

## EDITOR'S NOTE

In this 45<sup>th</sup> issue of the POSHAN Abstract Digest, we bring you a collection of articles on child, adolescent, and maternal malnutrition. It features studies on micronutrient deficiencies and on anemia among adolescents, inequities in undernutrition among children, and inequities in overweight and obesity among women. It also features an evaluation study of self-group-based behavior change intervention in rural India and its impacts on multiple maternal and child outcomes, and a comprehensive review of smartphone applications delivering child nutrition information.

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Enjoy reading!

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## PEER-REVIEWED

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### Prevalence of Specific Micronutrient Deficiencies in Urban School Going Children and Adolescence of India: A Multicenter Cross-Sectional Study

Awasthi, S., Kumar, D., Mahdi, A.A., Agarwal, G.G., Pandey, A.K., Parveen, H., Singh, S., Awasthi, R., Pande, H., S, A.T., Mahanta, B.N., Singh, C.M., Mathew, J.L., Ahmad, M.K., Singh, K., Bhat, M.A., R, S.A., Kar, S., and S. Nair. 2022. "Prevalence of Specific Micronutrient Deficiencies in Urban School Going Children and Adolescence of India: A Multicenter Cross-Sectional Study." *PLoS ONE* 17(5): e0267003. doi: <https://doi.org/10.1371/journal.pone.0267003>

**Introduction:** Childhood and adolescence require adequate amount of micronutrients for normal growth and development. The primary objective of study was to assess the prevalence of deficiencies of Vitamins (Vitamin A, 25 Hydroxy Vitamin D, Vitamin B12 and Folate) and minerals (Calcium, Zinc, Selenium and Iron), among urban school going children aged 6–11 and 12–16 years in ten cities of India. Secondary objective was to find the association between micronutrient deficiencies with sociodemographic and anthropometric indicators. **Methods:** A multi-center cross-sectional study was conducted across India. Participants in the age groups of 6 to 11 years (group 1) and 12 to 16 years (group 2) were selected from randomly chosen schools from each center. Data on socio economic status, anthropometric measures was collected. Blood samples were collected for biochemical analysis of micronutrients. Point estimates and 95% confidence intervals was used to assess the prevalence of deficiencies. Associations were observed using chi square, student t test and ANOVA test. **Results:** From April 2019 to February 2020, 2428 participants (1235 in group 1 and 1193 group 2) were recruited from 60 schools across ten cities. The prevalence of calcium and iron deficiency was 59.9% and 49.4% respectively. 25 Hydroxy Vitamin D deficiency was seen in 39.7% and vitamin B12 in 33.4% of subjects. Folate, Selenium and Zinc were deficient in 22.2%, 10.4% and 6.8% of subjects respectively. Vitamin A deficiency least (1.6%). Anemia was prevalent in 17.6% subjects and was more common among females. **Conclusion:** One or more micronutrient deficiencies are found in almost one half of school going children in urban area. Hence efforts must be made to combat these on priority.

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### Anaemia in Indians Aged 10–19 Years: Prevalence, Burden and Associated Factors at National and Regional Levels

Scott, S., Lahiri, A., Sethi, V., de Wagt, A., Menon, P., Yadav, K., Varghese, M., Joe, W., Vir, S.C., and P.H. Nguyen. 2022. "Anaemia in Indians Aged 10–19 Years: Prevalence, Burden and Associated Factors at National and Regional Levels." *Maternal & Child Nutrition* 20: e13391. doi: <https://doi.org/10.1111/mcn.13391>

Anaemia control programmes in India are hampered by a lack of representative evidence on anaemia prevalence, burden and associated factors for adolescents. The aim of this study was to: (1) describe the national and subnational prevalence, severity and burden of anaemia among Indian adolescents; (2) examine factors associated with anaemia at national and regional levels. Data (n = 14,673 individuals aged 10-19 years) were from India's Comprehensive National Nutrition Survey (CNNS, 2016-2018). CNNS used a multistage, stratified, probability proportion to size cluster sampling design. Prevalence was estimated using globally comparable age- and sex-specific cutoffs, using survey weights for biomarker sample collection. Burden analysis used prevalence estimates and projected population from 2011 Census data. Multivariable logistic regression models were used to analyse factors (diet, micronutrient deficiencies, haemoglobinopathies, sociodemographic factors, environment) associated with anaemia. Anaemia was present in 40% of girls and 18% of boys, equivalent to 72 million adolescents in 2018, and varied by region (girls 29%-46%; boys 11%-28%)

and state (girls 7%-62%; boys 4%-32%). Iron deficiency (ferritin < 15 µg/L) was the strongest predictor of anaemia (odds ratio [OR]: 4.68, 95% confidence interval [CI]: [3.21,6.83]), followed by haemoglobinopathies (HbA2 > 3.5% or any HbS) (OR: 2.81, 95% CI: [1.66,4.74]), vitamin A deficiency (serum retinol <20 ng/ml) (OR: 1.86, 95% CI: [1.23,2.80]) and zinc deficiency (serum zinc < 70 µg/L) (OR: 1.32, 95% CI: [1.02,1.72]). Regional models show heterogeneity in the strength of association between factors and anaemia by region. Adolescent anaemia control programmes in India should continue to address iron deficiency, strengthen strategies to identify haemoglobinopathies and other micronutrient deficiencies, and further explore geographic variation in associated factors.

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### Improving Nutrition Budgeting in Health Sector Plans: Evidence From India's Anaemia Control Strategy

Saini, A., Shukla, R., Joe, W. and A. Kapur. 2022. "Improving Nutrition Budgeting in Health Sector Plans: Evidence From India's Anaemia Control Strategy." *Maternal & Child Nutrition* 18(2):e13253. doi: <https://doi.org/10.1111/mcn.13253>

In India, 15 nutrition interventions are delivered and financed through the National Health Mission (NHM). Programmatic know-how, however, on tracking nutrition budgets in health sector plans is limited. Following the four phases of the budget cycle-planning, allocations, disbursements and expenditure, this paper presents a new method developed by the authors to track nutrition budgets within health sector plans. Using the example of the Anemia Mukt Bharat (AMB) or Anemia Free India strategy, it reports preliminary findings on the application of the first two phases of the method, that is, to track and act for improved planning and allocations, covering 12 states. The paper lists out the budget heads, cost norms and developed tools to plan adequately. Supportive action was undertaken through sharing trends and trainings for AMB's budgeting to create opportunities for improvements. It was observed that the AMB budget increased over 3 years despite the COVID situation. It increased from INR 6184 million in FY 2019-2020 to INR 6293 million, a 2% increase in FY 2020-2021, and to INR 7433 million, an 18% increase in FY 2021-2022. The difference in allocations and planned budgets were low (16%, 4% and 11%, respectively) while the difference in required budgets and planned budgets were significant but reduced consistently (41%, 31% and 22%, respectively). The paper concludes that the methods adopted for tracking and acting for improved nutrition budgets helped in informing national and state governments regarding yearly trends. Such methods can be effective and be developed for other nutrition interventions.

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### Predictive Algorithm To Stratify Newborns At-Risk for Child Undernutrition in India: Secondary Analysis of the National Family Health Survey-4

Soni, A., Fahey, N., Ash, A., Bhutta, Z., Li, W., Simas, T.M., Nimbalkar, S., and J. Allison. 2022. "Predictive Algorithm To Stratify Newborns At-Risk for Child Undernutrition in India: Secondary Analysis of the National Family Health Survey-4." *Journal of Global Health* 12: 04040. doi: <https://doi.org/10.7189/jogh.12.04040>

**Background:** India is at the epicentre of global child undernutrition. Strategies to identify at-risk populations are needed in the context of limited resources. **Methods:** Data from children under the age of five surveyed in the 2015-2016 National Family Health Survey were used. Child undernutrition was assessed using anthropometric measurements. Predictor variables were identified from the extant literature and included if they could be measured at the time of delivery. Survey-weighted logistic regression was applied to model the outcome. Internal validation of the model was performed using 200 bootstrapped samples representing half of the total data sets. **Results:** In 2016, 54.4% (95% CI = 54.0%-54.8%) of Indian children were undernourished, according to a composite index of anthropometric failure. The predictive model for overall undernutrition included maternal

(height, education, reproductive history, number of antenatal visits), child (sex, birthweight), and household characteristics (district of residence, caste, rural residence, toilet availability, presence of a separate kitchen). The model demonstrated reasonable discrimination ability (optimism-adjusted  $c = 0.67$ ). The group of children classified in the lowest decile for risk of undernutrition had a prevalence of 25.9%, while the group classified in the highest decile had a prevalence of 77.4%.

**Conclusions:** It is possible to stratify newborns at the time of delivery based on their risk for undernutrition in the first five years of life. The model developed by this study represents a first step in adopting a risk-score based approach for the most vulnerable population to receive services in a timely manner.

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### Understanding the Socio-Economic Vulnerability in Child Malnutrition Between Migrants and Non-Migrants Children (12–59 Months) in India: Evidence from a Cross-Sectional Study

Mishra, P.S., Jamadar, M., Tripathy, A., and A. Anand. 2022. "Understanding the Socio-Economic Vulnerability in Child Malnutrition Between Migrants and Non-Migrants Children (12–59 Months) in India: Evidence from a Cross-Sectional Study." *Child Indicators Research*. doi: <https://doi.org/10.1007/s12187-022-09943-3>

India has witnessed increasing trends in internal migration over the last three decades. In India, migrant children are not a homogeneous group and their reasons for movement and vulnerabilities vary across socio-economic stratum. For some children, migration may open possibilities and is associated with expanding social and economic spheres, but for many others, it may bring serious risks. Therefore, the study has been carried out to understand socio-economic vulnerability in child nutrition with migration status and other contributing factors in India. This study used data from the National Family Health Survey, the fourth in the NFHS series which was conducted in 2015–2016 (NFHS-4). We were interested in looking at the children age 12–59 months for their nutritional indicators such as stunting and underweight across migrants and non-migrants children. This resulted in a sample of 199,448 children in selected age group and among them 33.1% children belongs to the migrant family as compared to 67% of non-migrant children. Overall, 44.2% of children were stunted and 39.5% were underweight among non-migrant children as compared to 37.4% & 32.8% of migrant children were stunted and underweight respectively. Further, the results showed that among the social groups, scheduled caste children were found a high variation in underweight (34% vs. 41.6%) and stunting (36% vs. 46%) between migrants and non-migrants children. Similar trend of malnourishment is found in the poor wealth quintile, for rural residents and low educated women with non-migrant status. Those children who were poor but non-migrant were more likely to be malnourished as underweight [aOR; 1.15, CI: 1.11–1.18] and stunted [aOR; 1.17, CI:1.13–1.20] as compared to migrant status children in the same category of the household. Similarly in reference to scheduled caste migrant group, the scheduled caste non-migrant were more likely to be underweight [aOR; 1.15, CI: 1.09–1.20] and stunted [aOR; 1.18, CI: 1.12–1.23] than the children with migrant status. There were huge differences between migrant and non-migrant children in nutritional statuses. Education, caste and wealth index are found to be an important variables to explain the differential between migrants and non-migrants in child's nutritional aspects. Children associated with poor socio-economic vulnerability and non-migrant category need to be taken care of more and a community targeted approach is required to understand the gaps. The programs such as ICDS, and Poshan Abhiyan need to be revamped adding the migration aspect of the families and children in terms of their health and nutritional aspects.

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### Application of Quantile Regression To Examine Changes in the Distribution of Height for Age (HAZ) of Indian Children Aged 0–36 Months Using Four Rounds of NFHS Data

Mokalla, T.R., and V.V.M. Rao. 2022. "Application of Quantile Regression To Examine Changes in the Distribution of Height for Age (HAZ) of Indian Children Aged 0–36 Months Using Four Rounds of NFHS Data." *PLOS ONE* 17(5): e0265877. doi: <https://doi.org/10.1371/journal.pone.0265877>

**Background:** The prevalence of stunting among under- three Indian children though decreased, still it is considered to be alarmingly high. In most of the previous studies, traditional (linear and logistic) regression analyses were applied. They were limited to encapsulated cross-distribution variations. The objective of the current study was to examine how the different determinants were heterogeneous in various percentiles of height for age (HAZ) distribution. **Methods and findings:** This article examined the change in the HAZ distribution of children and examined the relationships between the key co-variate trends and patterns in HAZ among children aged <3 years over a period of 24 years. Four successive rounds of the National Family Health Survey data 1992–93, 1998–99, 2005–06, and 2015–16 were used for analysis. The final study included 206579 children aged <3 years (N = 106136 male, 100443 female). To explain and analyse differences in the HAZ distribution, the lambda-mu-sigma (LMS) method was used. Trends in height for age (HAZ) distribution over time were analysed using separate gender-stratified quantile regression (QR). The selected socio-economic, demographic and other predictors were considered for this analysis. The quantile regressions have indicated that mothers who have higher than primary level education were more proactive in mitigating malnutrition among children at the lower end of the distribution. The age, birth order, mother's body-mass-index (BMI) and economic status, among children, were some more determining factors for HAZ. Results of selected quantile regression were estimated at the 5th, 10th, 25th, 50th, 75th, 90th, and 95th quantiles. **Conclusions:** The outcome of various covariates working differently across the HAZ distribution was suggested by quantile regression. The major discrepancies in different aspects were underlined by socioeconomic and demographic aspects among the Indian population. The heterogeneity of this effect was shown using quantile regression. Policymakers may choose to concentrate on the most important factors when formulating policies to lessen the prevalence of stunting in India.

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### Alarming Level of Severe Acute Malnutrition in Indian Districts

Ulahannan, S.K., Wilson, A., Chhetri, D., Soman, B., and N.S. Prashanth. 2022. Alarming Level of Severe Acute Malnutrition in Indian Districts." *BMJ Global Health* 7: e007798. Doi: <http://dx.doi.org/10.1136/bmjgh-2021-007798>

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.

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### Modeling the Potential Impacts of Improved Monthly Income on Child Stunting in India: A Subnational Geospatial Perspective

Kishore, S., Thomas, T., Sachdev, H., Kurpad, A.V., and P. Webb. 2022. "Modeling the Potential Impacts of Improved Monthly Income on Child Stunting in India: A Subnational Geospatial Perspective." *BMJ Open* 12(4): e055098. doi: <https://doi.org/10.1136/bmjopen-2021-055098>

**Objectives:** Approximately one-third of the world's stunted (low height-for-age) preschool-aged children live in India. The success of interventions designed to tackle stunting appears to vary by location and depth of poverty. We developed small-area estimation models to assess the potential impact of increments in household income on stunting across the country. **Design:** Two nationally representative cross-sectional datasets were used: India's National Family Health Survey 4 (2015-2016) and the 68th round of the National Sample Survey on consumer expenditure. The two datasets were combined with statistical matching. Gaussian process regressions were used to perform geospatial modelling of 'stunting' controlling for household wealth and other covariates. **Setting and participants:** The number of children in this sample totalled 259 627. Children with implausible height-for-age z-scores (HAZs) >5 or <-5, or missing data on drinking water, sanitation facility, mother's education, or geolocation and children not residing in mainland India were excluded, resulting in 207 695 observations for analysis. **Results:** A monthly transfer of ~\$7 (500 Indian rupees) per capita to every household (not targeted or conditional) was estimated to reduce stunting nationally by 3.8 percentage points on average (95% credible interval: 0.14%-10%), but with substantial variation by state. Estimated reduction in stunting varied by wealth of households, with the poorest quintile being likely to benefit the most. **Conclusion:** Improving household income, which can be supported through cash transfers, has the potential to significantly reduce stunting in parts of India where the burdens of both stunting and poverty are high. Modelling shows that for other regions, income transfers may raise incomes and contribute to improved nutrition, but there would be a need for complementary activities for alleviating stunting. While having value for the country as a whole, impact of income gained could be variable, and underlying drivers of stunting need to be tackled through supplementary interventions.

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### Association Between Anthropometric Criteria and Body Composition Among Children Aged 6–59 Months With Severe Acute Malnutrition: A Cross-Sectional Assessment From India

Sinha, R.K., Kumar, P., Daniel, A., Shah, H., Sriswan, R., Kokane, A., Mohapatra, A., Kashyap, V., Goel, A.K., Kumar, V., Kiran, A., Arlappa, N., Joshi, A., Nayak, R.R., Sayal, S., and A. de Wagt. 2022.

"Association Between Anthropometric Criteria and Body Composition Among Children Aged 6–59 Months With Severe Acute Malnutrition: A Cross-Sectional Assessment From India." *BMC Nutrition* 8(56). doi: <https://doi.org/10.1186/s40795-022-00551-6>

A multicentric study is being conducted in which children with severe acute malnutrition (SAM) aged 6–59 months are identified with only weight-for-height z-score (WHZ) < -3 criteria. The present study aimed to assess associations of anthropometric parameters and body composition parameters, to improve treatment of SAM. We conducted a cross-section assessment using the enrolment data of children who participated in a multi-centric longitudinal controlled study from five Indian states. Fat-free mass (FFM) and fat mass (FM) were determined by bio-electrical impedance analysis (BIA). Six hundred fifty-nine children were enrolled in the study using WHZ < -3 criteria. Available data shows that WHZ, WAZ and BMIZ were significantly associated with FFMI while MUACZ was significantly associated with both FMI and FFMI. Children with both severe wasting and severe stunting had significantly lower FFMI compared to those who were only severely wasted. All forms of anthropometric deficits appear to adversely impact FFM and FM.

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### Inequalities in Overweight and Obesity Among Reproductive Age Group Women in India: Evidence From National Family Health Survey (2015–16)

Kumar, P., Mangla, S., and S. Kundu. 2022. "Inequalities in Overweight and Obesity Among Reproductive Age Group Women in India: Evidence From National Family Health Survey (2015–16)." *BMC Women's Health* 22: 205. doi: <https://doi.org/10.1186/s12905-022-01786-y>

**Background:** In developing nations like India, fertility and mortality have decreased, and diseases related to lifestyle have become more common. Females in India are more prone to being overweight and obese than their male counterparts, more specifically in affluent families than the poor ones. Understanding the overweight and obesity trend may help develop feasible public health interventions to reduce the burden of obesity and associated adverse health outcomes. **Methods:** The study utilizes the fourth round of the National Family Health Survey (NFHS-4), 2015–16. Descriptive statistics, bivariate and multivariate analysis was used to check the significant relationship between overweight and obesity, and other background characteristics. Income-related inequality in overweight and obesity among women was quantified by the concentration index and the concentration curve. Further, Wagstaff decomposition analysis was done to decompose the concentration index, into the contributions of each factor to the income-related inequalities. **Results:** Overweight & obesity among women had a significant positive association with their age and educational level. The odds of overweight and obesity were 57% more likely among women who ever had any caesarean births than those who did not [AOR: 1.57; CI: 1.53–1.62]. The likelihood of overweight and obesity was 4.31 times more likely among women who belonged to richest [AOR: 5.84; CI: 5.61–6.08] wealth quintile, than those who belonged to poor wealth quintile. Women who ever terminated the pregnancy had 20% higher risk of overweight and obesity than those who did not [AOR: 1.20; CI: 1.17–1.22]. The concentration of overweight and obesity among women was mostly in rich households of all the Indian states and union territories. Among the geographical regions of India, the highest inequality was witnessed in Eastern India (0.41), followed by Central India (0.36). **Conclusion:** The study results also reveal a huge proportion of women belonging to the BMI categories of non-normal, which is a concern and can increase the risks of developing non-communicable diseases. Hence, the study concludes and recommends an urgent need of interventions catering to urban women belonging to higher socio-economic status which can reduce the risks of health consequences due to overweight and obesity. Development nutrition-specific as well as sensitive interventions can be done for mobilization of local resources that addresses the multiple issues under which a woman is overweight or obese.

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### Does Maternal Overnutrition Carry Child Undernutrition in India?

Kumar, M., and P. Mohanty. 2022. "Does Maternal Overnutrition Carry Child Undernutrition in India?" *PLOS ONE* 17(6): e0265788. doi: <https://doi.org/10.1371/journal.pone.0265788>

**Background and objectives:** Studies in low-and middle-income countries where nutrition transition is underway provides mixed evidence of double burden of maternal overnutrition and child undernutrition among mother-child pairs. Shifting dietary pattern and rapid increase in overweight/obesity among adults with persistent child undernutrition indicate that India is experiencing nutrition transition and double burden of malnutrition. Hence, the study explores the presence of and the factors associated with mother-child dyads of over- and undernutrition in India. **Methods and materials:** The study uses National Family Health Survey 2015–16 data. The analytic sample consists of 28,817 weighted mother-child pairs where an overweight/obese mother is paired with an undernourished child. The nutritional status of children is defined according to WHO 2006 child growth standards as underweight (i.e., low weight-for-age), stunting (i.e., low height-for-age)

and wasting (i.e., low weight-for-height). Maternal overweight/obesity (i.e., BMI  $\geq$  25 kg/m<sup>2</sup>) is defined using adult BMI criterion. Descriptive, bivariate, and adjusted multivariable logistic regression analysis are conducted. **Results:** Of the overweight/obese mothers, 21.3%, 26.5%, and 14% have underweight, stunted, and wasted children respectively. In adjusted models, maternal short stature (aOR: 2.94, 95% CI: 2.30–3.75), age of child (aOR: 3.29, 95% CI: 2.76–3.92), and poorest wealth status (aOR: 2.01, 95% CI: 1.59–2.54) are significant predictors of overweight/obese mothers and stunted child pairs. Similarly, poor wealth status (aOR: 1.68, 95% CI: 1.32–2.14), maternal stature (aOR: 2.70, 95% CI: 2.08–3.52), and child aged 2–5 years (aOR: 1.77, 95% CI: 1.51–2.08) are also significantly associated with higher occurrence of overweight/obese mother and-underweight child pairs. **Conclusion:** Findings of the study are consistent with the phase of nutrition transition and double burden of malnutrition. The paper concludes with suggestions to improve the socioeconomic condition, more strategic nutrition specific investments and policy interventions to eliminate all forms of malnutrition for achieving SDGs.

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### A Quasi-Experimental Evaluation of a Nutrition Behavior Change Intervention Delivered Through Women's Self-Help Groups in Rural India: Impacts on Maternal and Young Child Diets, Anthropometry, and Intermediate Outcomes

Scott, S., Gupta, S., Menon, P., Raghunathan, K., Thai, G., Quisumbing, A., Prasad, V., Hegde, A., Choudhury, A., Khetan, M., Nichols, C., and N. Kumar. 2022. "A Quasi-Experimental Evaluation of a Nutrition Behavior Change Intervention Delivered Through Women's Self-Help Groups in Rural India: Impacts on Maternal and Young Child Diets, Anthropometry, and Intermediate Outcomes." *Current Developments in Nutrition* 6(6): nzac079. doi: <https://doi.org/10.1093/cdn/nzac079>

**Background:** Women's self-help groups (SHGs) have become one of the largest institutional platforms serving the poor. Nutrition behavior change communication (BCC) interventions delivered through SHGs can improve maternal and child nutrition outcomes. **Objectives:** The objective was to understand the effects of a nutrition BCC intervention delivered through SHGs in rural India on intermediate outcomes and nutrition outcomes. **Methods:** We compared 16 matched blocks where communities were supported to form SHGs and improve livelihoods; 8 blocks received a 3-y nutrition intensive (NI) intervention with nutrition BCC, and agriculture- and rights-based information, facilitated by a trained female volunteer; another 8 blocks received standard activities (STD) to support savings/livelihoods. Repeated cross-sectional surveys of mother-child pairs were conducted in 2017–2018 (n = 1609 pairs) and 2019–2020 (n = 1841 pairs). We matched treatment groups over time and applied difference-in-difference regression models to estimate impacts on intermediate outcomes (knowledge, income, agriculture/livelihoods, rights, empowerment) and nutrition outcomes (child feeding, woman's diet, woman and child anthropometry). Analyses were repeated on households with  $\geq$ 1 SHG member. **Results:** Forty percent of women were SHG members and 50% were from households with  $\geq$ 1 SHG member. Only 10% of women in NI blocks had heard of intervention content at endline. Knowledge improved in both NI and STD groups. There was a positive NI impact on knowledge of timely introduction of animal-sourced foods to children ( $P < 0.05$ ) but not on other intermediate outcomes. No impacts were observed for anthropometry or diet indicators except child animal-source food consumption ( $P < 0.01$ ). In households with  $\geq$ 1 SHG member, there was a positive NI impact on child unhealthy food consumption ( $P < 0.05$ ). **Conclusions:** Limited impacts could be due to limited exposure or skills of volunteers, and a concurrent national nutrition campaign. Our findings add to a growing literature on SHG-based BCC interventions and the conditions necessary for their success.

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### Comprehensive Overview of Smartphone Applications Delivering Child Nutrition Information

Srivastava, R., Kushwaha, S., Khanna, P., Gupta, M., Bharti, B., and R. Jain. 2022. "Comprehensive Overview of Smartphone Applications Delivering Child Nutrition Information." *Nutrition* 103–104: 111773. doi: <https://doi.org/10.1016/j.nut.2022.111773>

Numerous smartphone-based applications that guide parenting, child nutrition and child health-related knowledge are available. Here, we have tried to review the applications available in the Google Play Store for child nutrition, primarily focused on children under the age of five years. The keywords used in the search were "child nutrition", "child nutrition status assessment", and "parenting". Three hundred seventy apps were identified from the play store and thirty-three apps qualified for the review. Out of thirty-three, three apps were not updated in the last three months, and nineteen apps didn't mention their source of information. Four apps didn't require the child's name, date of birth, and gender for logging in. Twenty-three apps were available in English only. The output features of the selected apps were food, growth, development and vaccine trackers, data export, reminders, meal planner, feeding tips, list of food, recipes details, about nutrients and question/answer with the expert. Only eight apps gave access to consultation with experts and three suggested nutrient requirements of the child. Three apps have scored similar based on features, although the feature type differs. Findings from this review suggest that the apps don't follow any uniform guidelines for delivering the child nutrition information to the caregivers. About 50% of apps didn't mention the consulted source for its development, indicating the unavailability of uniform guidelines or policy documents for child nutrition app development. App-based intervention studies are recommended to assess the effectiveness of child nutrition/health smartphone applications.

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### **A Critical Comparison of the Indian School Food and Nutrition Guidelines With the WHO-Nutrition Friendly School Initiative and the Review of Existing Implementation Scenario**

Matela, H., Panchal, P., Yadav, S.S., Muley, A., Medithi, S., and K. Menon. 2022. "A Critical Comparison of the Indian School Food and Nutrition Guidelines With the WHO-Nutrition Friendly School Initiative and the Review of Existing Implementation Scenario." *Nutrition and Health*. doi: <https://doi.org/10.1177%2F02601060221105734>

**Background:** The school-based food and nutrition guidelines approach has the potential to combat undernutrition, overnutrition and micronutrient deficiencies among children and adolescents and set the foundation for a healthy adult lifestyle. **Aim:** To critically compare the Nutrition Friendly School Initiative (NFSI) of the World Health Organization (WHO) with the Food Safety and Standards Authority of India (FSSAI) and the Indian Academy of Pediatrics (IAP) guidelines to gauge the strengths and limitations. Additionally, to summarize the existing studies on implementing school food and nutrition guidelines. **Methods:** Policy documents of the above guidelines were critically evaluated, and narrative analysis was conducted. An electronic search was conducted for full-text research articles published in the English language between January 2007 to September 2021 in Science Direct, PubMed, Web of Science, and SCOPUS databases. **Results:** Upon critical comparison of the three guidelines, it was found that the NFSI and FSSAI guidelines shared similarities in many components and the FSSAI guidelines, if implemented adequately, could improve the school food environment and combat the triple malnutrition burden in India. After screening the articles based on the eligibility criteria, 11 studies were included in the preparation of the review. Studies reported partial or inadequate implementation and poor compliance with the guidelines or approach. A few studies identified barriers to guideline implementation. **Conclusion:** Implementation of school food and nutrition guidelines could improve the nutritional outcomes in children and adolescents. To sustain the effective implementation, adequate resources and preparedness are essential in low-and middle-income countries, including India.

**NON-PEER REVIEWED**

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### **The Role of Maternal Nutrition in Reducing Childhood Stunting**

Vir, S., and S. Suri. 2022. *The Role of Maternal Nutrition in Reducing Childhood Stunting*. New Delhi, India: Observer Research Foundation. <https://policycommons.net/artifacts/2445922/the-role-of-maternal-nutrition-in-reducing-childhood-stunting/3467664/>

Maternal nutrition impacts not only the woman's health during pregnancy but also that of her newborn; the child's health in their first 1,000 days of life, in turn, will influence outcomes during childhood. Indeed, maternal undernutrition is estimated to account for 20 percent of childhood stunting in India. It is therefore important to ensure that women enter pregnancy in good health, as measured for example in adequate height and weight, and micronutrient deficiency parameters such as those that determine susceptibility to anaemia. This paper argues for strengthening the implementation of both, direct nutrition services and nutrition-sensitive measures that will improve maternal health. A comprehensive national maternal nutrition policy that incorporates interventions through various platforms should accelerate India's efforts in improving maternal nutrition and reducing childhood stunting.

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### **Inclusion of Dried Small Fish in the ICDS Supplementary Nutrition Programme Pilot Study in Odisha, India**

Chadag, V. 2022. *Inclusion of Dried Small Fish in the ICDS Supplementary Nutrition Programme Pilot Study in Odisha, India*. Report: 2022-03. Odisha, India: WorldFish. <https://digitalarchive.worldfishcenter.org/handle/20.500.12348/5159>

Aquatic foods, especially fish, have long been regarded as a rich source of animal protein and micronutrients, and, therefore, considered a key constituent of nutritious diets. With a common goal of enhancing the nutritional outcomes from aquatic foods and to assist in accelerating progress on reducing malnutrition in hard-to-reach tribal communities, USAID and WorldFish along with other partner organizations such as Fisheries and Animal Resources Development (FARD) and Indian Council of Agricultural Research and Central Institute of Fisheries Technology (ICAR-CIFT) collaborated with the Women and Child Development Department and Mission Shakti (WCD & MS) of the government of Odisha to pilot the inclusion of small fish and fish-based products in the SNP. Subsequently, a Memorandum of Understanding (MoU) was signed by WorldFish and WCD & MS on 10th November 2020. Specifically, this piloting involves the inclusion of small fish powder in HCM for 3-6-year-old children and dried small fish in THR for Pregnant and Lactating Women (PLW) and 14-18-year-old Adolescent Girls (AG). Based on an approved Standard Operating Procedure (SOP), the pilot has been implemented in 50 Anganwadi Centers of Kaptipada block, Mayurbhanj district and the duration of the project was 6 months starting from April 2021 to September 2021. Based on feedback and acceptance received from the community of the inclusion of dried fish-based products in SNP, as well as enhanced understanding on nutritional outcomes from aquatic foods congregated from the pilot, this nutrition-sensitive approach can be adopted and scaled to ameliorate the undernutrition scenarios across Odisha.

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### **100 High Burden Districts of Undernutrition Among Children and Women, in India, in 2019–21**

Gune, S., Christopher, A., Singh, S. K., Sarwal, R., Bhatia, N., Menon, P. and P.H. Nguyen. 2022. *100 High Burden Districts of Undernutrition Among Children and Women, in India, in 2019–21*. POSHAN Data Note 90. New Delhi, India: International Food Policy Research Institute (IFPRI). doi: <https://doi.org/10.2499/p15738coll2.135829>

Malnutrition, in all its forms, includes undernutrition (wasting, stunting, underweight), micronutrient deficiencies, overweight, obesity, and diet-related non-communicable diseases such as diabetes and high blood pressure (WHO 2021). This Data Note describes trends in key nutritional outcomes for children and women at the national- and state-levels. The findings are based on data from the National Family Health Survey (NFHS)-4 (2015-2016) and -5 (2019-2021). In addition to standard prevalence-based analyses, this Data Note includes headcount-based analyses at the state-and district-levels, using data from NFHS-5. The goals of POSHAN Abhiyaan are to improve nutritional status of children from 0-6 years, adolescent girls, pregnant women, and lactating mothers in a time-bound manner. Given the district-level focus of POSHAN Abhiyaan, the burden of stunting, underweight, wasting, severe wasting, and anemia were ranked to help identify priority districts with the highest burden of undernutrition among children and women. \*\*This Data Note can be used by national-, state-, and district-level officials, non-governmental organizations (NGOs), and research institutes to direct resources and strengthen the implementation of programs and policies to improve these outcomes.

## UPCOMING EVENTS & DEADLINES

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### **Delivering for Nutrition (D4N) in South Asia: Implementation Research in the Context of COVID-19**

Healthy diets are necessary for achieving optimal growth and development; however, many people do not have access to safe, affordable, healthy food, particularly in South Asia. To add, the COVID-19 pandemic exacerbated and exposed the existing gaps and inequities in food systems, health and nutrition services, and economies in the region. IFPRI's Partnerships and Opportunities to Strengthen and Harmonize Actions for Nutrition in India (POSHAN), together with the One CGIAR South Asia regionally integrated initiative Transforming Agri-Food Systems in South Asia (TAFSSA) and a range of regional co-hosts, are pleased to announce the virtual conference, 'Delivering for Nutrition in South Asia: Transforming Diets,' scheduled for November 9–10, 2022. The purpose of this conference is to synthesize relevant evidence and stimulate dialogue to inform and guide policy and program initiatives in South Asia for improving equitable access to and consumption of healthy diets.

**When:** November 9–10, 2022

**Where:** Online

**For more information:** <https://poshan.ifpri.info/delivering-for-nutrition-in-south-asia-transforming-diets/>

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### **22nd International Congress of Nutrition (ICN)**

The 22nd International Congress of Nutrition (ICN) will be held in Tokyo, Japan, in December of 2022. ICN is a meeting of the International Union of Nutritional Sciences (IUNS) that takes place every four years, the tenth of which was successfully held in Kyoto in 1975.

**When:** December 6-11, 2022

**Where:** Tokyo, Japan

**For more information:** <https://icn22.org/>

## ABOUT POSHAN

Partnerships and Opportunities to Strengthen and Harmonize Actions for Nutrition in India (POSHAN) is a multi-year initiative that aims to build evidence on effective actions for nutrition and support the use of evidence in decision-making. It is supported by the Bill & Melinda Gates Foundation and led by IFPRI in India.

## ABOUT ABSTRACT DIGEST

In each issue, the POSHAN Abstract Digest brings you some of the new and noteworthy studies on maternal and child nutrition. It focuses on India-specific studies and also brings to you other relevant global or regional literature with broader implications for maternal and child nutrition. The Abstract Digest is based on literature searches to identify selected studies that we think are most relevant to nutrition issues in India and to Indian programs and policies. We share with you a collection of abstracts from articles published in peer-reviewed journals, as well as selected non-peer-reviewed articles by researchers in reputed academic and/or research institutions and which demonstrated rigor in their research objectives, methodology, and analysis. The abstracts in this document are reproduced in their original form from their source, and without editorial commentary about specific articles.

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