Scoring Child Nutrition in India

Measuring the Performance of States

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Essential nutrition interventions are found to be strongly associated with lower under-nutrition levels in India. This is shown by constructing and comparing a child under-nutrition index and child nutrition score, both of which use data from India's latest National Family Health Survey (NFHS–3). The CUI indicates that 16 of the 28 states have high or very high levels of child under-nutrition. The CNS indicates that 24 states have poor or very poor performance in delivering essential nutrition interventions for children. The strongest association between the CUI and the CNS is that states with higher CNS tend to have lower CUI. Effective state governance systems need to prioritise programmes to scale up the coverage and equity of proven interventions in the fight against child under-nutrition in India.

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Under-nutrition remains a major threat to the survival, growth and development of Indian children. India's latest National Family Health Survey (NFHS-3) showed that 43% of Indian children 0-59 months old were underweight, with a weight-for-age below minus two standard deviations of the median weight-for-age in the World Health Organisation (WHO) Child Growth Standards (IIPS 2007). Thus, at any one point, an average of 53 million Indian children are underweight and therefore dangerously undernourished to survive, grow and develop to their full potential, which is the same potential as that of children in developed countries (Bhandari et al 2002; WHO 2006a).

The same data sources indicate that levels of children underweight in Indian states range from 20% to 60%, indicating significant interstate disparities. However, ranking the nutrition performance of Indian states on the basis of the prevalence of underweight children only can be inaccurate as "underweight" is a composite indicator and does not differentiate between prenatal under-nutrition (intra-uterine growth restriction), acute under-nutrition (wasting), chronic under-nutrition (stunting), or "hidden" micronutrient under-nutrition (deficiencies in essential vitamins and minerals such as iron, iodine and vitamin A).

The objectives of this paper are: (1) to present a child under-nutrition index (CUI) that captures the multidimensional nature of child under-nutrition in India and reflects which states face the greatest nutrition risk; (2) to present a child nutrition score (CNS) that captures the performance of Indian states in delivering proven essential nutrition interventions for infants and young children; and (3) to assess the links between under-nutrition risk and nutrition performance as measured by the CUI and the CNS, respectively. Both the index and the score use data from India's NFHS-3.

Index, Score and Methods

The CUI presented here is a multidimensional approach to measuring child under-nutrition in India. It combines four equally-weighted indicators:

(1) The prevalence of low birth weight, defined as the percentage of children 0-59 months old born with a birth weight below 2,500 grams, indicating the proportion of the child population with a poor nutritional status at birth, a proxy indicator for intra-uterine growth restriction (foetal under-nutrition) and therefore women's nutrition during pre-pregnancy and gestation;

(2) The prevalence of moderate or severe wasting, defined as the percentage of children 0-59 months old with a weight-for-height below minus two standard deviations of the median weight-for-height of the WHO Child Growth Standards (WHO 2006b), indicating the proportion of the child population who are acutely undernourished;
(3) The prevalence of moderate or severe stunting, defined as the percentage of children 0-59 months old with a height-for-age below minus two standard deviations of the median height-for-age of the WHO Child Growth Standards, indicating the proportion of the child population who are chronically undernourished;
(4) The prevalence of moderate or severe anaemia, defined as the percentage of children 6-59 months old with a haemoglobin concentration below 10 g/dl, a proxy indicator for the share of the child population with micronutrient under-nutrition due to deficiencies in essential vitamins and minerals ("hidden under-nutrition").

The CNS presented here is a multidimensional approach to measuring the performance of Indian states in delivering proven nutrition interventions (use of essential services and adoption of positive practices) for infants and young children. It combines ten equally-weighted indicators:
(1) Early initiation of breastfeeding: proportion of last born children who started breastfeeding within one hour of birth;
(2) Exclusive breastfeeding under six months: proportion of infants 0-5 months of age (first semester of life) who are fed exclusively with breast milk;
(3) Timely introduction of complementary foods: proportion of infants 6-8 months of age (third trimester of life) who are fed solid, semi-solid or soft complementary foods;
(4) Minimum dietary diversity: proportion of children 6-23 months of age who are fed foods from four or more food groups;
(5) Minimum meal frequency: proportion of children 6-23 months of age who are fed solid, semi-solid, or soft foods a minimum number of times per day;
(6) Consumption of iron-rich complementary foods: proportion of children 6-23 months of age who are fed iron-rich foods;
(7) Vitamin A supplementation: percentage of children 6-59 months old given vitamin A supplements in the last six months;
(8) Use of iodised salt: percentage of children 6-59 months living in households using adequately iodised salt;
(9) Full vaccination: proportion of children 12-23 months who received all basic vaccinations;
(10) Safe disposal of stools: proportion of children 0-59 months of age whose stools are disposed safely.

The CUI ranks child under-nutrition in Indian states on a scale of 0 to 100, with 0 being the best score (no child under-nutrition) and 100 being the lowest score (universal child under-nutrition). Index values below 10 indicate low levels of child under-nutrition, values between 10 and 19.9 indicate moderate levels of child under-nutrition, values between 20 and 29.9 indicate high levels of child under-nutrition; values between 30.0 and 39.9 indicate very high levels of child under-nutrition.

The CNS ranks the nutrition performance of Indian states on a scale of 0 to 100, with 100 being the best score (universal coverage of essential nutrition interventions) and 0 being the lowest score (nil coverage or essential nutrition interventions). Score values < 33.3 indicate very poor nutrition performance; values ranging from 33.3 and 49.9 indicate poor nutrition performance; values between 50.0 and 66.5 indicate moderate nutrition performance; values ≥ 66.6 reflect good nutrition performance.

Results and Analysis

Globally, the CUI was calculated for countries where 80% of the world's undernourished children live (UNICEF 2009) to assess how India ranks among the countries with a high burden of child under-nutrition. Nationally, the index was calculated for children living in rural and urban areas of India or belonging to different socio-economic and gender groups. Sub-nationally, the index was calculated for all major states, and the interstate ranking according to the index was determined.

Table 1 summarises the data used to calculate the CUI by country, the value of the index by country and the inter-country ranking according to the index. India's index (33.1) is the fourth highest, lower than that of Yemen (37.5), Sudan (35.8) and Niger (35.3) and higher than that of Bangladesh (31.8), Nigeria (29.8), Ethiopia (29.8), the Democratic Republic of the Congo (28.8), Indonesia (22.5), the Philippines (21.0) or Mexico (10.5).

Table 1: Child Under-nutrition Index in the Countries with the Highest Burden of Child Under-nutrition Worldwide[1]

	Prevalence of Low Birth Weight	Prevalence of Wasting	Prevalence of Stunting	Prevalence of Anaemia	Child Under-nutrition Index	Country Ranking According to CUI
Yemen	32	15	58	45	37.5	1
Sudan	31	16	40	56	35.8	2
Niger	27	12	47	55	35.3	3
India	22	20	48	43	33.1	4
Madagascar	17	15	53	45	32.5	5
Bangladesh	22	17	43	45	31.8	6
Pakistan	32	14	42	34	30.5	7
Nigeria	14	14	41	50	29.8	8
Ethiopia	20	12	51	36	29.8	8
DR-Congo	12	10	46	47	28.8	10
Nepal	21	13	49	32	28.8	10
Myanmar	15	11	41	42	27.3	12
Tanzania	10	4	44	48	26.5	13
Uganda	14	6	38	48	26.5	13
Indonesia	9	14	37	30	22.5	15
Philippines	20	6	34	24	21.0	16
Egypt	13	7	29	32	20.3	17
Mexico	8	2	16	16	10.5	18

1 The countries with the highest burden of child under-nutrition (n=24) comprise 80% of the world's undernourished children (UNICEF 2009).The data used to calculate the CUI are: the prevalence of low birth weight (percentage of children born with a birth weight < 2,500 g), the prevalence of moderate or severe wasting (percentage of children 0-59 months old with WHZ<-2 SD), the prevalence of moderate or severe stunting (percentage of children 0-59 months old with HAZ<-2 SD) and the prevalence of moderate or severe anemia (percentage of children 0-59 months old with a haemoglobin concentration <99 g/l) estimated at two-thirds of the prevalence of all anaemia (haemoglobin concentration <110 g/l). It was possible to determine the CUI for 18 of the 24 countries as data on low birth weight was not available for Afghanistan, data on wasting was not available for China, and data on wasting and stunting as per 2006 WHO Child Growth Standards was not available for Kenya, Mozambique, South Africa and Vietnam at the time of writing this report.

Table 2: Child Under-nutrition Index by Socio-economic Group

	Prevalence of Low Birth Weight	Prevalence of Wasting	Prevalence of Stunting	Prevalence of Anaemia	Child Under-nutrition Index
Lowest wealth quintile	25.4	25.0	59.9	48.8	39.8
Second wealth quintile	25.4	22.0	54.3	46.7	37.1
Middle wealth quintile	23.7	18.8	48.9	43.1	33.6
Fourth wealth quintile	21.8	16.6	40.8	39.9	29.8
Highest wealth quintile	17.4	12.7	25.3	31.3	21.7
Scheduled castes	22.3	21.0	53.9	47.3	36.5
Scheduled tribes	23.7	27.6	53.9	50.5	38.6
Other Backward Classes	21.3	20.0	48.8	43.5	33.4
Other	20.7	16.3	40.7	36.9	28.7
Rural	23.3	20.7	50.7	45.0	34.9
Urban	19.3	16.9	39.6	37.3	28.3
Boys	19.7	20.5	48.1	43.4	32.9
Girls	22.5	19.1	48.0	42.9	33.1
India	21.5	19.8	48.0	43.1	33.1

Table 2 indicates that within India the index shows important variations among different socio-economic groups. The index in the lowest wealth quintile is almost twofold (1.8) higher than in the highest wealth quintile (39.8 vs 21.7 respectively). Similarly, the index among children who belong to scheduled tribes (ST) and scheduled castes (SC) is 1.35 and 1.27 times higher respectively than among children who belong to other social identity groups (38.6 and 36.5 among ST and in SC children respectively vs 28.7 in other groups). Significant index differences are also observed among rural (34.9) and urban (28.3) children while the value of the index among girls and boys is comparable (33.1 vs 32.9, respectively).

Table 3: Child Under-nutrition Index by States

	Prevalence of Low Birth Weight	Prevalence of Wasting	Prevalence of Stunting	Prevalence of Anaemia	Child Under-nutrition Index	State Ranking According to the CUI
Bihar	27.6	27.1	55.6	48.4	39.7	1
M Pradesh	23.4	35.0	50.0	47.0	38.9	2
U Pradesh	25.1	14.8	56.8	48.6	36.3	3
Haryana	32.7	19.1	45.7	46.5	36.0	4
Jharkhand	19.1	32.3	49.8	41.0	35.6	5
Rajasthan	27.5	20.4	43.7	46.9	34.6	6
Gujarat	22.0	18.7	51.7	44.7	34.3	7
Chhattisgarh	17.5	19.5	52.9	47.2	34.3	8
Meghalaya	18.0	30.7	55.1	32.7	34.1	8
Maharashtra	22.1	16.5	46.3	41.4	31.6	10
Tripura	27.3	24.6	35.7	35.3	30.7	10
Karnataka	18.7	17.6	43.7	41.8	30.5	12
An Pradesh	19.4	12.2	42.7	47.1	30.4	13
Odisha	20.6	19.5	45.0	36.1	30.3	13
Uttarakhand	24.6	18.8	44.4	32.9	30.2	15
Assam	19.4	13.7	46.5	40.9	30.1	16
Punjab	27.7	9.2	36.7	44.7	29.6	17
W Bengal	22.9	16.9	44.6	30.9	28.8	18
H Pradesh	24.8	19.3	38.6	29.0	29.7	19
Delhi	21.5	15.4	42.2	30.7	27.5	20
T Nadu	17.2	22.2	30.9	37.2	26.9	21
Ar Pradesh	14.1	15.3	43.3	29.9	25.7	22
Jammu and Kashmir	19.4	14.8	35.0	32.8	25.5	23
Sikkim	10.3	9.7	38.3	30.3	22.2	24
Goa	22.2	14.1	25.6	18.6	20.1	25
Kerala	16.1	15.9	24.5	21.0	19.4	26
Mizoram	7.6	9.0	39.8	20.6	19.3	27
Manipur	13.1	9.0	35.6	15.5	18.3	28

Comparing CUI and CNS of states

Table 3 summarises the data used to calculate the CUI for the states, the value of the index by state, and the interstate ranking according to the index. The index ranks from 18.3 in Manipur to 39.7 in Bihar. The interstate ranking sorts the states in descending order, as the index measures the scale of child under-nutrition by state. The states with the highest index (highest child under-nutrition) are ranked at the top while the states with the lowest index (lowest child under-nutrition) are ranked at the bottom. Five states – Bihar, Madhya Pradesh, Uttar Pradesh, Haryana and Jharkhand – top the interstate ranking, with an index ≥ 35, and 16 of the 28 states have an index ≥ 30.0 indicating very high levels of child under-nutrition. Nine states have an index between 20.0 and 29.9 indicating high levels of child under-nutrition. Only three states – Kerala, Mizoram and Manipur – have an index between 10.0 and 19.9, indicating moderate levels of child under-nutrition (Figure 1). No state has low levels of child under-nutrition (index < 10.0).

Figure 1: Child Under-nutrition Index by State

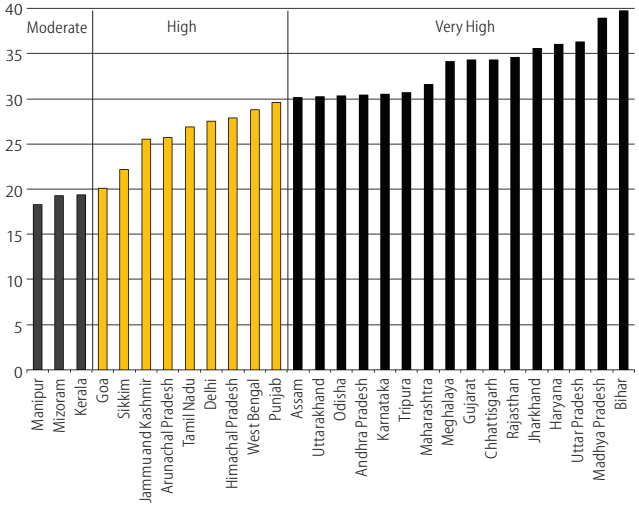


Table 4 (p 100) summarises the data used to analyse the association between the CUI and socio-economic indicators. We used 2004-05 net state domestic product (NSDP) per capita figures to assess the association between the CUI and per capita income by state (Central Statistics Office 2013). The NSDP per capita ranged from Rs 7,514 per year in Bihar to Rs 76,968 per year in Goa. We found a moderate inverse association between the two variables (R= -0.4073; P= 0.0314): higher state per capita income levels tend to be associated with lower index values (Figure 2, p 100). However, a number of states deviate from the predicted line. For example the average NSDP per capita in Gujarat and Kerala are similar (Rs 32,021 and Rs 31,871 respectively), while the index in Gujarat (34.3) is 1.8 times higher than in Kerala (19.4). Similarly, in Rajasthan and Manipur, two states with comparably low NSDP per capita (Rs 18,565 and Rs 18,640 respectively), the index is nearly two times higher in Rajasthan than in Manipur (34.6 vs 18.3, respectively).

Table 4: Economic Indicators and Child Under-nutrition Index by States

	NSDP at Current Prices (2004-05) (Rs)	Real Growth Rate (2001-05) (%)	Per Capita Calorie Intake (2004-05) kcal	Proportion of the Population Below Poverty Line (2004-05)	Child Under-nutrition Index (2005-06)
An Pradesh	25,321	6.3	1,997	11.1	30.4
Ar Pradesh	27,271	8.5	n/a	13.4	25.7
Assam	16,782	4.3	2,081	15	30.1
Bihar	7,759	5.5	2,082	32.5	39.7
Chhattisgarh	18,559	5.5	n/a	32	34.3
Delhi	61,560	6.4	n/a	10.2	27.5
Goa	76,426	4.9	n/a	12	20.1
Gujarat	32,021	6.6	1,940	12.5	34.3
H Pradesh	32,564	6.2	n/a	6.7	29.7
Haryana	37,842	7.8	2,141	9.9	36
Jammu and Kashmir	21,314	4.1	n/a	4.2	25.5
Jharkhand	18,512	4.1	n/a	34.8	35.6
Karnataka	26,745	4.3	1,874	17.4	30.5
Kerala	31,871	6.2	2,007	11.4	19.4
M Pradesh	15,442	1.9	1,938	32.4	38.9
Maharashtra	35,915	4.9	1,904	25.2	31.6
Manipur	18,527	3.8	n/a	13.2	18.3
Meghalaya	23,793	5.8	n/a	14.1	34.1
Mizoram	24,662	5.6	n/a	9.5	19.3
Odisha	17,380	6.1	2,079	39.9	30.3
Punjab	32,948	3.9	2,204	5.2	29.6
Rajasthan	18,565	4.2	2,161	17.5	34.6
Sikkim	26,693	7.4	n/a	15.2	22.2
Tamil Nadu	30,105	4.5	1,888	17.8	26.9
Tripura	24,394	7.7	n/a	14.4	30.7
U Pradesh	12,840	3.7	2,179	25.5	36.3
Uttarakhand	24,740	9.2	n/a	31.8	30.2
W Bengal	22,654	5.4	2,050	20.6	28.8

We used 2001-05 real growth rates of the per capita NSDP to assess the association between the index and annual economic growth over the five-year period preceding the NFHS-3 survey (ibid). Annual economic growth rates ranged from 1.9% in Madhya Pradesh to 8.5% in Arunachal Pradesh (Table 4). We found no significant association between the index and the rate of economic growth (R=-0.15; P= 0.43): high index values are observed both in states with high and low recent economic growth rates (Figure 3). For example the index in Gujarat and Uttar Pradesh are similarly high (34.3 and 36.3, respectively), while the annual economic growth rate in Gujarat was almost two times higher than that in Uttar Pradesh (6.63% vs 3.67%).

Figure 2: Child Under-nutrition Index in Relation to Per Capita Income by States

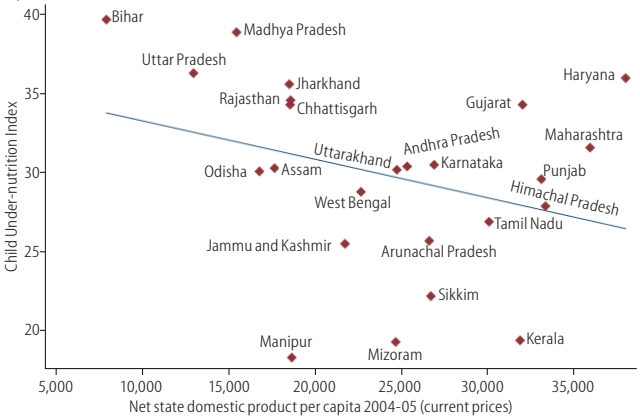
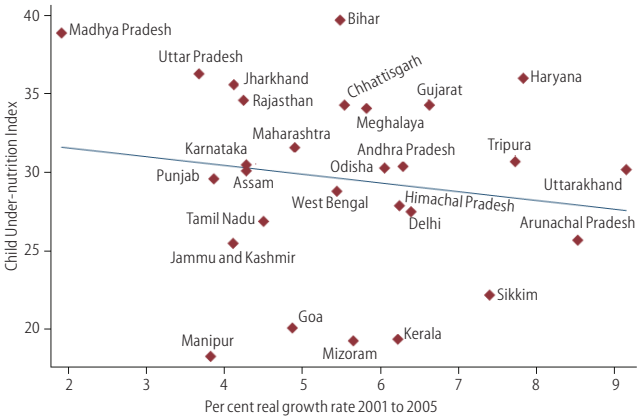
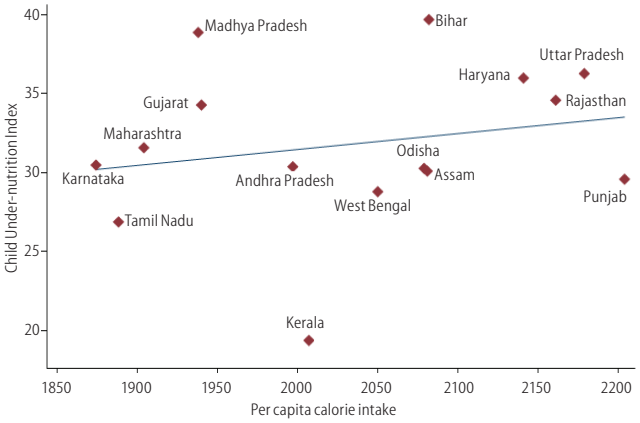


Figure 3: Child Under-nutrition Index in Relation to Rate of Economic Growth by States



We used 2004-05 per capita calorie intake figures (NSSO 2007) to assess the association between the index and food availability in the state. Average daily per capita calorie intake figures ranged from 1,874 kcals in Karnataka to 2,204 kcals in Punjab (Table 4). We found no significant association between the index and the average per capita calorie intake in the state (R=0.2151; P=0.44). High index values are observed in states with high per capita calorie intakes and low index values are seen in states with low per capita calorie intakes (Figure 4). For example, the index in Madhya Pradesh (38.9) is 1.45 times higher than in Tamil Nadu (26.9), while the per capita calorie intake in Madhya Pradesh is higher than in Tamil Nadu (1,938 kcals vs 1,888 kcals, respectively).

Figure 4: Child Under-nutrition Index in Relation to Per Capita Calorie Intake by States



Under-nutrition and Poverty

Finally, we used 2004-05 poverty level figures (ibid) to assess the association between the index and poverty levels by state. The proportion of the population living below the poverty line ranged from 4.2% in Jammu and Kashmir to 39.9% in Odisha. We found a strong association between the index and the proportion of the population living below the poverty line by states (R=0.5252, P=0.0041). In general, higher index values are found in states with higher poverty levels

(Figure 5). Some states deviate from the predicted line. States such as Gujarat and Haryana have low poverty levels (12.5% and 9.9% respectively) and high index values (34.3 and 36.0 respectively), while Odisha has a lower index value (30.3), the proportion of the population living below the poverty line (39.9%) is three to four times higher than in Gujarat or Haryana.

Figure 5: Child Under-nutrition Index in Relation to Poverty Level by States

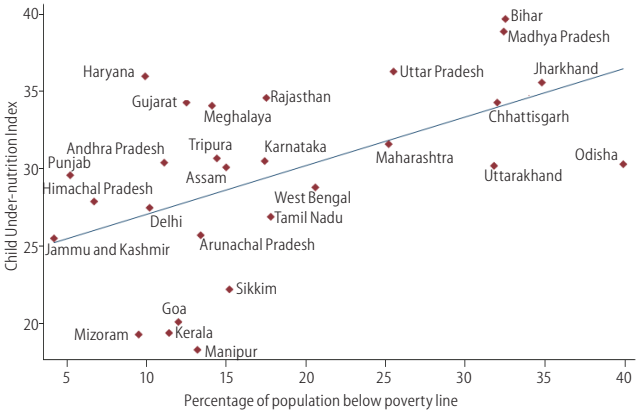


Table 5 (p 102) summarises the data used to calculate India's CNS and indicates that the score in the highest wealth quintile is almost twofold (1.8) higher than in the lowest wealth quintile (48.9 vs 27.5 respectively). Similarly, the score among children who do not belong to ST or SC families is significantly higher than among children who belong to SC or ST households (39.7 in non-SC/ST children vs 30.7 and 33.2 among ST and SC children respectively). Significantly higher score values are observed among urban children than among those living in rural areas (42.7 vs 32.0 respectively). Finally, the value of the score among boys is slightly higher than among girls (35.2 vs 33.5 respectively).

Figure 6: Child Nutrition Score by States

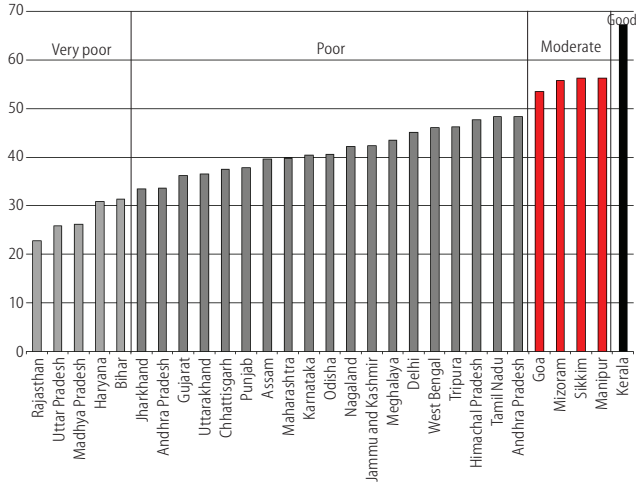
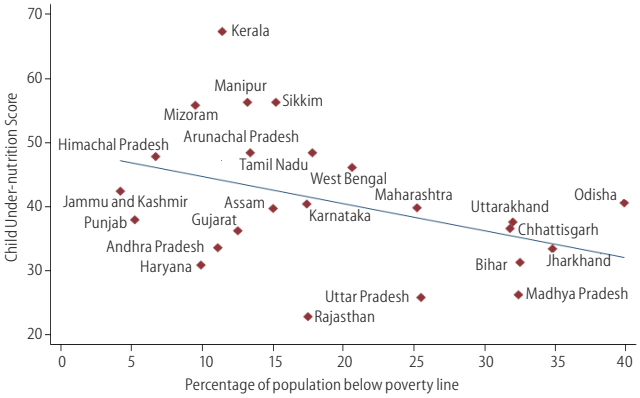


Table 6 (p 102) summarises the data used to calculate the CNS for India's states, the value of the score by state, and the interstate ranking according to the score. The score ranks range from 22.8 in Rajasthan to 67.3 in Kerala. The interstate ranking sorts the states in ascending order; the states with the lowest score (lowest coverage of essential nutrition interventions) are ranked at the top while the states with the highest score (highest coverage of essential nutrition interventions) are ranked at the bottom.

Five states – Rajasthan, Uttar Pradesh, Madhya Pradesh, Haryana and Bihar – bottom the interstate ranking, with a Score < 33.3 (very poor nutrition performance), 19 states have a Score comprised between 33.3 and 49.8 (poor nutrition performance), four states (Goa, Mizoram, Sikkim and Manipur) have a Score comprised between 50 and 66.5 (moderate nutrition performance) and only Kerala has a Score ≥ 66.6 indicating good nutrition performance (Figure 6).

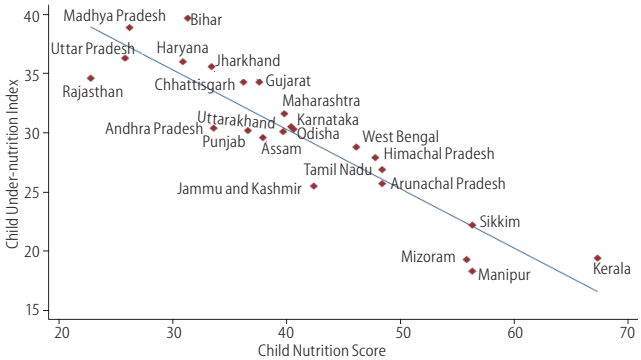
When analysing the association between the CNS and socio-economic indicators we did not find any significant association between the score and per capita NSDP (R=-0.361; P=0.0591) or real growth rate of the per capita NSDP (R=-0.2640; P=0.1747). However, we found a significant association between

Figure 7: Child Nutrition Score in Relation to Poverty Level by States



the score and the proportion of the population living below the poverty line (R=-0.4283, P=0.0230), indicating that in general, lower score values are found in states with higher poverty levels (Figure 7). We found the strongest association between the CUI and the CNS (R=-0.8994; P=0.000). Higher score values are significantly associated with lower index values indicating that states with a high CNS tend to have a low child under-nutrition index (Figure 8).

Figure 8: Child Under-nutrition Index in Relation to Child Nutrition Score by States



Discussion

The CUI builds on the work by the International Food Policy Research Institute (IFPRI) with the *Hunger Index*, a composite tool for measuring hunger and malnutrition (IFPRI 2010).

Analyses have indicated that child under-nutrition accounts for over 60% of India's Hunger Index (IFPRI 2009). Therefore, it is important to understand how India and Indian states score in fighting child under-nutrition.

The CUI presented here captures the multidimensional nature of child under-nutrition in India as it takes into account four key dimensions of child under-nutrition: low birth weight, wasting, stunting, and anaemia, reflecting more accurately which states face the greatest nutrition risk. Our analysis shows that India's CUI is the fourth highest among the 20 countries with the largest number of undernourished children worldwide. Importantly, the index indicates that levels of child under-nutrition in India are significantly higher than those in Asian and African countries with poorer

Table 5: Child Nutrition Score by Socio-economic Characteristics

	Early Initiation of Breast-feeding	Exclusive Breastfeeding in Infants < 6 M	Timely Intro-duction of Complementary Foods	Children 6-23 M Fed Minimum Number of Food Groups	Children 6-23 M Fed a Minimum Number of Times	Children Who Consumed Foods Rich in Iron	Children 6-59 M Receiving VAS	Children Living in Households with Iodised Salt (>15 ppm)	Children Receiving All Essential Vaccines	Children Whose Stools Are Disposed Safely	Child Nutrition Score
Lowest wealth quintile	17.9	52.5	53.5	26.7	40.4	10.0	14.4	31.7	24.4	3.5	27.5
Second wealth quintile	20.6	50.6	51.2	32.8	40.3	13.0	15.6	37.7	33.2	6.2	30.1
Middle wealth quintile	26.4	42.5	55.2	36.1	39.7	15.4	19.6	42.1	46.9	11.9	33.6
Fourth wealth quintile	29.0	39.6	62.0	38.7	41.4	18.0	20.5	58.3	55.3	32.1	39.5
Highest wealth quintile	32.1	35.8	66.7	47.8	47.2	19.1	22.8	82.0	71.0	64.7	48.9
Scheduled castes	23.2	50.5	56.2	32.9	41.6	14.0	18.0	42.9	39.7	13.2	33.2
Scheduled tribes	28.5	55.6	51.4	24.1	41.7	13.3	14.6	36.7	31.3	10.2	30.7
Other Backward Classes	21.9	41.7	57.2	36.2	42.0	11.3	17.0	43.2	40.7	17.4	32.9
Other	27.2	42.5	57.8	39.4	40.7	19.7	20.7	60.0	53.8	34.9	39.7
Boys	24.7	45.7	56.7	35.8	41.3	14.2	18.3	48.1	45.3	22.2	35.2
Girls	24.3	45.2	57.0	34.8	41.6	15.0	17.8	46.9	41.5	10.7	33.5
Rural	30.3	39.0	62.8	40.6	43.4	18.8	19.5	67.9	57.6	47.2	42.7
Urban	22.4	47.5	55.0	33.5	40.8	13.1	17.5	40.3	38.6	11.4	32.0
India	24.5	46.4	56.7	35.3	41.5	14.6	18.1	47.5	43.5	21.1	34.9

Table 6: Child Nutrition Score by States

	Early Initiation of Breast-feeding	Exclusive Breastfeeding in Infants < 6 M	Timely Introduction of Comple-mentary Foods	Children 6-23 M Fed Minimum Number of Food Groups	Children 6-23 M Fed a Minimum Number of Times	Children Who Consumed Foods Rich in Iron	Children 6-59 M Receiving VAS	Children Living in HH with Iodised Salt (>15 ppm)	Children Receiving All Essential Vaccines	Children Whose Stools Are Disposed Safely	Child Nutrition Score	State Ranking according to the CUI
Rajasthan	14.1	32.7	39.6	20.1	37.4	1.3	10.0	35.1	26.5	11.1	22.8	1
U Pradesh	7.3	50.0	47.0	35.4	33	6.9	6.1	32.6	23.0	16.8	25.8	2
M Pradesh	15.9	21.6	54.0	23.5	45.4	4.1	14.1	32.5	40.3	10.4	26.2	3
Haryana	22.1	15.5	44.9	28.9	32.7	2.7	11.0	50.2	65.3	35.8	30.9	4
Bihar	3.7	27.0	58.0	33.6	53.5	6.4	26.4	64.4	32.8	6.9	31.3	5
Jharkhand	10.7	56.8	68.6	27.9	43.0	11.4	19.7	51.1	34.2	10.4	33.4	6
An Pradesh	24.6	61.3	67.2	26.7	25.1	15.7	21.1	28.7	46.0	19.2	33.6	7
India	24.5	46.4	56.7	35.3	41.5	14.6	18.1	47.5	43.5	21.1	34.9	8
Gujarat	27.8	46.3	56.6	33.5	41.5	5.6	14.8	53.2	45.2	37.8	36.2	9
Uttarakhand	33.5	28.7	52.8	48.2	39.3	13.2	14.4	39.6	60.0	36.6	36.6	10
Chhattisgarh	25.0	80.2	54.0	34.1	51.9	13.5	9.1	49.5	48.7	9.9	37.6	11
Punjab	12.7	35.0	50.0	38.3	30.7	10.3	16.8	72.8	60.1	52.2	37.9	12
Assam	50.9	62.0	60.6	32.1	40.8	24	12.6	68.1	31.4	14.0	39.7	13
Maharashtra	52.0	52.3	48.2	20.5	34.1	9.3	25.1	58.4	58.8	39.7	39.8	14
Karnataka	35.7	59.4	73.1	43.7	42.9	19.8	16.1	37.8	55.0	20.6	40.4	15
Odisha	54.8	50.3	67.8	44.2	55.7	14.8	21.9	38.0	51.8	7.0	40.6	16
Nagaland	54.2	29.7	72.2	29.5	59.3	38.4	6.7	81.0	21.0	30.6	42.3	17
J and K	31.6	42.8	58.3	46.8	37.9	24.3	12.7	69.8	66.7	33.5	42.4	18
Meghalaya	57.8	25.0	77.7	35.2	42.3	40.3	14.8	76.8	32.9	31.7	43.5	19
Delhi	21.0	31.1	61.4	48.2	54.5	15.8	13.8	79.7	63.2	61.8	45.1	20
West Bengal	23.5	57.8	56.0	58.9	38.6	47.6	31.4	65.2	64.3	18.0	46.1	21
Tripura	34.6	34.6	61.7	56.3	43.3	45.6	29.1	72.5	49.7	35.5	46.3	22
H Pradesh	45.4	25.9	67.0	66.9	46.4	10.1	29.2	80.5	74.2	32.3	47.8	23
Tamil Nadu	58.8	33.7	78.6	46.2	53.1	32.8	38.5	39.0	80.9	22.1	48.4	24
Ar Pradesh	58.6	59.4	78.6	33.9	63	34.3	16.3	83.0	28.4	28.7	48.4	25
Goa	59.4	17.7	69.8	64.3	55.8	48	30.7	67.1	78.6	44.2	53.6	26
Mizoram	66.4	47.7	87.4	35.6	52.5	31.5	40.9	82.7	46.5	67.2	55.8	27
Sikkim	42.9	37.2	89.6	70.6	63.7	23.1	19.2	73.2	69.6	73.5	56.3	28
Manipur	57.8	60.2	80.2	54.6	63.4	58.8	9.3	92.4	46.8	39.8	56.3	29
Kerala	56.5	54.8	93.6	73.9	79.4	60.5	34.8	70.2	75.3	73.7	67.3	30

performing economies than India's: Bangladesh, Pakistan, Nigeria, Ethiopia, Democratic Republic of the Congo, or Nepal to mention a few. Therefore, being a richer country or having a faster growing economy does not seem to confer a nutritional advantage to India.

A similar scenario is observed when we compare the situation among Indian states. Levels of child under-nutrition as measured by the CUI are only moderately associated with the states' NSDP and show no association with the states' economic growth or food availability. The case of Gujarat is a well-fitting example of the above as the levels of child under-nutrition in this state are comparable to those in Uttar Pradesh (despite an economy growing two times faster), 27% higher than in Tamil Nadu (despite comparable food availability) and 75% higher than in Kerala (despite similar NSDP).

Our analysis clearly indicates that levels of child under-nutrition in India are strongly associated with the performance of states in delivering proven nutrition interventions for children. Almost without exception, the higher the state's CNS – measuring the overall coverage of essential nutrition interventions for children – the lower the state's CUI. What is relevant to policy is the fact that the CNS tends to be significantly lower among the most vulnerable children and population groups. CNS is lower in the states with higher proportions of people surviving below the poverty line, among children from the poorest wealth quintiles, those who belong to SC/ST families, and/or those who live in rural areas.

Conclusions

Therefore our analysis suggests that there is no "Indian enigma" of inexplicably high rates of child under-nutrition in the context of unprecedented economic growth (Chatterjee 2007). Our findings indicate that in India child under-nutrition levels are lower where the economic growth dividend has been directed to: (1) reduce poverty and the proportion of children surviving in households below a minimum standard of living; and (2) improve the coverage and equity of proven essential nutrition interventions, particularly for the most vulnerable children.

Global evidence shows that increasing economic growth alone is rarely sufficient to address child under-nutrition. Countries like Brazil have been able to combine market-oriented reforms with progressive social policies, leading to a significantly higher reduction in poverty and under-nutrition than India despite lower economic growth (Ravallion 2010). There is also global evidence and national consensus that the window of opportunity for preventing child under-nutrition spans the period from conception to two years (Black et al 2008 and 2013; Coalition for Sustainable Nutrition Security in India 2009). During this 1000-day period, children are in greatest need of adequate amounts of nutritious foods fed frequently, age-appropriate care and stimulation, preventive and curative healthcare, and safe and hygienic environments. After age two, the effects of under-nutrition are largely irreversible.

Therefore, the challenge ahead for India is to ensure that national nutrition policies and social transfers are aimed at reducing inequalities and the disproportionate impact of under-nutrition among the poorest and most vulnerable groups in society (IFPRI 2010) and that nutrition interventions are delivered through effective governance systems that privilege evidence-based and cost-effective interventions (Haddad, Acosta and Fanzo 2012). Recent evidence from Maharashtra – the only state that has measured with rigour the nutrition situation of its children since 2006 – indicates that reducing the prevalence of child under-nutrition at an all-India scale is possible. This would require adequate governance structures such as the Maharashtra Nutrition Mission, human resources, financial investments, and well-designed programmes and interventions be put in place to reach out to the most vulnerable children (young, poor, social backward) with proven interventions and essential services and support.

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