EDITOR'S NOTE

Dear readers,

This issue of POSHAN's Abstract Digest features a special series of the Lancet that revisits maternal and child nutrition after the last Series was published 5 years ago. The Series updates the contribution of undernutrition to child morbidity and mortality, highlights the roles of nutrition-sensitive and nutrition-specific interventions, and provides insights into issues related to the political economy of nutrition. Other research in this Abstract Digest includes three multi-country studies that examine the importance of birthweight on mortality risk and linear growth beyond the neonatal period, thus suggesting the importance of fetal nutrition and need for interventions during pregnancy. One systematic review highlights the effect of daily iron supplementation among 4-23 months children on anemia, another systematic review explores the benefits of WASH interventions on linear growth among children under five, and yet another examines the role of RUTF in relation to severe acute malnutrition. India-specific studies highlight disparities among sub-population groups in child mortality and anemia and reflect on the role of sanitation in relation to the high burden of undernutrition in India. A study on the Janani Suraksha Yojana suggests it has succeeded in raising institutional births but more is needed to reduce maternal mortality rate. A study on the Mahatma Gandhi National Rural Employment Guarantee Act indicates it has had a positive effect on household food consumption, dietary patterns and nutritional food security of poor rural households of India. Last, but not least, a review paper calls for an increase in investment in quality nutrition research in India given that it was only 1% to the top nutrition journals between 2006-2010. We hope you find this issue useful in your research and advocacy!

Warm regards,

Dr. Rasmi Avula

About the POSHAN Abstract Digest:

In each issue, the POSHAN Abstract Digest brings to your fingertips 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.

About POSHAN

POSHAN (*Partnerships and Opportunities to Strengthen and Harmonize Actions for Nutrition in India*) is a 4-year initiative which 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.

The Institute for Development Studies, Sussex is a POSHAN partner who bring global expertise in mobilizing knowledge for development.

The Health Communication Division at the Public Health Foundation of India is a POSHAN partner who brings national level communications and advocacy experience in India.

PEER-REVIEWED LITERATURE

Special series of The Lancet: Maternal and Child Nutrition

EDITED BY: HORTON, R, JAMES, A, DAS, P, KLEINERT, S AND SUMMERSKILL, W.

Maternal and child undernutrition was the subject of a Series of papers in The Lancet in 2008. Five years after the initial series, we re-evaluate the problems of maternal and child undernutrition and also examine the growing problems of overweight and obesity for women and children, and their consequences in low-income and middle-income countries. Many of these countries are said to have the double burden of malnutrition: continued stunting of growth and deficiencies of essential nutrients along with the emerging issue of obesity. We also assess national progress in nutrition programmes and international efforts toward previous recommendations.

Executive summary of The Lancet Maternal and child Nutrition Series

http://download.thelancet.com/flatcontentassets/pdfs/nutrition-eng.pdf

Comments

Nutrition: a quintessential sustainable development goal
Horton, R, Lo, S. The Lancet, June, 2013. http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2813%2961100-9/fulltext#article_upsell

Maternal and child nutrition: building momentum for impact
Black, RE, Alderman, H, Bhutta, ZA, Gillespie, S, Haddad, L, Horton, S, Lartey, A, Mannar, V, Ruel, M, Victora, CG, Walker, SP, Webb, P, Maternal and Child Nutrition Study Group members. The Lancet, June, 2013.
http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2813%2960988-5/fulltext

Delivery platforms for sustained nutrition in Ethiopia
Lemma, F, Matji, J. The Lancet, June, 2013. http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2813%2961054-5/fulltext#article_upsell

Only collective action will end undernutrition
Taylor, A, Dangour, AD, Reddy, KS. The Lancet, June, 2013. http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2813%2961053-3/fulltext#article_upsell

Nutrition-sensitive food systems: from rhetoric to action
Pinstrup-Andersen, P. The Lancet, June, 2013.
http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2813%2961053-3/fulltext#article_upsell

Global child and maternal nutrition—the SUN rises
Nabarro, D. The Lancet, June, 2013. http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2813%2961086-7/fulltext#article_upsell

Early nutrition and adult outcomes: pieces of the puzzle
Bhutta, ZA. The Lancet, June, 2013. http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2813%2960716-3/fulltext

Series Papers

Maternal and child under nutrition and overweight in low-income and middle-income countries
Black, RE, Victora, CG, Walker, SP, Bhutta, ZA, Christian, P, Onis, M, Ezzati, M, Grantham-McGregor, S, Katz, J, Martorell, R, Uauy, R. The Lancet, August, 2013. http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2813%2960937-X/abstract

Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost?
Bhutta, ZA, Das, JK, Rizvi, AR, Gaffey, MF, Walker, N, Horton, S, Webb, P, Lartey, A, Black, RE. The Lancet, August, 2013.
http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2813%2960996-4/abstract

Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition?
Ruel, MT, Alderman, H. The Lancet, August, 2013. http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2813%2960843-0/abstract

Risk of childhood undernutrition related to small-for-gestational age and preterm birth in low- and middle-income countries

Background Low- and middle-income countries continue to experience a large burden of stunting; 148 million children were estimated to be stunted, around 30–40% of all children in 2011. In many of these countries, foetal growth restriction (FGR) is common, as is subsequent growth faltering in the first 2 years. Although there is agreement that stunting involves both prenatal and postnatal growth failure, the extent to which FGR contributes to stunting and other indicators of nutritional status is uncertain. **Methods** Using extant longitudinal birth cohorts (n¼19) with data on birthweight, gestational age and child anthropometry (12–60 months), we estimated study-specific and pooled risk estimates of stunting, wasting and underweight by small-for-gestational age (SGA) and preterm birth. **Results** We grouped children according to four combinations of SGA and gestational age: adequate size-for-gestational age (AGA) and preterm; SGA and term; SGA and preterm; and AGA and term (the reference group). Relative to AGA and term, the OR (95% confidence interval) for stunting associated with AGA and preterm, SGA and term, and SGA and preterm was 1.93 (1.71, 2.18), 2.43 (2.22, 2.66) and 4.51 (3.42, 5.93), respectively. A similar magnitude of risk was also observed for wasting and underweight. Low birthweight was associated with 2.5–3.5-fold higher odds of wasting, stunting and underweight. The population attributable risk for overall SGA for outcomes of childhood stunting and wasting was 20% and 30%, respectively. **Conclusions** This analysis estimates that childhood undernutrition may have its origins in the foetal period, suggesting a need to intervene early, ideally during pregnancy, with interventions known to reduce FGR and preterm birth.

Mortality risk in preterm and small-for-gestational-age infants in low-income and middle-income countries: a pooled country analysis

Background: Babies with low birth weight (<2500 g) are at increased risk of early mortality. However, low birthweight includes babies born preterm and with fetal growth restriction, and not all these infants have a birthweight less than 2500 g. We estimated the neonatal and infant mortality associated with these two characteristics in low-income and middle-income countries. Methods: For this pooled analysis, we searched all available studies and identified 20 cohorts (providing data for 2 015 019 live births) from Asia, Africa, and Latin America that recorded data for birthweight, gestational age, and vital statistics through 28 days of life. Study dates ranged from 1982 through to 2010. We calculated relative risks (RR) and risk differences (RD) for mortality associated with preterm birth (<32 weeks, 32 weeks to <34 weeks, 34 weeks to <37 weeks), small-for-gestational-age (SGA; babies with birthweight in the lowest third percentile and between the third and tenth percentile of a US reference population), and preterm and SGA combinations. Findings: Pooled overall RRs for preterm were 6·82 (95% CI 3·56–13·07) for neonatal mortality and 2·50 (1·48–4·22) for post-neonatal mortality. Pooled RRs for babies who were SGA (with birthweight in the lowest tenth percentile of the reference population) were 1·83 (95% CI 1·34–2·50) for neonatal mortality and 1·90 (1·32–2·73) for post-neonatal mortality. The neonatal mortality risk of babies who were both preterm and SGA was higher than that of babies with either characteristic alone (15·42; 9·11–26·12). Interpretation: Many babies in low-income and middle-income countries are SGA. Preterm birth affects a smaller number of neonates than does SGA, but is associated with a higher mortality risk. The mortality risks associated with both characteristics extend beyond the neonatal period. Differentiation of the burden and risk of babies born preterm and SGA rather than with low birthweight could guide prevention and management strategies to speed progress towards Millennium Development Goal 4—the reduction of child mortality.

Associations of linear growth and relative weight gain during early life with adult health and human capital in countries of low and middle income: findings from five birth cohort studies

Background: Fast weight gain and linear growth in children in low-income and middle-income countries are associated with enhanced survival and improved cognitive development, but might increase risk of obesity and related adult cardiometabolic diseases. We investigated how linear growth and relative weight gain during infancy and childhood are related to health and human capital outcomes in young adults. **Methods**: We used data from five prospective birth cohort studies from Brazil, Guatemala, India, the Philippines, and South Africa. We investigated body-mass index, systolic and diastolic blood pressure, plasma glucose concentration, height, years of attained schooling, and related categorical indicators of adverse outcomes in young adults. With linear and logistic regression models, we assessed how these outcomes relate to birthweight and to statistically independent measures representing linear growth and weight gain independent of linear growth (relative weight gain) in three age periods: 0–2 years, 2 years to mid-childhood, and mid-childhood to adulthood. **Findings**: We obtained data for 8362 participants who had at least one adult outcome of interest. A higher birthweight was consistently associated with an adult body-mass index of greater than 25 kg/m² (odds ratio 1·28, 95% CI 1·21–1·35) and a reduced likelihood of short adult stature (0·49, 0·44–0·54) and of not completing secondary school (0·82, 0·78–0·87). Faster linear growth was strongly associated with a reduced risk of short adult stature (age 2 years: 0·23, 0·20–0·52; mid-childhood: 0·39, 0·36–0·43) and of not completing secondary school (age 2 years: 0·74, 0·67–0·78; mid-childhood: 0·87, 0·83–0·92), but did raise the likelihood of overweight (age 2 years: 1·24, 1·17–1·31; mid-childhood: 1·12, 1·06–1·18) and elevated blood pressure (age 2 years: 1·12, 1·06–1·19; mid-childhood: 1·07, 1·01–1·13). Faster relative weight gain was associated with an increased risk of adult overweight (age 2 years: 1·51, 1·43–1·60; mid-childhood: 1·76, 1·69–1·91) and elevated blood pressure (age 2 years: 1·07, 1·01–1·13; mid-childhood: 1·22, 1·15–1·30). Linear growth and relative weight gain were not associated with dysglycaemia, but a higher birthweight was associated with decreased risk of the disorder (0·89, 0·81–0·98). **Interpretation**: Interventions in countries of low and middle income to increase birthweight and linear growth during the first 2 years of life are likely to result in substantial gains in height and schooling and give some protection from adult chronic disease risk factors, with few adverse trade-offs.

Effect of daily iron supplementation on health in children aged 4–23 months: a systematic review and meta-analysis of randomised controlled trials

Background: About 47% of preschool children worldwide are anaemic. Daily oral iron supplementation is a commonly recommended intervention for treatment and prevention of anaemia, but the efficacy and safety of iron supplementation programmes is debated. Thus, we systematically reviewed the evidence for benefit and safety of daily iron supplementation in children aged 4–23 months. **Methods**: We searched Scopus and Medline, from inception to Feb 5, 2013, WHO databases, theses repositories, grey literature, and references. Randomised controlled trials that assigned children 4–23 months of age to daily oral iron supplementation versus control were eligible. We calculated mean difference (MD) or standard MD (SMD) for continuous variables, risk ratios for dichotomous data, and rate ratios for rates. We quantified heterogeneity with the I^2 test and synthesised all data with a random-effects model. This review is registered with the International Prospective Register of Systematic Reviews, number CRD42011001208. **Findings**: Of 9533 citations identified by the search strategy, 49 articles from 35 studies were eligible; these trials Included 42 306 children. Only nine studies were judged to be at low risk of bias. In children receiving iron supplements, the risk ratio for anaemia was 0·61 (95% CI 0·50–0·74; 17 studies, n=4825), for iron deficiency was 0·30 (0·15–0·60; nine studies, n=2464), and for iron deficiency anaemia was 0·14 (0·10–0·22; six studies, n=2145). We identified no evidence of difference in mental (MD 1·65, 95% CI –0·63 to 3·94; six studies, n=1093) or psychomotor development (1·05, –1·36 to 3·46; six studies, n=1086). We noted no significant differences in final length or length-for-age, or final weight or weight-for-age. Children randomised to iron had slightly lesser length (SMD –0·83, –1·53 to –0·12; eight studies, n=868) and weight gain (–1·12, –1·19 to –0·33) over the course of the studies. Vomiting (risk ratio 1·38, 95% CI 1·10–1·73) and fever (1·16, 1·02–1·31) were more prevalent in children receiving iron. **Interpretation:** In children aged 4–23 months; daily iron supplementation effectively reduces anaemia. However, the adverse effect profile of iron supplements and effects on development and growth are uncertain. Adequately powered trials are needed to establish the non-haematological benefits and risks from iron supplementation in this group.

The effect of interventions to improve water quality and supply, provide sanitation and promote handwashing with soap on physical growth in children

Background: Water, sanitation and hygiene (WASH) interventions are frequently implemented to reduce infectious diseases, and may be linked to improved nutrition outcomes in children. **Objectives:** To evaluate the effect of interventions to improve water quality and supply (adequate quantity to maintain hygiene practices), provide adequate sanitation and promote handwashing with soap, on the nutritional status of children under the age of 18 years and to identify current research gaps. **Search strategy:** We searched 10 English-language (including MEDLINE and CENTRAL) and three Chinese-language databases for published studies in June 2012. We searched grey literature databases, conference proceedings and websites, reviewed reference lists and contacted experts and authors. **Selection criteria:** Randomised (including cluster-randomised), quasi-randomised and non-randomised controlled trials, controlled cohort or cross-sectional studies and historically controlled studies, comparing WASH interventions among children aged under 18 years. **Data collection and analysis:** Two review authors independently sought and extracted data on childhood anthropometry, biochemical measures of micronutrient status, and adherence, attrition and costs either from published reports or through contact with study investigators. We calculated mean difference (MD) with 95% confidence intervals (CI). We conducted study-level and individual-level meta-analyses to estimate pooled measures of effect for randomised controlled trials only. **Main results:** Fourteen studies (five cluster-randomised controlled trials and nine non-randomised studies with comparison groups) from 10 low- and middle-income countries including 22,241 children at baseline and nutrition outcome data for 9,469 children provided relevant information. Study duration ranged from 6 to 60 months and all studies included children under five years of age at the time of the intervention. Studies included WASH interventions either singly or in combination. Measures of child anthropometry were collected in all 14 studies, and nine studies reported at least one of the following anthropometric indices: weight-for-height, weight-for-age or height-for-age. None of the included studies were of high methodological quality as none of the studies masked the nature of the intervention from participants. Weight-for-age, weight-for-height and height-for-age z-scores were available for five cluster-randomised controlled trials with a duration of between 9 and 12 months. Meta-analysis including 4,627 children identified no evidence of an effect of WASH interventions on weight-for-age z-score (MD 0.05; 95% CI -0.01 to 0.12). Meta-analysis including 4,622 children identified no evidence of an effect of WASH interventions on weight-for-height z-score (MD 0.02; 95% CI -0.07 to 0.11). Meta-analysis including 4,627 children identified a borderline statistically significant effect of WASH interventions on height-for-age z-score (MD 0.08; 95% CI 0.00 to 0.16). These findings were supported by individual participant data analysis including information on 5,375 to 5,386 children from five cluster-randomised controlled trials. No study reported adverse events. Adherence to study interventions was reported in only two studies (both cluster-randomised controlled trials) and ranged from low (< 35%) to high (> 90%). Study attrition was reported in seven studies and ranged from 4% to 16.5%. Intervention cost was reported in one study in which the total cost of the WASH interventions was USD 15/inhabitant. None of the studies reported differential impacts relevant to equity issues such as gender, socioeconomic status and religion. **Authors' conclusions**: The available evidence from meta-analysis of data from cluster-randomised controlled trials with an intervention period of 9-12 months is suggestive of a small benefit of WASH interventions (specifically solar disinfection of water, provision of soap, and improvement of water quality) on length growth in children under five years of age. The duration of the intervention studies was relatively short and none of the included studies is of high methodological quality. Very few studies provided information on intervention adherence, attrition and costs. There are several ongoing trials in low-income country settings that may provide robust evidence to inform these findings.

Ready-to-use therapeutic food for home-based treatment of severe acute malnutrition in children from six months to five years of age

Background: Malnourished children have a higher risk of death and illness. Treating severe acute malnourished children in hospitals is not always desirable or practical in rural settings, and home treatment may be better. Home treatment can be food prepared by the carer, such as flour porridge, or commercially manufactured food such as ready-to-use therapeutic food (RUTF). RUTF is made according to a standard, energy-rich composition defined by the World Health Organization (WHO). The benefits of RUTF include a low moisture content, long shelf life without needing refrigeration and that it requires no preparation. **Objectives:** To assess the effects of home-based RUTF on recovery, relapse and mortality in children with severe acute malnutrition. **Search methods:** We searched the following electronic databases up to April 2013:Cochrane

Central Register of Clinical Trials (CENTRAL),MEDLINE, MEDLINE In-process, EMBASE, CINAHL, Science Citation Index, African Index Medicus, LILACS, ZETOC and three trials registers. We also contacted researchers and clinicians in the field and hand searched bibliographies of included studies and relevant reviews. **Selection criteria:** We included randomised and quasi-randomised controlled trials where children between six months and five years of age with severe acute malnutrition were treated at home with RUTF compared to a standard diet, or different regimens and formulations of RUTFs compared to each other. We assessed recovery, relapse and mortality as primary outcomes, and anthropometrical changes, time to recovery and adverse outcomes as secondary outcomes. **Data collection and analysis:** Two review authors independently assessed trial eligibility using prespecified criteria, and three review authors independently extracted data and assessed trial risk of bias. **Main results:** We included four trials (three having a high risk of bias), all conducted in Malawi with the same contact author. One small trial included children infected with human immunodeficiency virus (HIV). We found the risk of bias to be high for the three quasi-randomised trials while the fourth trial had a low to moderate risk of bias. Because of the sparse data for HIV, we reported below the main results for all children together. **RUTF meeting total daily requirements versus standard diet** When comparing RUTF with standard diet (flour porridge), we found three quasi-randomised cluster trials (n = 599). RUTF may improve recovery slightly (risk ratio (RR) 1.32; 95% confidence interval (CI) 1.16 to 1.50; low quality evidence), but we do not know whether RUTF improves relapse, mortality or weight gain (very low quality evidence). **RUTF supplement versus RUTF meeting total daily requirements** When comparing RUTF supplement with RUTF that meets total daily nutritional requirements, we found two quasi-randomised cluster trials (n = 210). For recovery, relapse, mortality and weight gain the quality of evidence was very low; therefore, the effects of RUTF are unknown. **RUTF containing less milk powder versus standard RUTF** When comparing a cheaper RUTF containing less milk powder (10%) versus standard RUTF (25% milk powder), we found one trial that randomised 1874 children. For recovery, there was probably little or no difference between the groups (RR 0.97; 95% CI 0.93 to 1.01; moderate quality evidence). RUTF containing less milk powder may lead to slightly more children relapsing (RR 1.33; 95% CI 1.03 to 1.72; low quality evidence) and to less weight gain (mean difference (MD) -0.5 g/kg/day; 95% CI -0.75 to -0.25; low-quality evidence) than standard RUTF. We do not know whether the cheaper RUTF improved mortality (very low quality evidence). **Authors' conclusions:** Given the limited evidence base currently available, it is not possible to reach definitive conclusions regarding differences in clinical outcomes in children with severe acute malnutrition who were given home-based ready-to-use therapeutic food (RUTF) compared to the standard diet, or who were treated with RUTF in different daily amounts or formulations. For this reason, either RUTF or flour porridge can be used to treat children at home depending on availability, affordability and practicality. Well-designed, adequately powered pragmatic randomised controlled trials of HIV-uninfected and HIV-infected children with severe acute malnutrition are needed.

Breastfeeding policy: a globally comparative analysis

Objective To explore the extent to which national policies guaranteeing breastfeeding breaks to working women may facilitate breastfeeding. **Methods** An analysis was conducted of the number of countries that guarantee breastfeeding breaks, the daily number of hours guaranteed, and the duration of guarantees. To obtain current, detailed information on national policies, original legislation as well as secondary sources on 182 of the 193 Member States of the United Nations were examined. Regression analyses were conducted to test the association between national policy and rates of exclusive breastfeeding while controlling for national income level, level of urbanization, female percentage of the labour force and female literacy rate. **Findings**: Breastfeeding breaks with pay are guaranteed in 130 countries (71%) and unpaid breaks are guaranteed in seven (4%). No policy on breastfeeding breaks exists in 45 countries (25%). In multivariate models, the guarantee of paid breastfeeding breaks for at least 6 months was associated with an increase of 8.86 percentage points in the rate of exclusive breastfeeding (P<0.05). **Conclusion** A greater percentage of women practise exclusive breastfeeding in countries where laws guarantee breastfeeding breaks at work. If these findings are confirmed in longitudinal studies, health outcomes could be improved by passing legislation on breastfeeding breaks in countries that do not yet ensure the right to breastfeed.

Disparities in child mortality trends: what is the evidence from disadvantaged states in India? The case of Orissa and Madhya Pradesh

Introduction: The Millennium Development Goals prompted renewed international efforts to reduce under-five mortality and measure national progress. However, scant evidence exists about the distribution of child mortality at low sub-national levels, which in diverse and decentralized countries like India are required to inform policy-making. This study estimates changes in child mortality across a range of markers of inequalities in Orissa and Madhya Pradesh, two of India's largest, poorest, and most disadvantaged states. **Methods:** Estimates of under-five and neonatal mortality rates were computed using seven datasets from three available sources – sample registration system, summary birth histories in surveys, and complete birth

histories. Inequalities were gauged by comparison of mortality rates within four sub-state populations defined by the following characteristics: rural–urban location, ethnicity, wealth, and district. **Results**: Trend estimates suggest that progress has been made in mortality rates at the state levels. However, reduction rates have been modest, particularly for neonatal mortality. Different mortality rates are observed across all the equity markers, although there is a pattern of convergence between rural and urban areas, largely due to inadequate progress in urban settings. Inter-district disparities and differences between socioeconomic groups are also evident. **Conclusions**: Although child mortality rates continue to decline at the national level, our evidence shows that considerable disparities persist. While progress in reducing under-five and neonatal mortality rates in urban areas appears to be levelling off, policies targeting rural populations and scheduled caste and tribe groups appear to have achieved some success in reducing mortality differentials. The results of this study thus add weight to recent government initiatives targeting these groups. Equitable progress, particularly for neonatal mortality, requires continuing efforts to strengthen health systems and overcome barriers to identify and reach vulnerable groups.

Socioeconomic determinants of iron-deficiency anemia among children aged 6 to 59 months in India

The extent of anemia and its socioeconomic determinants among the preschool children (6-59 months old) in India have been studied in this article. Relevant data are taken from the third round of the National Family Health Survey. The initial analysis reveals some interesting features. The most affected children are in the age-group of 6 to 23 months. Beyond this age a decreasing trend is observed up to the age of 48 to 59 months. The highest and the lowest prevalence of anemia have been found to be in the central and the northeast zones, respectively. The vulnerable groups are the children of illiterate parents and those belonging to the poor families in the rural areas. Categorical logistic regression also confirms that status of literacy and wealth of parents have strong negative association with the status of anemia of the children.

Maternal iron and folic acid supplementation is associated with lower risk of low birth weight in India

Improving maternal nutrition is an important step toward reducing low birth weight (LBW) and its sequelae. In India, an estimated 7.5 million babies are born each year with LBW, which accounts for more than one-third of the global burden. In this context, little is known about the population-level association of iron and folic acid supplementation (IFA) during pregnancy and reducing the outcome of LBW. Using pooled data from the nationally representative 1998/1999 and 2005/2006 National Family Health Surveys of India, we examined the association of IFA with LBW and birth weight using multivariable logistic and linear regression models, respectively ($n = 22,648$). We found that IFA during pregnancy was negatively associated with LBW after adjustment for socioeconomic status [OR = 0.77 (95% CI: 0.68, 0.87); $P < 0.001$] and further adjustment for antenatal care (ANC) utilization [OR = 0.82 (95% CI: 0.72, 0.94); $P < 0.001$]. This corresponded to a 41-g [(95% CI: 2 g, 80 g); $P < 0.05$] increase in birth weight, which attenuated to 28 g [(95% CI: −12 g, 68 g); $P = 0.71$] after additional adjustment for ANC. At the population level in a context where the burden of anemia is severe (prevalence ≥40%), IFA during pregnancy was significantly associated with decreased LBW. Measures to improve the implementation of this simple intervention should help to address India's burden of LBW.

Sanitation and stunting in India: undernutrition's blind spot

The puzzle of persistent undernutrition in India is largely explained by open defecation, population density, and lack of sanitation and hygiene. The impact on nutrition of many faecally-transmitted infections, not just the diarrhoeas, has been a blind spot. In hygienic conditions much of the undernutrition in India would disappear.

Towards universal salt iodisation in India: achievements, challenges and future actions

India is one of the first countries to introduce salt iodisation, but the national programme has experienced major setbacks. The purpose of this paper is to review the national efforts towards universal salt iodisation (USI) in India and highlight key challenges in programme implementation. A brief historical overview of the salt iodisation programme is provided and the current status of the household usage of iodised salt and population iodine status is described. The present status of the USI programme together with the challenges being faced towards achieving USI are classified in five categories, which represent the five guiding principles crucial to sustained USI programme success: ensuring political commitment, forming partnerships

and coalition, ensuring availability of adequately iodised salt, strengthening the monitoring system and maintaining continuous advocacy, education and communication. A future agenda towards the achievement of USI is also proposed.

India's conditional cash transfer programme (the JSY) to promote institutional birth: Is there an association between institutional birth proportion and maternal mortality?

Background: India accounts for 19% of global maternal deaths, three-quarters of which come from nine states. In 2005, India launched a conditional cash transfer (CCT) programme, Janani Suraksha Yojana (JSY), to reduce maternal mortality ratio (MMR) through promotion of institutional births. JSY is the largest CCT in the world. In the nine states with relatively lower socioeconomic levels, JSY provides a cash incentive to all women on birthing in health institution. The cash incentive is intended to reduce financial barriers to accessing institutional care for delivery. Increased institutional births are expected to reduce MMR. Thus, JSY is expected to (a) increase institutional births and (b) reduce MMR in states with high proportions of institutional births. We examine the association between (a) service uptake, i.e., institutional birth proportions and (b) health outcome, i.e., MMR. *Method*: Data from Sample Registration Survey of India were analysed to describe trends in proportion of institutional births before (2005) and during (2006–2010) the implementation of the JSY. Data from Annual Health Survey (2010–2011) for all 284 districts in above- mentioned nine states were analysed to assess relationship between MMR and institutional births. *Results:* Proportion of institutional births increased from a pre-programme average of 20% to 49% in 5 years (p<0.05). In bivariate analysis, proportion of institutional births had a small negative correlation with district MMR (r = -0.11). The multivariate regression model did not establish significant association between institutional birth proportions and MMR [CI: -0.10, 0.68]. *Conclusions:* Our analysis confirmed that JSY succeeded in raising institutional births significantly. However, we were unable to detect a significant association between institutional birth proportion and MMR. This indicates that high institutional birth proportions that JSY has achieved are of themselves inadequate to reduce MMR. Other factors including improved quality of care at institutions are required for intended effect.

Household consumption pattern and nutritional security among poor rural households: Impact of MGNREGA.

The paper has examined the changes in household food consumption and nutritional security of poor rural households and has assessed the impact of Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) on the dietary pattern and nutritional status of these households using the data from 66th round of National Sample Survey (NSS) pertaining to the year 2009. Since getting a job card is the first step for linkage with the MGNREG scheme, only job card holder households were considered in the study. These were further grouped into job seekers and non-job seekers. The non-job seekers were those who were not serious on getting an employment under MGNREGA but had got the job card issued to be used under emergency or as a trump card for getting higher wages from the present employer. The job seekers were also classified as 'beneficiaries' (who got employment) and 'non-beneficiaries (who did not get employment but got unemployment allowance). The study has revealed that MGNREGA has benefitted 22.5 per cent of the rural households by providing, on an average, wage employment for about 43 days. It has increased the income of rural households and has been successful in reducing the poverty level by 4 per cent. The MGNREGA has provided almost equal employment benefits to all the categories of farm-sizes, household-types and income-groups. The state-wise study has revealed that though all the states have been benefitted, wide variations do exist. It is observed that the economically weaker states of the country have been benefitted maximum and have implemented the MGNREGA more vigorously. The study has shown that the raise in income could lead to increase in food consumption — both of cereals and non-cereals by all the categories of households. A diversification in the dietary pattern of households has also been observed, which is again a strong indicator of better food consumption. These developments have resulted into a substantial increase in calorie-intake as well as protein-intake by different categories of households, leading to a decrease in the undernourished and nutrition-deficit households by 8-9 percent. In nutshell, the impact of MGNREGA has been positive and effective in increasing household food consumption, changing dietary pattern and providing nutritional food security to the poor rural households of India.

Nutrition research in India: Underweight, stunted, or wasted?

India has experienced dramatic economic growth in the past 2 decades accompanied by a rising burden of non-communicable diseases, which coexists with the unfinished agenda of undernutrition. Tackling these dual challenges requires strong investment in nutrition research. We compared India's research output with another rapidly developing

country (China) and an established developed country (USA). We analyzed trends for each country between the periods 2000 to 2005 and 2006 to 2010, in terms of quantity and quality of the publications. India produced 2,712 articles (1.9% of the global total) in the 2000 to 2005 period and 3,999 articles (2.1%) in the 2006 to 2010 period, and the country impact factor was 191 and 174, respectively. The contributions to the top 10 nutrition journals during 2006 to 2010 was 1%. India must increase investment in and attention towards quality nutrition research and address potential barriers to publish.

NON PEER-REVIEWED LITERATURE

Delivering the MDGs in India: Targeting children's nutrition and education
Young Lives, June 2013. India Policy Brief.
http://www.younglives-india.org/files/policy-papers/mdgs-targeting-children-nutrition-and-education

Economic reform in the 1990s has paid off for India which now has one of the most rapidly expanding economies in the world. However key engines of growth – energy, natural resources, transport infrastructure and skills – have not been able to keep pace and institutional bottlenecks, poor governance, social inequalities and regional disparities risk obstructing the achievement of the Millennium Development Goals targets. Current evidence suggests that MDG2 (achieving universal primary education) is the only 'on track' goal and MDG1 (reducing the proportion of population living below the poverty line) may be achieved by 2015. Wide inequalities are undermining the chances of reaching the more specific MDG targets (especially the prevalence of underweight children, the proportion of pupils starting Grade 1 who reach Grade 5, and the ratio of girls to boys in school). Using evidence from Young Lives this policy brief highlights progress towards achieving the MDG targets in Andhra Pradesh.

Nutrition, iron deficiency anemia and the demand for iron fortified salt: Evidence from an experiment from rural Bihar
Banerjee, A, Barnhardt, S, Duflo, E. May, 2013.
http://www.nber.org/chapters/c12984.pdf

Iron deficiency anemia is frequent among the poor worldwide. While it can be prevented with the appropriate supplement or food fortification, these programs often do not reach the poorest. Further, little is known about the impact of treating iron deficiency anemia on productivity. This paper is the first of a larger project that investigates the feasibility and the impact of addressing IDA through partly subsidized double fortified salt (DFS) ----salt fortified with iron and iodine--- in rural Bihar. Analysis of a baseline survey in 400 villages suggests that anemia is prevalent (over 50% of adult women are anemic) and is correlated with lower physical and cognitive fitness at all ages. This is despite the fact that consumption per capita is not particularly low by the standards of rural India (INR 56 per capita per day), and average BMI is not very low, indicating that overall caloric intake must be adequate. This suggests that micronutrient deficiency is likely playing a key role. Almost all households purchase salt, which makes DFS a promising channel to distribute supplemental iron. A randomized pricing experiment suggests that subsidizing DFS by about 55% led to fairly large take-up, even without a detailed information campaign.

Patterns and determinants of gender bias in child health in India
Patra, N. Institute of Health Management Research, 2013.
http://www.iussp.org/sites/default/files/event_call_for_papers/ARP-Nilanjan%20Patra-Full%20Paper.pdf

The study will make an attempt to identify patterns of gender gap in child health in India and their determinants, and examine the possible role of female education and women's agency in reducing the gap. It will apply Borda rule, Principal Component Analysis, Logistic regression techniques on three rounds of NFHS data. Children under three years of age are the units of analysis. With the help of 21 selected indicators of health-seeking behaviour and health outcome, it is shown that there are ample evidence of varying level of gender gap exists in all the states of India. It is found that the gender gap in various health outcomes are not much related to the gender gap in various indicators of health-seeking behaviour. However for the girl children's health achievement, the indicators of health-seeking behaviour are significantly related to the indicators of health outcome. It is also shown that any consistently robust pattern of gender bias against girl children in child health is not present in India. But there is a consistent pattern of girl children's absolute health achievement. Hence we focus on the girl children exclusively and tried to identify the determinants of health achievements for girl children. Given the Rawlsian theory of justice, the same determinants will, in turn, be able to reduce gender bias. We analyse the effects of some selected demographic and socioeconomic variables on the chance of full immunisation, chance of medical treatment in diarrhoea and medical treatment in fever/ cough, chance of breastfeeding, chance of malnutrition and chance of mortality for girl children. Except for a few cases, the results are consistently robust. It has been found that, among others, female education and women's empowerment do have a positive role in reducing gender bias in child health in India.

An empirical investigation of the calorie consumption puzzle in India

Over the past four decades, India has witnessed a paradoxical trend: average per capita calorie intake has declined even as real per capita monthly expenditure has increased over time. Since cross sectional evidence suggests a robust positive relationship between the two variables, the trend emerges as a major puzzle. The main explanations that have been offered in the literature to address the puzzle are: rural impoverishment, relative price changes, decline in calorie needs, diversification of diets, a squeeze on the food budget due to rising expenditures on non-food essentials, and decline in subsistence consumption. In this paper we construct a novel panel dataset from household-level National Sample Survey data on consumption expenditure to test the "food budget squeeze" hypothesis. Our panel consists of 74 NSS "state-regions" over six time periods (1983, 1987{88, 1993{94, 1999{00, 2004{05 and 2009{10). We demonstrate a statistically significant negative effect of a rising share of expenditures on non-food essentials (health, education, transportation and consumer services), on calorie intake. We also construct a food price index directly from household-level expenditure data and show that real food expenditure has been stagnant in India since the late 1980s.

Why are Indian children shorter than African children?

Height-for-age among children is lower in India than in Sub-Saharan Africa. This presents a puzzle since India is richer than the average African country and fares better on most other development indicators including infant mortality. Using data from African and Indian Demographic and Health Surveys, we document three facts. First, among first borns, Indians are actually taller than Africans; the Indian height disadvantage appears with the second child and increases with birth order. Second, investments in successive pregnancies and higher birth order children decline faster in India than Africa. Third, the India-Africa birth order gradient in child height appears to vary with sibling gender. These three facts suggest that parental preferences regarding higher birth order children, driven in part by cultural norms of eldest son preference, underlie much of India's child stunting.