

EDITOR'S NOTE

In this 40th issue of the POSHAN Abstract Digest, we bring to you a collection of articles on the burden of malnutrition in India, its distribution patterns and determinants. You will find several articles focused on nutrition-specific and nutrition-sensitive solutions aimed at improving nutritional outcomes and determinants. This issue also features two articles on data for nutrition, one pertaining to data availability for nutrition financing in India and another describing the current situation of reliable biomarker data availability on micronutrient deficiencies at the global level. We have also included a small section on COVID-19 focused peer-reviewed articles.

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Stay safe and enjoy reading!

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Nguyen et al. 2021. *The Journal of Nutrition*: nxab131.

Effect of Nutrition-Sensitive Agriculture Interventions With Participatory Videos and Women's Group Meetings on Maternal and Child Nutritional Outcomes in Rural Odisha, India (UPAVAN Trial): A Four-Arm, Observer-Blind, Cluster-Randomised Controlled Trial

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Home Fortification of Complementary Foods Reduces Anemia and Diarrhea among Children Aged 6–18 Months in Bihar, India: A Large-Scale Effectiveness Trial

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Pike et al. 2021. *Public Health Nutrition*: 1–12.

An Interrupted Time Series Analysis of the Lockdown Policies in India: A National-Level Analysis of COVID-19 Incidence

Thayer et al. 2021. *Health Policy and Planning* 36(5): 620–629.

Nutrition in the Actual COVID-19 Pandemic. A Narrative Review

Clemente-Suárez et al. 2021. *Nutrients* 13(6): 1924.

Leveraging Digital Platforms for Disseminating Health and Nutrition Information During COVID-19: Reflections From Project Samvad in India

Ali et al. 2021. *Journal of Global Health Reports* 5: e2021036.

COVID-19 Disrupted Provision and Utilization of Health and Nutrition Services in Uttar Pradesh, India: Insights from Service Providers, Household Phone Surveys, and Administrative Data

Nguyen et al. 2021. *The Journal of Nutrition* nxab135.

India Faces a Challenge with Its Mass Vaccination Efforts

Subramanian. 2021. *The Lancet Global Health*.

PEER-REVIEWED

Commentary

Pauses and Reversals of Infant Mortality Decline in 2017 and 2018

Dreze, J., A. Gupta, S.A. Parashar, and K. Sharma. 2021. "Pauses and Reversals of Infant Mortality Decline in 2017 and 2018." *Economic & Political Weekly* 56(19).

<https://www.epw.in/journal/2021/19/commentary/pauses-and-reversals-infant-mortality-decline-2017.html>

This note examines recent trends in infant mortality in India, based on summary reports from the Sample Registration System. We find evidence of slowdown, pauses, and reversals in infant mortality decline in large parts of India in 2017 and 2018. In urban areas, the infant mortality rate stagnated at 23 deaths per 1,000 births between 2016 and 2018. Worse, overall infant mortality increased in the poorer states of Chhattisgarh, Jharkhand, Madhya Pradesh, and Uttar Pradesh. One possible interpretation of these findings is that the demonetisation experiment in late 2016 and the subsequent economic slowdown had an adverse effect on child health.

Intraindividual Double-Burden of Anthropometric Undernutrition and "Metabolic Obesity" in Indian Children: A Paradox That Needs Action

Jeyakumar, A., S. Godbharle, and B.R. Giri. 2021. "Intraindividual Double-Burden of Anthropometric Undernutrition and 'Metabolic Obesity' in Indian Children: A Paradox That Needs Action." *European Journal of Clinical Nutrition* 42(1): 55–64. doi: <https://doi.org/10.1038/s41430-021-00916-3>

Background: Measuring undernutrition using composite index of anthropometric failure (CIAF) and identifying its determinants in tribal regions is essential to recognize the true burden of undernutrition in these settings. **Objective:** To determine anthropometric failure and its determinants among tribal children younger than 5 years in Palghar, Maharashtra, India. **Methods:** A cross-sectional survey employing CIAF was performed in children <5 years to estimate undernutrition in the tribal district of Palghar in Maharashtra, India. Anthropometric measurements, maternal and child characteristics were recorded from 577 mother–child pairs in 9 villages. **Results:** As per Z score, prevalence of stunting, wasting, and underweight were 48%, 13%, and 43%, respectively. According to CIAF, 66% of children had at least one manifestation of undernutrition and 40% had more than one manifestation of undernutrition. Odds of anthropometric failure were 1.5 times higher among children of mothers who were illiterate (adjusted odds ratio [AOR] =1.57, 95% CI: 1.0-2.3), children who had birth weight >2.5 kg had lesser odds (AOR: 0.63, 95% CI: 0.4-0.9) of anthropometric failure, and children who had initiated early breastfeeding had 1.5 times higher odds of anthropometric failure (crude odds ratio: 1.5, 95% CI: 1.0-2.1). However, when adjusted for other independent variables, the results were not significant. **Conclusion:** The alarming proportion of anthropometric failure among tribal children calls for urgent short-term interventions to correct undernutrition and long-term interventions to improve maternal literacy and awareness to prevent and manage child undernutrition.

Double Burden of Underweight and Overweight Among Indian Adults: Spatial Patterns and Social Determinants

Bhandari, P., E. Gayawan, and S. Yadav. 2021. "Double Burden of Underweight and Overweight Among Indian Adults: Spatial Patterns and Social Determinants." *Public Health Nutrition*: 1–15. doi: [10.1017/S1368980021001634](https://doi.org/10.1017/S1368980021001634)

Objective: The current study explores the spatial patterns of underweight and overweight among adult men and women in districts of India and identifies the micro-geographical locations where the risks of underweight and overweight are simultaneously prevalent, after accounting for demographic and socio-economic factors. **Design:** We relied on BMI (weight (kg)/height squared (m²)), a measure of nutritional status among adult individuals, from the 2015–2016 National Family and Health Survey. Underweight was defined as <18.5 kg/m² and overweight as ≥25.0 kg/m². **Setting:** We adopted Bayesian structured additive quantile regression to model the underlying spatial structure in underweight and overweight burden. **Participants:** Men aged 15–54 years (sample size: 108 092) and women aged 15–49 years (sample size: 642 002). **Results:** About 19.7 % of men and 22.9 % of women were underweight, and 19.6 % of men and 20.6 % of women were overweight. Results indicate that malnutrition burden in adults exhibits geographical divides across the country. Districts located in the central, western and eastern regions show higher risks of underweight. There is evidence of substantial spatial clustering of districts with higher risk of overweight in southern and northern India. While finding a little evidence on double burden of malnutrition among population groups, we identified a total of sixty-six double burden districts. **Conclusions:** The current study demonstrates that the geographical burden of overweight in Indian adults is yet to surpass that of underweight, but the coexistence of double burden of underweight and overweight in selected regions presents a new challenge for improving nutritional status and necessitates specialised policy initiatives.

Child Undernutrition in the States of India: An Analysis Based on Change in Composite Index of Anthropometric Failure from 2006 to 2016

Jith, J.R., and R. Bedamatta. 2021. "Child Undernutrition in the States of India: An Analysis Based on Change in Composite Index of Anthropometric Failure from 2006 to 2016." *Review of Development and Change* 26(1): 104–126. doi: <https://doi.org/10.1177%2F09722661211010376>

Stunting, wasting and underweight—the three traditional indicators of undernourishment among children—provide mutually non-exclusive categories of anthropometric failures: low height for age, low weight for height and low weight for age. Although these indicators are essential for designing specific clinical and child nutrition policy interventions, they fall short of estimating the prevalence of overall anthropometric failure, which provides a sense of the scale of the nutrition problem. This article estimates the alternative, more comprehensive measure Composite Index of Anthropometric Failure (CIAF) for Indian states, based on data from the National Family Health surveys of 2006 and 2016, for children under five years (Ch–U5). The CIAF-based undernutrition estimates show significantly high anthropometric failure levels among Indian children compared to only stunting, wasting and underweight. Based on population projections for Ch–U5, we also show that a sizeable number of states may have seen an increase in child undernutrition between 2006 and 2016. We also correlated CIAF with household wealth index scores and found a positive relationship with children facing no anthropometric failure.

Commentary

Children Staying Smaller but Growing Smarter Beyond the First 1000 Days

Prado, E.L. 2021. "Children Staying Smaller but Growing Smarter Beyond the First 1000 Days." *The Journal of Nutrition*: nxab136. doi: <https://doi.org/10.1093/jn/nxab136>

Many public health programs and global initiatives focus on improving children's nutrition and reducing stunted growth during the first 1000 days, from conception to 2 years after birth. During this period, humans experience the most rapid growth and development of the life span, and the

foundations are laid for the brain and other physiological systems. Nutrients are both the building blocks and the fuel for the construction of these systems.

Multilevel Analysis of Geographic Variation Among Correlates of Child Undernutrition in India

Jain, A., J. Rodgers, Z. Li, R. Kim, and S.V. Subramanian. 2021. "Multilevel Analysis of Geographic Variation Among Correlates of Child Undernutrition in India." *Maternal and Child Nutrition*: e13197. doi: <https://doi.org/10.1111/mcn.13197>

Prior research has identified a number of risk factors ranging from inadequate household sanitation to maternal characteristics as important determinants of child malnutrition and health in India. What is less known is the extent to which these individual-level risk factors are geographically distributed. Assessing the geographic distribution, especially at multiple levels, matters as it can inform where, and at what level, interventions should be targeted. The three levels of significance in the Indian context are villages, districts, and states. Thus, the purpose of this paper was to (a) examine what proportion of the variation in 21 risk factors is attributable to villages, districts, and states in India and (b) elucidate the specific states where these risk factors are clustered within India. Using the fourth National Family Health Survey dataset, from 2015 to 2016, we found that the proportion of variation attributable to villages ranged from 14% to 63%, 10% to 29% for districts and 17% to 62% for states. Furthermore, we found that Bihar, Jharkhand, Madhya Pradesh, and Uttar Pradesh were in the highest risk quintile for more than 10 of the risk factors included in our study. This is an indication of geographic clustering of risk factors. The risk factors that are clustered in states such as Bihar, Jharkhand, Madhya Pradesh and Uttar Pradesh underscore the need for policies and interventions that address a broader set of child malnutrition determinants beyond those that are nutrition specific.

Adolescent Undernutrition in South Asia: A Scoping Review

Querol, S.E., P. Gill, R. Iqbal, M. Kletter, N. Ozdemir, and L. Al-Khudairy. 2021. "Adolescent Undernutrition in South Asia: A Scoping Review." *Nutrition Research Reviews*: 1–11. doi: [10.1017/S0954422421000068](https://doi.org/10.1017/S0954422421000068)

Undernutrition is a growing public health challenge affecting growth and development during adolescence in many low- and middle-income countries. This scoping review maps the evidence on adolescent undernutrition (stunting, thinness and micronutrient deficiencies) in South Asia and highlights gaps in knowledge. Using Arksey and O'Malley's framework and the Joanna Briggs Institute Reviewers' Manual, the search included electronic bibliographic databases (Medline (OVID), Embase, Cochrane Library, Web of Science, CINAHL, PsycInfo, and Scopus) as well as various grey literature sources published up to March 2019. In total, 131 publications met the inclusion criteria of this review. All the included evidence used quantitative data and 115 publications used a cross-sectional design. Nearly 70% (n = 86) of the included publications were conducted in India. Prevalence of undernutrition was reported based on different growth references and cut-offs. Evidence is divided into publications that included an intervention component (n = 12) and publications that did not include an intervention component (n = 116), and presented in a narrative synthesis. This scoping review provides a wide range of publications on adolescent undernutrition in South Asia and identifies future research priorities in the field.

Precision Mapping Child Undernutrition for Nearly 600,000 Inhabited Census Villages in India

Kim, R., A.S. Bijral, Y. Xu, X. Zhang, J.C. Blossom, A. Swaminathan, G. King, A. Kumar, R. Sarwal, J.M.L. Ferres, and S.V. Subramanian. 2021. "Precision Mapping Child Undernutrition for Nearly 600,000

Inhabited Census Villages in India.” *PNAS* 118 (18): e2025865118. doi: <https://doi.org/10.1073/pnas.2025865118>

There are emerging opportunities to assess health indicators at truly small areas with increasing availability of data geocoded to micro geographic units and advanced modeling techniques. The utility of such fine-grained data can be fully leveraged if linked to local governance units that are accountable for implementation of programs and interventions. We used data from the 2011 Indian Census for village-level demographic and amenities features and the 2016 Indian Demographic and Health Survey in a bias-corrected semisupervised regression framework to predict child anthropometric failures for all villages in India. Of the total geographic variation in predicted child anthropometric failure estimates, 54.2 to 72.3% were attributed to the village level followed by 20.6 to 39.5% to the state level. The mean predicted stunting was 37.9% (SD: 10.1%; IQR: 31.2 to 44.7%), and substantial variation was found across villages ranging from less than 5% for 691 villages to over 70% in 453 villages. Estimates at the village level can potentially shift the paradigm of policy discussion in India by enabling more informed prioritization and precise targeting. The proposed methodology can be adapted and applied to diverse population health indicators, and in other contexts, to reveal spatial heterogeneity at a finer geographic scale and identify local areas with the greatest needs and with direct implications for actions to take place.

Maternal Vitamin B12 Deficiency and Perinatal Outcomes in Southern India

Finkelstein, J.L., A. Fothergill, J.T. Krisher, T. Thomas, A.V. Kurpad, and P. Dwarkanath. 2021. “Maternal Vitamin B12 Deficiency and Perinatal Outcomes in Southern India.” *PLoS ONE* 16(4): e0248145. doi: <https://doi.org/10.1371/journal.pone.0248145>

Background: Vitamin B12 deficiency during pregnancy has been associated with adverse maternal and infant health outcomes. Few prospective studies have investigated vitamin B12 status early in pregnancy, and its links to infant vitamin B12 status, particularly in India where the burden of vitamin B12 deficiency is estimated to be the highest globally. The objective of this study was to examine the associations of maternal vitamin B12 biomarkers with neonatal vitamin B12 status. **Methods:** Pregnant women (~12 weeks’ gestation) were enrolled in a perinatal cohort study in Bangalore, India. Total vitamin B12, methylmalonic acid (MMA), and homocysteine concentrations were evaluated in maternal samples at enrollment and in neonates at birth using cord blood. Linear and binomial regression models were used to evaluate the associations of maternal vitamin B12 biomarkers with neonatal vitamin B12 status and perinatal outcomes. **Results:** A total of 63.2% of women had vitamin B12 deficiency (<148 pmol/L), 87.2% had vitamin B12 insufficiency (<221 pmol/L), and 47.3% had impaired vitamin B12 status (vitamin B12<148 pmol/L and MMA>0.26µmol/L) at enrollment; 40.8% of neonates had vitamin B12 deficiency, 65.6% were insufficiency, and 38.1% had impaired vitamin B12 status at birth. Higher maternal vitamin B12 concentrations at enrollment were associated with increased neonatal vitamin B12 concentrations (β (SE): 0.40 (0.05); $p<0.0001$) and lower risk of neonatal vitamin B12 deficiency (Risk Ratio [RR]: 0.53; 95% CI: [0.43, 0.65]; $p<0.0001$). Maternal vitamin B12 deficiency (RR: 1.97 [1.43, 2.71]; $p<0.001$), insufficiency (RR: 2.18 [1.23, 3.85]; $p = 0.007$), and impaired vitamin B12 status (RR: 1.49 [1.13, 1.97]; $p = 0.005$) predicted a two-fold increase in the risk of neonatal vitamin B12 deficiency at birth.

Prevalence and Determinants of Vitamin A Deficiency Among Children in India: Findings from a National Cross-Sectional Survey

Kundu, S., B. Rai, and A. Shukla. 2021. “Prevalence and Determinants of Vitamin A Deficiency Among Children in India: Findings from a National Cross-Sectional Survey.” *Clinical Epidemiology and Global Health* 11: 100768. doi: <https://doi.org/10.1016/j.cegh.2021.100768>

Background: Vitamin A deficiency is major concern especially for the children living in developing countries. According to UNICEF around one third of the children are not receiving the supplementation of Vitamin A they need. **Aim:** The present study focuses on Vitamin A deficiency among the children aged 12–59 months in India by analysing the data from the latest nutritional survey. **Methods:** The Comprehensive National Nutrition Survey (CNNS), conducted during 2016–18, dataset for 0–5 years age has been used in the study. The study has employed bi-variate analysis to assess the prevalence of Vitamin A deficiency (VAD) based on the CRP (C-reactive protein) values ($CRP \leq 5$ mg/L), by the different socio-economic and demographic characteristics along with dietary diversity, stunting, anaemia and breastfeeding related variables. Log-binomial regression model has been used for the multivariable analysis and based on that predicted probabilities were computed. **Results:** The overall prevalence of VAD in India is 17.54%. Children who are exposed to longer duration of breastfeeding have lower prevalence of VAD. Children in poorer economic sections are more vitamin A deficient compared to children in richer economic sections. The prevalence of VAD among children having minimum diet diversity is 18.63%. **Conclusion:** The study suggests in focusing on the targeted groups of children who are at more risk in developing VAD and planning interventions for specific groups. The nutrition programs require a multisectoral approach for addressing the needs of macronutrient and micronutrient deficiencies simultaneously to enhance the current situation of nutrition among children in India.

Determinants of Anthropometric Failure Among Tribal Children Younger than 5 Years of Age in Palghar, Maharashtra, India

Jeyakumar A., S. Godbharle, and B.R. Giri. 2021. "Determinants of Anthropometric Failure Among Tribal Children Younger than 5 Years of Age in Palghar, Maharashtra, India." *Food and Nutrition Bulletin* 42(1): 55–64. doi: [10.1177/0379572120970836](https://doi.org/10.1177/0379572120970836)

Background: Measuring undernutrition using composite index of anthropometric failure (CIAF) and identifying its determinants in tribal regions is essential to recognize the true burden of undernutrition in these settings. **Objective:** To determine anthropometric failure and its determinants among tribal children younger than 5 years in Palghar, Maharashtra, India. **Methods:** A cross-sectional survey employing CIAF was performed in children <5 years to estimate undernutrition in the tribal district of Palghar in Maharashtra, India. Anthropometric measurements, maternal and child characteristics were recorded from 577 mother–child pairs in 9 villages. **Results:** As per Z score, prevalence of stunting, wasting, and underweight were 48%, 13%, and 43%, respectively. According to CIAF, 66% of children had at least one manifestation of undernutrition and 40% had more than one manifestation of undernutrition. Odds of anthropometric failure were 1.5 times higher among children of mothers who were illiterate (adjusted odds ratio [AOR] =1.57, 95% CI: 1.0-2.3), children who had birth weight >2.5 kg had lesser odds (AOR: 0.63, 95% CI: 0.4-0.9) of anthropometric failure, and children who had initiated early breastfeeding had 1.5 times higher odds of anthropometric failure (crude odds ratio: 1.5, 95% CI: 1.0-2.1). However, when adjusted for other independent variables, the results were not significant. **Conclusion:** The alarming proportion of anthropometric failure among tribal children calls for urgent short-term interventions to correct undernutrition and long-term interventions to improve maternal literacy and awareness to prevent and manage child undernutrition.

Determinants of Minimum Acceptable Diet Feeding Among Children Aged 6–23 Months in Odisha, India

Acharya, A., M.R. Pradhan, and A. Das. 2021. "Determinants of Minimum Acceptable Diet Feeding Among Children Aged 6–23 Months in Odisha, India." *Public Health Nutrition*: 1–11. doi: [10.1017/S1368980021002172](https://doi.org/10.1017/S1368980021002172)

Objective: To assess the level, pattern and determinants of minimum acceptable diet (MAD) feeding in Odisha, India. **Design:** Utilising cross-sectional data, the MAD was estimated through a dietary assessment method wherein the child's mother was asked to recall all the food intake of the youngest child the previous day and night of the surveyed date. **Setting:** National Family Health Survey 2015–2016. **Participants:** Children aged 6–23 months, living with mother and for whom complete information on MAD was available (n 3073). **Results:** Only 8.4 % of the children aged 6–23 months were fed MAD, and the MAD feeding varies considerably by socio-demographic characteristics. Children aged 12–17 months had two times (OR: 2.51, 95 % CI (1.48, 4.26)) and those aged 18–23 months had three times (OR: 3.77, 95 % CI (2.25, 6.30)) higher odds of having a MAD than their counterparts aged 6–8 months. Children whose mother was exposed to any mass media had a higher chance of MAD feeding (OR: 1.46, 95 % CI (1.01, 2.11)). **Conclusions:** The children of higher age, second or higher-order births, with mother exposed to mass media are significantly more likely to be fed with a MAD. At the same time, children from scheduled caste (SC) households have a lower probability of MAD feeding. The lower MAD feeding among the SC households suggests strengthening the ongoing programmes with a higher emphasis on the inclusion of this disadvantaged and marginalised group. Findings from the current study would assist policymakers, and public health managers improve MAD feeding practices in Odisha, India, in a targeted manner.

Haemoglobin Thresholds to Define Anaemia in a National Sample of Healthy Children and Adolescents Aged 1–19 Years in India: A Population-Based Study

Sachdev, H.P.S., A. Porwal, R. Acharya, S. Ashraf, S. Ramesh, N. Khan, U. Kapil, A.V. Kurpad, and A. Sarna. 2021. "Haemoglobin Thresholds to Define Anaemia in a National Sample of Healthy Children and Adolescents Aged 1–19 Years in India: A Population-Based Study." *The Lancet Global Health* 9(6): e822–e831. doi: [https://doi.org/10.1016/S2214-109X\(21\)00077-2](https://doi.org/10.1016/S2214-109X(21)00077-2)

Background: WHO's haemoglobin cutoffs to define anemia were based on five studies of predominantly White adult populations, done over 50 years ago. Therefore, a general re-examination of the existing haemoglobin cutoffs is warranted for global application, in representative healthy populations of children and adults. Such data are scarce in low-income and middle-income countries; however, a 2019, large-scale, nationally representative survey of children and adolescents aged 0–19 years in India (Comprehensive National Nutrition Survey [CNNS]) offered an opportunity for this re-examination. Using this survey, we aimed to assess the age-specific and sex-specific percentiles of haemoglobin and cutoffs to define anaemia in the CNNS population.

Methods: For this population-based study, we constructed age-specific and sex-specific haemoglobin percentiles from values reported for a defined healthy population in the CNNS, which used rigorous quality control measures during sample collection and in the laboratory analyses. To obtain a healthy population, we excluded participants with iron, folate, vitamin B12, and retinol deficiencies; inflammation; variant haemoglobins (haemoglobin A2 and haemoglobin S); and history of smoking. We considered age-specific and sex-specific 5th percentiles of haemoglobin derived for this healthy population as the study cutoff to define anaemia. We compared these with existing WHO cutoffs to assess significant differences between them at each year of age and sex for quantifying the prevalence of anaemia in the entire CNNS sample. **Findings:** Between Feb 24, 2016, and Oct 26, 2018, the CNNS survey collected blood samples from 49 486 individuals. 41 210 participants had a haemoglobin value, 8087 of whom were included in our study and comprised the primary analytical sample. Compared with existing WHO cutoffs, the study cutoffs for haemoglobin were lower at all ages, usually by 1–2 g/dL, but more so in children of both sexes aged 1–2 years and in girls aged 10 years or older. Anaemia prevalence with the study cutoffs was 19.2 percentage points lower than with WHO cutoffs in the entire CNNS sample with valid haemoglobin values across all ages and sexes (10.8% with study cutoffs vs 30.0% with WHO cutoffs). **Interpretation:** These

findings support the re-examination of WHO haemoglobin cutoffs to define anaemia. Our haemoglobin reference percentiles, derived from healthy participants in a large representative Indian survey, are suitable for national use in India. Substantial variations in the 5th percentile of haemoglobin values across the 1–19 years age range and between sexes argue against constructing common cutoffs in stratified age groups for convenience.

Strengthening Nutrition Interventions in Antenatal Care Services Affects Dietary Intake, Micronutrient Intake, Gestational Weight Gain, and Breastfeeding in Uttar Pradesh, India: Results of a Cluster-Randomized Program Evaluation

Nguyen, P.H., S. Kachwaha, L.M. Tran, R. Avula, M.F. Young, S. Ghosh, P.K. Sharma, J. Escobar-Alegria, T. Forissier, S. Patil, E.A. Frongillo, and P. Menon. 2021. "Strengthening Nutrition Interventions in Antenatal Care Services Affects Dietary Intake, Micronutrient Intake, Gestational Weight Gain, and Breastfeeding in Uttar Pradesh, India: Results of a Cluster-Randomized Program Evaluation." *The Journal of Nutrition*: nxab131. doi: <https://doi.org/10.1093/jn/nxab131>

Background: Maternal nutrition interventions are inadequately integrated into antenatal care (ANC). Alive & Thrive aimed to strengthen delivery of micronutrient supplements and intensify interpersonal counseling and community mobilization through government ANC services.

Objectives: We compared nutrition-intensified ANC (I-ANC) with standard ANC (S-ANC) on coverage of nutrition interventions and maternal nutrition practices. **Methods:** We used a cluster-randomized design with cross-sectional baseline (2017) and endline (2019) surveys (n ~660 pregnant and 1800 recently delivered women per survey) and a repeated-measures longitudinal study in 2018–2019 (n = 400). We derived difference-in-difference effect estimates (DIDs) for diet diversity, consumption of micronutrient supplements, weight monitoring, and early breastfeeding practices. **Results:** Despite substantial secular improvements in service coverage from India's national nutrition program, women in the I-ANC arm received more home visits [DID: 7–14 percentage points (pp)] and counseling on core nutrition messages (DID: 10–23 pp) than in the S-ANC arm. One-third of women got ≥3 home visits and one-fourth received ≥4 ANC check-ups in the I-ANC arm. Improvements were greater in the I-ANC arm than in the S-ANC arm for any receipt and consumption of iron–folic acid (DID: 7.5 pp and 9.5 pp, respectively) and calcium supplements (DID: 14.1 pp and 11.5 pp, respectively). Exclusive breastfeeding improved (DID: 7.5 pp) but early initiation of breastfeeding did not. Maternal food group consumption (~4 food groups) and probability of adequacy of micronutrients (~20%) remained low in both arms. Repeated-measures longitudinal analyses showed similar results, with additional impact on consumption of vitamin A–rich foods (10 pp, 11 g/d), other vegetables and fruits (22–29 g/d), and gestational weight gain (0.4 kg). **Conclusions:** Intensifying nutrition in government ANC services improved maternal nutrition practices even with strong secular trends in service coverage. Dietary diversity, supplement consumption, and breastfeeding practices remained suboptimal. Achieving greater behavior changes will require strengthening the delivery and use of maternal nutrition services integrated into ANC services in the health system. This trial was registered at clinicaltrials.gov as NCT03378141.

Effect of Nutrition-Sensitive Agriculture Interventions With Participatory Videos and Women's Group Meetings on Maternal and Child Nutritional Outcomes in Rural Odisha, India (UPAVAN Trial): A Four-Arm, Observer-Blind, Cluster-Randomised Controlled Trial

Kadiyala, S., H. Harris-Fry, R. Pradhan, S. Mohanty, S. Padhan, S. Rath, P. James, E. Fivian, P. Koniz-Booher, N. Nair, H. Haghparast-Bidgoli, N.K. Mishra, S. Rath, E. Beaumont, H. Danton, S. Krishnan, M. Parida, M. O'Hearn, A. Kumar, A. Upadhyay, P. Tripathy, J. Skordis, J. Sturgess, D. Elbourne, A. Prost, and E. Allen. 2021. "Effect of Nutrition-Sensitive Agriculture Interventions With Participatory Videos and Women's Group Meetings on Maternal and Child Nutritional Outcomes in Rural Odisha, India

(UPAVAN Trial): A Four-Arm, Observer-Blind, Cluster-Randomised Controlled Trial.” *Lancet Planet Health* 5: e263–76. doi: [https://doi.org/10.1016/S2542-5196\(21\)00001-2](https://doi.org/10.1016/S2542-5196(21)00001-2)

Background: Almost a quarter of the world’s undernourished people live in India. We tested the effects of three nutrition-sensitive agriculture (NSA) interventions on maternal and child nutrition in India. **Methods:** We did a parallel, four-arm, observer-blind, cluster-randomised trial in Keonjhar district, Odisha, India. A cluster was one or more villages with a combined minimum population of 800 residents. The clusters were allocated 1:1:1:1 to a control group or an intervention group of fortnightly women’s groups meetings and household visits over 32 months using: NSA videos (AGRI group); NSA and nutrition-specific videos (AGRI-NUT group); or NSA videos and a nutrition-specific participatory learning and action (PLA) cycle meetings and videos (AGRI-NUT+PLA group). Primary outcomes were the proportion of children aged 6–23 months consuming at least four of seven food groups the previous day and mean maternal body-mass index (BMI). Secondary outcomes were proportion of mothers consuming at least five of ten food groups and child wasting (proportion of children with weight-for-height Z score SD <−2). Outcomes were assessed in children and mothers through cross-sectional surveys at baseline and at endline, 36 months later. Analyses were by intention to treat. Participants and intervention facilitators were not blinded to allocation; the research team were. This trial is registered at ISRCTN, ISRCTN65922679. **Findings:** 148 of 162 clusters assessed for eligibility were enrolled and randomly allocated to trial groups (37 clusters per group). Baseline surveys took place from Nov 24, 2016, to Jan 24, 2017; clusters were randomised from December, 2016, to January, 2017; and interventions were implemented from March 20, 2017, to Oct 31, 2019, and endline surveys done from Nov 19, 2019, to Jan 12, 2020, in an average of 32 households per cluster. All clusters were included in the analyses. There was an increase in the proportion of children consuming at least four of seven food groups in the AGRI-NUT (adjusted relative risk [RR] 1·19, 95% CI 1·03 to 1·37, p=0·02) and AGRI-NUT+PLA (1·27, 1·11 to 1·46, p=0·001) groups, but not AGRI (1·06, 0·91 to 1·23, p=0·44), compared with the control group. We found no effects on mean maternal BMI (adjusted mean differences vs control, AGRI −0·05, −0·34 to 0·24; AGRI-NUT 0·04, −0·26 to 0·33; AGRI-NUT+PLA −0·03, −0·3 to 0·23). An increase in the proportion of mothers consuming at least five of ten food groups was seen in the AGRI (adjusted RR 1·21, 1·01 to 1·45) and AGRI-NUT+PLA (1·30, 1·10 to 1·53) groups compared with the control group, but not in AGRI-NUT (1·16, 0·98 to 1·38). We found no effects on child wasting (adjusted RR vs control, AGRI 0·95, 0·73 to 1·24; AGRI-NUT 0·96, 0·72 to 1·29; AGRI-NUT+PLA 0·96, 0·73 to 1·26). **Interpretation:** Women’s groups using combinations of NSA videos, nutrition-specific videos, and PLA cycle meetings improved maternal and child diet quality in rural Odisha, India. These components have been implemented separately in several low-income settings; effects could be increased by scaling up together.

Home Fortification of Complementary Foods Reduces Anemia and Diarrhea among Children Aged 6–18 Months in Bihar, India: A Large-Scale Effectiveness Trial

Young, M.F., R.V. Mehta, L. Gosdin, P. Kekre, P. Verma, L.M. Larson, A.W. Girard, U. Ramakrishnan, I. Chaudhuri, S. Srikantiah, and R. Martorell. 2021. “Home Fortification of Complementary Foods Reduces Anemia and Diarrhea among Children Aged 6–18 Months in Bihar, India: A Large-Scale Effectiveness Trial.” *The Journal of Nutrition*: nxab065. doi: <https://doi.org/10.1093/jn/nxab065>

Background: Home fortification of complementary foods with multiple micronutrient powders (MNPs) is recommended to reduce child anemia in resource-poor settings. However, evidence of program effectiveness in India to guide policies and programs is lacking. **Objectives:** We implemented a large-scale intervention of MNPs in Bihar, India. The primary outcome was MNP consumption and change in hemoglobin concentration among children aged 6–18 mo between baseline and endline (12 mo). Secondary outcomes were change in child weight and length and infant and young child feeding (IYCF) practices (initiation, diversity, and feeding frequency). Ad hoc

analyses included changes in anemia; stunting; underweight; wasting; and reported diarrhea, fever, and hospitalization. **Methods:** We conducted a cluster-randomized, effectiveness trial in >4000 children within the context of ongoing health and nutrition programs implemented by CARE, India. Seventy health subcenters were randomly assigned to receive either MNPs with IYCF counseling (intervention) or IYCF counseling only (control). We used an adjusted difference-in-difference approach using repeat cross-sectional surveys at baseline and endline to evaluate impact. **Results:** At baseline, 75% of intervention and 69% of control children were anemic and 33% were stunted. By endline, 70% of intervention households reported their child had ever consumed MNPs, and of those, 64% had consumed MNPs in the past month. Relative to control, hemoglobin concentration increased (0.22 g/dL; 95% CI: 0.00, 0.44 g/dL) and anemia declined by 7.1 percentage points (pp) (95% CI: -13.5, -0.7 pp). There was no impact on anthropometry nor IYCF practices. However, there was a decline of 8.0 pp (95% CI: -14.9, -1.1 pp) in stunting among children aged 12–18 mo. Diarrhea prevalence in the past 2 wk was reduced by 4.0 pp (95% CI: -7.6, -0.4 pp). **Conclusions:** Home fortification of complementary foods within a government-run program in Bihar had moderate compliance and caused modest improvements in hemoglobin and reductions in anemia and diarrhea prevalence.

Evaluation of Complex Agriculture, Nutrition, and Health Interventions Leading to Sustainable Healthy Diets

Frongillo, E. A., and J. Leroy. 2021. "Evaluation of Complex Agriculture, Nutrition, and Health Interventions Leading to Sustainable Healthy Diets." *The Journal of Nutrition*: nxab126. doi: <https://doi.org/10.1093/jn/nxab126>

Focus on the role that agriculture and food systems must play to improve nutrition and health has come through multiple lenses. Nutrition-sensitive interventions that address underlying determinants of nutrition are promoted as being complementary to nutrition-specific interventions by drawing on sectors including agriculture and health, being implemented at large scale, and reaching poor populations with high burdens of malnutrition.

Community-Level Women's Education and Undernutrition Among Indian Adolescents: A Multilevel Analysis of a National Survey

Shah, A.R., and M. A. Subramanyam. 2021. "Community-Level Women's Education and Undernutrition Among Indian Adolescents: A Multilevel Analysis of a National Survey." *PLoS ONE* 16(5): e0251427. doi: <https://doi.org/10.1371/journal.pone.0251427>

Background: Little research has explored the influence of social context on health of Indian adolescents. We conceptualized community-level women's education (proxy for value placed on women's wellbeing) as exerting contextual influence on adolescent hemoglobin level and body mass index (BMI). **Methods:** We derived our sample of more than 62,000 adolescent aged 15 through 17 years from the Indian National Family Health Survey 2015–16. The sample consisted of a total of 62648 adolescents (54232 girls and 8416 boys) for the hemoglobin, and 62846 adolescents (54383 girls and 8463 boys) for the BMI analysis. We fitted multilevel random intercepts linear regression models to test the association of village- and urban-ward-level-women's education with hemoglobin level and BMI of adolescents, accounting for their own and their mother's education; as well as relevant covariates. **Findings:** Our fully adjusted model estimated that if the 52% of communities with less than 20 percent of women having a tenth-grade education in our sample were to achieve 100 percent tenth-grade completion in women, hemoglobin would be 0.2 g/dl higher ($p < 0.001$) and BMI would be 0.62 kg/m² higher on average among all adolescents in such communities. Unexplained variance estimates at the contextual level remained statistically significant, indicating

the importance of context on adolescent undernutrition. **Interpretations:** Adolescents are deeply embedded in their context, influenced by contextual factors affecting health. Promoting adolescent health therefore implies altering social norms related to adolescent health and health behaviors; along with structural changes creating a health-promoting environment. Integrating our empirical findings with theoretically plausible pathways connecting community-level women's education with adolescent undernutrition, we suggest that enhancing community-level women's education beyond high school is necessary to facilitate these processes. **Implications:** Addressing contextual determinants of adolescent undernutrition might be the missing link in India's adolescent anemia and undernutrition prevention efforts, which are currently focused heavily on individual-level biomedical determinants of the problem.

Public Finance Management and Data Availability for Nutrition Financing in India

Kapur, A., and R. Shukla. 2021. "Public Finance Management and Data Availability for Nutrition Financing in India." *BMJ Global Health* 6: e004705. doi: [10.1136/bmjgh-2020-004705](https://doi.org/10.1136/bmjgh-2020-004705)

For investments to translate into improved public service delivery, having a strong public finance management (PFM) system that lays out the rules, institutions and processes by which public funds are managed is critical. To enable a better understanding of the nutrition financial landscape, this paper seeks to determine whether the current PFM system in India allows for capturing required nutrition data. It does this by mapping the availability and comparability of data for a set of key nutrition-specific interventions through the budget cycle: from budget formulation, to execution, and finally, evaluation. The study finds significant gaps in data availability including absence of financial data by level of governance, geography and intervention components. These challenges relate to gaps in PFM design in India from weak planning processes, line-item budgeting, unavailability of time costs, inefficient fund release processes, difficulties in estimating target populations and the lack of output costing. These gaps in the PFM system and consequent data issues have several implications which may lead to strained delivery. This in turn impacts quality and the possibility of course correction. Some of these challenges can be overcome by ensuring planning processes are enforced, expanding existing data systems, making more data available in the public domain, using existing research better and using assumptions carefully to cover data gaps.

Does Food Price Subsidy Affect Dietary Diversity? Evidence from South India

Malaiarasan, U., R. Paramasivam, and T. Felix. 2021. "Does Food Price Subsidy Affect Dietary Diversity? Evidence from South India." *Margin: The Journal of Applied Economic Research* 15(2): 268–290. doi: [10.1177/0973801021990397](https://doi.org/10.1177/0973801021990397)

The present study has tried to address the impact of subsidised rice distribution through the public distribution system on dietary diversity and nutrition intake in the state of Tamil Nadu in India as the state is considered a pioneer in introducing a number of food security programmes in India. We used National Sample Survey Organisation's data for the years 2004-05 and 2011-12, and the propensity score matching technique to estimate the actual impact of the subsidy programme on food consumption patterns and nutrient intake, as the data-set used for analysis was subjected to non-randomisation and selection bias. The estimated results reveal that the subsidy on rice has significantly and positively impacted food consumption and nutritional intake across households, irrespective of income groups. The increased purchasing power of the poor due to the subsidy is limited to the staple food commodities—rice, millets, pulses and vegetables—whereas middle- and high-income households are more likely to consume high-value commodities such as fruits, processed food and livestock products, with a resultant higher gain in fat and calcium. Our study

indicates that extending the price subsidy to nutritious foods, besides rice can help the poor diversify their diets towards healthy and nutrient-rich foods.

Measurement of Population Mental Health: Evidence from a Mobile Phone Survey in India

Coffey, D., P. Hathi, N. Khalid, and A. Thorat. 2021. "Measurement of Population Mental Health: Evidence from a Mobile Phone Survey in India." *Health Policy and Planning* 36: 606–619. doi: <https://doi.org/10.1093/heapol/czab023>

In high-income countries, population health surveys often measure mental health. This is less common in low- and middle-income countries (LMICs), including in India, where mental health is under-researched relative to its disease burden. The objective of this study is to assess the performance of two questionnaires for measuring population mental health in a mobile phone survey. We adapt the Kessler-6 screening questionnaire and the World Health Organization's Self-Reporting Questionnaire (SRQ) for a mobile phone survey in the Indian states of Bihar, Jharkhand and Maharashtra. The questionnaires differ in the symptoms they measure and in the number of response options offered. Questionnaires are randomly assigned to respondents. We consider a questionnaire to perform well if it identifies geographic and demographic disparities in mental health that are consistent with the literature and does not suffer from selective non-response. Both questionnaires measured less mental distress in Maharashtra than in Bihar and Jharkhand, which is consistent with Maharashtra's higher human development indicators. The adapted SRQ, but not the adapted Kessler-6, identified women as having worse mental health than men in all three states. Conclusions about population mental health based on the adapted Kessler-6 are likely to be influenced by low response rates (about 82% across the three samples). Respondents were different from non-respondents: non-respondents were less educated and more likely to be female. The SRQ's higher response rate (about 94% across the three states) may reflect the fact that it was developed for use in LMICs and that it focuses on physical, rather than emotional, symptoms, which may be less stigmatized.

Increasing the Availability and Utilization of Reliable Data on Population Micronutrient (MN) Status Globally: The MN Data Generation Initiative

Brown, K.H., S.E. Moore, S.Y. Hess, C.M. McDonald, K.S. Jones, S.R. Meadows, M.S. Manger, J. Coates, S. Alayon, and S.J.M. Osendarp. 2021. "Increasing the Availability and Utilization of Reliable Data on Population Micronutrient (MN) Status Globally: The MN Data Generation Initiative." *American Journal of Clinical Nutrition*: nqab173. doi: <https://doi.org/10.1093/ajcn/nqab173>

Micronutrient (MN) deficiencies can produce a broad array of adverse health and functional outcomes. Young, preschool children and women of reproductive age in low- and middle-income countries are most affected by these deficiencies, but the true magnitude of the problems and their related disease burdens remain uncertain because of the dearth of reliable biomarker information on population MN status. The reasons for this lack of information include a limited understanding by policy makers of the importance of MNs for human health and the usefulness of information on MN status for program planning and management; insufficient professional capacity to advocate for this information and design and implement related MN status surveys; high costs and logistical constraints involved in specimen collection, transport, storage, and laboratory analyses; poor access to adequately equipped and staffed laboratories to complete the analyses reliably; and inadequate capacity to interpret and apply this information for public health program design and evaluation. This report describes the current situation with regard to data availability, the reasons for the lack of relevant information, and the steps needed to correct this situation, including implementation of a

multi-component MN Data Generation Initiative to advocate for critical data collection and provide related technical assistance, laboratory services, professional training, and financial support.

A Scoping Review of Research on Policies to Address Child Undernutrition in the Millennium Development Goals Era

Pike, V., B. Bradley, A. Rappaport, S. Zlotkin, and N. Perumal. 2021. "A Scoping Review of Research on Policies to Address Child Undernutrition in the Millennium Development Goals Era." *Public Health Nutrition*: 1–12. doi: [10.1017/S1368980021001890](https://doi.org/10.1017/S1368980021001890)

Objective: The breadth of research on the impact of nutrition-specific policies to address child undernutrition is not well documented. This review maps the evidence base and identifies gaps on such policies. **Design:** We systematically searched Medline, Embase, PAIS Index for public policy, Scopus and Web of Science databases to identify eligible studies. Key study characteristics, including research design, type of policy, time span of policy before impact assessment, child age at outcome assessment and types of outcomes assessed, were abstracted in duplicate. **Setting:** Low-, middle- and high-income countries. **Participants:** Studies were eligible for inclusion if they aimed to assess the impact of population-level nutrition-specific policies on undernutrition among children under 10 years of age. **Results:** Of the 5646 abstracts screened, eighty-three studies were included. A range of policies to address child undernutrition were evaluated; the majority were related to micronutrient fortification. Most studies were observational, reported on mandatory regional or sub-national policies, were conducted in high-income countries and evaluated policies within 1 year of implementation. A narrow set of health outcomes were evaluated, most commonly iodine deficiency disorders and neural tube defects. **Conclusions:** Nutrition policies were commonly associated with improved child nutritional status and health. However, this evidence is primarily based on limited settings and on a limited number of outcomes. Further research is needed to assess the longer-term impact of a broader range of nutrition policies on child health, particularly in low- and middle-income countries.

COVID-19

An Interrupted Time Series Analysis of the Lockdown Policies in India: A National-Level Analysis of COVID-19 Incidence

Thayer, W.M., M.Z. Hasan, P. Sankhla, and S. Gupta. 2021. "An Interrupted Time Series Analysis of the Lockdown Policies in India: A National-Level Analysis of COVID-19 Incidence." *Health Policy and Planning* 36(5): 620–629. doi: <https://doi.org/10.1093/heapol/czab027>

India implemented a national mandatory lockdown policy (Lockdown 1.0) on 24 March 2020 in response to Coronavirus Disease 2019 (COVID-19). The policy was revised in three subsequent stages (Lockdown 2.0–4.0 between 15 April to 18 May 2020), and restrictions were lifted (Unlockdown 1.0) on 1 June 2020. This study evaluated the effect of lockdown policy on the COVID-19 incidence rate at the national level to inform policy response for this and future pandemics. We conducted an interrupted time series analysis with a segmented regression model using publicly available data on daily reported new COVID-19 cases between 2 March 2020 and 1 September 2020. National-level data from Google Community Mobility Reports during this timeframe were also used in model development and robustness checks. Results showed an 8% [95% confidence interval (CI) = 6–9%] reduction in the change in incidence rate per day after Lockdown 1.0 compared to prior to the Lockdown order, with an additional reduction of 3% (95% CI = 2–3%) after Lockdown 4.0, suggesting an 11% (95% CI = 9–12%) reduction in the change in COVID-19 incidence after Lockdown 4.0 compared to the period before Lockdown 1.0. Uptake of the lockdown policy is indicated by

decreased mobility and attenuation of the increasing incidence of COVID-19. The increasing rate of incident case reports in India was attenuated after the lockdown policy was implemented compared to before, and this reduction was maintained after the restrictions were eased, suggesting that the policy helped to ‘flatten the curve’ and buy additional time for pandemic preparedness, response and recovery.

Nutrition in the Actual COVID-19 Pandemic. A Narrative Review

Clemente-Suárez, V.J., D.J., Ramos-Campo, J. Mielgo-Ayuso, A.A. Dalamitros, P.A. Nikolaidis, A. Hormeño-Holgado, and J.F. Tornero-Aguilera. 2021. “Nutrition in the Actual COVID-19 Pandemic. A Narrative Review.” *Nutrients* 13(6): 1924. doi: <https://doi.org/10.3390/nu13061924>

The pandemic of Coronavirus Disease 2019 (COVID-19) has shocked world health authorities generating a global health crisis. The present study discusses the main finding in nutrition sciences associated with COVID-19 in the literature. We conducted a consensus critical review using primary sources, scientific articles, and secondary bibliographic indexes, databases, and web pages. The method was a narrative literature review of the available literature regarding nutrition interventions and nutrition-related factors during the COVID-19 pandemic. The main search engines used in the present research were PubMed, SciELO, and Google Scholar. We found how the COVID-19 lockdown promoted unhealthy dietary changes and increases in body weight of the population, showing obesity and low physical activity levels as increased risk factors of COVID-19 affection and physiopathology. In addition, hospitalized COVID-19 patients presented malnutrition and deficiencies in vitamin C, D, B12 selenium, iron, omega-3, and medium and long-chain fatty acids highlighting the potential health effect of vitamin C and D interventions. Further investigations are needed to show the complete role and implications of nutrition both in the prevention and in the treatment of patients with COVID-19.

Leveraging Digital Platforms for Disseminating Health and Nutrition Information During COVID-19: Reflections From Project Samvad in India

Ali, F., S.K. Paswan, G. Bennett, R. Pradhan, S.B. Nadagouda, and S.R. Choudhury. 2021. “Leveraging Digital Platforms for Disseminating Health and Nutrition Information During COVID-19: Reflections From Project Samvad in India.” *Journal of Global Health Reports* 5: e2021036. doi: [doi:10.29392/001c.22121](https://doi.org/10.29392/001c.22121)

Countries around the globe, including India, are making strides to combat maternal and child health issues. To support these efforts, Digital Green implemented Project *Samvad*, a USAID-funded reproductive, maternal, newborn, and child health (RMNCH) project working across six states in India. The project used a human-mediated community video approach to improve maternal and child health outcomes. In early 2020, due to mobility-related restrictions and norms related to physical distancing resulting from the COVID-19 pandemic, Project *Samvad*'s field activities stalled. This descriptive study highlights the project's pivot to the use of digital tools to reach beneficiaries during the COVID-19 pandemic. The project delivered COVID-19 related information by layering it on the existing RMNCH messages. It used WhatsApp and Interactive Voice Response System to reach out to the community and frontline workers. The content of the messages was locally relevant, culturally appropriate, and addressed the concerns of the local community concerning their immediate needs related to RMNCH and COVID-19. The project recorded a listenership of 85,199 and a content viewership of 283,866 in three months. The initiative also oriented 918 frontline workers virtually on their roles and responsibilities during COVID-19. The insights from the adaptation of our approach in the context of COVID-19 can help project managers and policymakers address communication issues during the pandemic or any other emergency, using digital

dissemination for reaching beneficiaries, building the capacities of partners, engaging community members and frontline workers for improved learning, and dealing with process-related challenges.

COVID-19 Disrupted Provision and Utilization of Health and Nutrition Services in Uttar Pradesh, India: Insights from Service Providers, Household Phone Surveys, and Administrative Data

Nguyen, P.H., S. Kachwaha, A. Pant, L.M. Tran, M. Walia, S. Ghosh, P.K. Sharma, J. Escobar-Alegria, E.A. Frongillo, P. Menon, and R. Avula. 2021. "COVID-19 Disrupted Provision and Utilization of Health and Nutrition Services in Uttar Pradesh, India: Insights from Service Providers, Household Phone Surveys, and Administrative Data." *The Journal of Nutrition* nxab135. doi: <https://doi.org/10.1093/jn/nxab135>

Background: The coronavirus (COVID-19) pandemic may substantially affect health systems, but little primary evidence is available on disruption of health and nutrition services. **Objectives:** This study aimed to 1) determine the extent of disruption in provision and utilization of health and nutrition services induced by the pandemic in Uttar Pradesh, India; and 2) identify how adaptations were made to restore service provision in response to the pandemic. **Methods:** We conducted longitudinal surveys with frontline workers (FLWs, n = 313) and mothers of children <2 y old (n = 659) in December 2019 (in-person) and July 2020 (by phone). We also interviewed block-level managers and obtained administrative data. We examined changes in service provision and utilization using Wilcoxon matched-pairs signed-rank tests. **Results:** Compared with prepandemic, service provision reduced substantially during lockdown (83–98 percentage points, pp), except for home visits and take-home rations (~30%). Most FLWs (68%–90%) restored service provision in July 2020, except for immunization and hot cooked meals (<10%). Administrative data showed similar patterns of disruption and restoration. FLW fears, increased workload, inadequate personal protective equipment (PPE), and manpower shortages challenged service provision. Key adaptations made to provide services were delivering services to beneficiary homes (~40%–90%), social distancing (80%), and using PPE (40%–50%) and telephones for communication (~20%). On the demand side, service utilization reduced substantially (40–80 pp) during the lockdown, but about half of mothers received home visits and food supplementation. Utilization for most services did not improve after the lockdown, bearing the challenges of limited travel (30%), nonavailability of services (26%), and fear of catching the virus when leaving the house (22%) or meeting service providers (14%). **Conclusions:** COVID-19 disrupted the provision and use of health and nutrition services in Uttar Pradesh, India, despite adaptations to restore services. Strengthening logistical support, capacity enhancement, performance management, and demand creation are needed to improve service provision and utilization during and post-COVID-19.

Commentary

India Faces a Challenge with Its Mass Vaccination Efforts

Subramanian, S.V. 2021. "India Faces a Challenge with Its Mass Vaccination Efforts." *The Lancet Global Health*. doi: [https://doi.org/10.1016/S2214-109X\(21\)00260-6](https://doi.org/10.1016/S2214-109X(21)00260-6)

In April, 2021, India recorded more than 48 000 deaths and more than 6.9 million new cases. This surge, which continued into May, 2021, occurred after a decline in the number of cases and fatalities. Simultaneously, India administered more than 84 million doses of vaccine, averaging 2.8 million doses per day in April, 2021. As of May 19, 2021, an India vaccine tracker reported that more than 186 million doses had been administered; only the USA and China have administered more vaccines. India ranks second in the world for the most vaccine doses given per day, with more than 3.66 million, ahead of the USA, which hit its peak at 3.38 million daily doses. If the Indian administration oversaw the vaccination programme in the UK, it would have vaccinated its entire

population twice and have more than 50 million doses to spare. Using the percentage of the population that has been vaccinated as the sole metric, India's performance has been characterised as slow or, at worst, botched. Such rhetoric is unwarranted and unfairly blames India for its population size.

NON-PEER REVIEWED

Global Database on the Implementation of Nutrition Action (GINA): Sodium Country Score Card

WHO (World Health Organization). 2021. *Global Database on the Implementation of Nutrition Action (GINA): Sodium Country Score Card*. Geneva.

<https://extranet.who.int/nutrition/gina/en/scorecard/sodium>

High sodium intake contributes to raised blood pressure and increased risk of heart disease and stroke. It is projected that lowering sodium intake from the estimated average of 3950mg/day to the World Health Organization recommended maximum of 2000 mg/day would avert at least three million premature deaths each year and possibly many more. Consequently, policies and actions to reduce population sodium intake have been identified as an action that should be undertaken immediately to produce accelerated results in terms of lives saved, disease prevented and costs avoided.

WHO monitors countries' progress in implementing legislative and other measures to reduce dietary intake of sodium and has developed the Sodium Country Score Card to track countries' performance on a continuous basis. The Score Card depicts countries that

- have made a national policy commitment towards sodium reduction (Score 1)
- have implemented voluntary approaches to reduce sodium in the food supply or encourage consumers to make healthier food choices (Score 2)
- have adopted mandatory declaration of sodium on pre-packaged food and implement at least one mandatory measures for sodium reduction (Score 3)
- have adopted mandatory declaration of sodium on pre-packaged food and implement multiple mandatory measures for sodium reduction as well as all the sodium-related WHO Best Buys for tackling NCDs (Score 4).

Composite Index of Anthropometric Failure and Its Correlates: A Cross-Sectional Study of Under Five Children in an Urban Informal Settlement of Mumbai, India

Bahuguna, M., S. Das, D. Osrin, S. Pantvaidya, and A. Jayaraman. 2021. *Composite Index of Anthropometric Failure and Its Correlates: A Cross-Sectional Study of Under Five Children in an Urban Informal Settlement of Mumbai, India*. Mumbai: Society for Nutrition, Education and Health Action.

<https://snehamumbai.org/wp-content/uploads/2021/04/Composite-Index-of-Anthropometric-Failure-Report.pdf>

Introduction: The use of conventional anthropometric indices by malnutrition management programs may miss children with dual or multiple forms of growth failure. The Composite Index of Growth Failure (CIAF) helps to identify such vulnerable children. **Objective:** We aimed to assess the prevalence of undernutrition and its subgroups using the CIAF among children under five residing in urban informal settlements of Mumbai, India. We also examined the factors associated with undernutrition. **Methods:** Data from a cross-sectional survey was used to construct CIAF; WHO Z-scores were used to categorize children into seven subgroups: (A) no failure, (B) wasting only, (C)

wasting and underweight, (D) wasting, stunting, and underweight, (E) stunting and underweight, (F) stunting only, (G) underweight only. Undernutrition prevalence was assessed by combining all these subgroups except subgroup A. Factors associated with undernutrition were explored using multilevel logistic regression models adjusted for child, maternal and households socioeconomic characteristics. **Results:** 3394 out of 6489 children (52.3%) were undernourished. Of these undernourished children, 37.2% had single anthropometric failure, 51.1% had dual anthropometric failures, and 11.6% had multiple anthropometric failures. Among all subgroups of undernourished children “stunting and underweight” had the highest prevalence (44.2%). Child’s age, mother’s age and education, parity, type of toilet facility used, and household economic status were associated with undernutrition. **Conclusions:** The CIAF can be used by nutrition programs to develop need-specific interventions to reduce the risk of aggravated morbidities and mortality. To improve child health and nutrition, Government programs should continue to focus on issues related to women’s education and early pregnancies.

Identifying Factors Associated with the Level of Child Malnutrition in India: Observations from the Comprehensive National Nutrition Survey

Khan, N., R. Acharya, P.K. Agrawal, A. Porwal, S. Ashraf, R. Johnston, A. Sarna, and S. Ramesh. 2021. “Identifying Factors Associated with the Level of Child Malnutrition in India: Observations from the Comprehensive National Nutrition Survey.” *Research Square*. doi: <https://doi.org/10.21203/rs.3.rs-379958/v1>

Background: Malnutrition is a complex phenomenon that has become a universal problem inhibiting human development. India is home of disproportionate height and weight of children including anemia are sign of malnutrition. This study aimed to examine child malnutrition by considering three parameters—stunting (short), underweight (thin), and/or anaemia—among children aged 1–9 years. **Methods:** This study used nationally representative data from the Comprehensive National Nutrition Survey (CNNS). The analytic sample was restricted to 25,885 children aged 1–9 years for whom data on height, weight, and haemoglobin level was available. This analytic sample was not significantly different from the total sample of 69,413. Based on World Health Organisation’s (WHO) cut-off for child growth standards, child malnutrition is defined as ‘severe’ if a child has suffered all 3 parameters—stunting, underweight, and anaemia, ‘mild/moderate’ if a child has suffered 1 or 2 parameters and ‘none’ if a child has not suffered from any of the 3 parameters. Univariate and bivariate analysis were used for descriptive associations and marginal effects probabilities were calculated using the ordinal logit regression model to identify the correlates of severe malnutrition. **Results:** Nine percent of children aged 1-9 years were severely malnourished in the country. The prevalence of malnutrition declined considerably with increasing age of children—13% in children aged 1–4 years to 6% in children aged 5–9 years. Severe malnutrition was significantly higher among higher birth order children, children born to illiterate mothers, children belonging to Scheduled Tribes and poor families, children living in rural areas and the eastern region of the country. Zinc deficiency was found more (22%, 95% CI:18.2–26.0) among severely malnourished children as compared to normal children (16%, 95% CI:13.9–17.3). **Conclusions:** Malnutrition is widely prevalent in children belonging to illiterate mothers, Scheduled Tribes, poor families, rural areas, and eastern region of the country. Frontline workers should identify such vulnerable children through regular monitoring of height, weight, and haemoglobin testing in their coverage areas.

Socio-Economic Inequality in Anthropometry Failure in Children Under 5 Years in India: Evidence from the Comprehensive National Nutrition Survey 2016–18

Porwal A, R. Acharya, S. Ashraf, P.K. Agarwal, S. Ramesh, N. Khan, A. Sarna, and R. Johnston. 2021. “Socio-Economic Inequality in Anthropometry Failure in Children Under 5 Years in India: Evidence

from the Comprehensive National Nutrition Survey 2016–18.” *Research Square*. doi: [10.21203/rs.3.rs-384339/v1](https://doi.org/10.21203/rs.3.rs-384339/v1)

Background: Conventional indicators used to assess the nutritional status of children tend to underestimate the overall undernutrition in the presence of multiple anthropometric failures. Further, factors contributing to the rich-poor gap in the composite index of anthropometric failure (CIAF) have not been explored. **Objective:** To estimate the prevalence of CIAF and quantify the contribution of factors that explain the rich-poor gap in CIAF. **Methods:** The present study used data of 38,060 children under the age of five and their biological mothers, drawn from the nationally representative Comprehensive National Nutrition Survey of children and adolescents aged 0–19 years in India. The CIAF outcome variables in this study provide an overall prevalence of undernutrition, with six mutually exclusive anthropometric measurements of height-for-age, height-for-weight, and weight-for-age, calculated using the WHO Multicenter Growth Reference Study. Multivariate regression and decomposition analysis were used to examine the association between covariates with CIAF and to estimate the contribution of different covariates in the existing rich-poor gap. **Results:** An overall CIAF prevalence of 48.2% among children aged 0–4 years was found in this study. 6.0% children had all three forms of anthropometric failures. The odds of CIAF were more likely among children belonging to poorest households (AOR: 2.41, 95% CI: 2.12–2.75) and those residing in urban area (AOR: 1.06, 95% CI 1.00–1.11). Children of underweight mothers and those with high parity were at higher risk of CIAF (AOR: 1.51, 95% CI: 1.42–1.61) and (AOR: 1.15, 95% CI: 1.08–1.22), respectively. Children of mother exposed to mass media were at lower risk of CIAF (AOR: 0.87, 95% CI: 0.81–0.93). **Conclusion:** This study estimated a composite index to assess the overall anthropometric failure, which also provides a broader understanding of the extent and pattern of undernutrition among children. Findings show that maternal covariates contribute the most to the rich-poor gap. As well, the findings suggest that intervention programs with a targeted approach are crucial to reach the most vulnerable groups and to reduce the overall burden of undernutrition.

Using Underweight for Predicting Stunting Among Children in India: Analysis From the Comprehensive National Nutrition Survey

Ramesh, S., R. Acharya, A. Sarna, S. Ashraf, P.K. Agrawal, A. Porwal, N. Khan, S. Deb, and R. Johnston. 2021. “Using Underweight for Predicting Stunting Among Children in India: Analysis From the Comprehensive National Nutrition Survey.” *Research Square*. doi: <https://doi.org/10.21203/rs.3.rs-378194/v1>

Background: Stunting and underweight are the most commonly used indicators to assess the nutritional status of children. Prior research has highlighted the problems encountered while measuring the height of child. The current paper aims to assess the relationship between stunting and underweight and derive regression equations to predict stunting from underweight prevalence among children under five years of age. **Method:** Data was drawn from 38,060 and 219,796 nationally representative sample of children aged 0–4 years, from Comprehensive National Nutrition Survey (CNNS, 2016–18) and National Family Health Survey 4 (NFHS-4, 2015–16), respectively. Anthropometric indicators, stunting and underweight was calculated based on the 2006 WHO Child Growth Standards. Univariate and bivariate analysis was done to obtain estimates for stunting and underweight. A series of regression models were run to obtain an estimate of percent stunted as a function of percent underweight at the national and regional level. Predicted stunting prevalence was estimated from regression equation for selected states and compared with observed prevalence from other studies. Data were analysed using STATA V.16.0. **Results:** Nearly one out of four children under 5 years of age were stunted and underweight in CNNS and NFHS-4. Out of those stunted, 67% and 65% were underweight in CNNS and NFHS-4, respectively. At the national level, there was high

correlation between the two indicators ($r > 0.7$) in both CNNS and NFHS-4, whereas at the regional level in NFHS-4, the correlation coefficient ranged from 0.32 for central region to 0.86 for southern region. At the national level the slope was 0.557 in CNNS and 0.610 in NFHS-4. At the regional level, it varied from 0.334 in the central region to 0.847 in the western region. Similarly, at the national level, the intercept (α) was almost same when we analyzed CNNS data or NFHS-4 data or both together (~15), however, wide variability was observed between different regions (4.61 in western region to 30.14 in central region). **Conclusion:** Our analysis shows that regression equations with child underweight prevalence may be used to predict stunting where the quality of length/ height measurement is poor or unavailable, in regions where high correlation between the two indicators was found.

Eliminating Female Anaemia in India: Prevalence, Challenges and Way Forward

Sharma, A. 2021. *Eliminating Female Anaemia in India: Prevalence, Challenges and Way Forward*. Issue Brief. New Delhi: Social and Political Research Foundation.

<https://sprf.in/eliminating-female-anaemia-in-india-prevalence-challenges-and-way-forward/>

India's 94th rank in the 2020 Global Hunger Index (2021) out of 107 reflects the rampant undernourishment in the country. While the economy has witnessed rapid growth in the past decades, improvements in nutrition status have been relatively steady, and hence, the need for substantial breakthroughs remains. A critical aspect of this public health challenge is the anaemia burden on women in India, recording one of the world's highest.

Agriculture, Food and Nutrition Security: A Study of Availability and Sustainability in India

Rukhsana, and A. Aslam. 2021. *Agriculture, Food and Nutrition Security: A Study of Availability and Sustainability in India*. Kolkata: Springer International Publishing.

<https://books.google.co.in/books?id=68EozgEACAAJ&dq>

This volume provides an interdisciplinary collection of studies that cover the trends and issues related to agricultural productivity and availability, food and nutrition security, and sustainability in India. The book discusses a broad range of vital issues concerning the production and consumption of food during the era of climate change, and has been prepared to generate awareness of these issues in a large agricultural economy to shed light on new perspectives and solutions to achieve sustainable food production and security in India. The book is organized into three major sections: Climate and Agricultural Productivity for Availability, Changes and Trends in Cropping Patterns and Food Security, and Food and Nutrition Security for Sustainable Development. The book will be of interest to students, researchers, policymakers, and other inquisitive readers interested in different aspects of agriculture, food and nutrition security, and sustainable development.

Using a Mobile Health Application by Peer Counselors to Promote Exclusive Breastfeeding in Rural India - A Training Curriculum

Bellad, R.M., N.S. Mahantshetti, U.S. Charantimath, T. Ma, Y. Washio, V.L. Short, K. Chang, P. Lalakia, F.J. Jaeger, P.J. Kelly, G. Mungarwadi, C. Karadiguddi, S.S. Goudar, and R.J. Derman. 2021. "Using a Mobile Health Application by Peer Counselors to Promote Exclusive Breastfeeding in Rural India - A Training Curriculum." *Research Square*. doi: <https://doi.org/10.21203/rs.3.rs-416409/v1>

Background: Despite strong evidence about the benefits of exclusive breastfeeding (EBF), rates have remained relatively unchanged over the past two decades in low-middle income countries. One strategy for increasing EBF is through community-based programs that use Peer Counselors (PCs) for

education and support. The use of mobile health (mHealth) applications is gaining increasing applicability in these countries. **Research Aim:** The present article describes our curriculum in the state of Karnataka, India for supporting new mothers to exclusively breastfeed using an mHealth application in rural India. **Methods:** Twenty-five women from the community were trained to be PCs and to use an mHealth application to conduct breastfeeding counselling. The three-day training was based on the WHO breastfeeding course, translated and adapted to the local culture. The curriculum was validated by twelve nursing and obstetric experts. Pre-post evaluation of breastfeeding knowledge, self-efficacy, and skills were evaluated with a 30 item survey. Usability of the mHealth application was assessed post-training with a Usability Scale for Mobile Breastfeeding Education App. **Results:** We observed a significant increase in the mean scores for knowledge ($P < .0001$) and skills ($P = .0006$) from pre to post training. Age of the PCs and their own breastfeeding experience correlated significantly with the acquisition of knowledge and skills. The mHealth app showed high usability scores. **Conclusions:** The culturally adapted curriculum was effective in training women from a rural setting in the acquisition of EBF knowledge and skills and in the use of an mHealth application to support their training.

Early Lessons From Swabhimaan, a Multi-Sector Integrated Health and Nutrition Programme for Women and Girls in India

Shrivastav, M., A. Saraswat, N. Abraham, R.S. Reshmi, S. Anand, A. Purty, R.S. Xaxa, J. Minj, B. Mohapatra, and V. Sethi. 2021. "Early Lessons From Swabhimaan, a Multi-Sector Integrated Health and Nutrition Programme for Women and Girls in India." *Field Exchange* 65: 103–108.
<https://www.enonline.net/fex/65/healthnutritionprogrammewomenindia>

What we know: Poor nutrition status before and during pregnancy is a serious problem in India and a key driver of low birth weight and child undernutrition. What this article adds: Swabhimaan is a five-year initiative (2016-2021) integrated within the Government of India's flagship poverty alleviation programme, Deendayal Antyodaya Yojana-National Rural Livelihoods Mission (DAY-NRLM), across three states in India, carried out in partnership with UNICEF. The programme aims to mobilise women via village-level women's collectives to develop and implement integrated nutrition microplans and strengthen local government services in order to improve the nutrition outcomes of women and adolescent girls. The results are presented of a midline evaluation carried out in 2018-2019 covering villages in five different sites across the three states (including 3,171 adolescent girls, 1,856 pregnant women and 3,277 mothers of children under two years of age). The results reveal strong progress in implementation with 336 village-level microplans developed, 77,000 females screened and 15,122 identified as being at nutritional risk and referred for nutrition, agriculture and social protection support. Midline results show a reduction in thinness in adolescent girls (13.8% versus 18.5% at baseline) and mothers with children under two years of age (44.6% versus 48.4% at baseline) and an increase in the average mid-upper arm circumference of pregnant women (24.0cm versus 23.5cm at baseline). Evidence also shows improved household food security and improved uptake of government health, water, sanitation and hygiene and social protection services. Results suggest that utilising and funding women's collectives to respond to nutrition needs in their communities with integrated responses are feasible. The results of the endline evaluation and an impact evaluation will be forthcoming.

UPCOMING EVENTS & DEADLINES

eCourse in Health, Safety & Environment Management

This is a three-month eLearning course for health, medical, environment, safety and engineering professionals. Developed by the Indian Institute of Public Health Gandhinagar (IIPHG), it will be delivered by a multidisciplinary team from IIPHG and experts in the field.

When: July 31, 2021

Where: Online

For more information: <https://cdl.phfi.org/portal/node/104>

Measurement and Survey Design Course

CLEAR/J-PAL South Asia's Measurement and Survey Design Course is a five-day course that introduces participants to foundational concepts within measurement theory and quantitative survey design. The course draws on J-PAL South Asia's vast experience in running randomised evaluations that involve extensive primary data collection. Through this course, participants will address questions such as:

- What data to collect
- How to design survey instruments
- Why and how to pilot survey instruments
- How to develop field protocols,
- How to conduct remote data collection
- and best practices related to each.

This course will also explore context-specific case studies through focused, interactive discussions with CLEAR/J-PAL South Asia staff and other participants, providing opportunities to forge connections with peers. This course will be conducted in English. MSDC 2021 will be led by senior CLEAR/J-PAL South Asia training and research staff.

When: August 2–6, 2021

Where: Online

For more information: <https://www.tfaforms.com/4894854>

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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