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EDITOR'S NOTE

Once again, the POSHAN Abstract Digest brings to you a tailored set of articles on issues pertaining to undernutrition in India and its solutions. Issue 39 features a series of studies that look into the trends and variability in inequality linked with child mortality, stunting, and the double burden of malnutrition. You will also find articles on the association between women's empowerment and child health, a systematic review of enablers and barriers to improving IYCF practices, and an evaluation of global experiences in large-scale double-fortified salt programs. In this issue we have included peer-reviewed and non-peer-reviewed COVID-19 related articles, and a special section on the *Ananya* program, a multi-component, multi-year initiative implemented in Bihar to improve reproductive, maternal, newborn and child health and nutrition.

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Stay safe and enjoy reading!

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Abdalla et al. *Journal of Global Health* 10(2): 021003.

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Abdalla et al. 2020. *Journal of Global Health* 10(2), 021004.

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Mehta et al. 2020. *Journal of Global Health* 10(2): 021007.

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Creanga et al. 2020. *Journal of Global Health* 10(2): 021008.

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Creanga et al. 2020. *Journal of Global Health* 10(2): 021009.

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Ghosh et al. 2020. *Journal of Global Health* 10(2): 021010.

Evaluation of a Large-Scale Reproductive, Maternal, Newborn and Child Health and Nutrition Program in Bihar, India, Through an Equity Lens
Ward et al. 2020. *Journal* of Global Health 10(2): 021011.

PEER-REVIEWED

Trends and Geographic Variability in Gender Inequalities in Child Mortality and Stunting in India, 2006–2016

Alderman, H., P.H. Nguyen, L.M. Tran, and P. Menon. 2021. "Trends and Geographic Variability in Gender Inequalities in Child Mortality and Stunting in India, 2006–2016." *Maternal and Child Nutrition* e13179. doi: https://doi.org/10.1111/mcn.13179

Gender disparities in child undernutrition and mortality in India have been a topic of interest for a long time, but little is known on trends or geographic variability in recent periods. We examined the degree to which historic patterns in gender disparities in child undernutrition and mortality in India have persisted given recent progress in health and nutrition. Using two nationally representative datasets from India between 2006 and 2016, we estimated mortality rates and stunting by gender and by birth order among children under 5 years old. We then tested for differences between boys and girls within each survey round for both national and state levels using bootstrapped standard errors, controlling for cluster and sampling weights. We found striking progress in child mortality and stunting in India between 2006 and 2016 for both boys and girls. Boys were more likely to die than girls during the first year of life. Girls had a higher risk of mortality between age 1 and 5 years than boys in 2006, but the improvements in survival eliminated this gender gap in 2016. For stunting, we found no gender difference in 2006, but girls had higher height-for-age Z-scores (HAZ) and lower stunting than boys in 2016. Trends in gender gaps in mortality and stunting vary substantially by birth order and between states. Our findings indicate that improvements in mortality and nutritional status among girls have started to close gender disparities. Policy efforts to close gaps must stay the course in states that have made progress and be accelerated in states where disparities are still prominent.

Does Socio-Economic Inequality Exist in Micro-Nutrients Supplementation Among Children Aged 6–59 Months in India? Evidence From National Family Health Survey 2005–06 and 2015–16

Srivastava, S., and S. Kumar. 2021. "Does Socio-Economic Inequality Exist in Micro-Nutrients Supplementation Among Children Aged 6–59 Months in India? Evidence From National Family Health Survey 2005–06 and 2015–16." *BMC Public Health* 21(545). doi: https://doi.org/10.1186/s12889-021-10601-6

Background: Globally, about 25% of children suffer from subclinical vitamin A deficiency (VAD), and approximately 300 million children globally had anemia as per 2011 estimates. Micronutrient deficiencies are generally referred to as "hidden hunger" because these deficiencies developed gradually. The present study determines the socio-economic inequalities in vitamin A supplementation (VAS) and Iron supplementation (IS) among children aged 6–59 months in India and to estimate the change in the percent contribution of different socio-economic correlates for such inequality from 2005 to 06 to 2015–16. **Methods:** Data from National Family Health Survey (NFHS) 2005–06 and 2015–16 was used for the analysis. Bivariate analysis and logistic regression analysis was used to carve out the results. Moreover, Wagstaff decomposition analysis was used to find the factors which contributed to explain socio-economic status-related inequality among children in India. **Results:** It was revealed that the percentage of children who do not receive vitamin A supplementation was reduced from 85.5% to 42.1%, whereas in the case of IS, the percentage reduced from 95.3% to 73.9% from 2005-06 to 2015–16 respectively. The child's age, mother's educational status, birth order, breastfeeding status, place of residence and empowered action group (EAG) status of states were the factors that were significantly associated with vitamin A supplementation and iron supplementation among children in India. Moreover, it was found the children who do not receive vitamin A supplementation and iron supplementation got more

concentrated among lower socio-economic strata. A major contribution for explaining the gap for socio-economic status (SES) related inequality was explained by mother's educational status, household wealth status, and empowered action group status of states for both vitamin A supplementation and iron supplementation among children aged 6–59 months in India. **Conclusion:** Schemes like the Integrated Child Development Scheme (ICDS) would play a significant role in reducing the socio-economic status-related gap for micro-nutrient supplementation among children in India. Proper implementation of ICDS will be enough for reducing the gap between rich and poor children regarding micro-nutrient supplementation.

The Double Burden of Malnutrition in India: Trends and Inequalities (2006–2016)

Nguyen, P.H., S. Scott, D.D. Headey, N. Singh, L.M. Tran, P. Menon, and M. Ruel. 2021. "The Double Burden of Malnutrition in India: Trends and Inequalities (2006–2016)." *PLoS ONE* 16(2): e0247856. doi: https://doi.org/10.1371/journal.pone.0247856

Rapid urban expansion has important health implications. This study examines trends and inequalities in undernutrition and overnutrition by gender, residence (rural, urban slum, urban non-slum), and wealth among children and adults in India. We used National Family Health Survey data from 2006 and 2016 (n = 311,182 children 0-5y and 972,192 adults 15-54y in total). We calculated differences, slope index of inequality (SII) and concentration index to examine changes over time and inequalities in outcomes by gender, residence, and wealth quintile. Between 2006 and 2016, child stunting prevalence dropped from 48% to 38%, with no gender differences in trends, whereas child overweight/obesity remained at ~7–8%. In both years, stunting prevalence was higher in rural and urban slum households compared to urban non-slum households. Within-residence, wealth inequalities were large for stunting (SII: -33 to -19 percentage points, pp) and declined over time only in urban non-slum households. Among adults, underweight prevalence decreased by ~13 pp but overweight/obesity doubled (10% to 21%) between 2006 and 2016. Rises in overweight/obesity among women were greater in rural and urban slum than urban non-slum households. Within-residence, wealth inequalities were large for both underweight (SII -35 to -12pp) and overweight/obesity (+16 to +29pp) for adults, with the former being more concentrated among poorer households and the latter among wealthier households. In conclusion, India experienced a rapid decline in child and adult undernutrition between 2006 and 2016 across genders and areas of residence. Of great concern, however, is the doubling of adult overweight/obesity in all areas during this period and the rise in wealth inequalities in both rural and urban slum households. With the second largest urban population globally, India needs to aggressively tackle the multiple burdens of malnutrition, especially among rural and urban slum households and develop actions to maintain trends in undernutrition reduction without exacerbating the rapidly rising problems of overweight/obesity.

Editorial

To Assist the Large Number of Countries Facing the Double Burden of Malnutrition We Must Understand Its Causes and Recognize the Need for Policies That Do No Harm

Popkin, B.M. 2021. "To Assist the Large Number of Countries Facing the Double Burden of Malnutrition We Must Understand Its Causes and Recognize the Need for Policies That Do No Harm." *The American Journal of Clinical Nutrition*: nqaa419. doi: https://doi.org/10.1093/ajcn/nqaa419

Globally, from Latin America to sub-Saharan Africa to Asia, we find a surprisingly high and rapidly increasing prevalence of overweight, even though stunting remains high also (1). Stunting, linked to poor nutrition and poor environmental conditions in the first 1000 d from conception through infancy, has declined slowly in most countries across the globe, whereas overweight and obesity

have risen rapidly (2, 3). Today no country can claim that <20% of its adult women have BMIs > 25 kg/m^2.

Maternal BMI Is Positively Associated With Human Milk Fat: A Systematic Review and Meta-Regression Analysis

Daniel, A.I., S. Sharma, S. Ismail, C. Bourdon, A. Kiss, M. Mwangome, R.H.J. Bandsma, and D.L. O'Connor. 2021. "Maternal BMI Is Positively Associated With Human Milk Fat: A Systematic Review and Meta-Regression Analysis." *The American Journal of Clinical Nutrition*: nqaa410. doi: https://doi.org/10.1093/ajcn/nqaa410

Background: Lack of robust estimates of human-milk nutrient composition and influential maternal factors, such as body composition, are barriers to informing nutrition policies and programs. **Objective:** The objective was to understand the relation between maternal BMI and human-milk energy, fat, and/or total protein. **Methods:** Four electronic databases (MEDLINE, Embase, CINAHL, and Web of Science) were searched. Outcomes assessed were human-milk energy (kcal/L), fat (g/L), and total protein (g/L) from mothers 1 to 6 mo postpartum. Studies with data on maternal BMI or weight and height that quantified human-milk energy, fat, or protein between 1 and 6 mo postpartum were eligible. Random-effects meta-regression weighted by the inverse of the study-level SE was completed for each of the 3 outcomes. The certainty of evidence for each outcome was assessed using the GRADE (Grading of Recommendations Assessment, Development, and Evaluation) approach. **Results:** A total of 11,373 titles and abstracts were identified, and after full-text screening, 69 articles of 66 studies were included. Meta-regression results showed a positive association between maternal BMI and human-milk fat (β: 0.56 g/L; 95% CI: 0.034, 1.1; P = 0.04; I2 = 93.7%, n = 63 datapoints). There was no significant association between maternal BMI and human-milk energy (β: 3.9 kcal/L; 95% CI: −1.6, 9.5; P = 0.16, I2 = 93.3%, n = 40 datapoints) or total protein (β: 0.13 g/L; 95% CI: −0.16, 0.41; P = 0.37, I2 = 99.1%, n = 40 datapoints). The certainty of evidence for human-milk energy was low and the certainty of evidence for fat and total protein was very low. **Conclusions:** Meta-regression analysis of available literature suggested an association between maternal BMI and human-milk fat between 1 and 6 mo postpartum. Future studies are needed to confirm the relation between maternal BMI; variation in human-milk energy, fat, and protein content; and the implications for child growth and development.

Commentary

Women's Empowerment Promotes Children Thriving Globally

Black, M.M., and A.J. Kowalski. 2021. "Women's Empowerment Promotes Children Thriving Globally." *The Journal of Nutrition* 151(3): 455–456. doi: https://doi.org/10.1093/jn/nxaa370

Caregiving behaviors are closely linked to children's health and nutrition, particularly early in life when children are highly dependent on their primary caregivers. Throughout the world, mothers provide most of the daily caregiving behaviors to young children. In low-income settings with limited resources, caregiving often involves difficult choices as mothers manage their children's daily care along with household responsibilities. In response to global evidence that women's empowerment supports children's health and nutrition, attention to women's empowerment has increased. However, little is known about the pathways linking empowerment to maternal caregiving behavior or strategies to increase women's empowerment.

Understanding the Enablers and Barriers to Appropriate Infants and Young Child Feeding Practices in India: A Systematic Review

Dhami, M.V., F.A. Ogbo, B.J. Akombi-Inyang, R. Torome, and K.E. Agho. 2021. "Understanding the Enablers and Barriers to Appropriate Infants and Young Child Feeding Practices in India: A Systematic Review." *Nutrients* 13(3): 825. doi: https://doi.org/10.3390/nu13030825

Despite efforts to promote infant and young child feeding (IYCF) practices, there is no collective review of evidence on IYCF enablers and barriers in India. This review was conducted using 2015 Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) guidelines. Six computerized bibliographic databases, Scopus, PubMed, PsycINFO, CINAHL, Embase, and Ovid MEDLINE, were searched for published studies on factors associated with IYCF practices in India from 1 January 1993, to 30 April 2020. IYCF practices examined were early initiation of breastfeeding, exclusive breastfeeding, continued breastfeeding at one year, introduction to solid semi-solid or soft foods, minimum dietary diversity, minimum meal frequency, minimum acceptable diet, continued breastfeeding at two years, predominant breastfeeding, and bottle feeding. In total, 6968 articles were retrieved, and 46 studies met the inclusion criteria. The common enablers of IYCF were higher maternal socioeconomic status (SES) and more frequent antenatal care visits (ANC) (≥3). Common barriers to IYCF practices were low SES and less frequent ANC. The review showed that the factors associated with IYCF practices in India are largely modifiable and multi-factorial. Improving IYCF practices would require the adoption of both facilities- and community-based policy interventions at the subnational and national levels in India.

Human Resources for Health-Related Challenges to Ensuring Quality Newborn Care in Low- and Middle-Income Countries: A Scoping Review

Bolan, N., K.D. Cowgill, K. Walker, L. Kak, T. Shaver, S. Moxon, and O. Lincetto. 2021. "Human Resources for Health-Related Challenges to Ensuring Quality Newborn Care in Low- and Middle-Income Countries: A Scoping Review." *Global Health: Science and Practice*. doi: https://doi.org/10.9745/GHSP-D-20-00362

Background: A critical shortage of health workers with needed maternal and newborn competencies remains a major challenge for the provision of quality care for mothers and newborns, particularly in low- and middle-income countries. Supply-side challenges related to human resources for health (HRH) worsen shortages and can negatively affect health worker performance and quality of care. This review scoped country-focused sources to identify and map evidence on HRH-related challenges to quality facility-based newborn care provision by nurses and midwives. **Methods:** Evidence for this review was collected iteratively, beginning with pertinent World Health Organization documents and extending to articles identified via database and manual reference searches and country reports. Evidence from country-focused sources from 2000 onward was extracted using a data extraction tool that was designed iteratively; thematic analysis was used to map the 10 categories of HRH challenges. **Findings:** A total of 332 peer-reviewed articles were screened, of which 22 met inclusion criteria. Fourteen additional sources were added from manual reference search and gray literature sources. Evidence has been mapped into 10 categories of HRH-related challenges: (1) lack of health worker data and monitoring; (2) poor health worker preservice education; (3) lack of HW access to evidence-based practice guidelines, continuing education, and continuing professional development; (4) insufficient and inequitable distribution of health workers and heavy workload; (5) poor retention, absenteeism, and rotation of experienced staff; (6) poor work environment, including low salary; (7) limited and poor supervision; (8) low morale, motivation, and attitude, and job dissatisfaction; (9) weaknesses of policy, regulations, management, leadership, governance, and funding; and (10) structural and contextual barriers. **Conclusion:** The mapping provides needed insight that informed new World Health Organization strategies and supporting efforts to address the challenges identified and strengthen human resources for neonatal care, with the ultimate goal of improving newborn care and outcomes.

The Double-Fortified Salt (Iodized Salt with Iron) Consultation: A Process for Developing Evidence-Based Considerations for Countries

Houston, R., B.L. Tsang, and J. Gorstein. 2021. "The Double-Fortified Salt (Iodized Salt with Iron) Consultation: A Process for Developing Evidence-Based Considerations for Countries." *The Journal of Nutrition* 151(Supplement 1): 1–2S. doi: https://doi.org/10.1093/jn/nxaa157

The addition of iodine to edible salt has been one of the most important public health successes of the past half century, enabling most countries to achieve optimal iodine intake and protect the brains of unborn children from the adverse consequences of iodine deficiency. Salt has been an ideal vehicle for this effort because of its near universal and narrow range of consumption, relative ease of technology for salt iodization, and capacity for virtually all salt producers to add iodine. As a result of the success of salt iodization, there has been growing interest in using salt as a vehicle for other important micronutrients, particularly the addition of iron to iodized salt to produce double-fortified salt (DFS), to combat the persistent problem of iron deficiency and iron deficiency anemia. Because of this growing interest in DFS and the need for a comprehensive review of evidence to support the viability of this intervention, the Iodine Global Network (IGN) initiated a global consultation to gather all available data on different aspects of DFS. IGN identified 4 key areas considered essential to understand for a successful fortification intervention: 1) efficacy and effectiveness, or how well DFS produces a health impact in controlled and real-life settings; 2) technical considerations for production, or what are the minimum requirements to manufacture DFS; 3) program implementation to describe experiences thus far with the delivery of DFS across multiple platforms; and 4) comparison of DFS with other iron fortification efforts to determine the comparative advantage of DFS to improve iron intake and prevent iron deficiency anemia. This preface provides an overview of the DFS Consultation objectives, process, and objectives.

Evaluation of Global Experiences in Large-Scale Double-Fortified Salt Programs

Moorthy, D., and L. Rowe. 2021. "Evaluation of Global Experiences in Large-Scale Double-Fortified Salt Programs." *The Journal of Nutrition* 151(Supplement 1): 38S–46S. doi: https://doi.org/10.1093/jn/nxaa284

Background: Double-fortified salt (DFS) is a vehicle for dual fortification with iron and iodine, to reduce their respective deficiencies. This background article is the third in a series reviewing available research, analyses, and experiences on DFS as an effective delivery vehicle for iron and iodine. **Objectives:** The objective of this article is to systematically evaluate current programs distributing DFS around the world and catalogue opportunities, risks, and challenges related to programs that incorporate DFS. We carried out a narrative review of DFS programs from around the world with our data sources deriving from a mix of a nonsystematic literature search and interviews with key informants. **Methods:** We assessed programmatic experience with DFS from social safety net programs in India (from the states of Bihar, Madhya Pradesh, and Uttar Pradesh) and from non–social safety net country programs or projects in Argentina, Cote d'Ivoire, Kenya, Morocco, Nigeria, Philippines, and Sri Lanka. **Results:** Findings revealed color change of the final DFS product was an issue in 9 of the 14 programs or studies reviewed and was the most significant challenge that had a direct impact on consumer acceptance and uptake regardless of type of program (open market or social safety net). Other challenges identified were related to the quality of the salt and lack of DFS formulation standards and regulatory monitoring protocols. **Conclusions:** DFS programs need to focus on *1*) improved technology with better consumer acceptance and better performance when used with lower-quality salt; *2*) elucidation and enforcement of DFS formulation quality standards, along with producer incentives; and *3*) strong government backing at the policy level. DFS offers a unique opportunity to leverage an almost universally consumed product with the addition of 2

important nutrients missing in many populations. However, program "maturity" will take time with urgent attention needed for quality production.

Protocol for a Cluster Randomised Trial Evaluating a Multifaceted Intervention Starting Preconceptionally—Early Interventions to Support Trajectories for Healthy Life in India (EINSTEIN): A Healthy Life Trajectories Initiative (HeLTI) Study

Kumaran, K., G.V. Krishnaveni, K.G. Suryanarayana, M.P. Prasad, A. Belavendra, S. Atkinson, R. Balasubramaniam, R.H.J. Bandsma, Z.A. Bhutta, G.R. Chandak, E.M. Comelli, S.T. Davidge. C. Dennis, G.L. Hammond, P. Jha, K.S. Joseph, S.R. Joshi, M. Krishna, K. Lee, S. Lye, P. McGowan, P. Nepomnaschy, V. Padvetnaya, S. Pyne, H.P.S. Sachdev, S.A. Sahariah, N. Singhal, J. Trasler, C.S. Yajnik, J. Baird, M. Barker, M. Martin, N. Husain, D. Sellen, C.H.D. Fall, P.S. Shah, and S.G. Matthews. 2021. "Protocol for a Cluster Randomised Trial Evaluating a Multifaceted Intervention Starting Preconceptionally—Early Interventions to Support Trajectories for Healthy Life in India (EINSTEIN): A Healthy Life Trajectories Initiative (HeLTI) Study." *BMJ Open* 11: e045862. doi: http://dx.doi.org/10.1136/bmjopen-2020-045862

Introduction: The Healthy Life Trajectories Initiative is an international consortium comprising four harmonised but independently powered trials to evaluate whether an integrated intervention starting preconceptionally will reduce non-communicable disease risk in their children. This paper describes the protocol of the India study. **Methods and analysis:** The study set in rural Mysore will recruit ~6000 married women over the age of 18 years. The village-based cluster randomised design has three arms (preconception, pregnancy and control; 35 villages per arm). The longitudinal multifaceted intervention package will be delivered by community health workers and comprise: (1) measures to optimise nutrition; (2) a group parenting programme integrated with cognitive–behavioral therapy; (3) a lifestyle behaviour change intervention to support women to achieve a diverse diet, exclusive breast feeding for the first 6 months, timely introduction of diverse and nutritious infant weaning foods, and adopt appropriate hygiene measures; and (4) the reduction of environmental pollution focusing on indoor air pollution and toxin avoidance. The primary outcome is adiposity in children at age 5 years, measured by fat mass index. We will report on a host of intermediate and process outcomes. We will collect a range of biospecimens including blood, urine, stool and saliva from the mothers, as well as umbilical cord blood, placenta and specimens from the offspring. An intention-to-treat analysis will be adopted to assess the effect of interventions on outcomes. We will also undertake process and economic evaluations to determine scalability and public health translation. **Ethics and dissemination:** The study has been approved by the institutional ethics committee of the lead institute. Findings will be published in peer-reviewed journals. We will interact with policy makers at local, national and international agencies to enable translation. We will also share the findings with the participants and local community through community meetings, newsletters and local radio.

COVID-19

Effects of the COVID-19 Pandemic on Maternal and Perinatal Outcomes: A Systematic Review and Meta-Analysis

Chmielewska, B., I. Barratt, R. Townsend, E. Kalafat, J. van der Meulen, I. Gurol-Urganci, P. O'Brien, E. Morris, T. Draycott, S. Thangaratinam, K. Le Doare, S. Ladhani, P. von Dadelszen, L. Magee, and A. Khalil. 2021. "Effects of the COVID-19 Pandemic on Maternal and Perinatal Outcomes: A Systematic Review and Meta-Analysis." *The Lancet Global Health*. doi: https://doi.org/10.1016/S2214-109X(21)00079-6.

Background: The COVID-19 pandemic has had a profound impact on health-care systems and potentially on pregnancy outcomes, but no systematic synthesis of evidence of this effect has been undertaken. We aimed to assess the collective evidence on the effects on maternal, fetal, and neonatal outcomes of the pandemic. **Methods:** We did a systematic review and meta-analysis of studies on the effects of the pandemic on maternal, fetal, and neonatal outcomes. We searched MEDLINE and Embase in accordance with PRISMA guidelines, from Jan 1, 2020, to Jan 8, 2021, for case-control studies, cohort studies, and brief reports comparing maternal and perinatal mortality, maternal morbidity, pregnancy complications, and intrapartum and neonatal outcomes before and during the pandemic. We also planned to record any additional maternal and offspring outcomes identified. Studies of solely SARS-CoV-2-infected pregnant individuals, as well as case reports, studies without comparison groups, narrative or systematic literature reviews, preprints, and studies reporting on overlapping populations were excluded. Quantitative meta-analysis was done for an outcome when more than one study presented relevant data. Random-effects estimate of the pooled odds ratio (OR) of each outcome were generated with use of the Mantel-Haenszel method. **Findings:** The search identified 3592 citations, of which 40 studies were included. We identified significant increases in stillbirth (pooled OR 1·28 [95% CI 1·07–1·54]; I^2=63%; 12 studies, 168 295 pregnancies during and 198 993 before the pandemic) and maternal death (1·37 [1·22–1·53; I^2=0%, two studies [both from low-income and middle-income countries], 1 237 018 and 2 224 859 pregnancies) during versus before the pandemic. Preterm births before 37 weeks' gestation were not significantly changed overall (0·94 [0·87–1·02]; I^2=75%; 15 studies, 170 640 and 656 423 pregnancies) but were decreased in high-income countries (0·91 [0·84–0·99]; I^2=63%; 12 studies, 159 987 and 635 118 pregnancies), where spontaneous preterm birth was also decreased (0·81 [0·67–0·97]; two studies, 4204 and 6818 pregnancies). Mean Edinburgh Postnatal Depression Scale scores were higher, indicating poorer mental health, during versus before the pandemic (pooled mean difference 0·42 [95% CI 0·02–0·81; three studies, 2330 and 6517 pregnancies). Surgically managed ectopic pregnancies were increased during the pandemic (OR 5·81 [2·16–15·6]; I^2=26%; three studies, 37 and 272 pregnancies). No overall significant effects were identified for other outcomes included in the quantitative analysis: maternal gestational diabetes; hypertensive disorders of pregnancy; preterm birth before 34 weeks', 32 weeks', or 28 weeks' gestation; iatrogenic preterm birth; labour induction; modes of delivery (spontaneous vaginal delivery, caesarean section, or instrumental delivery); post-partum haemorrhage; neonatal death; low birthweight (<2500 g); neonatal intensive care unit admission; or Apgar score less than 7 at 5 min. **Interpretation:** Global maternal and fetal outcomes have worsened during the COVID-19 pandemic, with an increase in maternal deaths, stillbirth, ruptured ectopic pregnancies, and maternal depression. Some outcomes show considerable disparity between high-resource and low-resource settings. There is an urgent need to prioritise safe, accessible, and equitable maternity care within the strategic response to this pandemic and in future health crises.

A Public Health Approach for Deciding Policy on Infant Feeding and Mother–Infant Contact in the Context of COVID-19

Rollins, N., N. Minckas, F. Jehan, R. Lodha, D. Raiten, C. Thorne, P. Van de Perre, N. Ververs, N. Walker, R. Bahl, and C.G. Victora. 2021. "A Public Health Approach for Deciding Policy on Infant Feeding and Mother–Infant Contact in the Context of COVID-19." *Health Policy* 9(4): E552–E557. doi: https://doi.org/10.1016/S2214-109X(20)30538-6

The COVID-19 pandemic has raised concern about the possibility and effects of mother–infant transmission of SARS-CoV-2 through breastfeeding and close contact. The insufficient available evidence has resulted in differing recommendations by health professional associations and national health authorities. We present an approach for deciding public health policy on infant feeding and mother–infant contact in the context of COVID-19, or for future emerging viruses, that balances the

risks that are associated with viral infection against child survival, lifelong health, and development, and also maternal health. Using the Lives Saved Tool, we used available data to show how different public health approaches might affect infant mortality. Based on existing evidence, including population and survival estimates, the number of infant deaths in low-income and middle-income countries due to COVID-19 (2020–21) might range between 1800 and 2800. By contrast, if mothers with confirmed SARS-CoV-2 infection are recommended to separate from their newborn babies and avoid or stop breastfeeding, additional deaths among infants would range between 188 000 and 273 000.

Shifting Research Priorities in Maternal and Child Health in the COVID-19 Pandemic Era in India: A Renewed Focus on Systems Strengthening

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Background: The remarkable progress seen in maternal and child health (MCH) in India over the past two decades has been impacted by setbacks from the COVID-19 pandemic. We aimed to undertake a rapid assessment to identify key priorities for public health research in MCH in India within the context and aftermath of the COVID-19 pandemic. **Methods:** A web-based survey was developed to identify top research priorities in MCH. It consisted of 26 questions on six broad domains: vaccine preventable diseases, outbreak preparedness, primary healthcare integration, maternal health, neonatal health, and infectious diseases. Key stakeholders were invited to participate between September and November 2020. Participants assigned importance on a 5-point Likert scale, and assigned overall ranks to each sub-domain research priority. Descriptive statistics were used to examine Likert scale responses, and a ranking analysis was done to obtain an "average ranking score" and identify the top research priority under each domain. **Results:** Amongst the 84 respondents, 37% were public-health researchers, 25% healthcare providers, 20% academic faculty and 13% were policy makers. Across the six domains, most respondents considered conducting research on systems strengthening as extremely important. The highest ranked research priorities were strengthening the public sector workforce (vaccine preventable diseases), enhancing public-health surveillance networks (outbreak preparedness), nutrition support through community workers (primary care integration), encouraging at least 4-8 antenatal visits (maternal health), neonatal resuscitation to reduce birth asphyxia (neonatal health) and pediatric and maternal screening and treatment of tuberculosis (infectious diseases). Common themes identified through open-ended questions were also systems strengthening priorities across domains. **Conclusions:** The overall focus for research priorities in MCH in India during the COVID-19 pandemic is on strengthening existing services and service delivery, rather than novel research. Our results highlight pivotal steps within the roadmap for advancing and sustaining maternal and child health gains during the ongoing COVID-19 pandemic and beyond.

Health Systems and Nutrition in the Time of COVID-19

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As infection rates rise, job losses increase and workers leave cities to walk back home, and there is a silent hunger and nutrition crisis striking the country. Those who will bear the brunt of this are the already vulnerable—namely, children, adolescent girls, nursing and expectant mothers—now denied even basic calories. Among these are some who are also suffering huge weight losses because of the

15 days of high fever. This tragedy will play out in various horrifying ways in the future and must be addressed with urgency. Our stimulus package promises loans, which will take time to reach the poor, and a meager ration of cereals and pulses, while hunger and insufficient nutrition are immediate problems as Raghuram Rajan pointed out recently.

From Resilient to Transilient Health Systems: The Deep Transformation of Health Systems in Response to the COVID-19 Pandemic

Haldane, V., and G.T. Morgan. 2021. "From Resilient to Transilient Health Systems: The Deep Transformation of Health Systems in Response to the COVID-19 Pandemic." *Health Policy and Planning* 36(1): 134–135. doi: https://doi.org/10.1093/heapol/czaa169

As countries confront and adapt to the impact of COVID-19, policymakers, public health officials and political leaders have rallied around one word: resilience. Resilience often narrowly focuses on 'bouncing back' to normal as quickly as possible, without critically assessing whether the pre-shock normal should be aspired to (Ebi and Semenza, 2008; Houston, 2015). We argue that the COVID-19 pandemic presents an opportunity for health systems to address the long-standing structural inequalities it reinforces, and the environmental sustainability it undermines, to work towards transformative resilience, or 'transilience' (Pelling, 2010).

ANANYA PROGRAM IN BIHAR

Improving Primary Health Care Delivery in Bihar, India: Learning from Piloting and Statewide Scale-Up of Ananya

Darmstadt, G.L., K.T. Pepper, V.C. Ward, S. Srikantiah, T. Mahapatra, U.K. Tarigopula, D. Bhattacharya, L. Irani, J. Schooley, I. Chaudhuri, P. Dutt, P. Sastry, R. Mitra, S. Chamberlain, S. Monaghan, P. Nanda, Y. Atmavilas, N. Saggurti, E. Borkum, A. Rangarajan, K.M. Mehta, S. Abdalla, J. Wilhelm, Y. Weng, S.L. Carmichael, H. Raheel, J. Bentley, W.A. Munar, A. Creanga, S. Trehan, D. Walker, and H. Shah. 2020. "Improving Primary Health Care Delivery in Bihar, India: Learning from Piloting and Statewide Scale-Up of Ananya." *Journal of Global Health* 10(2): 021001. doi: https://doi.org/10.7189/jogh.10.021001

In 2010, the Bill and Melinda Gates Foundation (BMGF) partnered with the Government of Bihar (GoB), India to launch the Ananya program to improve reproductive, maternal, newborn and child health and nutrition (RMNCHN) outcomes. The program sought to address supply- and demand-side barriers to the adoption, coverage, quality, equity and health impact of select RMNCHN interventions. Approaches included strengthening frontline worker service delivery; social and behavior change communications; layering of health, nutrition and sanitation into women's self-help groups (SHGs); and quality improvement in maternal and newborn care at primary health care facilities. Ananya program interventions were piloted in approximately 28 million population in eight innovation districts from 2011-2013, and then beginning in 2014, were scaled up by the GoB across the rest of the state's population of 104 million. A Bihar Technical Support Program provided techno-managerial support to governmental Health as well as Integrated Child Development Services, and the JEEViKA Technical Support Program supported health layering and scale-up of the GoB's SHG program. The level of support at the block level during statewide scale-up in 2014 onwards was approximately one-fourth that provided in the pilot phase of Ananya in 2011-2013. This paper – the first manuscript in an 11-manuscript and 2-viewpoint collection on Learning from Ananya: Lessons for primary health care performance improvement – seeks to provide a broad description of Ananya and subsequent statewide adaptation and scale-up, and capture the background and context, key

objectives, interventions, delivery approaches and evaluation methods of this expansive program. Subsequent papers in this collection focus on specific intervention delivery platforms. For the analyses in this series, Stanford University held key informant interviews and worked with the technical support and evaluation grantees of the Ananya program, as well as leadership from the India Country Office of the BMGF, to analyse and synthesise data from multiple sources. Capturing lessons from the Ananya pilot program and statewide scale-up will assist program managers and policymakers to more effectively design and implement RMNCHN programs at scale through technical assistance to governments.

Impact of the Ananya Program on Reproductive, Maternal, Newborn and Child Health and Nutrition in Bihar, India: Early Results from a Quasi-Experimental Study

Darmstadt, G.L., Y. Weng, K.T. Pepper, V.C. Ward, K.M. Mehta, E. Borkum, J. Bentley, H. Raheel, A. Rangarajan, D. Bhattacharya, U.K Tarigopula, P. Nanda, S. Sridharan, D. Rotz, S.L. Carmichael, S. Abdalla, W. Munar, and Ananya Study Group. 2020. "Impact of the Ananya Program on Reproductive, Maternal, Newborn and Child Health and Nutrition in Bihar, India: Early Results from a Quasi-Experimental Study." *Journal of Global Health* 10(2): 021002. doi: https://doi.org/10.7189/jogh.10.021002

Background: The Government of Bihar (GoB) in India, the Bill and Melinda Gates Foundation and several non-governmental organisations launched the Ananya program aimed to support the GoB to improve reproductive, maternal, newborn and child health and nutrition (RMNCHN) statewide. Here we summarise changes in indicators attained during the initial two-year pilot phase (2012-2013) of implementation in eight focus districts of approximately 28 million population, aimed to inform subsequent scale-up. **Methods:** The quasi-experimental impact evaluation included statewide household surveys at two time points during the pilot phase: January-April 2012 ("baseline") including an initial cohort of beneficiaries and January-April 2014 ("midline") with a new cohort. The two arms were: 1) eight intervention districts, and 2) a comparison arm comprised of the remaining 30 districts in Bihar where Ananya interventions were not implemented. We analysed changes in indicators across the RMNCHN continuum of care from baseline to midline in intervention and comparison districts using a difference-in-difference analysis. **Results:** Indicators in the two arms were similar at baseline. Overall, 40% of indicators (20 of 51) changed significantly from baseline to midline in the comparison districts unrelated to Ananya; two-thirds (n = 13) of secular indicator changes were in a direction expected to promote health. Statistically significant impact attributable to the Ananya program was found for 10% (five of 51) of RMNCHN indicators. Positive impacts were most prominent for mother's behaviours in contraceptive utilisation. **Conclusions:** The Ananya program had limited impact in improving health-related outcomes during the first two-year period covered by this evaluation. The program's theories of change and action were not powered to observe statistically significant differences in RMNCHN indicators within two years, but rather aimed to help inform program improvements and scale-up. Evaluation of large-scale programs such as Ananya using theory-informed, equity-sensitive (including gender), mixed-methods approaches can help elucidate causality and better explain pathways through which supply- and demand-side interventions contribute to changes in behaviour among the actors involved in the production of population-level health outcomes. Evidence from Bihar indicates that deep structural constraints in health system organisation and delivery of interventions pose substantial limitations on behaviour change among health care providers and beneficiaries.

Trends in Reproductive, Maternal, Newborn and Child Health and Nutrition Indicators During Five Years of Piloting and Scaling-Up of Ananya Interventions in Bihar, India

Abdalla, S., Y. Weng, K.M. Mehta, T. Mahapatra, S. Srikantiah, H. Shah, V.C. Ward, K.T. Pepper, J. Bentley, S.L. Carmichael, A. Creanga, J. Wilhelm, U.K. Tarigopula, P. Nanda, D. Bhattacharya, Y.

Atmavilas, G.L. Darmstadt, and Ananya Study Group. 2020. "Trends in Reproductive, Maternal, Newborn and Child Health and Nutrition Indicators During Five Years of Piloting and Scaling-Up of Ananya Interventions in Bihar, India." *Journal of Global Health* 10(2): 021003. doi: https://doi.org/10.7189/jogh.10.021003

Background: The Ananya program in Bihar implemented household and community-level interventions to improve reproductive, maternal, newborn and child health and nutrition (RMNCHN) in two phases: a first phase of intensive ancillary support to governmental implementation and innovation testing by non-government organisation (NGO) partners in eight focus districts (2012-2014), followed by a second phase of state-wide government-led implementation with techno-managerial assistance from NGOs (2014 onwards). This paper examines trends in RMNCHN indicators in the program's implementation districts from 2012-2017. **Methods:** Eight consecutive rounds of cross-sectional Community-based Household Surveys conducted by CARE India in 2012-2017 provided comparable data on a large number of indicators of frontline worker (FLW) performance, mothers' behaviours, and facility-based care and outreach service delivery across the continuum of maternal and child care. Logistic regression, considering the complex survey design and sample weights generated by that design, was used to estimate trends using survey rounds 2-5 for the first phase in the eight focus districts and rounds 6-9 for the second phase in all 38 districts statewide, as well as the overall change from round 2-9 in focus districts. To aid in contextualising the results, indicators were also compared amongst the formerly focus and the non-focus districts at the beginning of the second phase. **Results:** In the first phase, the levels of 34 out of 52 indicators increased significantly in the focus districts, including almost all indicators of FLW performance in antenatal and postnatal care, along with mother's birth preparedness, some breastfeeding practices, and immunisations. Between the two phases, 33 of 52 indicators declined significantly. In the second phase, the formerly focus districts experienced a rise in the levels of 14 of 50 indicators and a decline in the levels of 14 other indicators. There was a rise in the levels of 22 out of 50 indicators in the non-focus districts in the second phase, with a decline in the levels of 13 other indicators. **Conclusions:** Improvements in indicators were conditional on implementation support to program activities at a level of intensity that was higher than what could be achieved at scale so far. Successes during the pilot phase of intensive support suggests that RMNCHN can be improved statewide in Bihar with sufficient investments in systems performance improvements.

Geospatial Variations in Trends of Reproductive, Maternal, Newborn and Child Health and Nutrition Indicators at Block Level in Bihar, India, During Scale-Up of Ananya Program Interventions

Abdalla, S., E. Pair, K.M. Mehta, V.C. Ward, and G.L. Darmstadt. 2020. "Geospatial Variations in Trends of Reproductive, Maternal, Newborn and Child Health and Nutrition Indicators at Block Level in Bihar, India, During Scale-Up of Ananya Program Interventions." *Journal of Global Health* 10(2), 021004. doi: https://doi.org/10.7189/jogh.10.021004

Background: Geographical variations in the levels and trajectory of health indicators at local level can inform the adaptation of interventions and development of targeted approaches for efficient scale-up of intervention impact. We examined the hypothesis that time trends of a set of reproductive, maternal, newborn, and child health and nutrition (RMNCHN) indicators varied at block-level during the statewide scale-up phase of the Ananya program in Bihar, India. **Methods:** We used data on 22 selected indicators from four rounds of the Community-based Household Survey carried out between 2014 and 2017. Indicator levels at each round were estimated for each block. We used hierarchical Bayesian spatiotemporal modelling to smooth the raw estimates for each block with the estimates from its neighbouring blocks, and to examine space-time interaction models for evidence of variations in trends of indicators across blocks. We expressed the uncertainty around

the smoothed levels and the trends with 95% credible intervals. **Results:** There was evidence of variations in trends at block level in all but three indicators: facility delivery, public facility delivery, and age-appropriate initiation of complementary feeding. Fifteen indicators showed trends in opposite directions (increases in some blocks and declines in others). All blocks had at least 97.5% probability of a rise in immediate breastfeeding, early pregnancy registration, and having at least four antenatal care visits. All blocks had at least 97.5% probability of a decline in seeking care for pregnancy complications. **Conclusions:** The findings underscore the value of monitoring and evaluation at local level for targeted implementation of RMNCHN interventions. There is a need for identifying systematic factors leading to universal trends, or variable contextual or implementation factors leading to variable trends, in order to optimise primary health care program impact.

Impact of mHealth Interventions for Reproductive, Maternal, Newborn and Child Health and Nutrition at Scale: BBC Media Action and the Ananya Program in Bihar, India

Ward, V.C., H. Raheel, Y. Weng, K.M. Mehta, P. Dutt, R. Mitra, P. Sastry, A. Godfrey, M. Shannon, S. Chamberlain, R. Kaimal, S.L. Carmichael, J. Bentley, S. Abdalla, K.T. Pepper, T. Mahapatra, S. Srikantiah, E. Borkum, A. Rangarajan, S. Sridharan, D. Rotz, P. Nanda, U.K. Tarigopula, Y. Atmavilas, D. Bhattacharya, G.L. Darmstadt, and Ananya Group. 2020. "Impact of mHealth Interventions for Reproductive, Maternal, Newborn and Child Health and Nutrition at Scale: BBC Media Action and the Ananya Program in Bihar, India." *Journal of Global Health* 10(2): 021005. doi: https://doi.org/10.7189/jogh.10.021005

Background: Mobile health (mHealth) tools have potential for improving the reach and quality of health information and services through community health workers in low- and middle-income countries. This study evaluates the impact of an mHealth tool implemented at scale as part of the statewide reproductive,maternal, newborn and child health and nutrition (RMNCHN) program in Bihar, India. **Methods:** Three survey-based data sets were analysed to compare the health-related knowledge, attitudes and behaviours amongst childbearing women exposed to the Mobile Kunji and Dr. Anita mHealth tools during their visits with frontline workers compared with those who were unexposed. **Results:** An evaluation by Mathematica (2014) revealed that exposure to Mobile Kunji and Dr. Anita recordings were associated with significantly higher odds of consuming iron-folic acid tablets (odds ratio (OR) = 2.3, 95% confidence interval (CI) = 1.8-3.1) as well as taking a set of three measures for delivery preparedness (OR = 2.8, 95% CI = 1.9-4.2) and appropriate infant complementary feeding (OR = 1.9, 95% CI = 1.0-3.5). CARE India's Community-based Household Surveys (2012-2017) demonstrated significant improvements in early breastfeeding (OR = 1.64, 95% CI = 1.5-1.78) and exclusive breastfeeding (OR = 1.46, 95% CI = 1.33-1.62) in addition to birth preparedness practices. BBC Media Action's Usage & Engagement Survey (2014) demonstrated a positive association between exposure to Mobile Kunji and Dr. Anita and exclusive breastfeeding (58% exposed vs 43% unexposed, $P < 0.01$) as well as maternal respondents' trust in their frontline worker. **Conclusions:** Significant improvements in RMNCHN-related knowledge and behaviours were observed for Bihari women who were exposed to Mobile Kunji and Dr. Anita. This analysis is unique in its rigorous evaluation across multiple data sets of mHealth interventions implemented at scale. These results can help inform global understanding of how best to use mHealth tools, for whom, and in what contexts.

Health Impact of Self-Help Groups Scaled-Up Statewide in Bihar, India

Mehta, K.M., L. Irani, I. Chaudhuri, T. Mahapatra, J. Schooley, S. Srikantiah, S. Abdalla, V.C. Ward, S.L. Carmichael, J. Bentley, A. Creanga, J. Wilhelm, U.K. Tarigopula, D. Bhattacharya, Y. Atmavilas, P. Nanda, Y. Weng, K..T. Pepper, G.L. Darmstadt, and Ananya Group. 2020. "Health Impact of Self-Help

Groups Scaled-Up Statewide in Bihar, India." *Journal of Global Health* 10(2): 021006. doi: https://doi.org/10.7189/jogh.10.021006

Background: The objective of this study was to assess the impact of self-help groups (SHGs) and subsequent scale-up on reproductive, maternal, newborn, child health, and nutrition (RMNCHN) and sanitation outcomes among marginalised women in Bihar, India from 2014-2017. **Methods:** We examined RMNCHN and sanitation behaviors in women who were members of any SHGs compared to non-members, without differentiating between types of SHGs. We analysed annual surveys across 38 districts of Bihar covering 62 690 women who had a live birth in the past 12 months. All analyses utilised data from Community-based Household Surveys (CHS) rounds 6-9 collected in 2014-2017 by CARE India as part of the Bihar Technical Support Program funded by the Bill & Melinda Gates Foundation. We examined 66 RMNCHN and sanitation indicators using survey logistic regression; the comparison group in all cases was age-comparable women from the geographic contexts of the SHG members but who did not belong to SHGs. We also examined links between discussion topics in SHGs and changes in relevant behaviours, and stratification of effects by parity and mother's age. **Results:** SHG members had higher odds compared to non-SHG members for 60% of antenatal care indicators, 22% of delivery indicators, 70% of postnatal care indicators, 50% of nutrition indicators, 100% of family planning and sanitation indicators and no immunisation indicators measured. According to delivery platform, most FLW performance indicators (80%) had increased odds, followed by maternal behaviours (57%) and facility care and outreach service delivery (22%) compared to non-SHG members. Self-report of discussions within SHGs on specific topics was associated with increased related maternal behaviours. Younger SHG members (<25 years) had attenuated health indicators compared to older group members (≥25 years), and women with more children had more positive indicators compared to women with fewer children. **Conclusions:** SHG membership was associated with improved RMNCHN and sanitation indicators at scale in Bihar, India. Further work is needed to understand the specific impacts of health layering upon SHGs. Working through SHGs is a promising vehicle for improving primary health care.

Health Layering of Self-Help Groups: Impacts on Reproductive, Maternal, Newborn and Child Health and Nutrition in Bihar, India

Mehta, K.M., L. Irani, I. Chaudhuri, T. Mahapatra, J. Schooley, S. Srikantiah, S. Abdalla, V. Ward, S.L. Carmichael, J. Bentley, A. Creanga, J. Wilhelm, U.K. Tarigopula, D. Bhattacharya, Y. Atmavilas, P. Nanda, Y. Weng, K.T. Pepper, G.L. Darmstadt, and Ananya Group. 2020. "Health Layering of Self-Help Groups: Impacts on Reproductive, Maternal, Newborn and Child Health and Nutrition in Bihar, India." *Journal of Global Health* 10(2): 021007. doi: https://doi.org/10.7189/jogh.10.021007

Background: Self-help group (SHG) interventions have been widely studied in low and middle income countries. However, there is little data on specific impacts of health layering, or adding health education modules upon existing SHGs which were formed primarily for economic empowerment. We examined three SHG interventions from 2012-2017 in Bihar, India to test the hypothesis that health-layering of SHGs would lead to improved health-related behaviours of women in SHGs. **Methods:** A model for health layering of SHGs – Parivartan – was developed by the non-governmental organisation (NGO), Project Concern International, in 64 blocks of eight districts. Layering included health modules, community events and review mechanisms. The health layering model was adapted for use with government-led SHGs, called JEEViKA+HL, in 37 other blocks of Bihar. Scale-up of government-led SHGs without health layering (JEEViKA) occurred contemporaneously in 433 other blocks, providing a natural comparison group. Using Community-based Household Surveys (CHS, rounds 6-9) by CARE India, 62 reproductive, maternal, newborn and child health and nutrition (RMNCHN) and sanitation indicators were examined for SHGs with health layering (Pavivartan SHGs and JEEViKA+HL SHGs) compared to those without. We calculated mean,

standard deviation and odds ratios of indicators using surveymeans and survey logistic regression. **Results:** In 2014, 64% of indicators were significantly higher in Parivartan members compared to non-members residing in the same blocks. During scale up, from 2015-17, half (50%) of indicators had significantly higher odds in health layered SHG members (Parivartan or JEEViKA+HL) in 101 blocks compared to SHG members without health layering (JEEViKA) in 433 blocks. **Conclusions:** Health layering of SHGs was demonstrated by an NGO-led model (Parivartan), adapted and scaled up by a government model (JEEViKA+HL), and associated with significant improvements in health compared to non-health-layered SHGs (JEEViKA). These results strengthen the evidence base for further layering of health onto the SHG platform for scale-level health change.

Statewide Implementation of a Quality Improvement Initiative for Reproductive, Maternal, Newborn and Child Health and Nutrition in Bihar, India

Creanga, A.A., S. Srikantiah, T. Mahapatra, A. Das, S. Sonthalia, P.R. Moharana, A. Gore, S. Daulatrao, R. Durbha, S. Kaul, C. Galavotti, A. Laterra, K.T. Pepper, G.L. Darmstadt, and H. Shah. 2020. "Statewide Implementation of a Quality Improvement Initiative for Reproductive, Maternal, Newborn and Child Health and Nutrition in Bihar, India." *Journal of Global Health* 10(2): 021008. doi: https://doi.org/10.7189/jogh.10.021008

Background: CARE India designed and implemented a comprehensive, statewide quality improvement (QI) initiative to improve reproductive, maternal, newborn, and child health and nutrition (RMNCHN) services in public facilities in Bihar. We provide a description of this initiative and its key results during 2014-2017. **Methods:** We reviewed program documents to identify QI strategies employed and ascertain their coverage. We analysed data from: a) two public facility assessments to ascertain the availability of essential equipment and supplies and the distribution of human resources by facility level; b) a four-phase provider mentoring and training intervention covering 319 facilities to examine changes in emergency obstetric and newborn care (EmONC) practices; and c) four state-representative household surveys to explore changes in selected RMNCHN service utilisation by health sector. Associations of interest were ascertained using $\chi 2$ tests. **Results:** Thirty-eight District Quality Assurance Committees and QI teams in 98% of facilities were formed to develop an implementation plan for the QI initiative and oversee its execution. QI strategies were to strengthen facilities' infrastructure; build the state's contracting, procurement, and inventory management capacities; rationalise human resources; improve providers' skills; and modernise data systems. Implementation led to facility infrastructure upgrades, improved clinical staff distribution, and higher availability of equipment and supplies over time, especially in higher-level facilities. Following the mentoring and training intervention in facilities offering both basic and comprehensive EmONC, performance of key practices (eg, adequate administration of uterotonics <1 minute after birth, initiation of skin-to-skin care <5 minutes after birth) improved significantly ($P < 0.05$). CARE India collected program data and assisted with modernising data systems for tracking human resources, supplies, and program progress statewide. Of women seeking antenatal care, the proportion obtaining key screenings (eg, weight, blood pressure measurements) in public facilities increased over time ($P < 0.05$). A 6-percentage point decline in home deliveries during 2016-2017 was accompanied by a higher increase of deliveries in public than private facilities (5- vs 1-percentage point; $P < 0.05$). **Conclusion:** Substantial advances were made in improving RMNCHN service quality in Bihar. Continued improvement building on the established QI platform is expected and should be guided by data from now functional data systems.

Using a Mobile Nurse Mentoring and Training Program to Address a Health Workforce Capacity Crisis in Bihar, India: Impact on Essential Intrapartum and Newborn Care Practices

Creanga, A.A., S. Jiwani, A. Das, T. Mahapatra, S. Sonthalia, A. Gore, S. Kaul, S. Srikantiah, C. Galavotti, and H. Shah. 2020. "Using a Mobile Nurse Mentoring and Training Program to Address a Health Workforce Capacity Crisis in Bihar, India: Impact on Essential Intrapartum and Newborn Care Practices." *Journal of Global Health* 10(2): 021009. doi: https://doi.org/10.7189/jogh.10.021009

Background: To address a health workforce capacity crisis, in coordination with the Government of Bihar, CARE India implemented an on-the-job, on-site nurse mentoring and training intervention named – Apatkalin Matritva evam Navjat Tatparta (AMANAT, translated Emergency Maternal and Neonatal Care Preparedness) – in public facilities in Bihar. AMANAT was rolled-out in a phased manner to provide hands-on training and mentoring for nurses and doctors offering emergency obstetric and newborn care (EmONC) services. This study examines the impact of the AMANAT intervention on nurse-mentees' competency to provide such services in Bihar, India during 2015-2017. **Methods:** We used data from three AMANAT implementation phases, each covering 80 public facilities offering basic EmONC services. Before and after the intervention, CARE India administered knowledge assessments to nurse-mentees; ascertained infection control practices at the facility level; and used direct observation of deliveries to assess nurse-mentees' practices. We examined changes in nurse-mentees' knowledge scores using $\chi 2$ tests for proportions and t tests for means; and estimated proportions and corresponding 95% confidence intervals for routine performance of infection control measures, essential intrapartum and newborn services. We fitted linear regression models to explore the impact of the intervention on nurse-mentees' knowledge and practices after adjusting for potential confounders. **Results:** On average, nurse-mentees answered correctly 38% of questions at baseline and 68% of questions at endline ($P < 0.001$). All nine infection control measures assessed were significantly more prevalent at endline (range 28.8%-86.8%) than baseline. We documented statistically significant improvements in 18 of 22 intrapartum and 9 of 13 newborn care practices ($P < 0.05$). After controlling for potential confounders, we found that the AMANAT intervention led to significant improvements in nurse-mentees' knowledge (30.1%), facility-level infection control (30.8%), intrapartum (29.4%) and newborn management (24.2%) practices (all $P < 0.05$). Endline scores ranged between 56.8% and 72.8% of maximum scores for all outcomes. **Conclusion:** The AMANAT intervention had significant results in a health workforce capacity crisis situation, when a large number of auxiliary nurse-midwives were expected to provide services for which they lacked the necessary skills. Gaps in intrapartum and newborn care knowledge and practice still exist in Bihar and should be addressed through future mentoring and training interventions.

Simulation and Team Training Embedded Nurse Mentoring Programme and Improvement in Intrapartum and Newborn Care in a Low-Resource Setting in Bihar, India

Ghosh, R., H. Spindler, J. Dyer, A. Christmas, S.R. Cohen, A. Das, S. Sonthalia, T. Mahapatra, A. Gore, H. Shah, and D.M. Walker. 2020. "Simulation and Team Training Embedded Nurse Mentoring Programme and Improvement in Intrapartum and Newborn Care in a Low-Resource Setting in Bihar, India." *Journal of Global Health* 10(2): 021010. doi: https://doi.org/10.7189/jogh.10.021010

Background: Improvement of the quality of maternal and child health care remains a focus in India. Working with the Government of Bihar, CARE-India facilitated a comprehensive set of quality of care improvement initiatives. PRONTO's simulation and team-training was incorporated into the large-scale Apatkaleen Matritva evam Navjat Tatparta (AMANAT) nurse-mentoring program of the Government of Bihar supported by CARE-India to improve maternal and child health outcomes. Along-with the AMANAT program, the PRONTO components provided training on nontechnical and technical competencies for managing a variety of obstetric and neonatal conditions, as a team. This study assessed the effectiveness of nurse-mentoring including simulations on intrapartum and newborn care practices in 320 basic emergency obstetric and neonatal care (BEmONC) facilities.

Methods: Deliveries were observed to obtain specific information on evidence-based practice (EBP) indicators before and after the intervention. Intrapartum and newborn care composite scores – were calculated using those EBP indicators. A web-based routine monitoring system provided total training days, weeks and days/week of training and counts of simulation and teamwork-communication activities. Multilevel linear regression was used to examine the exposure-outcome associations. **Results:** The final analysis included 668 normal spontaneous vaginal deliveries (NSVDs) from 289 public health facilities in Bihar. Facility-level intrapartum and newborn scores improved by 37 and 26-percentage points, respectively, from baseline to endline. Compared to the bottom one-third facilities that performed fewest NSVD simulations, the top one-third had 6 (95% confidence interval (CI) = 1-12) percentage points higher intrapartum score. Similar comparison using maternal complication simulations yielded 7 (95% CI = 1-12) percentage point higher scores. The highest newborn scores were observed in the middle one-third of facilities relative to the bottom one-third that did the fewest NSVD simulations (5, 95% CI: 1-10). **Conclusions:** Findings suggest significant overall improvement in intrapartum and newborn care practices after the AMANAT nurse-mentoring program in public sector BEmONC facilities. Simulation and team-training likely contributed towards the overall improvement, especially for intrapartum care.

Evaluation of a Large-Scale Reproductive, Maternal, Newborn and Child Health and Nutrition Program in Bihar, India, Through an Equity Lens

Ward, V.C., Y. Weng, J. Bentley, S.L. Carmichael, K.M. Mehta, W. Mahmood, K.T. Pepper, S. Abdalla, Y. Atmavilas, T. Mahapatra, S. Srikantiah, E. Borkum, A. Rangarajan, S. Sridharan, D. Rotz, D. Bhattacharya, P. Nanda, U.K. Tarigopula, H. Shah, G.L. Darmstadt, and Ananya Group. 2020. "Evaluation of a Large-Scale Reproductive, Maternal, Newborn and *Child Health and Nutrition Program in Bihar, India, Through an Equity Lens." Journal* of Global Health 10(2): 021011. doi: https://doi.org/10.7189/jogh.10.021011

Background: Despite increasing focus on health inequities in low- and middle income countries, significant disparities persist. We analysed impacts of a statewide maternal and child health program among the most compared to the least marginalised women in Bihar, India. **Methods:** Utilising survey-weighted logistic regression, we estimated programmatic impact using difference-in-difference estimators from Mathematica data collected at the beginning (2012, n = 10 174) and after two years of program implementation (2014, n = 9611). We also examined changes in disparities over time using eight rounds of Community-based Household Surveys (CHS) (2012-2017, n = 48 349) collected by CARE India. **Results:** At baseline for the Mathematica data, least marginalised women generally performed desired health-related behaviours more frequently than the most marginalised. After two years, most disparities persisted. Disparities increased for skilled birth attendant identification [+16.2% (most marginalised) vs +32.6% (least marginalized), $P < 0.01$) and skin-to-skin care (+14.8% vs +20.4%, $P < 0.05$), and decreased for immediate breastfeeding (+10.4 vs -4.9, $P < 0.01$). For the CHS data, odds ratios compared the most to the least marginalised women as referent. Results demonstrated that disparities were most significant for indicators reliant on access to care such as delivery in a facility (OR range: 0.15 to 0.48) or by a qualified doctor (OR range: 0.08 to 0.25), and seeking care for complications (OR range: 0.26 to 0.64). **Conclusions:** Disparities observed at baseline generally persisted throughout program implementation. The most significant disparities were observed amongst behaviours dependent upon access to care. Changes in disparities largely were due to improvements for the least marginalised women without improvements for the most marginalised. Equity-based assessments of programmatic impacts, including those of universal health approaches, must be undertaken to monitor disparities and to ensure equitable and sustainable benefits for all.

NON-PEER REVIEWED

The Impact of Caste: A Missing Link in the Literature on Stunting in India

Ramachandran, R., and A. Deshpande. 2021. "The Impact of Caste: A Missing Link in the Literature on Stunting in India." IZA Discussion Paper No. 14173. Institute of Labor Economics. New Delhi, India. https://www.iza.org/publications/dp/14173/the-impact-of-caste-a-missing-link-in-the-literature-on-stunting-in-india

India is home to some 120 million children under the age of 5, 36 percent of whom are chronically malnourished. The associated high prevalence of stunting has generated a stream of research explaining why chronic malnourishment in India is higher than in poorer countries of sub-Saharan Africa. Surprisingly, this body of research has overlooked a crucial feature of chronic malnourishment in India – that is, the difference in stunting incidence across caste and religious groups. A comparison by social categories reveals that not only are the height gaps between social groups in India two to three times larger than the India–Africa gap, but that children from the socio-economically dominant group, the upper caste Hindus, are even taller than their African counterparts. We find significant caste gaps in child height in samples that are balanced on an extensive set of covariates. We also show that height gaps are higher in areas where discrimination is more prevalent. Our results suggest that incorporating considerations of caste is essential to understanding the problem of chronic malnourishment in India today.

Take Home Ration Service of the Integrated Child Services Scheme Documenting the Status in Select States of India

Khattar, D., A.J. Sharma, A. Joshi, and M.A. Subramanyam. 2021. "Take Home Ration Service of the Integrated Child Services Scheme Documenting the Status in Select States of India." Technical Report. Indian Institute of Technology Gandhinagar. Gandhinagar, India. doi: 10.13140/RG.2.2.22024.03841

India's Supplementary Nutrition Programme, one of the largest such initiatives in the world, was launched in 1975 under the Integrated Child Development Services (hereafter ICDS). ICDS was revised in 2000 to expand its access to all states. In 2006, the Supreme Court's judgement mandated universal access of ICDS services. In 2009, ICDS went through a financial expansion which resulted in improved coverage across all states and union territories, resulting in a wider reach amongst citizens with an emphasis to deliver the services to marginalized groups. One of the many services provided by the ICDS is the distribution of supplementary food to beneficiaries for consumption at home, labeled Take Home Ration (THR). The supplementary food could be in the form of fortified preblended food, dry ration, locally prepared recipes such as sattu, upma mix, and so on. In 2012, the Supreme Court of India ordered that the Take Home Ration service should ensure that safeguards are in place to protect the food meant for distribution from any form of contamination. The Take-Home Ration (THR) service is regulated by the Ministry of Women and Child Development. Broad guidelines have been issued by Food Safety and Standards Authority of India (FSSAI) whereas States regulate the specific guidelines for the production, fortification, supply and distribution models (Vaid et al., 2018) THR provides micronutrient-fortified and energy-dense food which meets 50% of the daily Recommended Dietary Allowance (RDA) per beneficiary (Schwarz et al., 2018). Beneficiaries of THR include infants (0-3 years), children (3-6 years), and pregnant and lactating women (PLW). Currently, ICDS serves approximately 8.5 crore children under six years of age, as well as about 2 crore pregnant and lactating women (ICDS guidelines). To strengthen the ICDS framework and to converge all the schemes aimed at reducing undernutrition, Government of India (hereafter GoI) launched the National Nutrition Mission (hereafter NNM). GoI aims to achieve the following

targets by 2022: reduction in the proportion of underweight children (35.7% to 20.7%), the prevalence of anemia in children below five (58.4% to 19.5%) and PLW (53.1% to 17.7%) (Nourishing India, 2018). A substantial proportion of the ICDS budget is spent on THR. State and central governments spend approximately Rs. 13,500 crores on THR (Schwarz, 2018). While THR is a key ICDS component given India's burden of undernutrition, it becomes extremely crucial during crises such as the COVID-19 pandemic, which has increased the vulnerability of the underprivileged by affecting livelihoods and the food distribution system. Through the strengthening of the THR, appropriate nutrition can be provided to support the growth, development and overall health of pregnant/lactating women and children. The present study is an attempt to understand and explore various THR models implemented by different states and union territories across the country. We describe THR contents, production models, supply, and distribution models in several states of India.

COVID-19

The Lockdown in India Understanding the Matrix of Caste, Class and Gender

Raina, V, and Ananya. 2021. "The Lockdown in India Understanding the Matrix of Caste, Class and Gender." *Economic & Political Weekly* 56(8).
https://www.epw.in/journal/2021/8/commentary/lockdown-india.html

The coronavirus pandemic, nationwide lockdown and the Indian demography are explored through the prisms of caste, class and gender. There is an evident link between the degree of vulnerability and susceptibility of certain people falling prey to the ills of the lockdown and the overlapping effects of class, caste and gender they belong to.

The World's Largest COVID-19 Vaccination Campaign

Bagcchi, S. 2021. "The World's Largest COVID-19 Vaccination Campaign." *The Lancet Infection Diseases* 21(3): P323. doi: https://doi.org/10.1016/S1473-3099(21)00081-5

India takes up the challenge to vaccinate 300 million people in the initial stage of COVID-19 immunisation programme. Sanjeet Bagcchi reports. As of Feb 8, more than 6 million people have been vaccinated in the world's largest COVID-19 vaccination campaign that started on Jan 16 in India. The first vaccine was administered to a sanitation worker at the All India Institute of Medical Sciences, New Delhi, and then the campaign picked up its speed. According to statement released on Feb 8 by the government's Press Information Bureau, "India has become the fastest country to vaccinate 6 million beneficiaries countrywide. This feat was achieved in just 24 days".

Asian Development Bank and World Bank Join Forces for a Resilient Recovery in South Asia

Asian Development Bank Blog. 2021. "Asian Development Bank and World Bank Join Forces for a Resilient Recovery in South Asia." Accessed February 8, 2021.
https://www.adb.org/news/features/asian-development-bank-world-bank-join-forces-resilient-recovery-south-asia

Zahida Bibi feared for her family's survival when she lost her job as a housekeeper in Islamabad during the COVID-19 outbreak. Zahida's four children depend on her income – and so does her husband, a cancer patient. Pakistan's Ehsaas Emergency Cash Program provided Zahida with a fast, digital lifeline she could access through a mobile phone. "This program is a ray of hope for poor families," she said. The Ehsaas program is a great example of how safety net systems, enhanced through digital connectivity, can reach the poorest and the most vulnerable in times of crisis. Those

in need use a text message and their national identification number to apply for Ehsaas help. Biometrics verify an applicant's identity before payments are issued. The system is data-driven, automated, and politically neutral. As a response to COVID-19, the World Bank Group and the Asian Development Bank are coordinating more than $15.4 billion in wide-ranging lending programs in South Asia. One of the priority areas of support has been providing technical expertise to enhance the digital infrastructures delivering safety net programs.

UPCOMING EVENTS & DEADLINES

Nutrition and Long-Term Economic Consequences

This webinar is being organized by the Center for Disease Dynamics, Economics & Policy.

When: April 27, 2021
Where: Online
For more information:
https://us02web.zoom.us/webinar/register/WN_T56JyS9bRpWvPkEd0kMrhw

Nutrition 2021

Join a truly global audience for Nutrition 2021 Live Online, June 7-10, to experience ground-breaking research, connect with peers from all over the world, engage with the greatest minds in nutrition, and see the latest technologies, products and services in the virtual exhibit hall.

When: July 7–10, 2021
Where: Online
For more information: https://meeting.nutrition.org/

ABOUT POSHAN

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

ABOUT ABSTRACT DIGEST

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

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