Working Paper 507

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Prem Shankar Mishra
Himanshu Chaurasia

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NUTRITION STATUS AND SOCIO-ECONOMIC INEQUALITY AMONG CHILDREN (0-59 MONTHS) ACROSS DIFFERENT GEOGRAPHICAL REGIONS OF UTTAR PRADESH, INDIA

Prem Shankar Mishra[1] and Himanshu Chaurasia[2]

Abstract

Nutritional status is determined by diverse, highly interrelated physical, biological, environmental, and socio-cultural factors. Among Indian states, Uttar Pradesh has an alarmingly high prevalence rate of child malnutrition. Various geographical regions are experiencing uneven growth and development in the state that has ultimately impacted on child health and nutritional development. Therefore, this paper explores the magnitude of the nutritional status and disparities among children in various regions of Uttar Pradesh. This study uses data from the 4thround of the NFHS (2015-16). Multivariate logistic regression and decomposition analyses were conducted to understand the socioeconomic inequality in childhood malnutrition. The result shows that the Bundelkhand (southern) region has the highest prevalence of underweight (45.4 per 100) and wasted (29.5 per 100) children; however, the Purvanchal (eastern) region has the highest prevalence of stunted (48.3 per 100) children respectively. The rural areasin the state have the highest percentage of underweight (40.9%) children followed by stunted (48.4%) and wasted children (17.9%) respectively. Among mothers with no schooling, about half (46.3%) of their children are underweight, and more than 55 percent of the children are stunted, and approximately 18 percent of children are wasted. The results also indicate that child malnutrition is highly concentrated among the poor. We found that regions with a lower prevalence of child malnutrition still had great socio-economic inequalities. This indicates that there is a need to redesign the existing programmes to reach the vulnerable (poor) and marginalised groups.

Keywords: Child-malnutrition, Socio-economic Determinants, Inequality, Decomposition, Uttar Pradesh and Its Geographical region, Sustainable Development Goals

Introduction

Malnutrition is the consequence of individual, household and community-level factors (Story and Carpiano, 2017). Some of these are issues like social identity, education, and poverty which affect the healthcare system. Child malnutrition is often related to poor food quality, insufficient food intake, and severe and repeated infectious diseases, or frequently some combinations of the three (De Onis, M., Blossner, M., & World Health Organization. 1997; Corsi *et al*, 2016). Diets that are poor in nutrition and inadequate healthcare services have made subjected children to severe conditions, rendering them underweight, stunted and wasted (IFPRI 2015; Chaudhary *et al*, 2018). There is a widely accepted framework propounded by UNICEF that addresses several underlying determinants that are responsible for child malnutrition (UNICEF, 2013). Child health and nutritional development require a multi-faceted response from multi-sectoral areas to fight malnutrition among children (UNSCN 2014; IFPRI 2015; Mohanty 2011; Awasthi, *et al*, 2019). However, despite this, the poor resource setting areas or under-developed regions with complex socio-demographic factors might also be responsible for

[1] Senior Research Fellow (PhD Scholar), Population Research Cnetre, Institute for Social and Economic Change, Bangalore, 560072, Karnataka, India Email address: premshankar@isec.ac.in

[2] Scientist B (Statistician), ICMR NIRRH, Mumbai, Maharashtra Email Address: hciips369@gmail.com

malnourishment among children (Pathak and Singh, 2009; Balarajan and Reich, 2016; Story and Carpiano, 2017).

Globally, nearly 6.9 million children under the age of five died from preventable causes in 2011, and of those, 45 percent of deaths may be attributed to under-nutrition (Black *et al*, 2013). India is no exception in this regard; besides it, malnutrition practices among children have led to severe health problems and ultimately led to high mortality elsewhere too (Chaudhary *et al*, 2018; NRHM, 2013). The household-level care, specifically nutritional-diverse dietary practices as well as nutritional-sensitive determinants, both together that impact as chronic risk factors for child under-nutrition, and it is explained that nearly 68 per cent of the burden of stunting and underweight among children in India (Corsi *et al*, 2016).

Indeed, child health indicator is one of the most influential development indicators in any society or country and it is highly determined by socio-economic development factors, particularly in developing countries (Reinhardt and Fanzo, 2014). In India, the socio-economic inequalities and regional disparities have increased tremendously in the last couple of years (Nandy *et al*, 2005; Joe *et al*, 2008; Sunny *et al*, 2018). Studies have shown that large economic inequalities prevail in the health status of children and the use of Integrated Child Development Scheme (ICDS) services in India (NFHS-3 2007; Nandy *et al*, 2005; Balarajan and Reich 2016; NFHS-4,2017). For example, in 2005-2006 (NFHS-3), 37 per cent of the children from the poorest quintile had received any ICDS services compared to only 16 per cent of the children from the richest quintile (NFHS-3 2007). Further, the inequalities in the use of ICDS services had contributed toward the substandard health status of women and children, who received limited access to healthcare facilities, mainly among the poor households. This had led to inferior physical growth and poor nutritional status. The risk of malnutrition, particularly among children belonging to the lower socioeconomic groups, has increased manifold compared to counterparts (Pathak and Singh, 2011; NFHS-4 2017). The burden of malnutrition was inexplicably concentrated among poor children. Besides, an average decline in malnutrition obscured large economic disparities across space and time (Pathak and Singh, 2009; Pathak and Singh, 2011). Regional variations in the prevalence of child malnutrition can be partially attributed to the variations in access to the ICDS programme across different regions. The access to the ICDS programme was found to be the poorest in the states which reported the worst nutritional indicators (NFHS-3 2007; NFHS-4 2017).

Though nutrition is central to achieve sustainable development goals (SDGs) in any country (UNSCN, 2014), however, this has been a long-awaited and neglected development sector in India. Comprising nutrition and its natural allies in food security, agriculture, water and sanitation health practices, gender and health communities, all are advocating for nutrition in the SDGs framework (Smith and Haddad, 2000; Balarajan and Reich, 2016; Achadi *et al*, 2016; Baye, 2017). India has failed to effectively address the child's nutritional health status, particularly child underweight, wasting and stunting. These indicators are increasingly recognised in the present context as a major concern in India as a whole and particularly for Uttar Pradesh which is severely affected. Uttar Pradesh faces severe challenges in child health and nutritional status across different socio-economic groups and regions that have contributed to child mortality and morbidity in the total in India (NRHM, 2013; SRS 2018; NFHS-4 2017; Awasthi *et al*, 2019). Uttar Pradesh state is located in north India with a nearly 200 million

population (Census, 2011). The state is facing severe under-nutrition among women and children (Singh *et al*, 2014; NFHS-4, 2017). Further, the poor public health care system and infrastructure development in the state have also led to poor health outcomes in the state. Children's nutritional status in Uttar Pradesh has improved since 2005 by somebut not all measures, which are visible as stunting decreased from 57 per cent to 46 per cent in the last 10 years between 2005 to 2015, and child underweight decreased marginally from 42 per cent to 40 percent, while wasted children increased from 15 per cent to 18 per cent (NFHS-4 2017) in the same period. Poor women's education and low empowerment, and the quantity and quality of healthcare services available in the state have also been key drivers for stunting and underweight. The socio-economic gap in food supplementary distribution from the ICDS programme in the state has also become highly inequitable. Further, income growth and governance have played essential facilitating roles in improving overall child health (Smith and Haddad 2014; Balarajan and Reich 2016), which is lacking in the state.

Numerous child health policies and programmes were launched in India, like the Integrated Child Development Scheme (ICDS), National Food Security Mission, Immunisation Programme and the multi-strategic intervention policy National Rural Health Mission (NRHM) to promote and benefit child health and development. But even many years after the programmes were implemented in the country, still India falls at the bottom of various child health, growth and nutritional development indicators among developing countries (NRHM, 2013). And, it is facing higher child malnutrition as a whole and particularly in Uttar Pradesh with huge disparities across regions and socio-economic groups. Hence, awareness, knowledge and education can lead to improving the dietary benefit of nourishment even in the absence of cleanliness and sanitation (Khadse and Chaurasia, 2019).

Lack of effectiveness, efficiency, and integration in the service coverage of all these programmes may have resulted in poor outcomes in India as a whole and Uttar Pradesh particularly. Evidence supports the contention that there exist inequality and inequity in the delivery of services across different groups (Singh *et al*, 2014 Corsi *et al*, 2016; Awasthi *et al*, 2019). The unequal distribution of service coverage by the state has led to unequal distribution of child malnutrition across groups and regions. Therefore, it becomes necessary to understand the inequity and inequality distributed across different clusters of the geographical regions and socioeconomic groups in the state therefore, to understand the coexistence of multiple factors responsible for achieving the goals in the state. The study explores the structural and institutional barriers prevailing in the state in reaching out to the service coverage of child health and nutrition.

Materials and Methods

The data were used from National Family Health Survey, fourth round, 2015-16. In Uttar Pradesh, NFHS-4 has provided information on reproductive and child health and nutritional care practices for all 71 districts of the state. The survey covered 76,233 households and collected information from 97,661 women in the age group of 15-49 and 13,835 men in the age groups 15-54. In the case of ever-married women, the sample is 41,375 in the state. The detailed sampling design, coverage and findings of the survey are available in the national and state report (IIPS and ICF, 2017). In this round of the survey, for the first time, district level (district module) information has been estimated on reproductive and

child healthcare services. The survey provides information on women's characteristics, marriages, fertility, contraception, reproductive health, children's immunisations, nutrition, and treatment of childhood illnesses. In the previous round of the survey, all these information were available at the state and national level. Bivariate and multivariate analysis has been done to understand the association between health parameters and related determinants. A simple chi-square test was conducted to test the association and, further binary logistic regression analysis was done by adjusting various socio-economic and demographic characteristics. To understand the inequality aspect among children's nutritional health status across regions of Uttar Pradesh, concentration curve and concentration index have been made and also decomposition techniques used to measure the degree of inequality across regions of Uttar Pradesh.

Key Outcomes Variables Used in the Study

Three indices were used to measure the nutritional status of children (0-59 months) which is used as a dependent variable, and these indices are height for age (stunting), weight for height (wasting), and weight for age (underweight).

Underweight: Weight-for-age is a composite index of height-for-age and weight-for-height. It takes into account both acute and chronic under nutrition. Children whose weight-for-age Z-score is below minus two standard deviations (-2 SD) from the median of the reference population are classified as underweight. Children whose weight-for-age Z-score is below minus three standard deviations (-3 SD) from the median are considered severely underweight (WHO, 2006).

Stunting: Height-for-age is a measure of linear growth retardation and cumulative growth deficits. Children whose height-for-age Z-score is below minus two standard deviations (-2 SD) from the median of the reference population are considered short for their age (stunted), or chronically undernourished. Children who are below minus three standard deviations (-3 SD) are considered severely stunted (WHO, 2006).

Wasting: Weight-for-height index measures body mass in relation to body height or length and describes the current nutritional status of children. Children whose Z-score is below minus two standard deviations (-2 SD) from the median of the reference population are considered thin (wasted), or acutely undernourished. Children whose weight-for-height Z-score is below minus three standard deviations (-3 SD) from the median of the reference population are considered severely wasted (WHO, 2006).

In the present study, Z-scores were used to assess the status of malnourishment. The values of the Z-scores were dichotomised and used as the binary response for stunting, wasted, and underweight. Several socioeconomic and demographic variables such as the age of mother, age at first birth, birth order, caste, region, education, media exposure, place of residence, religion, and sex of the child were included as the predictor variables in the study.

Concentration Index (CI): A concentration index value was calculated from the wealth index to understand the inequity-associated-inequality in child health, growth and nutritional practices between poor and non-poor households. More details on how to calculate individual and grouped levels data can be found in O'Donnell, O., *et al* (2016). Further, the CI value lies between –1 and 1. A negative value indicates the disproportionate concentration among the poor group while a positive value indicates the concentration exists among the non-poor (Szabo *et al*, 2016; Wagstaff *et al* 1991). A zero concentration index value indicates that there is no socio-economic inequality.

The concentration curve is used to show the prevailing inequality through graphs. It is defined as twice the area between the concentration curve and the line of equality that has been used by researchers and policymakers to measure health inequality (Kakwani *et al*, 1997). The concentration curve plots the cumulative percentage of the child health and nutritional outcomes indicators on the y-axis against the cumulative percentage of the sample population, ranked by socio-economic status on the x-axis. The concentration index measures the degree of income-related inequality in a health variable. It is calculated as twice the covariance of the health variables and a population ranked by economic status, divided by the variable mean. The value of the CI indicates the severity of socio-economic inequality: higher the CI, higher the inequality and lower the CI, lower the inequality.

$$C = \frac{2}{\mu} \mathrm{cov}_w (y_i, r_i)$$

Where $y_{i \text{ and }} r_i$ are the health status of the i^{th} individual and the fractional rank of the i^{th} individual; μ is the (weighted) mean of the health variable in the sample, and cov_w denoted the weighted covariance respectively (Kakwani *et al* 1997; Doorslaer and Koolman, 2004).

Decomposition Analysis: Wagstaff *et al* (1991) have proposed a method to decompose the variables related to socio-economic factors in health inequality which have an advantage over linear and non-linear regression models. In this study, it is used to estimate the relative contribution of factors in health inequality among children using different socio-economic and demographic variables. The study employs Fairlie decomposition (2005) model to understand the differential child health, growth and nutritional practices between poor and non-poor groups in the state. Based on the non-linear regression modelis seen the relationship between the outcome variable and the relative contribution of independent variables. The model expresses the difference in the value of Y for the poor and non-poor in accessing and utilising child healthcare and nutritional services. It is expressed as:

$$\bar{Y}^r - \bar{Y}^s = \sum_{i=1}^{N^r} \frac{F(X_i^r \hat{\beta}^r)}{N^r} - \sum_{i=1}^{N^s} \frac{F(X_i^s \hat{\beta}^r)}{N^s} + \sum_{i=1}^{N^s} \frac{F(X_i^s \hat{\beta}^r)}{N^s} - \sum_{i=1}^{N^s} \frac{F(X_i^s \hat{\beta}^s)}{N^s}$$

Where *N* is the sample size, and *Y* is the average probability of the binary outcome of the interest groups and *F* is the cumulative distribution function from the logistic distribution. The superscripts '*r*' and '*s*' stand for 'non-poor' and 'poor' groups. The mean difference between $\bar{Y}^r - \bar{Y}^s$ is considered as a discrimination or differential treatment coefficient of the poor-group.

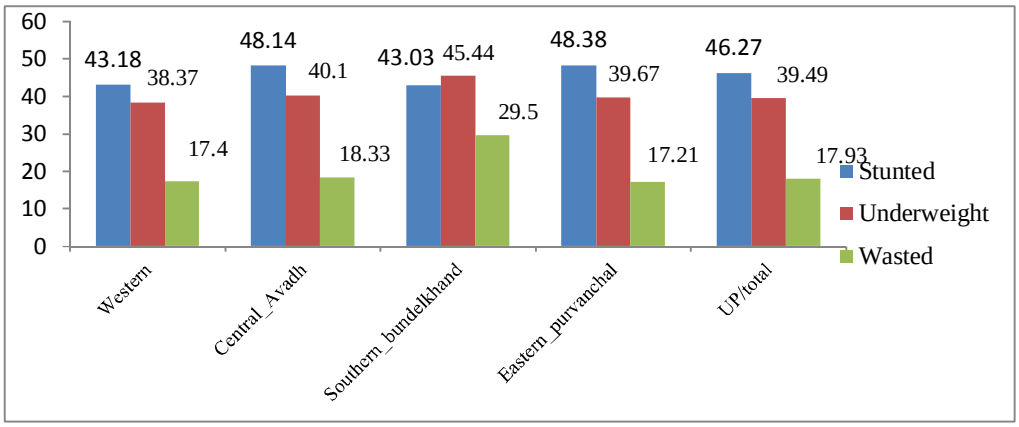
The decomposition analyses how each explanatory variable contributes to inequality in child health, growth and nutritional development indicators. The contribution of each predictor variable

depends on how wealth is distributed in society and how the distribution of wealth affects the child's health and nutritional practices among the children. Some variables play a significant role at individual, household and community levels in utilising and accessing the services. The dependent variables are binary as if child stunting, 0=no, and 1=yes; child underweight, 0=no and 1=yes; similarly child wasting, 0=no, and 1=yes.

Results and Discussion

The findings show that women who belong to the Purvanchal region suffer multiple vulnerabilities followed by those in the Avadh region. Our finding is also consistent with the study conducted in Uttar Pradesh which found a huge difference across regions in maternal and child healthcare (Mishra and Syamala, 2019). Figure 1 shows that overall, 39.5 per cent of children under-five years of age are underweight, 46.3 per cent are stunted and about 18 per cent are wasted respectively in the state.

Figure 1: Region-wise prevalence of child malnutrition in Uttar Pradesh, India, NFHS-4 (2015-16)



Source: Author's calculation from NFHS-4, 2015-16

The regional variation shows that 48.4 per cent of children are stunted in the Purvanchal region (highest) followed by the Avadh (central) region (48.1 percent), and the lowest in the Bundelkhand region (43.2 percent). Among the underweight children, the Bundelkhand region has the highest number with 45.4 per cent followed by the Avadh region (40 percent) and the lowest are in the western region (38.4 percent). In the case of wasted children, the Bundelkhand comes first with 29.5 per cent followed by the Avadh region (18.4 percent). The district-wise figures across rural-urban areas for the prevalence of underweight, stunted, and wasted children is shown in Table A (appendix).

Table 1 shows the rural-urban differences in the distribution of child malnutrition across the regions of Uttar Pradesh. Overall, the underweight (40.9 percent) and stunted (48.5 percent) children are more in rural areas compared to urban areas where underweight are 33.83 per cent while stunted are 37.93 per cent respectively. The rural-urban difference appeared strong among underweight children in Bundelkhand (southern) region followed by the Purvanchal (eastern) region among stunted children respectively. Very few differences have been seen in wasted children across regions, rural-urban, in the state.

Table 1: Rural-urban Differences of Child Malnutrition in Uttar Pradesh, India, NFHS-4 (2015-16)

Regions	Underweight		Stunted		Wasted	
	Urban	Rural	Urban	Rural	Urban	Rural
Western region	33.49	40.79	37.55	45.96	16.74	17.72
Central (Avadh) region	35.69	41.21	40.33	50.11	19.37	18.07
Southern (Bundelkhand)	37.46	47.54	34.58	45.26	29.31	29.55
Eastern (Purvanchal) region	32.8	40.52	37.72	49.7	18.65	17.04
Total	33.83	40.98	37.93	48.47	18.08	17.89

Source: Author's calculation from NFHS-4, 2015-16

Table 2: Percentage Distribution of Malnutrition among Children (0-59 months) by Socioeconomic Characteristics in Uttar Pradesh, India, NFHS-4 (2015-16)

Variables	Underweight	Stunted	Wasted	Variables	Underweight	Stunted	Wasted
Age of Mother* **				**Media Exposure*** **			
15-24	37.61	42.09	20.09	Print Media			
25-34	39.51	46.61	17.29	No	42.84	50.44	18.21
>35	43.5	53.72	16.39	Yes	28.85	33	17.04
Birth Order* **				Radio			
1	35.2	40.27	18.23	No	39.88	46.63	18.05
2-3	38.31	45.17	17.13	Yes	36.32	43.28	16.91
4 and More	46.92	55.63	19.02	TV			
Child Ever Born* **				No	44.92	53.45	18.61
1	33.77	36.03	21.69	Yes	34.88	40.17	17.35
2-3	37.43	44.43	16.77	**Social groups*** **			
4 and More	46.55	55.7	17.61	Scheduled caste	44.55	52.27	18.69
BMI* **				Scheduled Tribe	47.5	52.16	22.52
Underweight	50.47	54.28	22.03	OBCs	40.12	46.5	17.99
Normal	38.57	45.79	17.87	Other	29.74	36.26	16.42
Overweight	26.52	35.79	12.14	**Wealth Quintile*** **			
Obese	21.89	32.7	8.27	Poorest	48.95	57.31	19.57
Breast Feeding* **				Poor	41.95	50.49	17.06
No	39.54	48.96	14.26	Middle	35.49	42.75	17.47
Yes	38.18	43.26	20.20	Rich	32.17	36.29	16.54
Sex of Child				Richest	23.48	24.81	17.58
Male	39.48	46.34	19.12	**UP Regions*** **			
Female	39.51	46.18	16.61	Western	38.37	43.18	17.4
Place of Residence* **				Avadh (Centre)	40.1	48.14	18.33
Urban	33.83	37.93	18.08	Bundelkhand (South)	45.44	43.03	29.5
Rural	40.98	48.47	17.89	Purvanchal (East)	39.67	48.38	17.21
Mother Education* **				**Full Immunization*** **			
No Education	46.39	55.1	17.99	No	42.41	53.81	20.32
Primary	42.1	49.91	18.07	Yes	38.13	47.62	19.77
Secondary	34.45	39.92	17.83	**Ante-natal Care*** **			
Higher	23.36	24.88	17.79	No	45.32	53.90	18.84
Total/UP	**39.49**	**46.27**	**17.93**	Yes	38.35	44.78	17.75

Source: Author's calculation from NFHS-4, 2015-16

*Chi Square for categorical variables and t-test for continuous variables were done at significant level, <0.05.

Table 2 represents the nutritional status of children aged 0-59 months with background characteristics. Approximately 40 per cent of children are underweight, 46 per cent are stunted and 18 per cent wasted. Among women who belong to the higher age groups 35 and above, children are more severely underweight and stunted. Increasing mother's age and mother living in rural areas have led to children becoming more underweight and stunted while in the case of wasted children, it is the reverse. Moreover, children's malnutrition has shown variation across the regions. In the case of underweight, 45.5 per cent of children belong to the Bundelkhand region followed by Avadh (40 percent) and Purvanchal (39.7 percent), while in the case of stunted children, Purvanchal region standsthe highest with 48.4 per cent followed by Avadh 48.2 per cent respectively. Similarly for underweight children, the Bundelkhand region (29.5 percent) has the highest number of wasted children followed by the Avadh region (18.3 percent).

Further, to see the inequality prevalent in children's health and nutritious indicators across different regions, by rural-urban within region, we calculated the concentration index values on different child health indicators to measure how the distribution prevailed in the state.

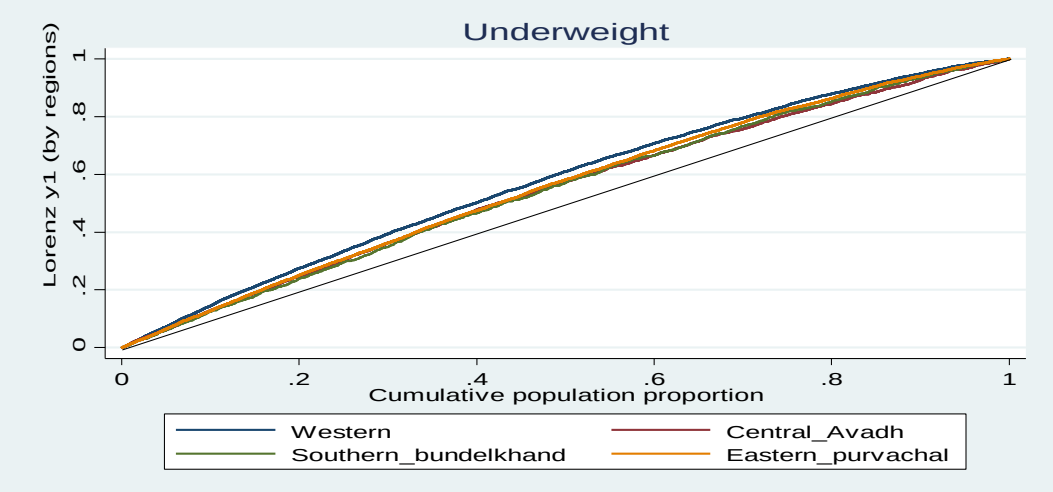
Table 3: Concentration Index Values for Underweight, Stunted, and Wasted Children across Different Regions of Rural-urban Uttar Pradesh, India, NFHS-4 (2015-16)

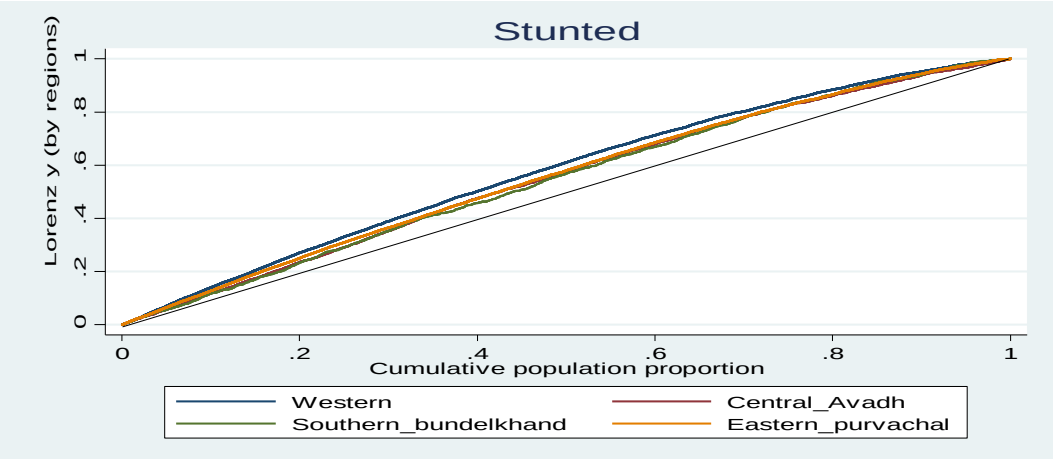
Uttar Pradesh regions	Underweight			Stunted			Wasted		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Western	-0.1302	-0.1388	-0.1481	-0.1560	-0.1284	-0.1484	-0.0008	-0.0610	-0.4516
Central (Avadh)	-0.0922	-0.0801	-0.0870	-0.1399	-0.0855	-0.1050	0.0906	-0.0292	-0.0025
Southern (Bundelkhand)	-0.1033	-0.0636	-0.0875	-0.1557	-0.0482	-0.0881	0.0464	-0.0459	-0.0222
Eastern (Purvanchal)	-0.1657	-0.1026	-0.1131	-0.1731	-0.0979	-0.1137	-0.0265	-0.0320	-0.0238
Total	-0.1302	-0.1052	-0.1183	-0.1560	-0.1041	-0.1263	0.0071	-0.0417	-0.0287

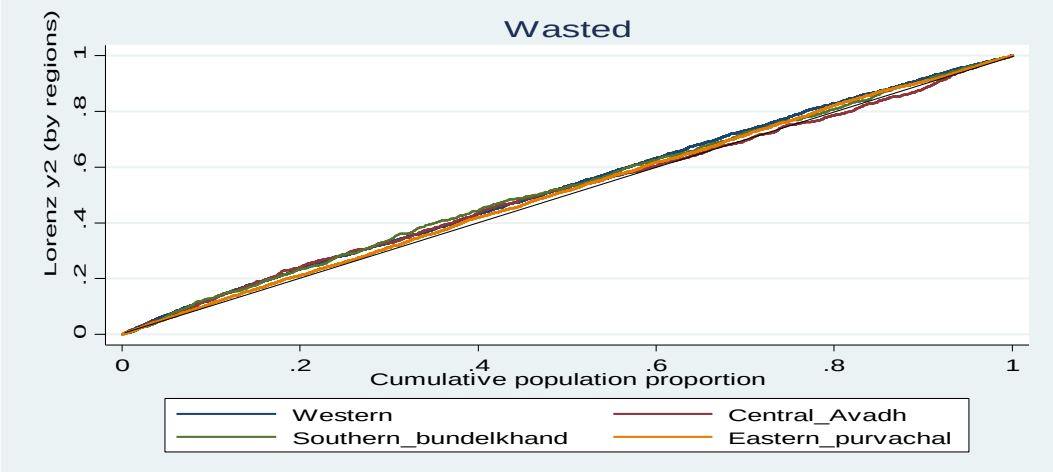
Source: Author's calculation from NFHS-4, 2015-16

The details concentration indexes based on wealth quintiles by region, within region rural-urban and district-wise are shown in Table 3, Figure 2, and Figure 3. The negative value of the concentration index indicates that society is characterised by pro-rich inequalities rather than pro-poor. The concentration curve in Figure 2 shows that inequality is more prevalent in the western region compared to the other three regions. The southern region (Bundelkhand) also shows that children who belong to this region are relatively poor, though the distribution showed relatively equal across different indicators compared to other three regions. The region which has a high socio-economic disparity led to high inequality in child health and nutrition development indicators as well. The negative sign indicates that it is disproportionate to the poor groups. Figure 3 presents the district-wise concentration index scenario which also supports the concentration curve that lies above the line of equality that means a disproportionate concentration among the poor (figure 2).

Figure 2: Region-wise concentration curve of underweight, stunted, and wastedchildren in Uttar Pradesh, India, NFHS-4 (2015-16)







Source: Author's calculation from NFHS-4, 2015-16

Figure 3: District-wise concentration index values for underweight, stunted, and wasted children in Uttar Pradesh, India, NFHS-4 (2015-16)

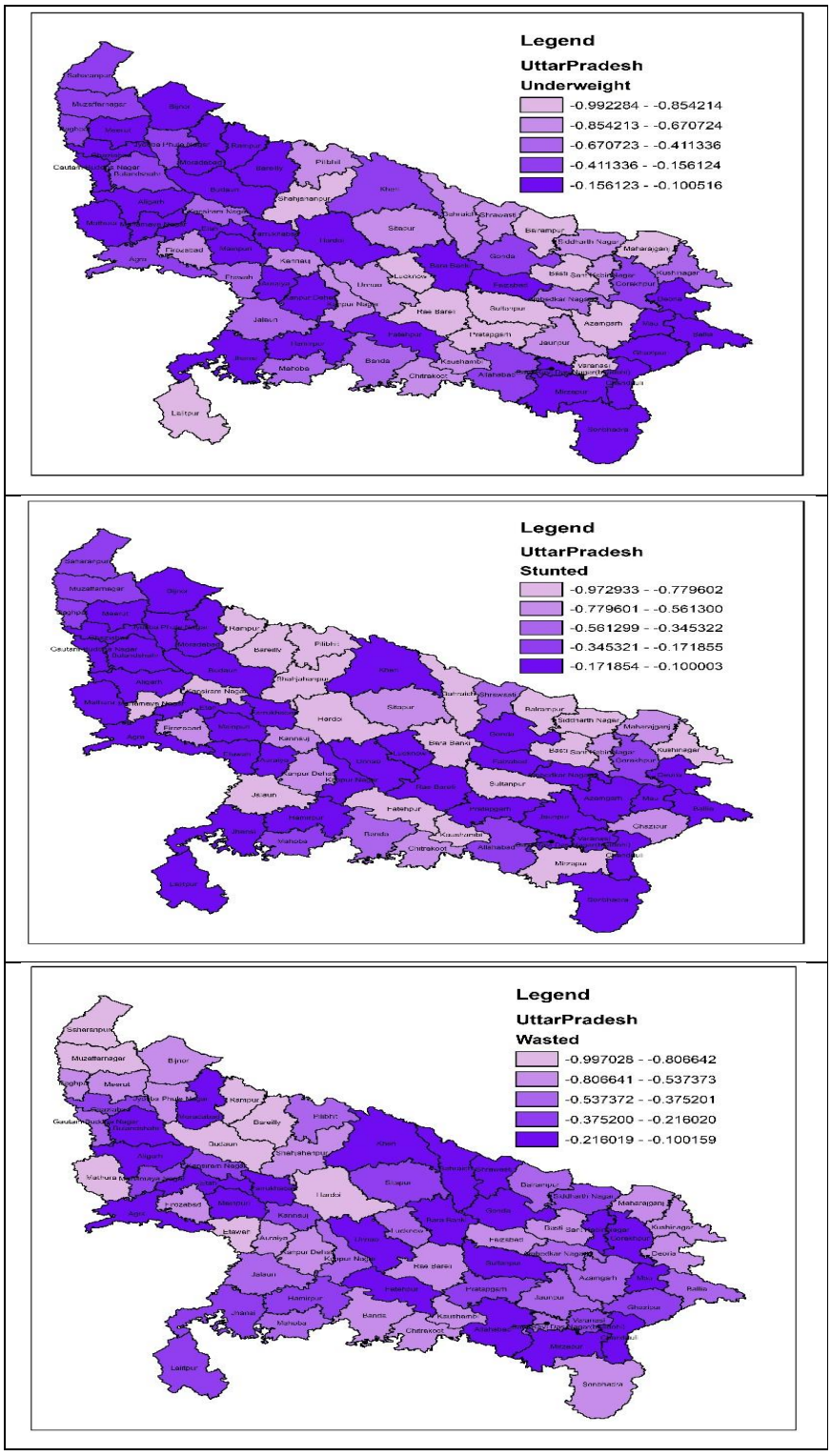


Table 5 represents the adjusted logistic regression (odds ratio) of underweight, stunted, and wasted children by selected background characteristics. The adjusted odds ratios show that children are less likely to be underweight and stunted in urban areas (aO.R=0.8) compared to their rural counterparts. The findings clearly show that as we move from the poorest to richest, the odds of underweight and stunted children are less likely to be affected and that is statistically significant in our study. It means children have ahigher nutritional status compared to the poorest quintile, and the finding is also consistent with the earlier study (Rajaram *et al*, 2007). Women with higher education are less likely to have their children underweight (aO.R=0.6) and stunted children (aO.R=0.7) compared to illiterate women. Mother's education has a direct impact on child nutritional practices and the result is also consistent with previous studies which identify that the odds of undernourishment have declined proportionally with the increase in maternal education (Mishra and Retherford, 2000; Abuya *et al* 2012; and Khadse and Chaurasia 2019). In reference to birth order, the odds of wasted children are higher among second and more order of children compared to the first order child with significant results. Concerning social groups, children belonging to SCs/STs are more likely to become underweight and stunted compared to other groups. A significant relationship is observed between the mother's BMI and child malnutrition. When adjusted for other factors, as the number of children ever born to women increases, the children are more likely to be stunted while less likely to be wasted respectively.

Table 5: **Adjusted logistic regression (odds ratio) of underweight, stunted, and wasted children by selected background characteristics in Uttar Pradesh, India, NFHS-4 (2015-16)**

Covariates	Odds Ratio (95 % at Confidence level)		
	Underweight	**Stunted**	**Wasted**
Place of Residence			
Urban®			
Rural	0.88* (0.73-1.06)	0.83** (0.69-0.99)	0.91 (0.73-1.14)
Wealth Quintile			
Poorest®			
Poor	0.86* (0.72-1.02)	0.87* (0.74-1.03)	0.85* (0.68-1.05)
Middle	0.77*** (0.61-0.94)	0.67*** (0.55-0.83)	1.01 (0.76-1.30)
Richer	0.77** (0.58-1.00)	0.55*** (0.43-0.72)	1.02(0.72-1.40)
Richest	0.60*** (0.42-0.82)	0.42*** (0.30-0.57)	1.25 (0.84-1.85)
Mother's Age			
15-24®			
25-34	1.17* (0.97-1.27)	1.11 (0.94-1.30)	0.97 (0.78-1.18)
35 & above	1.15 (0.86-1.51)	1.01 (0.77-1.32)	0.85 (0.59-1.20)
Mother's Education			
Illiterate®			
Primary	0.92 (0.75-1.10)	1.15* (0.95-1.39)	0.87 (0.66-1.12)
Secondary	0.85** (0.71-0.99)	0.96 (0.82-1.13)	0.93 (0.74-1.14)
Higher	0.58*** (0.42-0.78)	0.67*** (0.49-0.90)	0.81 (0.55-1.18)
Husband's Education			
Illiterate®			
Primary completed	0.97 (0.78-1.19)	1.13 (0.90-1.39)	1.09 (0.82-1.41)
Secondary completed	0.78*** (0.64-0.92)	0.81*** (0.67-0.95)	1.01 (0.79-1.27)
Higher	0.72*** (0.53-0.96)	0.76** (0.56-0.99)	0.93 (0.63-1.33)

Birth Order			
First order®			
2-3 order	0.98 (0.77-1.22)	0.74*** (0.59-0.91)	1.89*** (1.35-2.61)
Four and More	1.28* (0.88-1.83)	0.72** (0.49-1.01)	4.97*** (2.80-8.78)
Religion			
Hindu®			
Muslim	1.03 (0.85-1.23)	0.99 (0.84-1.19)	1.15 (0.91-1.44)
Other	(NA)	0.63 (0.13-2.93)	0.52 (0.06-3.93)
Social Group			
Scheduled Caste/Scheduled Tribe®			
Other Backward Classes	0.98 (0.83-1.13)	0.82*** (0.70-0.95)	1.06 (0.87-1.28)
Other	0.75*** (0.60-0.92)	0.77*** (0.62-0.94)	1.05 (0.80-1.37)
Mother BMI Status			
Underweight®			
Normal	0.69*** (0.58-0.81)	0.86** (0.73-1.01)	0.88 (0.72-1.07)
Obese/overweight	0.40*** (0.31-0.50)	0.70*** (0.55-0.88)	0.57*** (0.41-0.77)
Mass Media Exposure			
No®			
Yes	1.04 (0.89-1.20)	0.98 (0.83-1.12)	1.05 (0.87-1.26)
Benefits from ICDS Centre in Last One Year			
No®			
Yes	1.01 (0.86-1.14)	0.86** (0.74-0.98)	1.50*** (1.24-1.79)
UP's Region			
Western®			
Central_Avadh	0.97 (0.78-1.19)	0.99 (0.79-1.20)	1.18 (0.91-1.52)
Southern_Bundelkhand	1.39*** (1.06-1.80)	0.92 (0.70-1.20)	2.03*** (1.51-2.71)
Eastern_Purvanchal	0.93 (0.79-1.07)	1.15** (0.98-1.32)	1.01 (0.81-1.21)
Child Ever Born			
First®			
2	0.85* (0.66-1.08)	1.51*** (1.19-1.91)	0.36*** (0.25-0.49)
3	0.96 (0.71-1.28)	1.87*** (1.39-2.48)	0.31*** (0.20-0.46)
4 and More	0.87 (0.58-1.26)	2.09*** (1.43-3.04)	0.15*** (0.08-0.26)

Note: At significant level, ***p < 0.01, **p < 0.05, *p < 0.1.

Table 6: Contribution of Each Determinant in Poor & Non-poor Differentials in Stunted, Underweight and Wasted Children in Uttar Pradesh, India

Covariates	Stunted		Underweight		Wasted	
	Coefficient	% Contributions	Coefficient	% Contributions	Coefficient	% Contributions
Mother's age	0.002*	-1.77	0.001	-1.38	0.002**	-8.42
Mother Education	-0.050***	43.75	-0.038***	40.56	-0.002	8.57
Husband's Education	-0.003**	2.37	-0.004***	4.30	-0.002**	9.89
Birth Order	0.013***	-11.63	0.009**	-9.64	-0.013***	69.46
Religion	0.000	-0.26	0.001*	-1.59	0.002***	-9.46
Caste	-0.013***	11.41	-0.012***	13.12	-0.001	6.83
Place of Residence	0.004*	-3.41	0.006**	-6.62	0.004**	-20.96
Benefits from ICDS or Aganwadi centre in last one year	0.003***	-2.43	0.000	0.30	-0.004***	19.79
Exposure to Mass Media	-0.013***	11.37	-0.002	2.60	0.003	-13.24
Mother BMI Status	-0.017***	14.67	-0.025***	26.76	-0.013***	69.23
UP's Regions	-0.011***	9.85	-0.007***	7.77	-0.005***	25.49
Child Ever Born	-0.030***	26.07	-0.022***	23.82	0.011***	-57.18

Note: At level of Significant ***p < 0.01, **p < 0.05, *p < 0.1.

Summary of Fairlie Decomposition (expressed in per 100)			
	Stunted	**Underweight**	**Wasted**
Mean prediction of Non-poor	0.359	0.310	0.169
Mean prediction of poor	0.542	0.455	0.186
Row differentials	-0.183	-0.145	-0.017
Total explained	-0.114	-0.094	-0.015
% explained gap in wasted/stunted/underweight children between poor and non-poor	62.24	64.94	83.93
% unexplained gap in wasted/stunted/underweight children between poor and non-poor	37.76	35.06	16.06
Total Observation	36465	36465	36465

Fairlie decomposition result is shown in Table 6. The findings suggest that the variables are explained very well and influence child health, growth and nutritional development practices. Due to endowment factors, children's health and nutritional indicators i.e., stunted, underweight and wasted are explained by 62.2 percent, 65 percent, and 16 per cent respectively. The remaining unexplained percentage indicates that there is a wide gap differential in child nutrition and growth development practices between poor and non-poor. For that, we need more information to understand the unexplained gaps. It is also reflected through the National Rural Health Mission and National Nutrition Mission programmes perspective in the state that there is sluggish and low improvement after a decade of NRHM and that after 35 years of ICDS programme, still the situation in the development of child health and nutritional practices is unsatisfactory and poor. Further, the results give the contribution effect of each endowment factor in child care and nutritional development such as stunting, underweight and wasted (Table 6). The highest difference between poor and non-poor in stunting and underweight is mother's education and the positive sign shows that the gap between poor and non-poor is widening more at around 44 and 41 per cent respectively, whereas in the case of child wasting, child birth order shows a 69 per cent gap between poor and non-poor. It is due to the poor women having

more childbirths than non-poor women. Further, women's health status (BMI) have also made more disadvantaged among the poor women and the gaps between poor and non-poor in children's stunting, underweight and wasted is vast and contributed effects is found as 15 percent, 27 percent, and 69 per cent respectively. It means that children who belong to poor households have a greater chance to be malnourished. Social groups (caste) also play a major role in defining child health and well-being in the state. By caste, the gap found between poor and non-poor children across stunting, underweight and wasting as 11 percent, 13 percent, and about 7 per cent respectively. Children ever born are also a significant factor that made a significant contribution effect in these two groups, poor and non-poor. It is showing as 26 per cent in stunted and 24 per cent in underweight children.

Conclusion and Recommendations

The present study showed that the level and pattern of child health and nutrition indicators have varied across different socio-economic groups as well as regional and district levels in the state of Uttar Pradesh. A huge disparity across socio-economic groups and spatial-regional disparity could be seen in the child health development indicators in the state. Some regions are more vulnerable to child stunting and underweight than wasting as identified through this analysis. Purvanchal region faces multiple burdens in childcare and nutritional development indicators followed by Bundelkhand and Avadh regions. Overall, the western region faced tremendous inequality in child healthcare and nutritional development indicators between poor and non-poor. Moreover, the rural-urban distribution of child malnutrition has also varied across different regions and districts (for the district-wise figures, see appendix1). These huge disparities can be easily seen through the lens of agricultural, socio-economic, environmental, and other sectoral factors in the state while applying a regional approach. In addition, it is clearly reflected in the analysis that lack of proper regional health and nutrition planning and state policy interventions has led to haphazardly child health and nutritional outcomes i.e., underweight, stunting and wasting.

Moreover, nutrition related indicators were lacking in the early Millennium Development Goals in India and more especially in Uttar Pradesh, due to many reasons. Socio-economic and demographic determinants are also responsible for the statenot achieving the goals. Regional factors have also contributed towards child malnourishment in the state. Further, there is unawareness, lack of IEC (information, education, and communication) and technology which were meant to enhance the effectiveness, efficiency, and adequacy in implementing the health and nutritional related programmes. Hence, for achieving SDGs, the state must adopt the appropriate approaches to achieve its targets. Within India, Uttar Pradesh faces the highest burden of child malnutrition.

Thus, addressing the issues related to child growth, nutrition and lack of development in the state requires adequate attention and political will to enhance policy interventions with proper strategy at the grassroots level, especially the remote areas or at village level. Proper help in terms of awareness of child feeding practices, and recognising the risk of malnutrition, the Anganwadi staff at grassroot level must also be trained to screen the malnutrition of children. Also, any long-term project should align with and improve the public health system to ensure that the progress and momentum that have been gained so far are not lost. Though an effort by the Union Government, the National Health Mission

(NHM) and the National Nutrition Mission (NNM) are working to boost maternal and child health across India, however, the state government can also take some initiative to implement such programmes at district levels. Government funding and budget allocation, especially for childcare, education, development and nutrition seem to be proportionally inappropriate in the state (Balarajan, Y., & Reich, M. R. 2016). Therefore, it has negative repercussions on the overall child development in the state. Therefore, identifying the inequalities at the district level would be helpful to the planners and policy-makers to help build new interventions for those specific districts that are underprivileged (Murray *et al*, 2014; Falcao *et al*, 2015 and Khadse and Chaurasia, 2019).

The National Rural Health Mission (NRHM) was launched in 2005 (in 2013, thereafter named as National Health Mission), a multi-sectoral health programme aimed to provide maternal and child health care and nutritional services. We had a separate programme on women and child nutrition as Nutritional Health Mission, and now it is the *Poshan Abhiyan* (after 2018) which acts as a multi-sectoral response in providing nutritional services. The new *Poshan Abhiyan* (Nutrition Movement) can become a catalyst to fill up the gaps that have emerged in child health and nutritional development, if people participate in the programme. It is a holistic approach to attack the problems of nutrition in the country by addressing intersectional convergence for better services, useof ICT (information, communication, and technology) for real-time growth and monitoring, intensified health and nutrition services for the first 1,000 days and *Jan Andolan* (people'smovement). The programme is aimed to reduce stunting, under-nutrition, and anaemia (among young children, women, and adolescent girls) and also the low birth-weight which adversely affects health, growth, and development. The government introduced the Integrated Child Development Scheme (ICDS) in 1975, a gigantic programme aimed to address malnutrition, health and also development for young children, pregnant and nursing mothers. However, the low coverage of services, especially to the marginalised and oppressed groups of children, has been a matter of serious concern. Our present analysis carried out based on NFHS-4 showed that the level and patterns of children's nutritional status in Uttar Pradesh are way below the national averages. Therefore,a targeted approach to meet the SDGs is suggested, and it can further reduce socio-economic inequality and regional disparity in child health and nutritional outcomes indicators, where still a large segment of the population is devoid of basic services in the community.

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Appendix

Table 4: District-wise across rural-urban, the prevalence of underweight, stunted, and wasted children in Uttar Pradesh, India, NFHS-4 (2015-16)

S. No.	Districts	Stunting		Underweight		Wasting	
		Rural	Urban	Rural	Urban	Rural	Urban
1	Saharanpur	38.6	33.2	37.4	33.1	20.2	14.5
2	Muzaffarnagar	44.5	33.6	39.5	33.5	20.9	16.8
3	Bijnor	42.8	41.4	42.0	40.3	20.6	31.5
4	Moradabad	46.7	41.4	46.5	35.6	18.1	12.2
5	Rampur	46.9	36.3	44.8	42.0	20.8	21.3
6	Jyotiba Phule Nagar	45.4	40.8	45.6	33.5	23.4	19.2
7	Meerut	36.5	34.5	35.7	35.0	18.2	19.7
8	Baghpat	38.8	27.7	37.9	22.3	16.4	10.0
9	Ghaziabad	36.7	33.7	29.9	29.2	11.1	15.3
10	Gautam Buddha Nagar	32.3	32.6	27.9	29.0	12.0	18.9
11	Bulandshahr	42.2	48.4	32.8	38.8	16.5	14.9
12	Aligarh	51.9	41.9	38.3	37.8	11.9	20.9
13	Mahamaya Nagar	45.0	40.5	32.0	30.3	10.0	6.2
14	Mathura	43.0	32.9	25.3	31.6	11.0	15.9
15	Agra	48.4	39.4	38.0	29.7	14.3	14.4
16	Firozabad	43.6	44.5	28.4	26.5	12.6	9.4
17	Mainpuri	46.3	49.4	32.1	41.1	11.1	9.9
18	Budaun	57.9	37.3	57.0	34.4	20.8	16.9
19	Bareilly	47.5	41.3	45.3	34.6	20.4	15.8
20	Pilibhit	52.8	44.5	44.6	40.3	21.8	23.1
21	Shahjahanpur	51.2	42.1	56.0	46.7	24.2	19.9
22	Kheri	55.4	38.5	41.0	40.9	16.4	34.4
23	Sitapur	57.0	48.9	50.1	29.5	15.3	*
24	Hardoi	52.6	38.7	41.3	30.2	16.4	6.4
25	Unnao	48.3	34.8	35.5	28.4	13.8	8.2
26	Lucknow	42.7	31.8	46.7	42.0	32.1	33.8
27	Rae Bareli	36.6	36.8	42.4	29.5	32.1	22.4
28	Farrukhabad	51.0	38.0	31.1	33.8	7.4	14.5
29	Kannauj	51.8	41.1	33.5	27.9	12.0	11.8
30	Etawah	53.6	53.0	33.0	33.0	12.6	9.8
31	Auraiya	43.5	41.6	48.2	30.5	29.4	9.9
32	Kanpur Dehat	46.3	42.4	36.9	38.3	15.6	18.8
33	Kanpur Nagar	44.2	42.8	47.7	37.9	26.2	22.7
34	Jalaun	47.9	35.8	53.2	30.6	33.0	26.8
35	Jhansi	41.2	28.6	42.9	34.2	27.9	26.5
36	Lalitpur	41.3	37.1	50.1	44.5	39.4	37.3
37	Hamirpur	41.9	25.9	42.0	37.0	29.7	54.1
38	Mahoba	47.0	26.9	50.1	31.9	22.9	29.3
39	Banda	46.3	45.7	42.9	36.5	19.3	13.6
40	Chitrakoot	50.4	52.7	51.3	59.5	33.4	34.3

41	Fatehpur	51.5	57.6	40.1	38.1	14.7	14.5
42	Pratapgarh	42.1	11.1	43.8	19.3	24.6	19.3
43	Kaushambi	49.7	53.6	51.5	64.2	28.8	42.2
44	Allahabad	48.4	26.9	47.5	28.0	19.3	21.8
45	Bara Banki	54.1	22.7	42.9	18.6	13.2	4.3
46	Faizabad	52.4	38.1	46.4	38.4	18.9	21.5
47	Ambedkar Nagar	44.7	31.4	41.5	33.2	21.2	30.0
48	Sultanpur	46.3	25.3	39.5	29.0	19.6	8.2
49	Bahraich	65.5	61.9	44.8	28.5	14.3	1.7
50	Shrawasti	62.8	68.3	39.8	32.4	10.6	11.0
51	Balrampur	64.8	42.0	44.2	34.0	10.2	9.7
52	Gonda	58.3	44.8	39.6	21.2	9.5	7.1
53	Siddharth Nagar	58.7	34.7	43.8	25.8	14.1	4.0
54	Basti	48.8	51.7	32.9	34.4	13.5	26.2
55	Sant Kabir Nagar	50.2	55.9	36.6	40.8	10.7	10.1
56	Mahrajganj	54.2	46.9	37.0	34.5	12.0	10.4
57	Gorakhpur	44.5	24.2	36.1	22.3	18.1	28.9
58	Kushinagar	46.1	33.8	36.9	18.6	15.1	11.4
59	Deoria	42.1	34.8	32.1	24.7	13.0	21.6
60	Azamgarh	40.6	23.2	32.9	26.6	17.3	17.0
61	Mau	40.0	46.4	34.5	37.2	20.0	20.4
62	Ballia	40.0	38.2	30.4	35.8	15.1	8.2
63	Jaunpur	49.2	34.0	53.1	57.5	27.4	29.3
64	Ghazipur	41.4	38.8	32.1	31.3	18.0	21.5
65	Chandauli	44.3	37.0	37.0	26.4	17.2	21.5
66	Varanasi	48.7	39.5	46.8	45.0	25.5	25.0
67	Sant Ravidas Nagar	51.6	52.1	49.8	49.4	22.1	21.4
68	Mirzapur	50.4	44.0	49.0	35.3	20.6	20.0
69	Sonbhadra	47.4	27.4	48.1	27.3	23.3	16.8
70	Etah	52.6	39.6	34.9	13.8	10.9	1.8
71	Kanshiram Nagar	53.6	39.8	33.3	31.9	11.7	12.6
	Total	48.5	37.9	41.0	33.8	17.9	18.1

Source: Author's calculation from NFHS-4, 2015-16

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Dr V K R V Rao Road, Nagarabhavi P.O., Bangalore - 560 072, India
Phone: 0091-80-23215468, 23215519, 23215592; Fax: 0091-80-23217008
E-mail: balasubramanian@isec.ac.in; Web: www.isec.ac.in