaburagi Division (Kalyana Karnataka) Stunting dropped significantly (↓6.51%), along with wasting and underweight due to focused government interventions in backward regions, Increased access to maternal and child health services and Greater focus on tribal/rural development schemes. Bengaluru Division shows the wasting and underweight improved, which indicating better urban healthcare infrastructure. While stunting worsened slightly, which indicating that long-term nutrition still lacking in slums/peri-urban areas and unequal access to quality diet despite food availability. Belgaum Division recorded the moderate Improvement and wasting dropped significantly (↓10.17%) due to effective short-term nutrition response and health programs. But stunting and underweight showed minimal change, pointing to need for better maternal education, prenatal care, and long-term planning. The Mysore division accounts least number of children with stunted, wasted and underweight and the rest of the division indicates moderate levels, respectively. Which shows overall deterioration and stunting increased by 2.6%, wasting slightly up too, due to deterioration in long-term nutritional intake. Comparing the divisions regarding the malnutritional status children, the Kalburgi has the least performed among the divisions and the Mysore division is best performed in Karnataka.

Table 6: Estimated infant mortality rate for four divisions of Karnataka from 2009-10 to 2020-21.

Years	Bengaluru Division	Mysuru Division	Belgaum Division	Kalaburagi Division
2009-10	18.99	20.31	29.31	30.00
2010-11	13.22	13.42	22.12	26.52
2011-12	6.89	7.67	11.34	12.90
2012-13	4.40	7.23	8.35	9.14
2013-14	4.63	14.18	8.99	11.07
2014-15	7.72	18.05	11.89	17.61
2015-16	12.58	17.39	14.47	21.81
2016-17	11.72	15.05	11.52	18.57
2017-18	17.66	22.64	13.98	21.68
2018-19	23.88	31.56	18.50	27.73
2019-20	21.84	30.60	17.82	28.46
2020-21	18.18	28.50	13.47	24.74

Source: Author's Calculation

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The above table 6 presents the division-wise infant mortality rate over a period of time. The IMR in four Karnataka divisions experienced a significant drop from 2009-10 to 2012-13, followed by a significant rise from 2013-14 to 2018-19, and a small decline into 2020-21, with variations in direction. The mean values for Bengaluru, Mysuru, Belgaum, and Kalaburagi have fluctuated over the years. The average infant mortality rate in Bengaluru has fluctuated from 18.99 to 18.18 over a period of 12 years, with the lowest price being 4.40 in 2012-13 and the highest price being 23.88 in 2018-19. As well, the average of Mysuru is 18.88, with the lowest value being 7.23 from 2012-13 and the highest value being 31.56 from 2018-19. Furthermore, in the Belgaum division, it ranges from 29.31 to 13.47, with the lowest value of 8.35 from 2012-13 and the highest value of 29.31 from 2009-10. The Kalaburagi division shows an average infant mortality rate of 20.85, with the lowest value of 9.14 in 2012-13 and the highest value of 30.00 in 2009-10. The divisions reached their minimum in 2012-13, indicating successful early interventions such as improved maternal/newborn care, immunization, nutrition, and sanitation before the period. The Kalaburagi (Kalyana Karnataka) division accounted the highest infant mortality rate over a period of time. The rise in IMR in Mysuru and Bengaluru from 2013-14 to 2018-19 is attributed to state-level effects, possibly due to weakening service delivery, increased rural-urban migration, or worsening social determinants.

CONCLUSION

The study quantified spatial inequality in the malnutritional status of children in Karnataka. The study reveals that several divisions in Karnataka have seen an increase in the prevalence of stunted children, while the rest have seen declines. The districts of Tumakuru, Mandya, Gadag, Dharwad, Chitradurga, Chickkmagaluru, Bengaluru Rural, Bengaluru Urban, Bagalkote, Bijapur, Chamarajanagara, Raichuru, Mysore, Udupi, Yadgiri, Kodagu, Dakshina Kannada, and Hassan have also seen an increase in the prevalence of underweight. The study also found that the prevalence of stunted children in the Bengaluru Division has declined, except for Shimoga. The districts of Gadag, Dharwad, and Bijapur have also seen an increase in stunted children, while the Uttara Kannada district has seen a decline in wasted children. The Kalyana Karnataka Division has seen an increase in stunted children, with Raichuru and Yadgiri showing an increasing trend. The study also found that underweight in all districts of the Kalyana Karnataka division have declined. The Mysore Division has seen an increase in stunted children, with districts like Dakshina Kannada, Mysore, and Chickkmagaluru having an increase in the prevalence of wasted children. The Kalburgi division has the highest number of stunted, wasted, and underweight in the study period, while the Mysore division has the least rare cases. In terms of child health status, the Kalburgi division has performed the least among the divisions, while the Mysore division is the best performed in Karnataka. The divisions' infant mortality rate reached their minimum in 2012-13, indicating successful early interventions in maternal/newborn care, immunization, nutrition, and sanitation. The Kalaburagi division had the highest infant mortality rate. The rise in IMR in Mysuru and Bengaluru from 2013-14 to 2018-19 is attributed to state-level effects. The findings underscore the need for targeted interventions that integrate nutrition programs, maternal and child health services, and socio-economic development initiatives. It also highlights the need to identify malnutrition risk factors, improve socioeconomic status, and closer monitoring by ICDS and maternal-child health systems. It also highlights the importance of adult literacy programs and women's empowerment initiatives.

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