



*Eunice Kennedy Shriver* National Institute  
of Child Health and Human Development

# **Socio-Ecological Factors and the Double Burden of Malnutrition (DBM) Among Children and Adolescents in Low- and Middle-Income Countries (LMICs)**

## **Executive Summary**

**October 19–20, 2022**

**Virtual**

### **DAY 1**

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#### **WELCOME AND OPENING REMARKS**

Jenelle Walker, Ph.D., welcomed the attendees to the NICHD Global Health Conference on behalf of the NICHD Office of Global Health and Director, Dr. Vesna Kutlesic. Dr. Walker stated the purpose of the conference was to better understand recent etiological and socio-ecological factors that are contributing to the increased prevalence of the DBM, which has been defined as the coexistence of undernutrition with overweight, obesity, and diet-related noncommunicable diseases (NCDs) at the individual, family, and community levels. The meeting explored evidence-based interventions and identified important research and policy questions.

Alison Cernich, Ph.D., NICHD deputy director, noted the NICHD global research program's key role in research activities involving children in LMICs. She welcomed this opportunity to hear new approaches for implementing better nutritional developmental programs in LMICs.

Roger Glass, M.D., Ph.D., NIH Fogarty International Center (FIC) director, recalled his years working in Bangladesh with severely malnourished children and described the support of the FIC Center for Global Health Studies for research projects on global nutrition and food security.

#### **Introduction of First Keynote Speaker by Vesna Kutlesic, Ph.D., NICHD**

Barry Popkin, Ph.D., is the W. R. Kenan, Jr. Distinguished Professor of Nutrition at the University of North Carolina at Chapel Hill and founder of the Global Food Research Program.

#### **First Keynote Address: The DBM and the New Nutritional Reality**

The DBM is the combination of stunting or low weight for age and obesity at the country level. In the past decade, undernutrition and stunting have declined and overweight has rapidly increased in LMICs, as the burden of overweight and obesity has shifted from higher- to lower-income populations, particularly in sub-Saharan Africa and South and Southeast Asia. Body

mass index (BMI) and waist circumference have increased in all age groups, driven by increased consumption of ultra-processed foods, decline in physical activity, drop in cooking at home, and investment in the modern food industry. A large NIH trial comparing a less-processed diet with an ultra-processed diet in normal-weight adults found that over a 2-week period, participants on the ultra-processed diet gained almost a kilogram of body weight, which they lost when they changed over to a healthy diet. Shifts in inflammatory and other biomarkers that are key measures of cardiovascular disease (CVD), cancer risks, and type 2 diabetes were also seen, suggesting a link between diet and the increasing risk of NCDs, obesity, and mortality. These issues require multisectoral approaches to change cultural norms toward healthy eating.

### **Introduction of Second Keynote Speaker by Andrew Bremer, M.D., Ph.D., NICHD**

Elaine Borghi, Ph.D., is the head of the Monitoring Nutrition Status and Food Safety Events Unit in the Department of Nutrition and Food Safety at the World Health Organization (WHO) in Geneva, Switzerland.

### **Second Keynote Address: Global Regional Differences in the DBM Among Children and Adolescents in LMICs**

The multiple forms of malnutrition (i.e., stunting, wasting, and overweight in children under 5 years old; anemia in women of reproductive age; low birth weight; and inadequate breastfeeding) cannot be addressed in isolation, because most countries are afflicted by more than one of these. The coexistence of different forms of malnutrition has become the “new normal” in LMICs, particularly in sub-Saharan Africa. Children and adolescents 5 to 19 years old are trending toward stagnating underweight and rising overweight, with girls more overweight than boys. Socio-economic data from Guatemala on household wealth scores and adolescents’ education levels showed that higher household wealth and more advanced education correlated with a lower prevalence of the DBM in adolescents. In children and adolescents in LMICs, undernutrition is declining while overweight is increasing, in patterns that vary by sex. This trend will continue as long as the global food system makes less nutritious food cheaper and more accessible.

## **SESSION I: BROADER CONTEXT AND ENVIRONMENTAL INFLUENCES FOR CHILDREN AND ADOLESCENTS IN LMICs**

### **Moderator**

*Daniel Raiten, Ph.D., FASN, NICHD*

### **How Adolescents Perceive Nutrition and Food Security Around the World**

*Rafael Pérez-Escamilla, Ph.D., Yale School of Public Health*

Dr. Pérez-Escamilla shared adolescents’ perspectives about nutrition, gleaned from interviews with 656 participants 12 to 18 years old (61% female) in 18 low-, middle-, and high-income countries across five world regions. The study found that adolescents understand the importance of healthy eating but consume unhealthy foods. Their food choices are influenced by family, media, friends, advertising, body image, and food taste. Barriers to adolescents’ healthy eating include the high cost of healthy foods and the aggressive marketing of ultra-processed foods and beverages by the food industry. Adolescent-centered solutions to unhealthy eating must involve multisectoral efforts with strong input from adolescents

themselves to address unhealthy food systems, food environments, marketing of ultra-processed foods, family meals, and peer pressure issues, such as body image.

### **Environmental Influences for the DBM for LMICs: An African Perspective and Current Opportunities for Action**

*Namukolo Covic, Ph.D., M.Sc., Regional Director, Consultative Group for International Agricultural Research, East and Southern Africa*

Food systems in Africa are leading to a clear DBM situation as stunting has declined and the prevalence of overweight in adolescent girls and adult women has increased significantly. These issues were at the forefront of the 2021 United Nations Food System Summit (UNFSS), which launched new actions to address widespread poor diets and malnutrition in LMICs. Food transformation efforts must focus on three areas: addressing environmental influences, making complementary diets more appealing, and increasing food affordability. The African continent has responded to the UNFSS by developing food systems transformation pathways targeting the DBM. Ethiopia's holistic plan to transform its food systems from production to consumption is one example. Food transformation requires collaboration among food system actors and adherence to a framework for monitoring transformation efforts. African countries have new opportunities to create a synergistic momentum to improve nutrition across the continent.

### **The Global Syndemics of Obesity, Food and Nutrition Insecurity, and Climate Changes on the DBM**

*William H. Dietz, M.D., Ph.D., George Washington University*

Syndemics, clusters of diseases within a population that have adverse disease-promoting interactions at the biological and biosocial levels, have a disproportionate impact on LMICs. Obesity, undernutrition, and climate change are interrelated and costly; malnutrition in all its forms costs \$3.5 trillion per year. Agricultural and food processing systems have been disrupted by the deleterious effect of greenhouse gasses (GHGs), driven largely by beef and dairy production and consumption. The resulting changes in weather conditions negatively affect crops and fishing. Transportation and urbanization systems have been compromised by car use, which is associated with physical inactivity, obesity, and climate change. Solutions to the agricultural problems include increasing plant-based foods, reducing beef consumption, redirecting subsidies for commodity crops, and implementing sustainable dietary guidelines. Solutions to the transportation problems include designing mixed-use neighborhoods to reduce commuting, supporting infrastructure for public transport systems, adding parks and trails to increase physical activity, eliminating fossil fuel subsidies, and increasing the gasoline tax.

## **SESSION II: INDIVIDUAL/PARENT/FAMILY/HOUSEHOLD LEVEL: PREVENTION AND EVIDENCE-BASED INTERVENTIONS FOR CHILDREN AND ADOLESCENTS IN LMICS**

### **Moderator**

*Ashley Vargas, Ph.D., M.P.H., RDN, NICHD*

### **Double-Duty Actions to Address the DBM**

*Corinna Hawkes, Ph.D., University of London*

Double-duty actions are interventions and policies that simultaneously prevent or reduce the risk of both nutritional deficiencies leading to underweight, wasting, stunting and/or

micronutrient deficiencies and problems of obesity and diet-related NCDs. They are premised on the presence of shared drivers (e.g., early-life nutrition, socioeconomic factors) of all forms of malnutrition, which presents opportunities to address malnutrition on shared platforms. Double-duty actions must be carefully designed to avoid actions intended to prevent undernutrition that exacerbate obesity. Double-duty platforms include health services (e.g., promoting optimal breastfeeding), social safety nets (e.g., incentivizing healthy eating with vouchers), education (e.g., redesigning school feeding programs to meet children’s energy and nutrient needs), and food systems (e.g., designing agricultural programs to promote healthy diets). More research to understand how consuming foods associated with obesity also influences undernutrition is needed. Next steps include designing new double-duty approaches that include evaluations, adapting existing programs to the double-duty approach, and training nutrition professionals.

### **The DBM: Targets for Interventions and Future Directions**

*Nancy Krebs, M.D., M.S., University of Colorado School of Medicine*

There is a multiple, not just double, burden of malnutrition, because the global syndemic includes obesity, undernutrition, and climate change. Each life cycle stage (i.e., fetal growth and development, infancy and young childhood, childhood and pre-adolescence, adolescence, and reproductive age for women) provides clues to intervention points. The multicountry, multi-cohort Women First (WF): Preconception Nutrition Trial, which randomized participants to arms providing nutrition interventions prior to conception, interventions during late first trimester, or no supplementation at all, illustrated the potential for discovering intervention points by finding a lesser response to the interventions in the Guatemalan cohort, likely due in part to the low percentage of nulliparous and anemic Guatemalan women, and a possible nutritional intervention in the first trimester to mitigate the negative effect of heat on birth length. Evidence-based strategies to address the global syndemic as they relate to points of intervention at each stage of the life cycle, such as reducing anemia in women of reproductive age and adolescents, reducing heat stress during fetal growth, and improving maternal education, should be implemented.

### **Food Systems and Diet Quality: Role in the DBM for Children and Adolescents**

*Isabel Madzorera, Sc.D., University of California, Berkeley*

The vast majority of people who are hungry live in LMICs, where diets are rapidly shifting to processed, refined, and fast foods. Suboptimal diets are the biggest risk factor for mortality and are associated with diet-related NCDs. The role of maternal diet during pregnancy is a critical component of the DBM in children and adolescents. Dr. Madzorera’s studies showed that women with more diverse diets were less likely to have small-for-gestational-age or underweight babies, and eating healthy foods was associated with a lower risk of poor birth outcomes. No association with maternal diet during pregnancy was seen with stunting and wasting. The studies suggest that low maternal dietary diversity and diet quality could be modifiable risk factors for adverse birth outcomes and early child growth. Dr. Madzorera’s school-based study of more than 4,000 sub-Saharan adolescents’ dietary intake found low intake of healthy foods and high intake of unhealthy foods. The prevalence of overweight and obesity in girls and of underweight in both boys and girls suggested that poor-quality diets

could be exposing African adolescents to the DBM. A key challenge in assessing diet quality is the limited availability of validated diet quality metrics.

### **SESSION III: SCHOOL/COMMUNITY LEVEL: PREVENTION AND INTERVENTIONS FOR CHILDREN AND ADOLESCENTS IN LMICS**

#### **Moderator**

*Sujata Bardhan, Ph.D., M.S., NICHD*

#### **Socio-Ecological Factors and the DBM Among Children and Adolescents in LMICS**

Trias Mahmudiono, Ph.D., Universitas Airlangga, Indonesia

Dr. Mahmudiono discussed the socio-ecological effects of DBM at the individual, interpersonal, and population and country levels. In Indonesia, one driving factor of stunting at the individual level is marriage of girls under the age of 18, a time of high anemia, indicating the need for interventions before pregnancy. The prevalence of overweight and obesity also increases risk factors for NCDs. At the interpersonal level, mothers play an important role through breastfeeding, but risk factors such as large family size, the transition from traditional foods to modern meals, and the consumption of unhealthy foods are causing an increase in overweight and obesity. The prevalence of child stunting and maternal overweight is highly correlated with a lack of maternal nutrition knowledge, suggesting that maternal education should be targeted as an intervention. At the population and country levels, overweight and obesity are higher in urban areas in Indonesia, but overweight is also increasing among poor rural and urban women. Addressing all forms of malnutrition requires an integrated agenda to determine root causes at all stages of the life course.

#### **School Feeding Programs**

*Maureen M. Black, Ph.D., University of Maryland School of Medicine, University of Maryland School of Medicine and RTI International*

School meals, many fortified with micronutrients, are among the most important global health and nutrition interventions. In 2020, the United Nations World Food Program (WFP) fed 388 million school-aged children daily in at least 161 countries. These programs also had a positive community impact, creating 1,668 jobs for every 100,000 children receiving school meals. A 2020 meta-analysis of school feeding programs in LMICs showed that the programs had beneficial effects on weight, height, and school attendance but no impact on hemoglobin, serum ferritin, or math scores. Dr. Black's trial in India showed that adding micronutrients to preschoolers' midday meal significantly reduced anemia (from 48% to 9%) and iron deficiency (from 70% to 30%). A review of universal school meals in the Organization for Economic Cooperation and Development countries showed positive associations with attendance, diet quality, food security, and academic performance, with no adverse effects on BMI. More work is needed to expand school meals and align them with nutritional guidelines.

#### **School-Based Interventions Addressing Adolescent Malnutrition in LMICS**

*Sachin Shinde, Ph.D., M.P.A., M.A., Harvard School of Public Health*

The Africa Research, Implementation Science, and Education (ARISE) Network was launched in 2014 to advance collaborative education and research activities among 21 institutions in Africa with the goal of understanding the developmental needs of adolescents in LMICs and building

evidence for effective interventions to address adolescent health. ARISE studies showed that 1 in 5 adolescents was underweight (boys more so than girls) and 1 in 10 was overweight (girls more so than boys). There was a high burden of anemia, a pattern of unhealthy eating, and diminished physical activity. School meal programs in sub-Saharan African countries reached only 30% of all children of primary school age, with many programs unaware of nutritional interventions. ARISE developed interventions to promote healthy diets, physical activity, and nutrition education; provided fortified school meals; and created school environments that address overweight and obesity. Systematic assessments of the quality of interventions, as well as trials evaluating interventions, are ongoing in sub-Saharan Africa. Key areas for future research include collecting data on neglected age groups (e.g., boys 10 to 14 years old), context-specific research to understand the full range of the effects of multifaceted interventions in LMICs, and alternate platforms to reach out-of-school adolescents.

## DAY 2

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### SESSION IV: COUNTRY/GLOBAL LEVEL: PREVENTION AND EVIDENCE-BASED INTERVENTIONS FOR CHILDREN AND ADOLESCENTS IN LMICS

#### Moderator

*Juanita J. Chinn, Ph.D., NICHD*

#### DBM: Prospective Studies in Pune, India

*Chittaranjan Yajnik, M.D., KEM Hospital Research Centre, India*

Dr. Yajnik described his intergenerational Pune Maternal Nutrition Study (PMNS), a prospective study begun in 1993 to look at the nutritional determinants of fetal growth and the life course evolution of various phenotypes at the preconception, intrauterine, birth, prenatal, and 6-, 12-, 18-, and 24-year-old stages. The area has undergone rapid socioeconomic development, with a clear trend toward a decrease in undernutrition, a gradual increase in overnutrition, and a gradual increase in glucose intolerance, which presented as prediabetes and diabetes in both parents, with a striking prevalence of prediabetes in their children. The pathophysiology of type 2 diabetes in young people in LMICs is predominantly driven by insulin deficiency. Dr. Yajnik cautioned that looking only at the first 1,000 days misses the critical preconception and periconception windows of epigenetic programming that occur within 48 to 72 hours of conception, citing a preconceptional maternal micronutrient supplementation program that improved neurodevelopmental outcomes at 2 years of age.

#### Food Environment Regulations

*Camila Corvalán, M.D., Ph.D., University of Chile, Santiago*

Food environment is defined as the stage where consumers interact with the food system. As LMICs are exposed to an increasing amount of unhealthy food, actions targeting the food environment are being used to stem the consumption of unhealthy foods. One example of this approach is Chile's law requiring warning "stop signs" on the front of packages containing unhealthy food, limits on the marketing of unhealthy products to children, and bans of

unhealthy products from school feeding programs. After the law rolled out, 40% of packaged foods carried labels identifying them as unhealthy, marketing of unhealthy foods to children declined by 70%, unhealthy food products in the school environment declined by 85%, the purchase of sugared beverages dropped by 24%, and dietary intake of sugars and sodium (but not fat) declined. More research is needed about the food industry's response to regulations and the development of tools for assessing complex interventions.

### **Transformation of Diets and Supply Chains in LMICs: Policy Implications**

*Thomas Reardon, Ph.D., Michigan State University*

Food supply chains are the main factor affecting the availability of food and patterns of food consumption in low- and middle-income countries. Most food consumption (65%) occurs in cities, and nearly 100% of the urban diet and at least 65% of the rural diet is purchased through supply chains. Processed and convenience foods are very important to the lifestyle needs of urban and rural consumers. These mostly low-processed foods save time and improve quality of life, especially for women. Ultra-processed food is a minor part of the diet. In LMIC urban and rural areas combined, supply chains deliver about 90% of the healthy foods that adolescents and others should be eating. The nutrition debate should focus on increasing the consumption of healthy foods by encouraging governments to invest in improving wholesale markets and roads as their central pro-nutrition policy. The availability of healthy foods is not decided by nutrition programs, policies, or taxes; it is decided by wholesalers, markets, truckers, and the quality of the roads. The vitality of wholesale markets is overwhelmingly the most important factor in determining whether children and adolescents in LMICs are getting to eat fruits and vegetables.

## **SESSION V: GLOBAL DISSEMINATION AND IMPLEMENTATION SCIENCE**

### **Moderator**

*Susan Vorkoper, M.P.H., M.S.W., FIC, NIH*

### **Policy and Implementation Challenges for Addressing the DBM Among Children and Adolescents in LMICs**

*Edward A. Frongillo, Ph.D., University of South Carolina*

Schools can be an important platform for interventions influencing children and adolescents by providing fortified meals, banning unhealthy foods, teaching dietary diversity, and hosting school gardens. Other factors that influence children and adolescents' dietary choices include regulations (e.g., food package labeling), social safety net programs (e.g., food stamps), social protection programs (e.g., the Bangladesh Female Secondary Stipend and Assistance Program), and social media, such as Bangladesh's Eat Well, Live Well program, which was led by adolescents. Common features of adolescent diets include lack of access to nutritious food, low cost and high appeal of unhealthy foods, and a wide variety of contexts and autonomy in choosing traditional, mixed, and modern diets. Knowledge gaps about adolescents' nutrition begin with the lack of basic data to inform action. Many countries lack dietary data, there are wide variations in methods of assessment, and a globally accepted set of measures and indicators of healthy diets is only now being developed. Simultaneously addressing under- and

overnutrition for children and adolescents requires an in-depth understanding of root causes, needs, and sustainable actions, requiring a widespread platform for data collection.

### **Addressing the DBM: Applying Implementation Science (IS) and Knowledge Brokering to Accelerate Progress**

*Isabelle Michaud-Létourneau, Ph.D., M.P.H., RD, University of Montreal*

The mission of the Society for Implementation Science in Nutrition (SISN) is to bring scientific knowledge and practical experience to the design and implementation of nutrition-based actions by evaluating the strengths and weaknesses of the planning and implementation process. SISN developed the Implementation Science System (ISS) Operational Model, which is based on three different forms of knowledge to initiate action: contextual knowledge and experience (e.g., the knowledge of actors in a country), global knowledge and experience (e.g., existing knowledge to identify potential solutions and bottlenecks), and contextual implementation research (e.g., implementation research studies to further understand bottlenecks and potential solutions). Knowledge brokering, a complement to the ISS Operational Model, is a central implementation strategy that facilitates movement from knowledge to action by undertaking assessment activities and bottleneck solution inventories that drive action. Guiding principles for the IS approach include mobilizing existing knowledge to address bottlenecks, collaboratively identifying priority research topics, and facilitating formal and informal interaction, knowledge exchange, and collaboration between researchers and program and policy actors.

### **Fostering Information Systems and Networks to Support LMIC Decision Makers in Addressing the DBM: Learning from Sub-Saharan Africa**

*Rebecca Heidkamp, Ph.D., Johns Hopkins University*

Periodic and routinely collected data for population-based monitoring are the foundation of the National Nutrition Information System (NNIS), which countries use to guide decisions, actions, and accountability. Nutrition-relevant periodically and routinely collected data for children 6 to 12 years old in LMICs are lacking, and the limited data that are available are neither standardized nor comparable. Improving data collection on these children and adolescents with the goal of influencing decision makers will require instituting a multistage nutrition data value chain to delineate how data are prioritized, defined, collected, analyzed, and used. A coalition of international organizations is developing a program of global metrics, and a Nigerian team has developed recommendations addressing common national data challenges. Although many policy makers listen more closely to advocates from their own constituencies, the main factor influencing policy makers' decisions is how a problem is defined, framed, and positioned. For example, "the first 1,000 days" framing has been very effective in focusing countries on pregnancy and early childhood. A clear and compelling framing around the DBM in children and adolescents is needed for it to rise on agendas.



## SESSION VI: EVIDENCE-BASED PROGRAM AND POLICY IMPLEMENTATION

### Moderator

*Layla Esposito, Ph.D., M.A., NICHD*

### Nutrition-Related Evidence-Based Program and Policy Implementation at the United States Agency for International Development (USAID)

*Lindy Fenlason, M.D., USAID*

USAID nutrition-related activities have led to increases in high-quality nutrition services, multisectoral programming for improved nutrition outcomes, and global leadership to achieve adequate dietary intake and lower disease burden. Disruptions to USAID programs from the COVID-19 pandemic catalyzed the greater use of social media platforms for communication and leveraging digital applications to create markets and increase sales of nutritious foods. More research is needed on delivery platforms for double-duty actions and how food systems affect both the DBM and the environment in LMICs. USAID is committed to increasing access to nutritious foods, particularly in the first 1,000 days, strengthening health systems, and improving access to diverse markets.

### The DBM Among Children and Adolescents in LMICs

*Carmen Burbano de Lara, M.P.A., WFP, Italy and Peru*

School-based platforms are among the most important venues for interventions for school-aged children in Africa. Properly designed school meals and complementary programs are valued by governments, because they return up to \$9 for every \$1 invested and create 2,000 new jobs for every 100,000 children fed. The COVID-19 pandemic deprived 370 million children of their meals, education, and well-being. In 2021, a global alliance of countries created the School Meals Coalition to restore school meal programs to 440 million children, reach the 73 million children not previously covered, and raised the quality of the school health and nutrition programs, all by 2030. The Coalition has also focused on developing a school meals database to support evidence-based interventions.

### Evidence-Based DBM Program and Policy Implementation Roundtable Presentation

*Boitshepo Bibi Giyose, M.S.N., African Union Development Agency (AUDA)*

Ms. Bibi Giyose reported that one in seven people globally are facing serious malnutrition. At least one form of malnutrition (i.e., overweight, stunting, and anemia) significantly affects 143 countries worldwide; 37 countries, mainly in Africa, experience all three forms. There are insufficient data on what children are eating. However, research has found several factors contribute to malnutrition, including peer pressure, lack of nutrition education, inadequate guidance, movement away from traditional foods, and poor food choices. The concomitant burdens of overweight, stunting, and wasting make it difficult for governments to define priorities and allocate resources. Initiatives to get more nutritious and appealing food onto plates in LMICs are needed. Progress can be made if countries take advantage of opportunities to: 1) invest in context-specific and multisectoral research targeted to local nutrition problems; 2) increase national investments in early childhood development; 3) educate consumers, especially children, to create a culture that values nutrient-dense products; 4) understand the

links among climate change, soil health, food production, and healthy diets and nutrition; and 5) revamp data and information systems.

### **Childhood and Adolescent Overweight and Obesity Prevention and Reduction in Mexico— Investment Case Study**

*Mauro Brero, M.Sc., UNICEF, Mexico*

To help inform the Mexican government’s work on preventing overweight and obesity, UNICEF developed a study, modeled over a period of 65 years, to show the cost of childhood obesity in terms of health (i.e., disability-adjusted life years) and economics (i.e., costs and benefits of implementing five priority interventions). The study found that if no further interventions were instituted, the cost of childhood and adolescent obesity would be an estimated \$1,840.7 trillion. Introducing the five interventions (breastfeeding promotion, fiscal programs [e.g., taxing sugary beverages], marketing restrictions on unhealthy food, school programs to promote healthy diets and physical activity), and strengthening other school-based interventions) resulted in economic benefits totaling \$124 billion (\$104 billion from averted mortality, \$1.8 billion for saved healthcare costs, \$13.7 billion from productivity gains, and \$4.6 billion from wage gains). The investment was shown to be an effective policy response for reducing the cost related to increasing rates of overweight and obesity.

### **Intensify In-Country Nutrition Discovery and Research and Development**

*Jian Yan, Ph.D., Bill & Melinda Gates Foundation (BMGF)*

The BMGF supports nutrition research and product development to optimize health outcomes for high-risk pregnant and postpartum women, preterm and underweight infants 0 to 6 months old, and moderately and severely malnourished children 6 to 24 months old. Primary data and research in LMIC countries are needed to move toward a precision public health approach to avoid relying only on data from high-income countries. Fundamental research on multiple micronutrient requirements as well as the role of gut microbiome in health could lead to host- and microbiome-directed maternal interventions. In other areas, the research focus is expanding beyond the first 1,000 days to 8,000 days to optimize interventional approaches women’s and girl’s health. Normal brain and cognitive development is key for children to realize their full potential, but gaps exist in understanding neurodevelopment in LMICs. The BMGF is also addressing power asymmetries in global health by funding in-country researchers directly, supporting the South-South collaborations, and strongly fostering public–private partnerships.

## **HIGHLIGHTS OF DAYS 1 AND 2**

### **Moderator**

*Kimberlea Gibbs, M.P.H., RDN, CHES, NICHD*

Ms. Gibbs summarized the presentations and discussions from the meeting.

### **GENERAL DISCUSSION**

Topics included:

- Indicators that should be prioritized for inclusion in national nutrition information systems, the difficulty of tracking changes in children as they age, the need for more

data about the dietary intake of school-aged children and adolescents, and the importance of prioritizing data that serves a country's needs most directly

- Developing a common nutrition terminology so stakeholders understand research goals, linking the DBM to food systems and climate in an understandable way to influence decision makers, and integrating nutrition into the entire range of complex malnutrition and climate issues to make clear that the biology of nutrition is not just about food but is also about the biological link between the food system and health
- The benefit of implementers having access to a wide range of knowledge from other practitioners to help obviate the problems that can arise when researchers apply solutions that worked in one country to an entirely different country
- Concern that the nutrition community has taken a one-dimensional, monolithic view of the DBM when the problems are actually multidimensional; the need for algorithms to comprehensively capture the internal and external ecology so that when a child arrives with one or more problems, that child can be precisely evaluated and treated with a context-specific intervention that is equitable and appropriate for the situation and the setting; the need to identify priorities the nutrition community should converge around, because the notion of the DBM is not specific enough to clarify what actions are needed to affect child and adolescent development; and the benefit of taking an ecological approach to demonstrate how nutrition plays an integral role in all aspects of human health, irrespective of what the DBM might be in an individual or population, to more fully engage in the entire continuum of activity required to address complex issues

## CLOSING COMMENTS

*Jenelle R. Walker, Ph.D., M.S., NICHD*

Dr. Walker thanked everyone for the thoughtful presentations and robust discussions that so clearly elucidated the challenges of the DBM and the global opportunities to address them.