

### EDITOR'S NOTE

Happy New Year!!

In this new year issue of Abstract Digest, we bring to you the much-awaited birth cohort MAL-ED study, two systematic reviews, as well as feature an article which mapped state-level disease burden and risk factors for the states in India, and several other interesting articles. In our non-peer reviewed section, we feature several papers from a book on 'Nutritional Adequacy, Diversity and Choice Among Primary School Children: Policy and Practice in India.'

- The MAL-ED Network Investigators conducted a longitudinal birth cohort study (2017) in 7 sites in 3 continents and show that neonatal and maternal factors play a more influential role than postnatal factors during early childhood, and their contributions remained significant throughout the first 24 months.
- Harding et al. (2017) review patterns and trends of deficiencies in South Asia pertaining to iodine, Fe, vitamin A and Zn and urge combining targeted health system delivery of quality services with multisector actions to address hidden hunger.
- De-Regil and colleagues (2017) in a systematic review conclude that point-of-use fortification of foods with micronutrient powders containing iron reduced anaemia and iron deficiency in preschool- and school-age children compared with no intervention or a placebo.
- Seth and colleagues (2017) have studied the differential effects of community health worker visits across socioeconomic groups in Uttar Pradesh, India, and drawn a link between social inequities and health disparities.
- Dodos et al. (2017) examine the main findings from the 12 most recent studies, which used Link NCA methodology and state that inadequate WASH conditions are often identified as major contributors to undernutrition and provide recommendations for better alignment and integration of WASH and nutrition interventions.
- A comprehensive mapping of state-level estimates of disease burden and risk factors over time (1990-2016) across the states of India by Dandona and colleagues (2017) provides crucial inputs for more specific health planning for each state.
- Alderman and colleagues (2017) examine the questions of food, vouchers, and cash transfers to shed light on the complex, bumpy and non-linear process of how some flagship food-based social protection programs have evolved over time, and how they currently work in some low and middle-income countries.
- Through a systematic review, Ahner-McHaffie and colleagues (2017) look at impact evaluations on integrated development interventions to assess whether synergistic and amplified impacts are being measured and evaluated.
- Chandak and colleagues (2017) explain in their protocol of the EMPHASIS study (Epigenetic Mechanisms linking Pre-conceptual nutrition and Health Assessed in India and Sub-Saharan Africa) on what and how they propose to investigate the epigenetic mechanisms underpinning the long-term impact of maternal nutrition on offspring health.

Enjoy reading!

## PEER-REVIEWED

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### Childhood stunting in relation to the pre- and postnatal environment during the first 2 years of life: The MAL-ED longitudinal birth cohort study

MAL-ED Network Investigators. 2017. *PLOS Medicine* 14(10): e1002408.

<http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1002408>

**Background:** Stunting is the most prevalent manifestation of childhood malnutrition. To characterize factors that contribute to stunting in resource-poor settings, we studied a priori selected biological and social factors collected longitudinally in a cohort of newborns. **Methods & Findings:** We enrolled 1,868 children across 7 resource-poor settings in Bangladesh, Brazil, India, Nepal, Peru, South Africa, and Tanzania shortly after birth and followed them for 24 months between 2 November 2009 and 28 February 2014. We collected longitudinal anthropometry, sociodemographic factors, maternal-reported illnesses, and antibiotic use; child feeding practices; dietary intake starting at 9 months; and longitudinal blood, urine, and stool samples to investigate non-diarrheal enteropathogens, micronutrients, gut inflammation and permeability, and systemic inflammation. We categorized length-for-age Z-scores into 3 groups (not stunted,  $\geq -1$ ; at risk,  $< -1$  to  $-2$ ; and stunted,  $< -2$ ), and used multivariable ordinal logistic regression to model the cumulative odds of being in a lower length-for-age category (at risk or stunted). A total of 1,197 children with complete longitudinal data were available for analysis. The prevalence of having a length-for-age Z-score below  $-1$  increased from 43% (range 37%-47% across sites) shortly after birth (mean 7.7 days post-delivery, range 0 to 17 days) to 74% (16%-96%) at 24 months. The prevalence of stunting increased 3-fold during this same time period. Factors that contributed to the odds of being in a lower length-for-age category at 24 months were lower enrollment weight-for-age (interquartile cumulative odds ratio = 1.82, 95% CI 1.49-2.23), shorter maternal height (2.38, 1.89-3.01), higher number of enteropathogens in non-diarrheal stools (1.36, 1.07-1.73), lower socioeconomic status (1.75, 1.20-2.55), and lower percent of energy from protein (1.39, 1.13-1.72). Site-specific analyses suggest that reported associations were similar across settings. While loss to follow-up and missing data are inevitable, some study sites had greater loss to follow-up and more missing data than others, which may limit the generalizability of the findings. **Conclusions:** Neonatal and maternal factors were early determinants of lower length-for-age, and their contribution remained important throughout the first 24 months of life, whereas the average number of enteropathogens in non-diarrheal stools, socioeconomic status, and dietary intake became increasingly important contributors by 24 months relative to neonatal and maternal factors.

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### Hidden hunger in South Asia: a review of recent trends and persistent challenges

Harding, K.L., Aguayo, V.M., and Webb, P. 2017. *Public Health Nutrition*.

doi:10.1017/S1368980017003202

[https://www.cambridge.org/core/services/aop-cambridge-core/content/view/2725C310F5DA6BEDE83500CF5E7342FF/S1368980017003202a.pdf/hidden\\_hunger\\_in\\_south\\_asia\\_a\\_review\\_of\\_recent\\_trends\\_and\\_persistent\\_challenges.pdf](https://www.cambridge.org/core/services/aop-cambridge-core/content/view/2725C310F5DA6BEDE83500CF5E7342FF/S1368980017003202a.pdf/hidden_hunger_in_south_asia_a_review_of_recent_trends_and_persistent_challenges.pdf)

Hidden hunger is a term used to describe human deficiencies of key vitamins and minerals, also known as micronutrients. While global in scale, the prevalence of micronutrient deficiencies is particularly high in South Asia despite recent successes in economic growth, agricultural output and health care. The present paper reviews the most recent evidence on patterns and trends of hidden hunger across the region, with a focus on the most significant deficiencies— iodine, Fe, vitamin A and Zn – and interprets these in terms of health and economic consequences. The challenge for South Asian policy makers is to invest in actions that can cost-effectively resolve chronic nutrient gaps facing millions of house-holds. Appropriate solutions are available today, so governments should build on evidence-based successes that combine targeted health system delivery of quality services with carefully designed multisector actions that help promote healthier diets, reduce poverty and ensure social protection simultaneously.

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### Point-of-use fortification of foods with micronutrient powders containing iron in children of preschool and school-age

De-Regil, L.M., M.E.D. Jefferds, and J.P.A. Peña-Rosas. 2017. *Cochrane Database of Systematic Reviews* 11. DOI: [10.1002/14651858.CD009666.pub2](https://doi.org/10.1002/14651858.CD009666.pub2).

<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009666.pub2/full>

**Background:** Approximately 600 million children of preschool and school age are anaemic worldwide. It is estimated that at least half of the cases are due to iron deficiency. Point-of-use fortification of foods with micronutrient powders (MNP) has been proposed as a feasible intervention to prevent and treat anaemia. It refers to the addition of iron alone or in combination with other vitamins and minerals in powder form, to energy-containing foods (excluding beverages) at home or in any other place where meals are to be consumed. MNPs can be added to foods either during or after cooking or immediately before consumption without the explicit purpose of improving the flavour or colour. **Objectives:** To assess the effects of point-of-use fortification of foods with iron-containing MNP alone, or in combination with other vitamins and minerals on nutrition, health and development among children at preschool (24 to 59 months) and school (five to 12 years) age, compared with no intervention, a placebo or iron-containing supplements. **Results:** We included 13 studies involving 5810 participants from Latin America, Africa and Asia. We excluded 38 studies and identified six ongoing/unpublished trials. All trials compared the provision of MNP for point-of-use fortification with no intervention or placebo. No trials compared the effects of MNP versus iron-containing supplements (as drops, tablets or syrup). The sample sizes in the included trials ranged from 90 to 2193 participants. Six trials included participants younger than 59 months of age only, four included only children aged 60 months or older, and three trials included children both younger and older than 59 months of age. MNPs contained from two to 18 vitamins and minerals. The iron doses varied from 2.5 mg to 30 mg of elemental iron. Four trials reported giving 10 mg of elemental iron as sodium iron ethylenediaminetetraacetic acid (NaFeEDTA), chelated ferrous sulphate or microencapsulated ferrous fumarate. Three trials gave 12.5 mg of elemental iron as microencapsulated ferrous fumarate. Three trials gave 2.5 mg or 2.86 mg of elemental iron as NaFeEDTA. One trial gave 30 mg and one trial provided 14 mg of elemental iron as microencapsulated ferrous fumarate, while one trial gave 28 mg of iron as ferrous glycine phosphate. In comparison with receiving no intervention or a placebo, children receiving iron-containing MNP for point-of-use fortification of foods had lower risk of anaemia prevalence ratio (PR) 0.66, 95% confidence interval (CI) 0.49 to 0.88, 10 trials, 2448 children; moderate-quality evidence) and iron deficiency (PR 0.35, 95% CI 0.27 to 0.47, 5 trials, 1364 children; moderate-quality evidence) and had higher haemoglobin (mean difference (MD) 3.37 g/L, 95% CI 0.94 to 5.80, 11 trials, 2746 children; low-quality evidence). Only one trial with 115 children reported on all-cause

mortality (zero cases; low-quality evidence). There was no effect on diarrhoea (risk ratio (RR) 0.97, 95% CI 0.53 to 1.78, 2 trials, 366 children; low-quality evidence). **Conclusions:** Point-of-use fortification of foods with MNPs containing iron reduces anaemia and iron deficiency in preschool- and school-age children. However, information on mortality, morbidity, developmental outcomes and adverse effects is still scarce.

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### Differential effects of community health worker visits across social and economic groups in Uttar Pradesh, India: a link between social inequities and health disparities

Seth, A., S. Tomar, K. Singh, D. Chandurkar, A. Chakraverty, A. Dey, A.K. Das, K. Hay, N. Saggurti, S.C. Boyce, A. Raj, and J.G. Silverman. 2017. *International journal for equity in health* 16(1):46. DOI: 10.1186/s12939-017-0538-6.

<https://www.ncbi.nlm.nih.gov/pubmed/28270151>

**Background:** Uttar Pradesh (UP) accounts for the largest number of neonatal deaths in India. This study explores potential socio-economic inequities in household-level contacts by community health workers (CHWs) and whether the effects of such household-level contacts on receipt of health services differ across populations in this state. **Methods:** A multistage sampling design identified live births in the last 12 months across the 25 highest-risk districts of UP (N = 4912). Regression models described the relations between household demographics (caste, religion, wealth, literacy) and CHW contact, and interactions of demographics and CHW contact in predicting health service utilization (> = 4 antenatal care (ANC) visits, facility delivery, modern contraceptive use). **Results:** No differences were found in likelihood of CHW contact based on caste, religion, wealth or literacy. Associations of CHW contact with receipt of ANC and facility delivery were significantly affected by religion, wealth and literacy. CHW contact increased the odds of 4 or more ANC visits only among non-Muslim women, increased the odds of both four or more ANC visits and facility delivery only among lower wealth women, increased the odds of facility delivery to a greater degree among illiterate vs. literate women. **Conclusion:** CHW visits play a vital role in promoting utilization of critical maternal health services in UP. However, significant social inequities exist in associations of CHW visits with such service utilization. Research to clarify these inequities, as well as training for CHWs to address potential biases in the qualities or quantity of their visits based on household socio-economic characteristics is recommended.

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### Relationship between water, sanitation, hygiene, and nutrition: what do Link NCA nutrition causal analyses say?

Dodos, J., B. Mattern, J. Lapegue, M. Altmann, and M.A. Aissa. 2017. *Waterlines* 36(4).

<http://www.developmentbookshelf.com/doi/full/10.3362/1756-3488.17-00005>

Defined by UNICEF as 'the outcome of insufficient food intake and repeated infectious diseases', undernutrition is one of the world's most serious problems, with long-lasting harmful impacts on health and devastating consequences for social and economic development. The three main underlying causes of undernutrition, namely unsuitable or insufficient food intake, poor care practices, and infectious diseases, are directly or indirectly related to inadequate access to water, sanitation facilities, and hygiene practices (WASH). There is a growing base of evidence showing the

links between poor WASH conditions, especially exposure to poor sanitation, and stunting (low height for age ratio). However, the effects of WASH interventions on wasting (low weight for height ratio) and the impact of environmental enteric dysfunction (chronic infection of small intestine caused by extended exposure to faecal pathogens) on undernutrition should be explored further. Action Against Hunger (Action Contre la Faim) promotes a participatory nutrition causal analysis, the Link NCA methodology, which is used to analyse complex, dynamic, locally specific causes of undernutrition. This article aims to assess the main findings from 12 most recent Link NCA studies, conducted from the beginning of 2014 until the end of 2016. Results show that inadequate WASH conditions are often identified as major contributors to undernutrition in the study areas. The article also provides lessons learned and a set of practical recommendations for better alignment and integration of WASH and nutrition interventions.

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### Nations within a nation: variations in epidemiological transition across the states of India, 1990–2016 in the Global Burden of Disease Study

Dandona, L. et al. 2017. *The Lancet* 390(10111): 2437-2460.

[http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(17\)32804-0/abstract](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(17)32804-0/abstract)

**Background:** 18% of the world's population lives in India, and many states of India have populations similar to those of large countries. Action to effectively improve population health in India requires availability of reliable and comprehensive state-level estimates of disease burden and risk factors over time. Such comprehensive estimates have not been available so far for all major diseases and risk factors. Thus, we aimed to estimate the disease burden and risk factors in every state of India as part of the Global Burden of Disease (GBD) Study 2016. **Methods:** Using all available data sources, the India State-level Disease Burden Initiative estimated burden (metrics were deaths, disability-adjusted life-years [DALYs], prevalence, incidence, and life expectancy) from 333 disease conditions and injuries and 84 risk factors for each state of India from 1990 to 2016 as part of GBD 2016. We divided the states of India into four epidemiological transition level (ETL) groups on the basis of the ratio of DALYs from communicable, maternal, neonatal, and nutritional diseases (CMNNDs) to those from non-communicable diseases (NCDs) and injuries combined in 2016. We assessed variations in the burden of diseases and risk factors between ETL state groups and between states to inform a more specific health-system response in the states and for India as a whole. **Findings:** DALYs due to NCDs and injuries exceeded those due to CMNNDs in 2003 for India, but this transition had a range of 24 years for the four ETL state groups. The age-standardised DALY rate dropped by 36.2% in India from 1990 to 2016. The numbers of DALYs and DALY rates dropped substantially for most CMNNDs between 1990 and 2016 across all ETL groups, but rates of reduction for CMNNDs were slowest in the low ETL state group. By contrast, numbers of DALYs increased substantially for NCDs in all ETL state groups, and increased significantly for injuries in all ETL state groups except the highest. The all-age prevalence of most leading NCDs increased substantially in India from 1990 to 2016, and a modest decrease was recorded in the age-standardised NCD DALY rates. The major risk factors for NCDs, including high systolic blood pressure, high fasting plasma glucose, high total cholesterol, and high body-mass index, increased from 1990 to 2016, with generally higher levels in higher ETL states; ambient air pollution also increased and was highest in the low ETL group. The incidence rate of the leading causes of injuries also increased from 1990 to 2016. The five leading individual causes of DALYs in India in 2016 were ischaemic heart disease, chronic obstructive pulmonary disease, diarrhoeal diseases, lower respiratory infections, and cerebrovascular disease; and the five leading risk factors for DALYs in 2016 were child and maternal malnutrition, air pollution, dietary risks, high

systolic blood pressure, and high fasting plasma glucose. Behind these broad trends many variations existed between the ETL state groups and between states within the ETL groups. Of the ten leading causes of disease burden in India in 2016, five causes had at least a five-times difference between the highest and lowest state-specific DALY rates for individual causes. **Interpretation:** Per capita disease burden measured as DALY rate has dropped by about a third in India over the past 26 years. However, the magnitude and causes of disease burden and the risk factors vary greatly between the states. The change to dominance of NCDs and injuries over CMNNDs occurred about a quarter century apart in the four ETL state groups. Nevertheless, the burden of some of the leading CMNNDs continues to be very high, especially in the lowest ETL states. This comprehensive mapping of inequalities in disease burden and its causes across the states of India can be a crucial input for more specific health planning for each state as is envisioned by the Government of India's premier think tank, the National Institution for Transforming India, and the National Health Policy 2017.

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### The 1.5 Billion People Question: Food, Vouchers, or Cash Transfers?

Alderman, H., U. Gentilini, and R. Yemtsov. 2018. *The 1.5 Billion People Question: Food, Vouchers, or Cash Transfers?*. Washington, DC: World Bank.

<https://openknowledge.worldbank.org/handle/10986/27907>

Most of the people in low and middle-income countries covered by social protection receive assistance in the form of in-kind food. The origin of such support is rooted in countries' historical pursuit of three interconnected objectives, namely attaining self-sufficiency in food, managing domestic food prices, and providing income support to the poor. This volume sheds light on the complex, bumpy and non-linear process of how some flagship food-based social protection programs have evolved over time, and how they currently work. In particular, it lays out the broad trends in reforms, including a growing move from in-kind modalities to cash transfers, from universality to targeting, and from agriculture to social protection. Case studies from Egypt, India, Indonesia, Mexico, Sri Lanka, and United States document the specific experiences of managing the process of reform and implementation, including enhancing our understanding of the opportunities and challenges with different social protection transfer modalities.

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### Evaluating integrated development: are we asking the right questions? A systematic review

Ahner-McHaffie, T.W., G. Guest, T. Petruney, A. Eterno, and B. Dooley. 2017. *Gates Open Research* 1(6).

<https://gatesopenresearch.org/articles/1-6>

**Background:** Development Agenda - are revealing increasingly interrelated goals and challenges, poised to be addressed by similarly integrated, multi-faceted solutions. Research to date has focused on determining the effectiveness of these approaches, yet a key question remains: are synergistic effects produced by integrating two or more sectors? We systematically reviewed impact evaluations on integrated development interventions to assess whether synergistic, amplified impacts are being measured and evaluated. **Methods:** The International Initiative for Impact Evaluation's (3ie) Impact Evaluation Repository comprised our sampling frame (n = 4,339). Following PRISMA guidelines, we employed a three-stage screening and review process. **Results:** We identified

601 journal articles that evaluated integrated interventions. Seventy percent used a randomized design to assess impact with regard to whether the intervention achieved its desired outcomes. Only 26 of these evaluations, however, used a full factorial design, the only design capable of statistically detecting synergistic effects produced by integrating sectors. Of those, seven showed synergistic effects. **Conclusions:** To date, evaluations of integrated development approaches have demonstrated positive impacts in numerous contexts, but gaps remain with regard to documenting whether integrated programming produces synergistic, amplified outcomes. Research on these program models needs to extend beyond impact only, and more explicitly examine and measure the synergies and efficiencies associated with linking two or more sectors. Doing so will be critical for identifying effective integrated development strategies that will help achieve the multi-sector SDG agenda.

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### Protocol for the EMPHASIS study; epigenetic mechanisms linking maternal pre-conceptional nutrition and children's health in India and Sub-Saharan Africa

Chandak, G.R., M.J. Silver, A. Saffari, K.A. Lillycrop, S. Shrestha, S.A. Sahariah, C. Di Gravio, G. Goldberg, A.S. Tomar, M. Betts, S. Sajjadi, L. Acolatse, P. James, P. Issarapu, K. Kumaran, R.D. Potdar, A.M. Prentice, C.H.D. Fall, the EMPHASIS study group, L. Acolatse, M. Ahmed, M. Betts, G.R. Chandak, H. Chopra, C. Cooper, M.K. Darboe, C. Di Gravio, C.H.D. Fall, M. Gandhi, G.R. Goldberg, P. Issarapu, P. James, R. Janha, L.M.A. Jarjou, L. Kaur, S.H. Kehoe, K. Kumaran, K.A. Lillycrop, M. Ngum, S.S. Nongmaithem, S. Owens, R.D. Potdar, A.M. Prentice, A. Prentice, T.D.S. Priyanka, A. Saffari, S.A. Sahariah, S. Sajjadi, H. Sane, S. Shrestha, M.J. Silver, A.S. Tomar, K.A. Ward, D.K. Yadav, and C.S. Yajnik. 2017. *BMC Nutrition* 3(81).

<https://bmcnutr.biomedcentral.com/articles/10.1186/s40795-017-0200-0>

**Background:** Animal studies have shown that nutritional exposures during pregnancy can modify epigenetic marks regulating fetal development and susceptibility to later disease, providing a plausible mechanism to explain the developmental origins of health and disease. Human observational studies have shown that maternal peri-conceptional diet predicts DNA methylation in offspring. However, a causal pathway from maternal diet, through changes in DNA methylation, to later health outcomes has yet to be established. The EMPHASIS study (Epigenetic Mechanisms linking Pre-conceptional nutrition and Health Assessed in India and Sub-Saharan Africa, ISRCTN14266771) will investigate epigenetically mediated links between peri-conceptional nutrition and health-related outcomes in children whose mothers participated in two randomized controlled trials of micronutrient supplementation before and during pregnancy. **Methods:** The original trials were the Mumbai Maternal Nutrition Project (MMNP, ISRCTN62811278) in which Indian women were offered a daily snack made from micronutrient-rich foods or low-micronutrient foods (controls), and the Peri-conceptional Multiple Micronutrient Supplementation Trial (PMMST, ISRCTN13687662) in rural Gambia, in which women were offered a daily multiple micronutrient (UNIMMAP) tablet or placebo. In the EMPHASIS study, DNA methylation will be analysed in the children of these women (~1100 children aged 5–7 y in MMNP and 298 children aged 7–9 y in PMMST). Cohort-specific and cross-cohort effects will be explored. Differences in DNA methylation between allocation groups will be identified using the Illumina Infinium MethylationEPIC array, and by pyrosequencing top hits and selected candidate loci. Associations will be analysed between DNA methylation and health-related phenotypic outcomes, including size at birth, and children's post-natal growth, body composition, skeletal development, cardio-metabolic risk markers (blood pressure, serum lipids, plasma glucose and insulin) and cognitive function. Pathways analysis will be used to test for enrichment of nutrition-sensitive loci in biological pathways. Causal mechanisms for

nutrition-methylation-phenotype associations will be explored using Mendelian Randomization. Associations between methylation unrelated to supplementation and phenotypes will also be analysed. **Conclusion:** The study will increase understanding of the epigenetic mechanisms underpinning the long-term impact of maternal nutrition on offspring health. It will potentially lead to better nutritional interventions for mothers preparing for pregnancy, and to identification of early life biomarkers of later disease risk.

## NON-PEER REVIEWED

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### Impact evaluation brief: Improving maternal and child health in India

International Initiative for Impact Evaluation. 2017. Accessed on 20 Dec 2017 [www.3ieimpact.org](http://www.3ieimpact.org)

[http://www.3ieimpact.org/media/filer\\_public/2017/10/24/maternal-health-mortality.pdf](http://www.3ieimpact.org/media/filer_public/2017/10/24/maternal-health-mortality.pdf)

This brief is based on the findings of an impact evaluation of two state government programmes aimed at improving maternal health, especially among women living below the poverty line. These programmes, in collaboration with private health providers, sought to encourage pregnant women to opt for institutional deliveries rather than deliver at home. Despite incentives, the take-up for the programme remained low and did not contribute to improvements in either child or maternal health.

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### Overweight Mothers with Stunted Children: A Nutrition Paradox

van den Berg, C., and S. van Kooten. 2017. SIGCHI conference paper, The Netherlands.

[http://scholar.google.co.in/scholar\\_url?url=http://knob.tudelft.nl/index.php/sure/article/download/1909/2026&hl=en&sa=X&scisig=AAGBfm0DWUhvPCDdSSjbrZIWQK2oIID0Lw&nossl=1&oi=scholaralt](http://scholar.google.co.in/scholar_url?url=http://knob.tudelft.nl/index.php/sure/article/download/1909/2026&hl=en&sa=X&scisig=AAGBfm0DWUhvPCDdSSjbrZIWQK2oIID0Lw&nossl=1&oi=scholaralt)

This paper investigates prevalence of stunted child overweight mother pairs using cross-sectional data (N=89,941) from 17 Low- and Middle-Income Countries. We examine the association of this 'Double Burden of Malnutrition' (DBM) with wealth, urbanisation and education. DBM is present in roughly 7% of all households studied. Pooled logistic regressions reveal that the probability a child-mother pair exhibits DBM increases as the mother is older and less educated, the child is older and male, and the household is larger, wealthier and urban. However, 78% of all sample variation in DBM is attributable to unmeasured country-specific factors, possibly including cultural and policy influences.

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### Nutrition-Sensitive Agriculture What Have We Learned and Where Do We Go from Here?

Ruel, M.T., A.R. Quisumbing, and M. Balagamwala. 2017. *Nutrition-sensitive agriculture: What have we learned and where do we go from here?* IFPRI Discussion Paper 1681. Washington, D.C.

<http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/131461/filename/131673.pdf>

A growing number of governments, donor agencies, and development organizations are committed to supporting nutrition-sensitive agriculture (NSA) to achieve their development goals. Although consensus exists on pathways through which agriculture may influence nutrition-related outcomes, empirical evidence on agriculture's contribution to nutrition and how it can be enhanced is still weak. This paper reviews recent empirical evidence (since 2014), including findings from impact evaluations of a variety of NSA programs using experimental designs as well as observational studies that document linkages between agriculture, women's empowerment, and nutrition. It summarizes existing knowledge regarding not only impacts but also pathways, mechanisms, and contextual factors that affect where and how agriculture may improve nutrition outcomes. The paper concludes with reflections on implications for agricultural programs, policies, and investments, and highlights future research priorities.

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### **Nutritional Status of School-Going Children: What Do We Know?**

**Rao, S.S., and J. Ramakrishna. 2018. "Nutritional Status of School-Going Children: What Do We Know?" In *Nutritional Adequacy, Diversity and Choice Among Primary School Children: Policy and Practice in India*, 1-14. Springer, Singapore.**

[https://link.springer.com/chapter/10.1007/978-981-10-3470-1\\_1](https://link.springer.com/chapter/10.1007/978-981-10-3470-1_1)

India continues to face an epidemic of malnutrition: data from national surveys are a constant reminder of the unacceptably high levels of underweight, stunting, and wasting among children aged 0–5 years of age. Despite the well-known impacts of malnutrition on the cognitive, psycho-motor and social development of children, the tracking and monitoring of common indicators of malnutrition has been done only intermittently, and has been confined to the under 5-year age group. Information on the nutritional status of older children of primary school-going age is dependent on data generated by small research studies and provides a patchy picture of the nutritional needs of children in a critical age group, where nutritional deficits might have a seriously deleterious impact on their ability to learn and benefit from schooling. This book arose out of a primary research study conducted in three districts of Karnataka, India: Do we know what they eat, and why? A Study on Dietary Adequacy and Impact of Cultural Beliefs on Dietary Choice of Primary School Children in Rural Karnataka, India. We bring together the available evidence in the literature, along with additional information and insights gleaned from the study, to analyze the problem of nutritional deficiencies among school-going children. The book explores some of the complexities of measuring and assessing both nutritional deficiency and dietary choice, and offers insights on how some of the complexities can be resolved in the Indian context. The book ends by making recommendations to address the challenges of enhancing nutritional outcomes for school-going children at various levels—the family, school, community, programs, and policies - to confront this serious issue.

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### **Food and Nutrition Policy: The Government Response**

**Rao, S.S., and J. Ramakrishna. 2018. "Food and Nutrition Policy: The Government Response" In *Nutritional Adequacy, Diversity and Choice Among Primary School Children: Policy and Practice in India*, 143-157. Springer, Singapore.**

[https://link.springer.com/chapter/10.1007/978-981-10-3470-1\\_7](https://link.springer.com/chapter/10.1007/978-981-10-3470-1_7)

Drawing linkages between multiple dimensions of poverty, socioeconomic status of students attending government schools and evidence on nutritional outcomes of children, the chapter critically analyzes government interventions in terms of nutritional policies and programs. Examining the evolution, scope, implications, and impact of programs such as ICDS, MDMS, and PDS, the chapter draws linkages between the accessibility and adequacy of such programs and the implications for children, their households and varied stakeholders. Since health and nutrition policies can have far-reaching impacts on the achievement of other social sector goals—for example, Education for All—it is important that the Government rethinks the current approach. Supporting health and nutrition policies and programs for children in the school age can promote equity by helping to level the playing field between the poorest children and their better off counterparts, and in some cases even remediate early deprivation so that children can reach their full potential. In order to succeed, there needs to be genuine convergence between all policies and programs aimed at enhancing health and nutrition outcomes for children; and no matter what the mechanism, a common understanding and mission needs to be evolved that keeps the interests of the child at front and center.

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### **A Health and Nutrition Framework for Primary Schools: Policy Recommendations**

**Rao, S.S., and J. Ramakrishna. 2018. “A Health and Nutrition Framework for Primary Schools: Policy Recommendations” In *Nutritional Adequacy, Diversity and Choice Among Primary School Children: Policy and Practice in India*, 159-170. Springer, Singapore.**

[https://link.springer.com/chapter/10.1007/978-981-10-3470-1\\_8](https://link.springer.com/chapter/10.1007/978-981-10-3470-1_8)

The book concludes by introducing a multi-dimensional support system, “a Health and Nutrition Framework”, to enable children to grow and develop to their full potential. Going beyond looking at the systemic response, we suggest a framework that puts the child at the center, and conceptualize what it would take for a concerted “child-centric” response. While current thinking proposes using the school as the locus of action to redress nutritional deficits among school children, we propose an ecosystem approach, bringing together the family, school, the community, as well as policy and programs at local and national levels.

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### **Situational Analysis of Pulse Production and Consumption in India**

**Rampal, P. 2017. LANSAs (Leveraging Agriculture for Nutrition in South Asia) WORKING PAPER SERIES.**

[https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/13350/LANSAs\\_Working\\_paper\\_20\\_Pulse\\_Production\\_India.pdf?sequence=1&isAllowed=y](https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/13350/LANSAs_Working_paper_20_Pulse_Production_India.pdf?sequence=1&isAllowed=y)

This paper discusses the importance of encouraging the production and consumption of pulses, given their nutritional benefits, to achieve the Sustainable Development Goal of reducing hunger and poverty as well as promoting health and nutrition. It gives a situational analysis of the production, consumption and prices of pulses. Further, it describes the various government programmes that have been initiated in India since 2000-01 to increase the production of pulses. This paper undertakes a situational analysis of area, production and yield — state-wise and crop-wise — for 5 major pulses (Bengal gram, red gram, green gram, black gram and lentils), along with that of total pulses, with reference to the time periods in which the various government schemes

were launched. It also examines the state-wise growth performance in area, production and yield for these pulses along with an analysis of the share of these pulses in the statistics of total pulses. On the consumption side, the paper analyses the patterns in consumption using the 61st and 68th rounds of the National Sample Survey corresponding to the years 2004-05 and 2011-12. The area and production under pulses has been almost stagnant in the time period starting early 2000. The per capita availability of pulses was less than the recommended dietary allowance (RDA) of 40 g per day even till 2009-10, in spite of imports. Only after 2009-10 is the RDA being met. Though the availability has just reached the minimum level of RDA, the volatility in pulse prices is a major issue that needs to be taken care of. This volatility, which alternates between adversely impacting consumers and producers, creates dilemmas for public policy. The paper concludes with a few policy recommendations.

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### Maternal high-risk fertility behavior and its association with chronic undernutrition among children under-5 in India, Bangladesh, and Nepal: do poor children have the higher risk?

Rahman, M., S.E. Haque, M.S. Zahan, M.J. Islam, M.M. Rahman, M. Asaduzzaman, M.N. Haque, A.Z. Islam, M.D. Huda, and M.G. Mostofa. 2017. *Nutrition*. DOI: <https://doi.org/10.1016/j.nut.2017.10.001>.

<http://www.sciencedirect.com/science/article/pii/S0899900717302174#!>

**Objectives:** We aimed to examine (1) whether an association exists between maternal high-risk fertility behavior and chronic undernutrition among children under-5 and (2) exploring the relationship between poverty and high-risk fertility behavior and the relative roles they play as obstacles to reducing the risk of undernutrition among children. **Methods:** Analysis were based on response from married women aged 15 to 49 years living with at least one children under-5 years by considering three cross-sectional, nationally representative samples from India, Bangladesh, and Nepal. **Results:** Maternal high-risk fertility behavior was associated with an increased risk of chronic undernutrition among children in India, Bangladesh and Nepal respectively. Multiple high-risk categories appeared to have more profound consequences on the outcome measured. Findings also demonstrated that for the risk of undernutrition, children among those mothers who were either poor or experienced high-risk fertility were not uniquely disadvantaged. **Conclusions:** The results suggest that for the risk of chronic undernutrition, the negative effect of high-risk fertility behavior extends across all economic backgrounds and is not limited to children among those mothers who were either poor or experienced high-risk fertility.

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### Gender differentials in feeding practices, health care utilization and nutritional status of children in northern India

Singh, A., and S.K. Patel. 2017. *International Journal of Human Rights in Healthcare* 10(5): 323-331.

<http://www.emeraldinsight.com/doi/pdfplus/10.1108/IJHRH-05-2017-0023>

**Purpose:** The objective of this study was to determine the gender differentials in childhood feeding practices, health care utilization and nutritional status of children by birth order and sex composition of previous living children in northern India. **Design/methodology/approach:** In this paper data was drawn from India's 2006 National Family Health Survey (NFHS). A variety of different analytic methods were used to look for gender differentials in childhood feeding practices, health care

utilization and nutritional status of children. Bi-variate analysis was applied to examine the raw values of gender differentials in childhood feeding, health care and nutritional status of children. Besides, gender differentials at the different birth order and sex composition of previous living children, has been measured through multivariate logistic regression analysis. **Findings:** The raw values of gender differentials in childhood feeding, health care and nutritional status of children, regardless of child's birth order, mother's number of living sons, and other characteristics of the child or mother shows that the proportion of children who received any liquid, proportion of children receiving solid/semi-solid food and the proportion of fully immunized children, varies by their gender significantly. The results of standardized gender differentials by birth order and sex composition of previous living in the selected indicators of childhood feeding, immunization and health care, and nutritional status of children based on multivariate binary logistic regression shows that among children of birth order 3+ (3 and higher), male children were less likely to receive solid/semi-solid foods during 24 hours prior to the survey in families with no living son but two times more likely to receive any solid/semi-solid food than female children in families with 1+ living sons ( $p < 0.0001$ ). Male children aged 12-23 months born to mothers with no living son were more likely to be fully immunized than female children, while male children born to mothers with 1+ living sons were less likely to be fully immunized than female children ( $p < 0.05$ ) at birth order 3+. However, analysis showed no significant gender differentials in the nutritional status of children. **Research limitations/implications:** We observed a strong association between the extents of gender differentials and birth order of the index child and the sex composition of older living siblings. Strong evidence of sex bias against female children was found in families with no living sons and particularly at higher birth orders 2 and 3+ (3 and higher). Overall, our study demonstrates the need to focus on predominance of intra-household differential rather than inter-household differential.

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### Does planning of births affect childhood undernutrition? evidence from demographic and health surveys of select South Asian countries

Rana, M.J., and S. Goli. 2017. *Nutrition*. DOI: <http://dx.doi.org/10.1016/j.nut.2017.10.006>.

[http://www.nutritionjrn.com/article/S0899-9007\(17\)30223-X/abstract](http://www.nutritionjrn.com/article/S0899-9007(17)30223-X/abstract)

**Objective:** The prevalence of child undernutrition in South Asia is as higher as Sub-Saharan African countries and the unmet need for family planning is also quite high. In the previous literature, the bio-demographic relationship of family planning particularly birth order and birth spacing with nutritional status of children has been assessed separately. In this study, we sought to work on the hypothesis that the planning of births comprising timing, spacing and limiting of births improves the child undernutrition particularly stunting and underweight. **Methods:** We used recent Demographic and Health Survey data from four select South Asian countries. Binary logistic regression models were applied to estimate the adjusted percentage of stunting and underweight by identified independent factors. **Results:** Findings suggest that after controlling other socioeconomic factors, children of birth order 1 with >24 months of the interval between marriage and first birth have a lower risk of stunting (20%,  $p < 0.01$ ) and underweight (14%,  $p < 0.05$ ) respectively than other scenarios of the planning of births. The probability of child undernutrition is lower among the children born with >24 months of birth spacing than its counterpart in all birth orders, but the significance of birth spacing reduces with increasing birth orders. **Conclusion:** Well planning of births using family planning methods in countries with high birth rates has the potential to reduce childhood undernutrition. Thus, the planning of births emerges as an important bio-demographic

approach to eradicate childhood undernutrition especially in developing region like South Asia and thereby to achieve Sustainable Development Goals by 2030.

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### Food Security and Child Malnutrition in India

Kjelsrud, A., and R. Somanathan. 2017. *Food Security and Child Malnutrition in India*. F-35125-INC-1. London, UK: International Growth Center.

[https://www.theigc.org/wp-content/uploads/2017/10/Kjelsrud\\_Final-report\\_cover.pdf](https://www.theigc.org/wp-content/uploads/2017/10/Kjelsrud_Final-report_cover.pdf)

The National Food Security Act (NFSA) in India was passed in 2013 to remove hunger and reduce malnutrition. The Act provides 75% of the rural population and 50% of the urban population with a minimum entitlement of 5 kilograms of grain per person per month. This paper explores the likely effects of the Act on food security and malnutrition. We use data from nationally representative household surveys to examine whether the presence of malnourished children is correlated with household calorie intakes. We find rates of stunting and wasting are only weakly related to calorie consumption. Household and village amenities and parental education are more important predictors of these nutritional indicators. We also find that the NFSA grain entitlements are below the current consumption levels of most households and are therefore unlikely to alter consumption by much. A fully implemented NFSA can still benefit the poor through the income transfers implicit in food subsidies. These transfers are likely to be more progressive than under the current Public Distribution System, because the NFSA stipulates individual rather than household entitlements and poor households are larger than average.

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### Association of Nutritional Status and Drinking Water Among the Children of North East India

Srivastava, M., P. Roy, S. Bharati, M. Pal, and P. Bharati. 2018. "Association of Nutritional Status and Drinking Water Among the Children of North East India." In *Issues on Health and Healthcare in India. India Studies in Business and Economics*, edited by De U., M. Pal, and P. Bharati, 459-465. Singapore: Springer.

[https://link.springer.com/chapter/10.1007/978-981-10-6104-2\\_26](https://link.springer.com/chapter/10.1007/978-981-10-6104-2_26)

The first Millennium Development Goal deals with eradication of extreme poverty and hunger. While hunger continues to decline, progress in reducing undernutrition has been uneven across the world and even within the country. The prevalence of underweight and stunted children under-five years of age is considered as an indicator to measure undernutrition situation. In the context where food availability and access is primarily achieved, the prevalence of undernutrition indicates towards the nutritional aspect of food security. Drinking water is one of the most important factors that needs to be considered while we deal with the utilization dimension of food security. In this context, the chapter intends to focus on the association of drinking water with the nutritional status of children (0–5) years of North East India. For this study, data were taken from the latest round of National Family Health Survey-III (2005–2006). For assessing the nutritional status of children; Weight-for-age and Height-for-age are mainly considered. Results show that undernutrition level is the highest in Tripura and Assam as compared to the other northeastern states. We have also seen the relation between nutritional status and other socio-demographic variables. Expected results were obtained. Statistically significant association was found between drinking water and nutritional status. The

chapter also discusses the possibilities of integrating human rights-based approaches, in relevant national MDG-based policies to combat the problem.

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### Interplay Between Maternal Micronutrients, DNA Methylation, and Brain Development

Rathod, R., and S. Joshi. 2017. "Interplay Between Maternal Micronutrients, DNA Methylation, and Brain Development" in *Handbook of Nutrition, Diet, and Epigenetics*, edited by Patel, V., and V. Preedy, 1-23. ISBN: 978-3-319-31143-2: (Print) 978-3-319-31143-2 (Online): Springer International Publishing.

[https://link.springer.com/referenceworkentry/10.1007/978-3-319-31143-2\\_59-1](https://link.springer.com/referenceworkentry/10.1007/978-3-319-31143-2_59-1)

Nutrition during critical periods of life (pregnancy and infancy) is known to play a major role in maintaining brain growth and development. The concept of early-life "programming" reflects the significance of early environmental exposures on the subsequent health of the offspring. Emerging evidence has shown an association between the early-life nutritional deficits with cognitive decline in later life. However, the underlying mechanisms are not well understood. Reports indicate that epigenetic mechanisms that are known to regulate gene expression may play a crucial role in mediating the link between early-life adversities and adult health. This chapter summarizes the role of maternal nutrition especially micronutrients in influencing brain development in the offspring. Micronutrients are required in smaller amounts by the body and act as cofactors for several enzymes involved in biological reactions within the cell. An overview of studies investigating the role of nutrition and DNA methylation patterns in the brain is also provided. A better understanding of the role of nutrition in influencing the brain epigenome may hold the key for prevention of brain disorders.

### UPCOMING EVENTS

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#### 19th International Congress on Nutrition & Health

Theme of the 19th International Congress on Nutrition & Health is 'Amalgamation of competent researchers across the globe to foster the novel research in the field of Nutrition & Health.' The call for abstracts is now open.

**When:** April 12-14, 2018

**Where:** Amsterdam, Netherlands

**For more information:** <https://health.nutritionalconference.com/>

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#### 28th World Nutrition Congress

World Nutrition 2018 highlights the theme "Promulgating improved innovations in Nutrition" which includes keynote presentations, plenary sessions, young researcher talks, poster presentations, nutrition workshops and public health care sessions, and exhibition of dietary supplements. It is planned to offer a prominent opening to the experts in the fields of Nutrition and food sciences to discuss latest research and challenges in the meadow.

**When:** August 9-10, 2018

**Where:** Manila, Philippines

**For more information:** <https://worldnutrition.conferenceseries.com/>

#### 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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