BMJ Global Health

Alarming level of severe acute malnutrition in Indian districts

Sabu Kochupurackal Ulahannan ,[1,2] Alby Wilson ,[2] Deepshikha Chhetri,[3] Biju Soman,[1] NS Prashanth [2]

To cite: Ulahannan SK, Wilson A, Chhetri D, *et al*. Alarming level of severe acute malnutrition in Indian districts. *BMJ Global Health* 2022;**7**:e007798. doi:10.1136/bmjgh-2021-007798

Handling editor Seye Abimbola

► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/bmjgh-2021-007798).

Received 21 October 2021
Accepted 20 March 2022

[1]Achutha Menon Centre for Health Science Studies, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram, Kerala, India
[2]Health Equity Cluster, Institute of Public Health, Bangalore, India
[3]Consultant, Headquarter, Department of Women and Child Development, Government of Haryana, India, Chandigarh, Haryana, India

Correspondence to
Sabu Kochupurackal Ulahannan; sabu@iphindia.org

ABSTRACT

Over the last two decades, severe acute malnutrition (SAM) has been increasing in India despite favourable national-level economic growth. The latest round of the National Family Health Survey 5 (NFHS-5) results was released, allowing us to assess changes in the malnutrition trends. Analysis of the previous rounds of the NFHS (NFHS-4) has already shown disturbing levels of wasting, often co-occurring with other forms of anthropometric failures. These have been shown to occur in clusters of districts across India that already needed urgent policy and programmatic action. A rapid assessment of data from NFHS-5 for some of these districts for which data are now available shows an alarming increase in SAM in several malnutrition hotspot districts. Surprisingly, some districts outside hotspots and in states and regions that have previously not been known for high malnutrition too have shown increasing SAM prevalence in the latest round. The data from NFHS-5 was collected just before the COVID-19 pandemic and hence does not yet reflect the likely impact of the pandemic on food security, livelihoods and other social stressors among the most marginalised Indian households. Based on this emerging pattern of increasing SAM, we call for an urgent policy and programmatic action to strengthen the Anganwadi system, which caters to preschool children in India and community-based management of acute malnutrition based on recent evidence on their effectiveness.

Summary box

- ⇒ Children with severe acute malnutrition (SAM) have an elevated risk of mortality and morbidity.
- ⇒ In this analysis paper, we compared the district level trend in the prevalence of SAM between the National Family Health Survey 4 (NFHS 4) (2015–2016) and NFHS 5 (2019–2021).
- ⇒ Manifold increase in SAM prevalence in several Indian districts is a public health emergency that requires urgent policy response.
- ⇒ Worsening of SAM in districts which were already identified as undernutrition hotspots in India requires prioritised policy action.
- ⇒ We call for an urgent policy and programmatic action to strengthen the Anganwadi system, which caters to preschool children in India and community-based management of acute malnutrition based on recent evidence on their effectiveness.

INTRODUCTION

The prevalence of severe acute malnutrition (SAM) among preschool children has been on a steady rise in India over the last two decades. It has increased from 6.6% in 2005–2006 as per the National Family Health Survey-3 (NFHS-3)[1] to 7.5% in NFHS-4 in 2015–2016.[2] As per the most recent NFHS-5 survey (2019–2021)[3] covering 36 states and union territories (UTs), the prevalence continues to be an alarming 7.7%. SAM is defined as weight-for-height below −3 z-scores of the median WHO growth standards known as severe wasting.[4] Children with SAM are at 9–11 times higher risk of mortality and morbidity than well-nourished children.[5 6] Case fatality rate among SAM children receiving inpatient treatment based on WHO protocol[7] ranged from 3.4% to 35%.[6] An estimate based on the NFHS-4 survey suggests that approximately 10 billion children in India suffer from SAM.[8] Meaning that the case fatality rate of 3.4%–35% would translate into 340 000 to 3.5 million deaths among under-five children in India. This is an unprecedented public health emergency requiring urgent policy attention. Although the prevalence trend in SAM between NFHS-4 and NFHS-5 shows an almost stagnant position at the national level, the national average hides the worsening of SAM at several individual districts due to the improvement in other districts. Hence, identifying districts or region with a higher burden of SAM and providing focused priority to such districts/region is a critical aspect of equitable public policy intervention. Moreover, district is an important subunit for action in India's flagship nutritional initiative of *POSHAN Abhiyaan*, and district level planning and monitoring is a critical aspect in its execution. Indian districts are relatively large with population ranging from 1 million to few million people. Hence, in this article, we analyse the district level trend in

SAM prevalence between NFHS-4 and NFHS-5 surveys to prioritise the districts/region for immediate public policy intervention.

District level prevalence data of severe wasting was extracted from NFHS-4 (2015–2016) and NFHS-5 (2019–2021). The data collection for NFHS-5 was conducted in two phases. The first phase was conducted between June 2019 and February 2020, and the second phase was between January 2020 and April 2021. Though data collection in the second phase was started in January 2020, it was suspended on 21 March 2020 due to the nationwide lockdown on account of the COVID-19 pandemic. The survey was resumed in November 2020 and completed in April 2021. In the NFHS-4 survey, data were collected from 640 districts. However, by the time the NFHS-5 was conducted the number of districts increased by 67 districts (n=707) for which data were not available in NFHS-4. The 67 newly added districts in NFHS-5 were formed bifurcating the geographical regions from one or more districts included in the NHFS-4 survey. Of the 67 new districts, 15 districts have been formed, adding geographical units from two or more parent districts. Of the remaining 52 new districts, each district was formed from one parent district each. In order to make the comparison of the district level SAM prevalence between two surveys for newly formed districts, we followed the method adopted by Subramaniam *et al* in the NFHS policy tracker for Indian districts.[9] In the case of the 52 new districts formed from singly parent districts, the prevalence value of the parent district was assigned to its corresponding new district. In cases where a new district was formed adding geographical areas from two or more parent districts, the mean prevalence value of the respective parent districts was calculated, and the calculated mean prevalence was assigned to the newly formed district. Further to this, the differences in SAM prevalence between the two data sets was calculated. SAM prevalence in NFHS-4 and NFHS-5 surveys was categorised as low, medium, high, very high and critical prevalence based on district-level mean prevalence and SD. Additionally, we examined the prevalence trend in SAM in the 111 undernutrition hotspot districts identified using the Composite Index of Anthropometric Failures (CIAF) based on the NFHS-4 data.[10] Finally, the district level data set for SAM prevalence from NHFS-4 and NFHS-5 survey was linked with India spatial database with district boundaries in Quantum Geographic Information Systen (QGIS) open source software. Using this data set, we constructed choropleth maps to visualise the district level variations in SAM in NFHS-4 (figure 1A), in NFHS-5 (figure 1B) and the changes in SAM between NFHS-4 and NFHS-5 (figure 1C), and to highlight the districts in the undernutrition hotspots that have reported further worsening of SAM (see figure 2A,B).

INCREASING SAM TREND IN SOME HIGH-PREVALENCE DISTRICTS

Among the 707 districts from 36 states and UTs, 341 districts reported at least some increase, and 9 districts reported no changes in SAM prevalence between the two surveys. The mean district-level prevalence of SAM reported in NHFS-5 was 7.56% (SD=3.97). Districts with one SD higher from mean prevalence was categorised as high prevalence districts (11.5%–15.5%), two SD higher from mean prevalence was categorised as very high prevalence districts (15.5%–19.5%) and three SD higher from mean prevalence was categorised as critical districts (>19%) that need urgent policy attention on an urgent priority (table 1). We identified a total of 112 districts as critical (n=7), very serious (n=19) and serious (n=86) districts which require priority policy attention. The critical districts include Dang (22.2%) and Panchmahal (19.7%) from Gujarat, and Chandrapur (21.8%), Nagpur (20%) from Maharashtra, Karimganj (30.5%) in Assam, Sheohar (21.4%) in Bihar and Saraikela (23%) Kharsawan in Jharkhand (see online supplemental

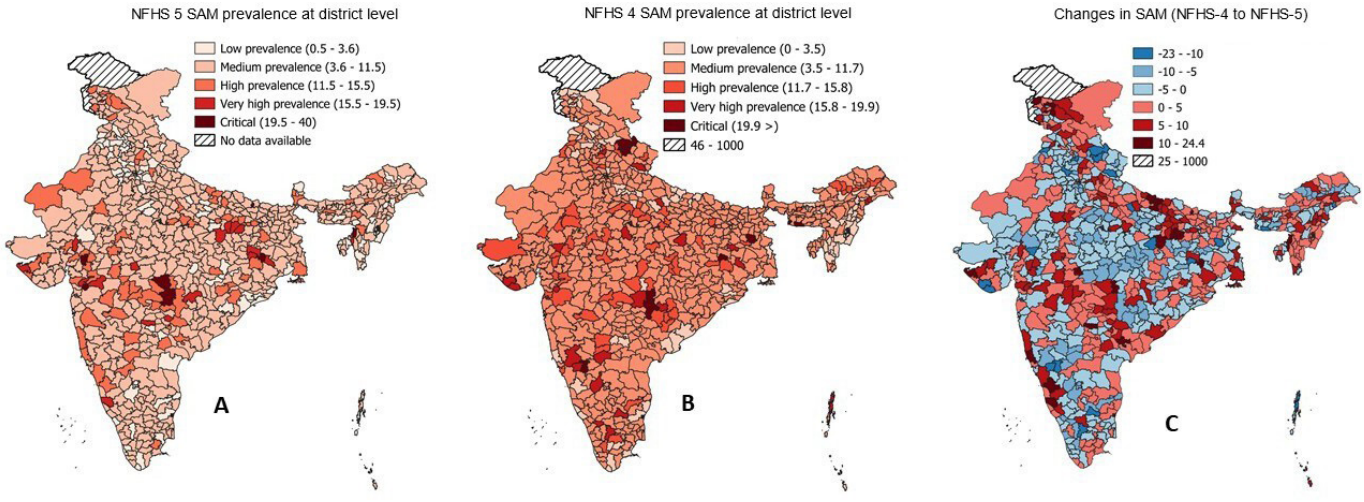

Figure 1 (A) Prevalence of SAM based on NFHS-4, (B) prevalence of SAM based on NFHS-5, (C) changes in SAM between NFHS-4 and NFHS-5. NFHS, National Family Health Survey; SAM, severe acute malnutrition.

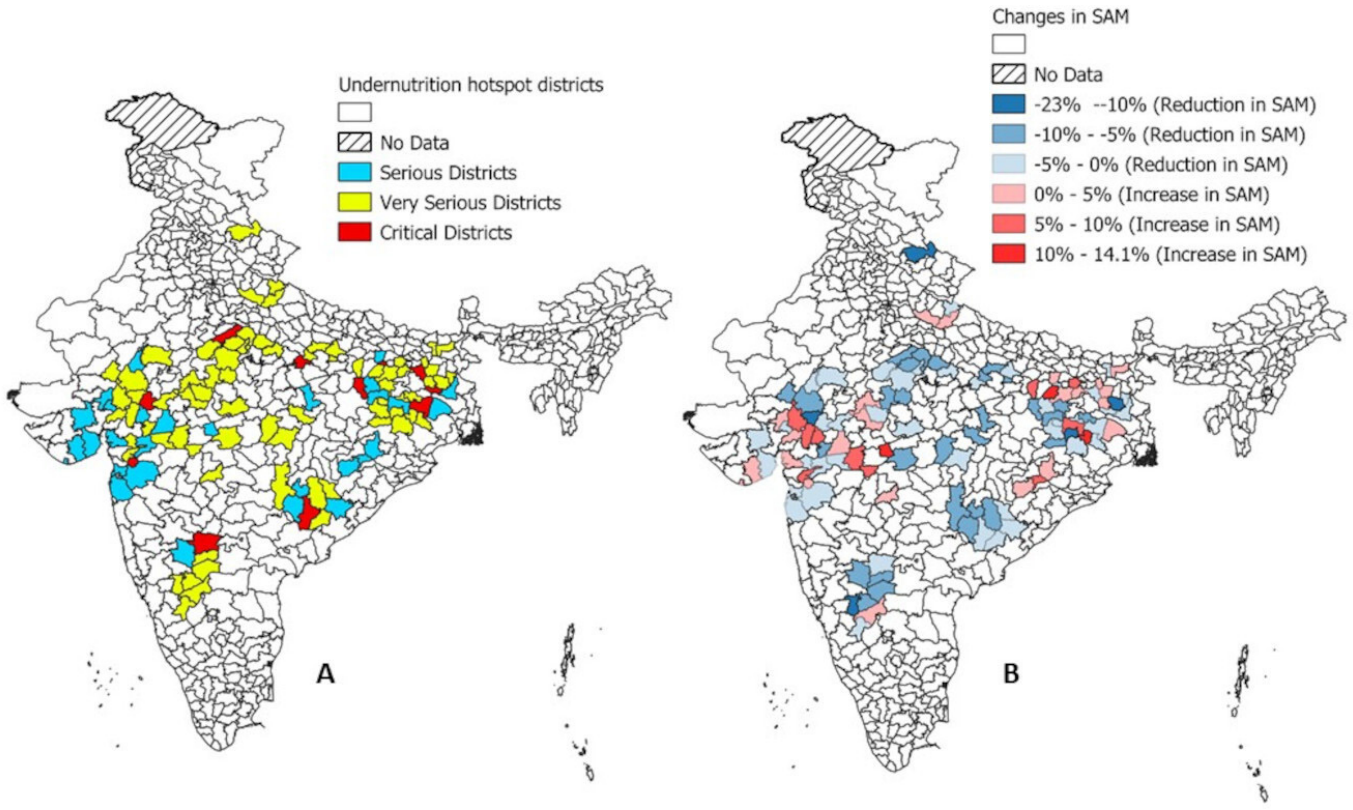

Figure 2 (A) District level undernutrition hotspot based on the high prevalence of simultaneous two and three anthropometric failures (NFHS-4) (source:[10]). (B) Changes in SAM prevalence in undernutrition hotspots (NFHS-5). NFHS, National Family Health Survey; SAM, severe acute malnutrition.

table A). Nineteen districts were in a very high prevalence category. These districts include Kaimur (15.9%), Aurangabad (18.5%), Rohtas (11.3%) in Bihar; Tapi (9.6%–17.1%), Sabarkantha (7%–16.6%) and Devbhumi Dwarka (17.2%) in Gujarat; Ranchi (16.8%), Purbi Singhbhum (16.8%) and Khunti (16.8%) from Jharkhand; Kamareddy (17.9%) and Peddapalli (15.6%) from Telangana. The remaining eight districts in this category are Uttar Bastar Kanker (15.7%) in Chhattisgarh, Shopian (17.4%) in Jammu and Kashmir, Dakshin Kannada (15.7%) in Karnataka, Harda (18.8%) in Madhya Pradesh, Dhule (18.1%) in Maharashtra, North Tripura (18.1%), Sonbhadra (17.4%) in Uttar Pradesh and Kolkata (16.9%) in West Bengal (see online supplemental table B). Among the 86 districts in the serious category, there were 13 districts each from the state of Maharashtra and Uttar Pradesh; 9 districts from Gujarat; 6 districts each from Telangana, Jammu and Kashmir and Karnataka; 5 districts each from Bihar, Assam and Rajasthan; 4 districts from Odisha; 3 districts from Madhya Pradesh; 2 districts each from Jharkhand, West Bengal and Arunachal Pradesh; and 1 district each from Chhattisgarh, Nagaland, Sikkim, Delhi and Tamil Nadu (see online supplemental table C). Overall, the highest number of districts that need urgent policy attention are from the state of Maharashtra (16 districts), Gujarat and Uttar Pradesh (14 districts each) and Bihar (9 districts).

Table 1 Descriptive statistics of severe acute malnutrition for 707 Indian districts

	NFHS-5 (2019–2021)	NFHS-4 (2015–2016)
District level mean prevalence	7.56	7.6
SD	3.97	4.1
Minimum	1	0
Maximum	30.5	27
Low prevalence	<3.6	<3.5
Medium prevalence	3.6–11. 5	3.5–11.7
High prevalence	11.5–15.5	11.7–15.8
Very high prevalence	15.5 –19.5	15.8–19.9
Critical	19.5>	19.9>

NFHS, National Family Health Survey; SD, Standard Deviation.

Among the 341 districts that recorded an increasing trend in SAM between NFHS-4 and NFHS-5, 115 districts recorded a manifold increase of SAM. However, despite a rapid increase in SAM in 65 districts, given a low prevalence recorded in NFHS-4, the alarming nature of the increase was masked by the fact that they still appear in medium prevalence category. Whereas 50 districts moved from the medium or low prevalence category in NFHS-4 to serious or very serious or critical category in NHFS-5. Among

these districts highest increase between NFHS-4 and NFHS-5 survey was recorded in the district of Karimganj in Assam (6.1%– 30.5%); Sheohar in Bihar (4.3%–21.4%); Saraikela Kharsawan in Jharkhand (8.9%–23%); North Tripura district in Tripura (4.3%–18.1%); Kupwara (1%– 14.7%) and Shopian (3.8%–17.4%) in Jammu and Kashmir. Additionally, 17 districts recorded more than 10% of the increase in SAM between NFHS-4 and NFHS-5. These districts are from Uttar Pradesh (n=4), two districts each from Bihar, Jammu and Kashmir, Karnataka, Maharashtra and Telangana, and one district each from Gujarat, Madhya Pradesh and West Bengal. In contrast, 21 districts reported more than a 10% reduction in SAM during the same period. Among these districts largest reduction was reported in Gadag (27.5%–4.5) in Karnataka; Tehri Garhwal (28.1%–5.2%) and Uttarkashi (23.6%–5.4%) in Uttarakhand; Southwest Garo Hills (23.7%–7.1%) in Meghalaya and Lucknow (17.9%–1.4%) in Uttar Pradesh. The remaining 16 districts, there were 2 districts each from the state of Gujarat, Hariyana, Jharkhand and Tamil Nadu; and 1 district each from the state of Arunachal Pradesh, Madhya Pradesh, Meghalaya, Punjab, Rajasthan, Uttar Pradesh and Uttarakhand and from the UT of Andaman and Nicobar Islands (see figure 1C).

In this section we outlined the changes in SAM prevalence in districts identified as hotspots for malnutrition based on a comprehensive analysis using the CIAF by Kochupurackal *et al*.[10] Kochupurackal *et al* identified 111 districts clustered in four malnutrition hotspots in India that requires urgent policy intervention. Out of 111 districts across these hotspots, 11 were critical, 72 were very serious and 28 were serious (see figure 1A). These hotspots have been shown to have co-occurring anthropometric failures using the CIAF. Children with simultaneous three or two nutritional failures have an elevated risk of mortality and morbidity compared with single nutritional failures.[11] In terms of prioritising districts, those with a high proportion of children with simultaneous two/three anthropometric failures ought to be prioritised.

The district level data for NFHS-5 shows that, 35 districts out of 111 undernutrition hotspot districts reported further worsening of SAM. Among these districts, nine each from Gujarat (Dangs, Panchmahal, Tapi, Sabarkantha, Dohad, Kheda, Amreli, Baruch and Mahesana), and Bihar (Aurangabad, Kaimur, Bhojpur, Nalanda, Banka, Gaya, Munger, Nawada and Purnia), five from Madhya Pradesh (Harda, Burhanpur, West Nimar, Shajapur and Dhar); three each from Jharkhand (Saraikela Kharsawan, Ranchi and Deoghar) and Odisha (Subarnapur, Balangir and Sambalpur); two districts from Uttar Pradesh (Shahjahanpur and Budaun). The remaining four districts are from Karnataka (Bellary), Maharashtra (Washim), Rajasthan (Jhalawar) and West Bengal (Bankura). Bellary district in Karnataka is the only district from south India to appear in this category. Both SAM and multidimensional nutritional failures are known to have the highest risk of child mortality and morbidity unless adequately treated. The possible coexistence of these two conditions in these districts indicates an alarming situation.

SYSTEMIC AND PROGRAMMATIC GAPS IN SAM DETECTION AND TREATMENT

Aggregate and actionable programmatic data from the current nutritional programme to identify children suffering from SAM and providing treatment is a major lacuna in the current nutritional programme in India. Integrated Child Development Services—Common Application Software (ICDS-CAS) was created to digitise the records and create a real-time monitoring system for the beneficiaries under the National Nutrition Mission (*POSHAN Abhiyaan*). However, until 2019, out of the 1 027 058 *Anganwadi* centres (AWCs) (preschool childcare and nutritional centres across India), only 611 369 Anganwadi workers (AWW) were equipped with ICDS-CAS.[12] Based on the data collected through ICDS-CAS by AWWs, only 7.07% of children in India recorded wasting, which is a much lower prevalence of wasting compared with NFHS-5 fact sheets, indicating under-reporting in programmatic data. Studies conducted in several parts of the country reported such under-reporting of SAM due to inadequate capacity-building of AWWs and the supply of growth monitoring devices. Adding to this, administrative pressure from higher authorities forces AWWs to under-report the prevalence of SAM, fearing retribution due to reputational harm to the district rather than support for dealing with SAM children.[13–15] Based on the NFHS-4 (2015–2016), children from Scheduled Tribal communities or the poorest wealth quintiles with a higher risk of SAM are less likely to access Anganwadi services.[16–19] Hence, these groups may go unnoticed if they are in SAM. Therefore, in addition to the geographical clustering of SAM, an unfair clustering of SAM prevalence occurs among the socially marginalised communities. An estimated 800 000 children with SAM needed treatment in Nutrition Rehabilitation Centres (NRCs). However, the recent data suggests that only 20% of children could be covered, possibly due to poor functioning of facility-based NRCs and high drop-out rate.[12 20–23]

URGENT POLICY AND PROGRAMME ACTION

With the current increase in the prevalence of SAM, urgent policy action for effective identification and treatment of children suffering from SAM is crucial to prevent child mortality and foster nutritional equity. The systemic gap in identifying SAM children calls for more comprehensive policy action to strengthen community-level screening. AWCs are the prominent institutions at the village level to identify the SAM; improving the efficiency of AWCs can be a critical step in identifying the current gap. Capacity building of AWWs, a crucial component of *POSHAN Abhiyaan*, needs to include a specific focus

on the appropriate use of growth monitoring devices. Continued training and supervision on the proper use of growth monitoring devices among the AWWs have been shown to identify SAM.[14 15 24] However, beyond the individual capacity of AWWs, studies have shown multiple levels of factors beyond their individual capacity that hampered the Anganwadi programme's effectiveness, especially in poor-performing states. These include inadequate financing and infrastructure, prejudicial caste-based social relationships, seasonal labour migration, governance failures, inadequate/delayed salaries, punitive supervision and high workload.[18 19 25] Hence, it is imperative to strengthen the AWC through capacity-building programmes for AWWs to accurate anthropometric measurement, provide supportive supervision with sufficient logistic support and increase financial incentives corresponding to their work burden.

Given the current burden of children with SAM and the available NRCs in India, operationally, it is not feasible to treat all the SAM children in NRCs. Considering the relatively lower mortality and morbidity rate among the SAM children in India compared with African countries, mainstreaming of community-based management of acute malnutrition (CMAM) for the management of uncomplicated SAM has been suggested.[26 27] CMAM requires additional provisioning in the existing subcentres and primary healthcare centres to provide facility-based treatment to children with medically complicated SAM at the community, and children with uncomplicated SAM to be monitored every week and treated using ready to use therapeutic food and other nutrient-dense food at home.[28] Several models of CMAM interventions in Bihar, Madhya Pradesh, Odisha, Chhattisgarh and Rajasthan reported having increased the timely treatment coverage in a more cost-effective way.[29] A systematic review conducted on the effectiveness of CMAM concluded that CMAM for uncomplicated SAM is as effective as WHO recommended standard treatment using F-100.[26] Finally, a more lasting solution to SAM requires addressing socioeconomic and gender inequality that limits the parental and household capacity to provide a nurturing environment and caring for children belonging to poor and marginalised children in India.[8]

COVID-19 CRISIS AND WORSENING MALNUTRITION

The data represented in NFHS-5 is primarily collected before the COVID-19 pandemic. Hence, the nutritional trend in the majority of the districts revealed in NFHS-5 is the status before the COVID-19 pandemic lockdown was declared on 11 March 2020.[30] It is likely that the COVID-19 pandemic and the measures to control it have further amplified the existing nutritional crisis. The unemployment rate in India was the highest in 2019 over the past 45 years,[31] which could have worsened during the COVID-19 lockdown.[32] The migrant labourers in the unorganised sectors, street vendors, daily wage labourers and farmers already in a precarious situation were hard hit by the COVID-19 lockdown.[33 34] This worsening economic crisis among the poor can cause reduced food expenditure and household food insecurity, further compromising India's already worsening nutritional crisis. Adding to this was the disruption in the food and nutritional services in the country. Systemic gaps in addressing malnutrition that were already present even before the COVID-19 pandemic was further amplified during this period. The school mid-day meal programme in India is a protection against household food insecurity among poor households.[35] The current disruption in Integrated Child Development Scheme (ICDS) and the school mid-day meal programme adds to household food insecurity.[36] They can further worsen the child nutritional crisis in India. Amid all the indications showing worsening child undernutrition, there was a report on a steep decline in the number of children referred to NRC following the COVID-19 lockdown on 25 March 2020, which too is probably not due to nutritional improvements but due to lockdown adversities.[37]

Twitter Sabu Kochupurackal Ulahannan @SabujosephK and NS Prashanth @prashanthns

Acknowledgements We thank James Devasia and Debajyoti Bhattacharya for their help with preparing the shape file of India containing 707 districts.

Contributors SKU was involved in conceptualisation, data curation, methodology, formal analysis, visualisation, preparation of original draft and finalised the manuscript of the study. AW was involved in data curation, methodology, formal analysis, visualisation, preparation of original draft, reviewing, and editing. DC was involved in conceptualisation, preparation of the original draft, formal analysis, reviewing, editing and validating data. BS was involved in conceptualisation, methodology, visualisation, reviewing, editing and supervision. NSP was involved in conceptualisation, methodology, visualisation of data, reviewing, editing and overall supervision in review and writing.

Funding This work was supported by the DBT/Wellcome Trust India Alliance Fellowship to PNS [IA/CPHI/16/1/502648]. This award also supports SKU and AW. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository.

Author note Disclosure: Deepshikha Chhetri declares that her participation in this paper does not constitute a representation of the views of the Dept of Women and Child Development, Govt of Haryana.

ORCID iDs
Sabu Kochupurackal Ulahannan http://orcid.org/0000-0002-7649-4401
Alby Wilson http://orcid.org/0000-0001-5624-2365
NS Prashanth http://orcid.org/0000-0003-0968-0826

REFERENCES

1 NFHS-3. *National family health survey*. Government of India: Ministry of Health and Family Welfare, 2005.
2 NFHS-4. *National family health survey*. Government of India: Ministry of Health and Family Welfare, 2015.
3 NFHS-5. *National family health survey*. Government of India: Ministry of Health and Family Welfare, 2020.
4 WHO. *WHO child growth standards and the identification of severe acute malnutrition in infants and children: joint statement by the World Health Organization and the United Nations Children's Fund*. WHO, 2009.
5 Black RE, Victora CG, Walker SP, *et al*. Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet* 2013;382:427–51.
6 Lenters LM, Wazny K, Webb P, *et al*. Treatment of severe and moderate acute malnutrition in low- and middle-income settings: a systematic review, meta-analysis and Delphi process. *BMC Public Health* 2013;13:1–15.
7 WHO. Guideline update: technical aspects of the management of severe acute malnutrition in infants and children. Geneva, 2013. Available: https://scholar.google.com/scholar_lookup?title=Guideline%20update%3A%20Technical%20aspects%20of%20the%20management%20of%20severe%20acute%20malnutrition%20in%20infants%20and%20children&publication_year=2013 [Accessed 9 Feb 2022].
8 Mohan P, Mohan SB. Management of children with severe acute malnutrition in India: we know enough to act, and we should act now. *Indian Pediatr* 2017;54:813–4.
9 Subramaniam SV, Kumar A, Tripathi N. *Geographic insights lab. NFHS policy Tracker for districts*. Cambridge, USA: Harvard Center for Population and Development Studies and Center for Geographic Analysis at Harvard, 2021.
10 Kochupurackal SU, Channa Basappa Y, Vazhamplackal SJ, *et al*. An intersectional analysis of the composite index of anthropometric failures in India. *Int J Equity Health* 2021;20:1–11.
11 McDonald CM, Olofin I, Flaxman S, *et al*. The effect of multiple anthropometric deficits on child mortality: meta-analysis of individual data in 10 prospective studies from developing countries. *Am J Clin Nutr* 2013;97:896–901.
12 Aayog N. *Accelerating progress on nutrition in India: what will it take?* Third Progress Report, 2020.
13 Prasad V. Misconceived measures for malnutrition. *Econ Polit Wkly* 2021;56:7–8.
14 Prabha C, Srivastava RK, Gupta MK. Skill up; gradation of anganwadi workers pertaining to growth chart plotting and interpretation in rural areas of Varanasi district, India. *Int J Res Med Sci* 2019;7:4635.
15 Meshram K, Mourya A, Hinge M, *et al*. Effectiveness of planned teaching on knowledge and practice regarding growth monitoring of Under-Five children among Anganwadi workers in the rural area of Wardha district. *Int J Curr Res Rev* 2020;12:20–4.
16 Nakkeeran N, Jadhav S, Bhattacharya A. Recasting food: an ethnographic study on how caste and resource inequality perpetuate social disadvantage in India. *CASTE Glob J Soc Exclusion* 2020;1:1–16.
17 Monya M. Integrated child development services (ICDs) scheme in India-a Tired horse or an ignored one. An evaluation in a tribal district of Maharashtra, India. *Arch Community Med Public Health* 2021;7:092–8.
18 John A, Nisbett N, Barnett I, *et al*. Factors influencing the performance of community health workers: a qualitative study of Anganwadi workers from Bihar, India. *PLoS One* 2020;15:e0242460.
19 Diwakar G. D. Addressing utilization of the ICDs programme in Tamil Nadu, India: how class and caste matters. *Int J Sociol Soc Policy* 2014;34:166–80.
20 Taneja G, Dixit S, Khatri A, *et al*. A study to evaluate the effect of nutritional intervention measures on admitted children in selected nutrition rehabilitation centers of indore and ujjain divisions of the state of Madhya Pradesh (India). *Indian J Community Med* 2012;37:107.
21 Hunger SNC. Under-Nutrition and Food Security in India. In: Mehta AK, Bhide S, Kumar A, *et al*, eds. *Poverty, chronic poverty and poverty dynamics: policy imperatives*. Singapore: Springer, 2018: 55–92.
22 Masoodi A. The failing health of Delhi's nutritional rehabilitation centres. mint, 2014. Available: https://www.livemint.com/Politics/L8y3IPyL26Q7PDzkKeaOLM/The-failing-health-of-Delhis-nutritional-rehabilitation-cen.html
23 Dasgupta R, Ahuja S, Yumnam V. Can nutrition rehabilitation centers address severe malnutrition in India? *Indian Pediatr* 2014;51:95–9.
24 Verghese Anjilivelil T. *Identification of severe acute malnutrition among Anganwadi children in the Vellore urban ICDs project area*, 2013.
25 Verma R, Gupta S, Birner R. Can vigilance-focused governance reforms improve service delivery? the case of integrated child development services (ICDs) in Bihar, India. *Dev Policy Rev* 2018;36:O786–802.
26 Gera T. Efficacy and safety of therapeutic nutrition products for home based therapeutic nutrition for severe acute malnutrition a systematic review. *Indian Pediatr* 2010;47:709–18.
27 Prasad V. Foregrounding 'Community' in Community Management of Severe Acute Malnutrition. *World Nutr* 2017;8:79–86.
28 Burza S, Mahajan R, Marino E, *et al*. Community-Based management of severe acute malnutrition in India: new evidence from Bihar. *Am J Clin Nutr* 2015;101:847–59.
29 Mathur M, Halim A, Gupta M, *et al*. Community-Based management of acute malnutrition (CMAM) in India: a position paper. *Int J Res Med Sci* 2018;6:4128.
30 World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19 2020, 2020. Available: https://www.who.int/dg/speeches/ detail/who-director-general-s-opening-remarks-atthe-media-briefing-on-covid-19-11-may-2020
31 World Bank. Unemployment, total (% of total labor force) (modeled ILO estimate) - India | Data, 2020. Available: https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS?locations=IN [Accessed 19 Oct 2021].
32 Mishra K, Rampal J. The COVID-19 pandemic and food insecurity: a viewpoint on India. *World Dev* 2020;135:105068.
33 Jaacks LM, Veluguri D, Serupally R, *et al*. Impact of the COVID-19 pandemic on agricultural production, livelihoods, and food security in India: baseline results of a phone survey. *Food Secur* 2021:1323–39.
34 Khanna A. Impact of migration of labour force due to global COVID-19 pandemic with reference to India. *J Health Manag* 2020;22:181–91.
35 Reardon T, Mishra A, Nuthalapati CS. COVID-19's disruption of India's transformed food supply chains. *Econ Polit Wkly* 2020;55:18–22.
36 Alvi M, Gupta M. Learning in times of lockdown: how Covid-19 is affecting education and food security in India. *Food Secur* 2020;12:793–6.
37 Chandra J. Coronavirus lockdown | care for malnourished children hit. The Hindu, 2020. Available: https://www.thehindu.com/news/national/coronavirus-lockdown-care-for-malnourished-children-hit/article32497817.ece [Accessed 19 Oct 2021].