



Economic Well-being and Inequalities In Child Health Indicators- An Inter-State Analysis

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Abstract : In 2019, the under-five mortality rate is highest in the Sub-Saharan Africa region, followed by Central and Southern Asia globally. (UNICEF report 2020). According to research by Pearce et al. (2019), children from low socio-economic backgrounds experienced greater health deprivation. India faced highest levels of disparities in child malnutrition and child survival. Among three mal-nutritional indicators used here, prevalence of stunting (height-for-age) is higher in all socio-economic background in India. The greatest percentages of stunted, wasted, and underweight children were seen in households with low economic status. To measure socio-economic disparities in child nutrition and mortality, we used the Concentration Index. Using NFHS4 data, an effort has also been undertaken to create the Composite Child Health Inequality Index(CCHII) for 30 Indian states .The results indicate that a higher burden of child health disparity is seen in Sikkim, Karnataka, Tripura, Uttar Pradesh, and West Bengal, while states like Kerala, Delhi, Andhra Pradesh, Meghalaya, and Bihar show a lower degree of inequality.

Keywords- NMR, IMR, CMR, U5MR, Under-nutrition, Socio-Economic inequality, Concentration Index(CI), Composite Child Health Inequality Index (CCHII), Income-Health relationship.

Introduction

India has one of the poorest health records in the world with every three out of four children have anemia. Every third child in India is malnourished. Child mal-nutrition in India is widely varied with different socio-economic and demographic characteristics. According to WHO, globally 30% of children under five are estimated to be stunted and 18% have low weight-for-height, and 43 million children are overweight. As per NHP 2017 guidelines, targets are set to reduce under-five mortality to 23 by 2025, infant mortality rate to 28 by 2019, neo natal mortality to 16 and still birth rate to “single digit”, 40% reduction of incidence of under-five stunting, and by the age of one year more than 90% children are immunized by 2025. This new health policy tries to reach every individual by assuring highest possible level of health and well-being for all ages. National Health Policy in India (2015) confronts that health inequality is carried disproportionately by residence wise, different socio-economic and population subgroups wise. According to Pandey et al (1198) background characteristics are expected to have stronger effects on post-neonatal and child mortality than on neonatal mortality. Dhak (2022) observed that over the period of 23 years (from 1992-2016) 34% child under-nutrition is reduced by improvement of parental education, economic condition, coverage in immunization and betterment of reproductive health care facilities. Caste and economic status are two robust socio-economic determinants of health. A Nigerian paper by Adeyanju et al(2017) described that in low-income countries child mortality rates are higher amongst the poor population. Social imbalances have been observed in Rani’s literature (2021). Over time though malnourishment decreases, but in India higher burden of under-nutrition is substantially higher among children belonging from SC, ST categories and those be present in rural areas. After the introduction, II deals with data sources and methodology, Section III gives the outline of disparities of child nutritional health in India. Inter-state socio-economic disparities, Composite Child Health inequality index (CCHII) constructed, states are ranked accordingly and presented in IV. The conclusion of the study appears in V.

Objective Data sources

Under this backdrop, the specific objectives are to examine nature, trends and variations of inequalities of child health in India. Also aim is to discover inter-state child nutrition and mortality disparities.

This study is performed based DHS data, 3rd and 4th round of National Family Health Survey (NFHS-3 and NFHS-4) conducted in 2005-06 and 2015-16, by the International Institute for Population Sciences (IIPS), Mumbai under the stewardship of the Ministry of Health and Family welfare, GoI.

Methodology

Concentration Curve: In order to measure the degree of (social/demographic/economic) inequality in different child and maternal health care indicators, Concentration Index (CI) is appropriate measure, proposed by Wagstaff. $CI = (p_1L_2 - p_2L_1) + (p_2L_3 - p_3L_2) + (p_3L_4 - p_4L_3) + \dots + (p_{T-1}L_T - p_TL_{T-1})$

Here p is the cumulative percent of the sample ranked by either social or economic status, $L(p)$ is the corresponding concentration curve ordinate, and T is the number of socio-economic groups

Concentration Indices: The concentration curve is derived from the values of Concentration index.

Composite Child Health Inequality Index(CCHII): For constructing CCHII, three child health variables are considered here. These are U5MR (Under-five mortality rate), NFIC (Not fully immunized child) and anemic child. Among 30 states of India, we find out values of inequalities for each three variables known as CI_{U5MR} , CI_{NFIC} and lastly CI_{AC} .

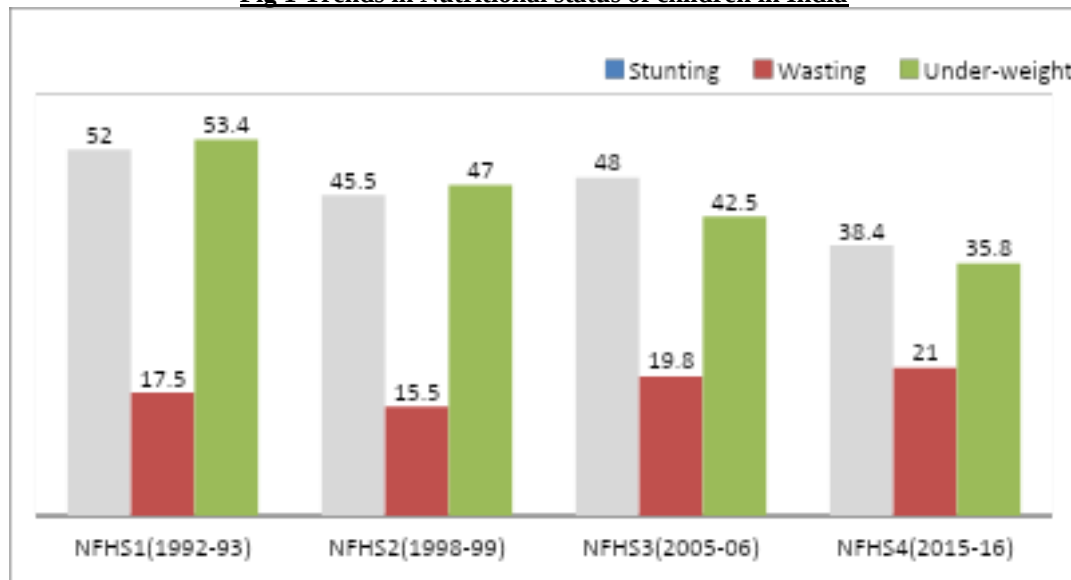
$$\text{Here, } CCHII = (CI_{U5MR} + CI_{NFIC} + CI_{AC}) / 3$$

Stunting (Height-for-age): is defined as the low height for age. A child is said to be stunted when he/she has the deficit in height for age.

Wasting (Weight-for-height): is referred when a children is suffered from adequate weight for height. When the exact age cannot determine, wasting is an appropriate measure to find out acute mal nutrition.

Underweight (Weight-for-age): means a child has low body weight for his/her respective age. An underweight child's weight for age is at least below the 2 standard deviation.

Fig 1 Trends in Nutritional status of children in India



Source: NFHS (India report)

Presently in India, 38% children are stunted, 21% children are marked as wasted and prevalence of under-weight children is 35%. From the latest secondary data it is found that from 1992-93 to 2015-16, trends in nutritional status is improving. The level of stunting is declined among the children from 52% to 38.4%. In 24 years between NFHS1 and NFHS4 percentages of wasted children increased from 17.5 percent to 21 percent. In the same period, percentage of under-weight children decreased from 53.4% to 35.8%. We can summarize that over 24 years prevalence of stunted and under-weight children has been reduced but India experienced with more percentages of wasted children. As per NFHS data, proportion of wasted children has been increased sharply through-out 1992-93 to 2016-16 from 17 percent to 21 percent.

In the previous part we are discussing about overall child nutritional status in India. But in India this nutritional condition is varied dramatically with different socio-economic and demographic characteristics in India. This is discussed below-

Table 1 Variations of nutritional status of children according to anthropometric indices by background characteristics in India for 2005-06 and 2015-16

Background Characteristic s	Stunted (Height-for-age)		Wasted(Weight-for-height)		Under-weight(Weight-for-age)	
	NFHS 4	NFHS 3	NFHS 4	NFHS 3	NFHS 4	NFHS3
Age in months						
<6	20.1	20.4	31.9	30.3	26.7	29.5
6-8	20.2	25.9	28	29.3	26.7	34.7
9-11	25.9	32	27.3	28.9	31	36.7
12-17	38.2	46.9	23.7	23.3	32.8	40.2
18-23	46.9	57.8	20.4	22.2	37.3	45.9
24-35	42.7	55.9	19.1	16.7	37.6	44.9
36-47	43.2	54.3	17.9	15.5	38.2	45.6
48-59	40	50.3	17.7	15.7	39.1	44.8
Sex						
Male	16.9	48.1	21.9	20.5	36.1	41.9
Female	15.6	48	20.1	19.1	35.3	43.1
Residence						
Urban	31	39.6	20	16.9	29.1	32.7
Rural	41.2	50.7	21.4	20.7	38.3	45.6
Schooling						
No Schooling	24.8	57.2	22.7	22.7	46.8	52
5-7 years schooling	16	45.6	21.6	18.8	37.6	38.5
10-11 years schooling	10.5	33	19.8	14.3	28.5	26.8
Religion						
Hindu	38.5	48	21.5	20.3	36.3	43.2
Muslim	39.8	50.3	19.4	18.4	34.9	41.8
Caste/Tribe						
SC	42.8	53.9	21.2	21	39.1	47.9
ST	43.8	53.9	27.4	27.6	45.3	54.5
OBC	38.7	48.8	20.5	20	35.5	43.2
Others	31.2	40.7	19	16.3	28.8	33.7
Wealth Index						
lowest	51.5	59.9	24.2	25	48.6	56.6
Second	43.5	54.3	21.7	22	40.4	49.2
Middle	36.5	48.9	20.2	18.8	33.2	41.4
Fourth	29.2	40.8	19.3	16.6	27.4	33.6
Highest	22.2	25.3	17.9	12.7	20.1	19.7

Source: NFHS report

The extent of child inequality in India is studied using three outcome indicators viz stunting, wasting, under-weight. From the above table it is seen that in 2015-16(NFHS4), as age increases children become more stunted and under-weighted. On the contrary incidence of wasted child is reduced as age increases. So we conclude that with the increase child's age, children become more stunted and under-weighted while the proportion of wasted children is less. Taking three anthropometric indicators, male children are more malnourished compare to the female children in India both in 2005-06 and 2015-16. Level of under-nutrition

is much more prominent in rural areas in India than urban areas. Among all three indicators, rural-urban gap is maximum for children who are stunted. Among the educated children, prevalence of under-nutrition is lowermost. Children from the muslim community are comparatively more stunted (39.8%) but hindu children are having higher weight-for-height (wasting) and weight-for-age (under-weight). Children belong from ST categories are much more undernourished compare to other caste categories. Prevalence of under-nutrition is also high among the children from SC category. Among the ST caste category, 43 percent of children are stunted, 27 percent children are wasted and nearly 45 percent children are marked as under-weight. Children in India belonging from other backward class category are also malnourished but their extent of malnourishment is comparatively less than children from SC, ST categories. A negative association associated with economic status and child malnutrition. Highest percentages of stunted, wasted, under-weight children observed among the household with poor economic status. Presently in India there is nearly 43% of children are stunted, 40% children are under-weight and 21% children are wasted with the wealth index of poorer category.

Socio-economic and demographic disparities in child nutrition in India, 2015-16

Now we want to capture the disparities among the three anthropometric measures in India with different background characteristics. These characteristics are birth order, mother's education, child's age in months and wealth index.

Table 2 Socio-economic inequalities in child-nutrition in India for 2005-06 and 2015-16

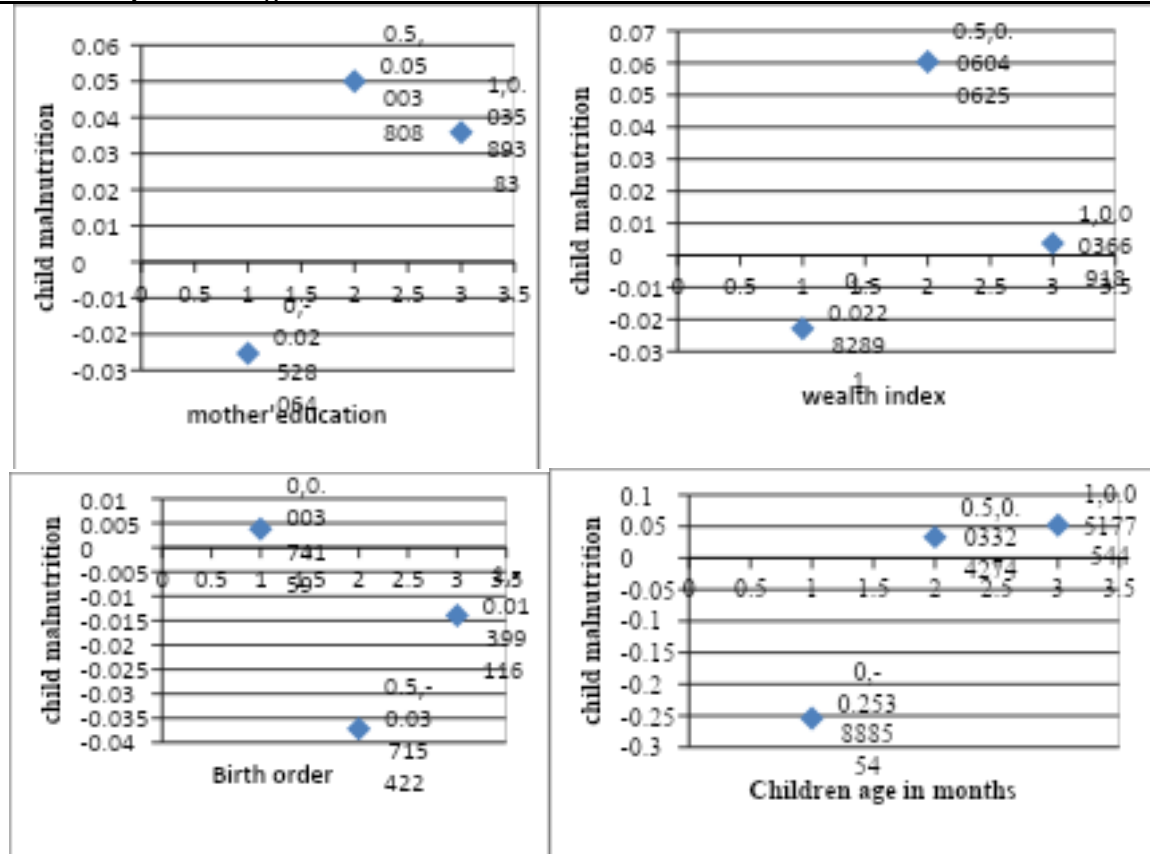
	Mother's education		Wealth Index		Birth order		Child's age	
	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16
Stunting	-0.12098	-0.14626	-0.12582	-0.14865	0.067286	0.071027	-0.26515	-0.51904
Wasting	-0.09305	-0.04031	-0.11831	-0.05791	0.05168	0.014526	-0.1379	-0.10466
Under-weight	-0.13831	-0.10241	-0.15833	-0.15466	0.078064	0.064073	-0.25792	-0.20615

Author's own calculation

Table 3 Socio-economic variations of child-nutrition from NFHS3 to NFHS4

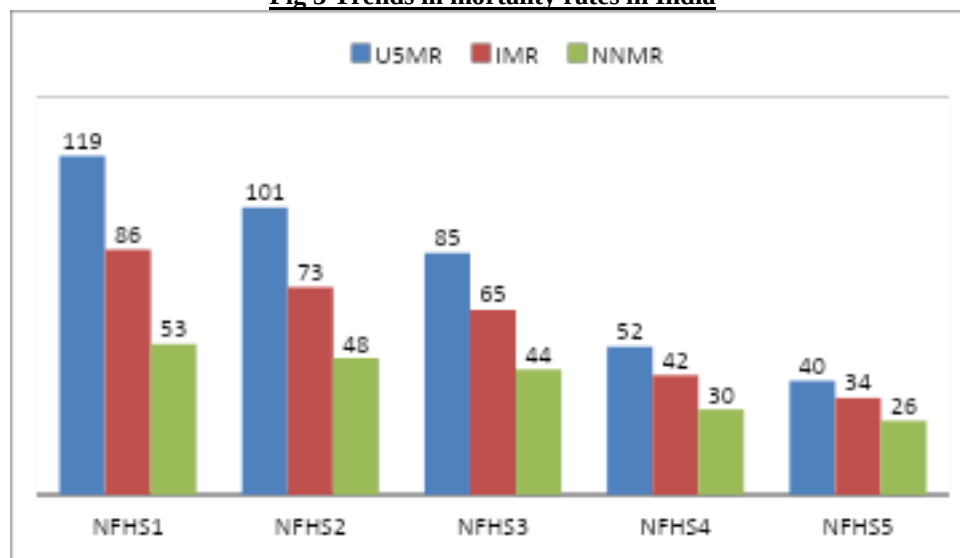
	Stunting	Wasting	Under-weight
Mother's edu	-0.02528	0.05003 8	0.03589 4
Wealth Index	-0.02283	0.06040 6	0.00366 9
Birth order	0.00374 2	-0.03715	-0.01399
Child's age	-0.25389	0.03324 3	0.05177 5

Author's own calculation

Figure 2 Scatter plot of changes in Concentration Indices for Child malnutrition in India from 2005-06 to 2015-16

Sign of nutritional concentration indices with mother's education, wealth index and child's age for 2005-06 and 2015-16 are negative. It implies that as mothers are educated, prevalence of under-nutrition decreases. Under-nutrition is higher among the children belong from lower economic class. Incidence of stunting, wasting and under-weight decreases as child become younger. Study reveals that with the lower order of birth, prevalence of under-nutrition are lower. Among the all three mal-nutritional indicators, prevalence of stunting (height-for-age) is higher in all socio-economic background in India.

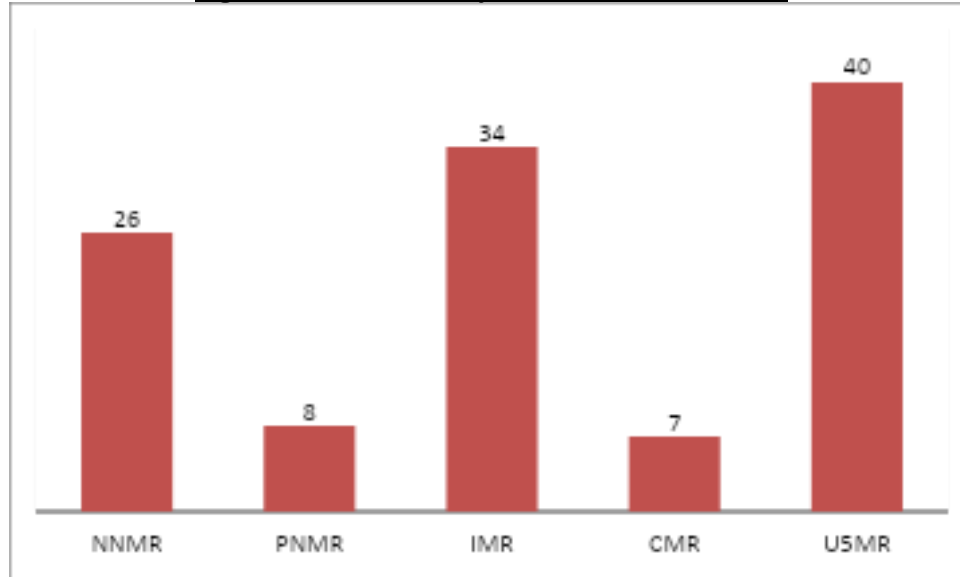
In India, inequalities in social-economic and demographic background have been reduced for wasting and under-weight children but inequalities are substantially increased for stunted children in India. So among the stunted children different social-economic and demographic inequalities are much more pronounced in 2015-16 with respect to 2005-06.

Fig 3 Trends in mortality rates in India

Neo-natal mortality (NNMR) is the probability of dying in the 1st month or 28 days of birth. Neonatal period is the first 28 days of life in which the possibility of death is maximum. Infant mortality rates (IMR) is the number of infant deaths less than one year of age given per thousand live births of that year. U5MR is the probability of dying before his/her 5th birthday.

Since the 1st round of NFHS which was conducted in 1992-93, country's under-five mortality rate was 119, in the next round (NFHS2) it was 101 per 1000 live births, 85 in 2005-06, 52 in 2014-15 and in the 5th round India's U5MR is 40. As per NFHS4 national report over the period of 23 years (from 1992-2015) India's IMR decreased by 48%. In 2019-20, it is 34 per 1000 live births. In 1992-93, India experienced with 86 IMR, 73 in 1998-99, 65 in 2005-06 and 42 in 2015-16. In 1992-93, NNMR was 53 per 1000 live births, which is reported as 26 in 2019-20. Throughout (from 1992-93 to 2019-20) rate of reduction in NNMR is very low, but reduction rate was lowest from NFHS2 (48) to NFHS3 (44). From above we conclude that, the extent of reduction in U5MR is comparatively higher than reduction in IMR.

Fig 4 Childhood mortality rates in India for 2019-20



Source: NFHS5 India report

National report of NFHS4 reveals that from 1992-93 to onwards, under-five and infant mortality rate are highest in Uttar Pradesh and minimum in Kerala. In case of still-birth and NNM, rate of reduction is quite lower in comparison with CMR and U5MR in India. In some states of India these reduction is remain stopped (NHP, 2015). According to NFHS5, among all morality rates, India accounted for highest U5MR (40 per 1000 live births). India displayed high risk of dying children during first 28 days of life compare Post neo natal phase. In India, new-born is at high risk as NNMR is high. "The high IMR is the consequence of neonatal mortality that still contributes about half of the total infant deaths. IMR is a very sensitive indicator of health not only for children but also to mothers and economic development as well" (Shil et al, 2016). Per 1000 live births, 34 infant deaths are occurred in India according to NFHS4 (2019-21). CMR is the conditional probability of dying between the 1st birthday and 5th birthday for those who survive the 1st year. India's CMR is 7 and U5MR is 40 per thousand live births for 2019-21.

Table 4 Composite Child Health Inequality Index(CCHII)

	CI_U5MR	CI_NFI	CI_Anemiac	CCHII	Rank
Andhra Pradesh	-0.09635**	0.021612**	-0.06168**	-0.04547	3
Arunachal Pradesh	-0.12956**	-0.0601**	-0.0518**	-0.08049	15
Assam	-0.16316**	-0.10192**	-0.05035**	-0.10515	21
Bihar	-0.07876**	-0.05457**	-0.03848*	-0.05727	5
Chandigarh	0.017677**	-0.14809**	-0.04199*	-0.05747	6
Chhattisgarh	-0.12894**	-0.13974**	-0.03488*	-0.10119	19
Gujarat	-0.12491**	-0.04457**	-0.11083*	-0.09343	16
Haryana	-0.23913**	-0.17834**	-0.01326*	-0.14358	25
Himachal Pradesh	-0.14215**	-0.05089**	-0.04244*	-0.07849	14
J & K	-0.17611**	-0.10473**	-0.0191*	-0.09998	18
Jharkhand	-0.13631**	-0.05204**	-0.02921*	-0.07252	11
Karnataka	-0.21302**	-0.02313**	-0.38134*	-0.20583	29
Kerala	-0.09678**	0.028907**	-0.04539*	-0.03776	1
Madhya Pradesh	-0.11165**	-0.09788**	-0.01647*	-0.07533	12
Maharashtra	-0.11065**	-0.05627**	-0.02815*	-0.06502	9
Manipur	-0.15167**	-0.1975**	-0.04513*	-0.13143	24
Meghalaya	-0.02418**	-0.11789**	-0.00069*	-0.04759	4
Mizoram	-0.09866**	-0.06875**	-0.06502*	-0.07748	13
Nagaland	-0.0953**	-0.09039**	-0.1226*	-0.10276	20
Delhi	-0.07723**	-0.06382**	0.009274*	-0.04392	2
Odisha	-0.16813**	-0.13151*	-0.09301*	-0.13088	23
Puducherry	-0.11233*	-0.05888*	-0.00552*	-0.05891	8
Punjab	-0.14038*	-0.16067*	-0.0282*	-0.10975	22
Rajasthan	-0.11757*	-0.03815*	-0.05198*	-0.06923	10
Sikkim	-0.21334*	-0.25325*	-0.23361*	-0.2334	30
Tamil Nadu	-0.1182*	-0.15235*	0.095855	-0.05823	7
Tripura	-0.27604*	-0.08469**	-0.23711	-0.19928	28
Uttar Pradesh	-0.09802*	-0.05804**	-0.35081	-0.16896	27
Uttarakhand	-0.18383*	-0.06954*	-0.02698*	-0.09345	17
West Bengal	-0.28369	-0.08004*	-0.13489*	-0.16621	26
India	-0.1398	0.00147	-0.03029	-0.05621	

Author's own calculation **significant at $p < 0.01$, *significant at $p < 0.05$

We are now focusing on inter-state diversification of child health condition. We have computed CI for selected indicators of health for 30 states of India. Across all the states values of CI are negative confirms poorest group have disproportionality higher burden of inequality.

Inequality value for all-India level is -0.0562 which comprises of inequality for U5MR is -0.1398, NFI is 0.00142 and anemic is -0.03029. On comparison of inequalities of 3 health indicators, inequalities for U5MR are more pronounced. Higher inequality in U5MR is observed in West Bengal (-0.28), Tripura (-0.27) and Sikkim (-0.21) respectively. The CC value of NFI child is maximum in Sikkim and minimum range of variation is found in Karnataka followed by Kerala and Rajasthan. CI value for anemic presents a wide range of variation with minimum (-0.00069) in Meghalaya and maximum in states of Uttar Pradesh (-0.35), Tripura (-0.236), Sikkim (-0.233) and in Nagaland (-0.122). Among other states inequalities that are also higher than national's CI are Karnataka, Gujarat, Punjab, Odisha, Manipur and West Bengal.

The range of CCHII varies from -0.03776 to -0.2334. Higher rank means lower the value of composite index and better the health situation. Kerala ranked 1st (-0.0377) in India with the lowest inequality value followed by Delhi, Andhra Pradesh and Meghalaya. Sikkim holds bottom (-0.2334) position. Ranking status of Karnataka, Uttar Pradesh, West Bengal, Tripura, Haryana, Manipur, Odisha, Punjab, Assam is very poor. West Bengal emerged at 26th position with the prominent burden of inequality (-0.16621). Child under-five mortality and Child-anemia in West Bengal are found to very high in West Bengal.

Table 5 Classification according to Income levels and Health Inequality

	Lower Health Inequality	Higher Health Inequality
Lower Income	Meghalaya	Bihar, Chhattisgarh, Jammu Kashmir, Jharkhand, Madhya Pradesh, Manipur, Nagaland, Orissa, Rajasthan, Tripura, Uttar Pradesh, West Bengal
Higher Income	Kerala, Andhra Pradesh, Delhi	Arunachal Pradesh, Assam, Chandigarh, Gujarat, Haryana, Himachal Pradesh, Karnataka, Maharashtra, Mizoram, Puducherry, Punjab, Sikkim, Tamil Nadu, Uttrakhand

For income, PCNSDP for 2014-15 current prices with base year 2011-12 and for Health Inequality, CI of U5MR, CI of Not fully immunized and CI of Anemic child are used with their all-india levels CI is considered as cut off marks to classify states with high and low categories.

Here we have classified all states in four categories using the data of CCHII and income data (PCNSDP) of all states. Health inequality is computed on the basis of national's inequality value which used as cut-off value. States with higher than cut-off marked as higher health inequality and states with lower the cut-off marks noted with lower health inequality. Four categories are-a) Lower income, Lower health inequality, b) Lower income, higher health inequality, c) Higher income, Lower health inequality and d) Higher income, higher health inequality.

Income related child health inequality reveals that Meghalaya experiences lower income and lower health inequality whereas states like Arunachal Pradesh, Assam, Chandigarh, Gujarat, Haryana, Himachal Pradesh, Karnataka, Maharashtra, Mizoram, Puducherry, Punjab, Sikkim, Tamil Nadu, Uttrakhand portray coexistence of higher income and higher health inequality. States consist of 'a and d' category depict straight forward relationship but no such clear cut relationship exist for the states belonging to 'b and c' category.

Conclusion

Finally we can conclude presently in India, 38% children are stunted (height-for-age), 21% children are marked as wasted (weight-for-height) and prevalence of under-weight (weight-for-age) children is 35%. Over 24 years (from 1992-93 to 2015-16), though prevalence of stunting and under-weight have been reduced drastically by 13 percent (reduction in stunting) and 17 percent (reduction in under-weight) but in India children are more likely to be wasted as wasting rate is increased from 17 percent (NFHS1) to 21 percent (NFHS4). As age increases children become more stunted and under-weighted while the incidence of wasted child is reduced as age increases. Level of under-nutrition is much more prominent in rural areas in India than urban areas. Among all three indicators, rural-urban gap is higher for children who are stunted. Among the educated children, prevalence of under-nutrition is lowermost. Children from the muslim community are comparatively more stunted (39.8%) but hindu children are having higher rate of weight-for-height (wasting) and weight-for-age (under-weight). Children belong from ST categories are much more undernourished compare to other caste categories. Prevalence of under-nutrition is also high among the children from SC category. Presently in India there is nearly 43% of children are stunted, 40% children are under-weight and 21% children are wasted with the wealth index of poorer category. Rural mortality rates in India are more or less same or higher than in total with respect to the all demographic and socio-economic characteristics except children belonging to the middle-income category.

As per NFHS4, under-five mortality level is higher in Madhya Pradesh (65 per 1000 live births) followed by Bihar (58), Uttarakhand (47), Andhra Pradesh Haryana (41 each). On the other hand a mortality rate under age of five is low in Kerala (7), Goa (13) Puducherry (16), Manipur (26), Tamil Nadu (27) and Maharashtra (29). Health Inequality Index is built to identify inter-state economic inequalities with different child health variables. Child health variables are Under-five mortality rates, not fully immunized child, anemic child. The range of CCHII varies from -0.03776 to -0.2334. Higher rank means lower the value of composite index and better the health situation. Kerala ranked 1st (-0.0377) in India with the lowest inequality value followed by Delhi, Andhra Pradesh and Meghalaya. Sikkim holds bottom (-0.2334) position. Ranking status of Karnataka, Uttar Pradesh, West Bengal, Tripura, Haryana, Manipur, Odisha, Punjab, Assam is very poor. West Bengal emerged at 26th position with the prominent burden of inequality (-0.16621). Child under-five mortality and Child-anemia in West Bengal are found to very high in West Bengal. For all the states of India, Concentration curve lies above the line. It implies that U5MR is disproportionately higher in lower economic class than

higher class. States of, Kerala, Puducherry, Meghalaya, Chandigarh showed lower extent of inequality compared to others states of India. This gap is much wider for the states like Assam, Haryana, Himachal Pradesh, Karnataka, Manipur, Sikkim, Tripura, Odisha, Uttarakhand and West Bengal.

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