

Setting the scene: An overview of issues related to policies and programs for moderate and severe acute malnutrition

Eileen Kennedy, Francesco Branca, Patrick Webb, Zulfigar Bhutta, and Rebecca Brown

Abstract

Background. Moderate acute malnutrition (MAM) and severe acute malnutrition (SAM) continue to exist at unacceptably high levels. There is a renewed momentum to dramatically improve nutritional status and decrease rates of malnutrition of all kinds. Although much focus is on the first 1,000 days, the period from conception to age 2 years, in relation to growth retardation (or stunting), it is just as important to pay adequate attention to wasting as a major contributor to both morbidity and mortality.

Objective. This paper reviews what is known about effective approaches for treatment and prevention of MAM and SAM, highlights nutrition blind spots in our strategies, and identifies programmatic and research gaps that, if addressed, will enhance our understanding of the menu of cost-effective approaches to alleviate acute forms of malnutrition.

Methods. The paper synthesizes presentations from the opening session of a May 2014 International Atomic Energy Agency symposium on Moderate Acute Malnutrition held in Vienna, Austria.

Results. Although understanding of efficacious approaches to the treatment and prevention of MAM and SAM has recently improved, the evidence base for informed policies and programs remains limited.

Conclusions. If priority evidence gaps can be urgently addressed, our understanding of the menu of cost-effective interventions to alleviate acute forms of malnutrition will be considerably enhanced and the potential for impact at global scale significantly increased.

Key words: Evidence, interventions, malnutrition, wasting

Introduction

There has been a reemergence of interest in nutrition globally, in particular a focus on maternal and preschooler health and well-being. Several seminal publications and initiatives have placed a spotlight on the until recently neglected area of nutrition. The 2008 *Lancet* Series provided a solid scientific basis for the identification of interventions of known efficacy that, if appropriately implemented, could significantly improve the nutritional status of women and children [1]. The *Lancet* Series was one key to fostering a serious dialogue about how to bring approaches of known efficacy to scale. The Scaling Up Nutrition (SUN) Movement, launched in 2010, used the 2008 *Lancet* Series as the evidence base for developing a SUN framework for action [2]. Beginning with a handful of countries, the SUN Movement now involves 52 national governments and their partners committed to scaling up policies and programs to combat malnutrition in all its forms. The primary focus of SUN is on the 1,000 days from conception through the first 2 years of life.* The more recent 2013 *Lancet* Series added further evidence of effective policies and programs [3]. This series emphasized both direct nutrition interventions and nutrition-sensitive approaches as dual strategies to enhance health and nutrition. The elucidation of indirect approaches to improving nutrition has prompted many national governments (including Nepal, Ethiopia, and Uganda) to revisit multisector approaches as

* While the participating countries use the SUN framework as a starting point, each national government modifies the strategy to best accommodate country-specific needs and local context, building further on the strength of SUN. The SUN Movement has been complemented by parallel national efforts like the US Agency for International Development's Feed the Future and the United Kingdom's nutrition priorities under the Department for International Development.

Eileen Kennedy and Patrick Webb are affiliated with the Gerald J. and Dorothy R. Friedman School of Nutrition Science and Policy, Tufts University, Boston; Francesco Branca is affiliated with the World Health Organization, Geneva; Zulfigar Bhutta is affiliated with the Sick Kids Center for Global Child Health, Toronto; Rebecca Brown is affiliated with the CMAM Forum, London.

Please direct queries to the corresponding author: Eileen Kennedy, Gerald J. and Dorothy R. Friedman School of Nutrition Science and Policy, Tufts University, 150 Harrison Ave., Boston, MA 02111, USA; e-mail: eileen.kennedy@tufts.edu.

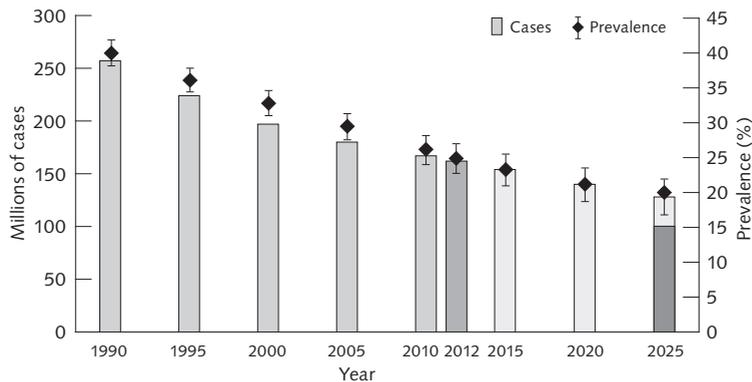


FIG. 1. Prevalence and predicted worldwide prevalence of stunting among children under 5 years of age from 1990 to 2025.

Source: United Nations Children's Fund/World Health Organization/World Bank [7]

a way to more rapidly decrease malnutrition [4–6].

The collective effect of the revitalized interest in nutrition is a commitment to advancing the nutrition agenda globally; the centerpiece of this is a commitment to promoting optimum fetal and child nutrition and development [2, 3]. While fetal and child nutrition takes many forms, alleviating the crisis of acute malnutrition is a priority. Acute malnutrition can be moderate acute malnutrition (MAM) or severe acute malnutrition (SAM).^{*} In contrast to SAM, approaches for the management of MAM have changed only little in the past 30 years [7]. The renewed commitment by governments and donors to nutrition provides a window of opportunity to renew efforts to tackle the problem of MAM.

The present paper provides an overview of five key areas related primarily to MAM: Trends and Nature of the Nutrition Problem, What Works in Managing MAM?, Missing Links, Programmatic and Research Gaps, and Next Steps. Each of these five areas is explored more in depth in the other papers in this Supplement.

Trends and nature of the nutrition problem

An estimated 51 million children worldwide suffer from acute malnutrition, either moderate or severe, including 17 million suffering from SAM [7]. Acute malnutrition accounts for 12.6% of deaths in children under five, with SAM contributing to 7.4% of all deaths. In addition, there are huge regional variations in rates of acute malnutrition; indeed, 69% of the global burden

is located in Asia, in particular South Asia [8, 9].

Both MAM and SAM can affect stunting, since repeated bouts of weight loss associated with wasting can have a cumulative impact on final attained growth of individuals growing up in poor health environments. The proportion of children under the age of 5 years who are stunted has declined over the past 20 years (fig. 1), and this decline is projected to continue. The rate of decline in stunting is, however, insufficient to meet most internationally set targets, and thus, policy officials are exploring ways to accelerate the rate of improvement.

The prevalence of wasting also exhibits regional patterns of variation (fig. 2). The World Health Assembly (WHA) has established a target of reducing wasting prevalence to less than 5% by 2025 and stabilizing it at that level [10]. Many countries are not on track to achieve this target. Rates of wasting tend to change significantly seasonally during the year, with the biggest surge, most commonly, in the hungry or lean seasons [11]. This has underpinned calls for attention to the incidence of wasting, not merely its prevalence. In addition, there are countries with endemic rates of wasting, such as Nigeria (20%), Pakistan (10%), and India (20%), with these levels likely to increase during the hungry season [11].

The collective insults caused by acute malnutrition can be summarized as follows:

- » Wasting adversely affects linear growth, and recovery from wasting benefits linear growth.
- » During wasting, there is a point at which linear growth slows and potentially stops.
- » Evidence indicates that episodes of wasting in the previous months (approximately) have a negative impact on attained length-for-age.
- » Both wasting and stunting often coexist in the same child.
- » Wasted children are often deficient in vitamins K, D, A, E, and C and folic acid, as well as riboflavin and thiamine [11].

^{*} MAM is defined as a weight-for-age z-score (WAZ) between -3 and -2 SD below the median of the World Health Organization (WHO) growth standards [10]. MAM can be due to a low weight-for-height z-score (WHZ) (-3 to -2 SD), commonly called wasting, a low height-for-age z-score (HAZ) (-3 to -2 SD), called stunting, or a combination of both. SAM is defined by a $WHZ < -3$ SD.

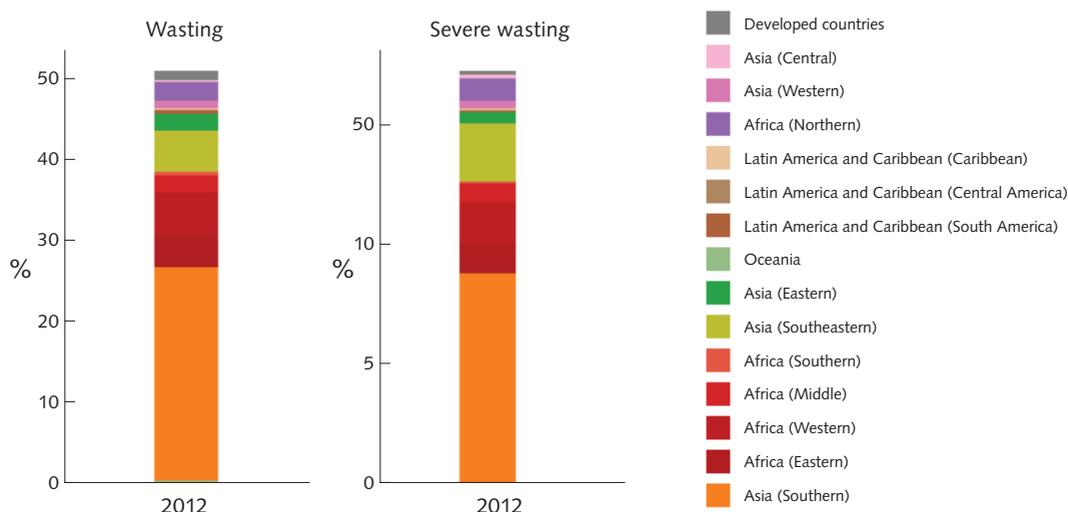


FIG. 2. Prevalence of wasting and severe wasting in children under 5 years of age in 2012. Source: United Nations Children's Fund/World Health Organization/World Bank [7]

In sum, globally there have been improvements in nutritional status. Yet, the rates of improvement in MAM and SAM, as well as in stunting, wasting, and micronutrient malnutrition, are insufficient to achieve many of the nationally and internationally agreed-upon targets. Policy officials are examining the range of approaches, including the complementarities among policies and interventions that might be most effective in reducing and alleviating malnutrition.

What works in managing MAM?

The results from a number of recent systematic reviews allow us to draw some conclusions about the impact of selected approaches to treating acute malnutrition [12–15]. Despite the heterogeneity in the studies, including different inclusion factors, time frames, and the interventions used, some very similar findings emerge [16]. Specifically:

- » Food supplements of various types are effective in the treatment of MAM and SAM.
- » Lipid-based ready-to-use therapeutic foods (RUTFs) have a greater effect on weight gain and faster recovery rates than do fortified blended foods.
- » On average, the studies suggest nonsignificant effects on mortality, or default to acute malnutrition status, and progression to a normal nutritional status.
- » Despite an increase in the number of studies available, there are still too few studies to allow findings to be generalized to a larger context with any confidence.
- » Too few studies have been conducted outside sub-Saharan Africa.
- » The quality of much of the evidence is either low or of unclear rigor.

» The heterogeneity of data typically prevents rigorous meta-analysis of subgroups within studies.

Attention has primarily focused on treatment of SAM because of its associated high risk of mortality. There is an increased risk of mortality, however, both for children with SAM and for those with MAM. In addition, in many cases, MAM can progress to SAM if left untreated. As shown by the data in [figure 3](#), scaling up of interventions for management of both SAM and MAM can save millions of lives of children under 5 years of age [3].

The studies on treatment of SAM and MAM, while limited in number and quality, provide some insights into potentially effective interventions. Unfortunately, there is a dearth of studies on the prevention of acute malnutrition, despite the fact that there is universal consensus that this should be the goal.

Given the severity of the prevalence of acute malnutrition, action to resolve the problem cannot wait. A new agenda for action has emerged, and national governments and the international community are now looking beyond nutrition-specific interventions as entry points for the prevention and treatment of acute malnutrition. The paper by de Pee et al. in this Supplement summarizes the emerging evidence that numerous multisector strategies—ranging from food- and health-based interventions to nutrition-sensitive interventions, including food security, livelihoods, water, sanitation, hygiene, and education—can be important in improving nutrition [17]. The research thus far suggests that embedding short-term interventions into longer-term strategies results in significantly better health and nutrition outcomes. This sentiment is captured by a statement for Dr. Gro Bruntland, former Director General of WHO: “The dual scourge of hunger and malnutrition will be truly vanquished

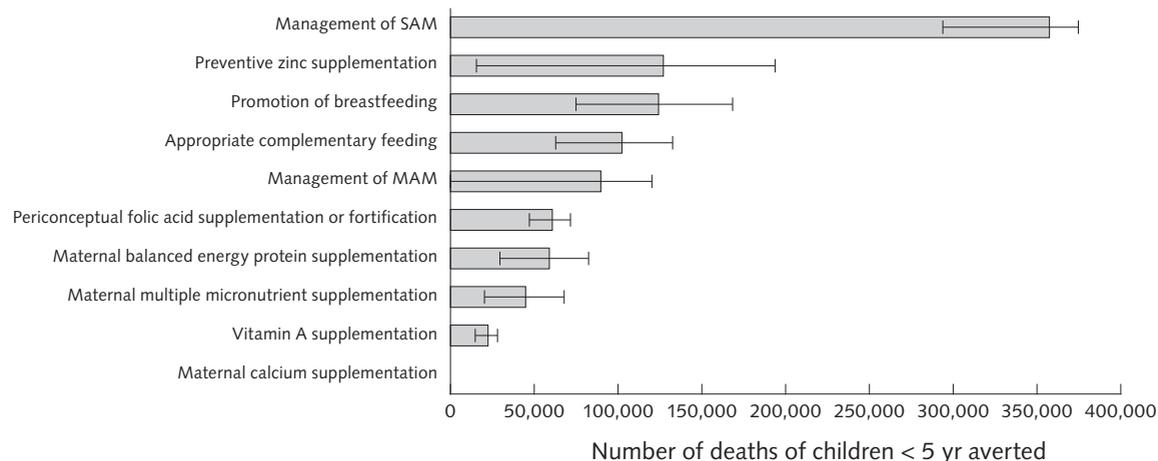


FIG. 3. Effect of scale-up interventions on deaths in children under 5 years of age in high burden countries. MAM, moderate acute malnutrition; SAM, severe acute malnutrition. Source: Bhutta et al. [19]. Error bars indicate ranges.

not only when granaries are full, but also when people's basic health needs are met and women are given their rightful role in societies" [18].

Missing links

Historically, much of the research on young child malnutrition has concentrated on examining the individual at birth and beyond. However, as many as one-half of all adolescent girls in developing countries are stunted, significantly increasing the risk of complications in pregnancy and delivery and contributing to poor fetal growth [19]. These data would suggest that investing in girls during the preconception period can be an essential strategy for improving the health and nutrition of future generations. A challenge continues to be how to identify existing, effective delivery systems for reaching high-risk preconceptional females when they are beyond formal education systems and tend to be low utilizers of the formal healthcare system.

Females have been the focus of health and nutrition interventions during pregnancy. Indeed, maternal malnutrition accounts for 7% of the global burden of disease, contributes to at least one-fifth of maternal deaths, and significantly increases the probability of poor pregnancy outcomes [3]. In addition, short maternal stature may lead to obstructed labor and/or fetal or neonatal death. Here again, there are regional differences in maternal undernutrition, with South East Asia, South Asia, and parts of Sub-Saharan Africa most affected [20]. Although the prevalence of low body mass index (BMI) (< 18.5) has decreased since 1980, the problem still affects more than 10% of the prenatal population globally. Finally, micronutrient deficiencies, particularly of iron and calcium, are common during pregnancy. Clearly, improvements in women's nutrition

during pregnancy are warranted.

The empirical evidence on the significant effects of improved maternal nutrition on neonatal outcomes is not new. In the 1960s, the results of a well-conducted study in India showed that food supplementation of high-risk pregnant women resulted in significantly reduced morbidity and mortality of their newborns [21]. More recently, a meta-analysis of studies with specified, rigorous inclusion criteria indicated that balanced protein-energy food supplements were a cost-effective way to improve neonatal outcomes [22]. Yet, 32.4 million babies were born small for gestational age (SGA) in 2011; this figure represents 27% of all births in low- and middle-income countries [20]. Evidence also suggests that 20% of stunting by 24 months of age can be attributed to SGA. Unequivocally dramatic reductions in child mortality could be achieved by targeting interventions to infants born too small or too soon.

Fortunately, enormous progress is being made in the identification of effective interventions for women, infants, and children to improve health and nutrition. The results of a meta-analysis identified essential nutrition actions that could be used across the life cycle from conception, pregnancy, infancy, and early childhood to enhance nutrition [23]. This consensus on effective interventions provides a road map at the national and subnational levels of packages of care across the continuum of care throughout the lifecycle.

Programmatic and research gaps

Each of the papers in this Supplement highlights gaps in our knowledge. There are some themes, however, that transcend the individual topical areas. At a very basic level, there needs to be a common language when

using the term “acute malnutrition.” Part of the ambiguity in the literature and ongoing dialogue is the lack of an agreed lexicon. Acute malnutrition, as noted, can be moderate or severe. The problem is that the term acute tends to carry an implication of short-termism, which may or may not be accurate. Similarly, moderate and acute can sometimes be applied to stunting, thereby confusing the outcomes and their etiology as well. One way to avoid this ambiguity is to routinely use the term moderate acute malnutrition (MAM) or severe acute malnutrition (SAM), and clearly articulate that this relates not so much to a child’s linear growth as to that child’s immediate mortality risk.

The issue of data quality is a recurrent one. This is seen when talking about measurement of inputs, process, and outcomes. One example will illustrate this point. In many countries, data on rates of low birthweight are based on the family’s perception of whether or not the infant is “small.” Yet these data are used for an enormous number of purposes, including targeting, monitoring, and evaluation. The paper in this Supplement by Jackson and Ashworth [24] discusses the need for increased investment in capacity. Added to this should be the imperative need for investment in delivery science capacity, which covers a range of issues, including agreed-upon protocols for defining and measuring program inputs and programming elements—and this includes more than simply a specific product provided—and appropriate range of outcomes. There are limited data on the effects of treatment and prevention of MAM on cognitive development in both the short and the longer term; since some literature suggests a possible effect of interventions, more attention is needed on how to operationalize this concept. Attention to data quality is essential in order to better link to the broader development agenda.

Few studies have compared the cost-effectiveness of individual food products or a combination of food products in the treatment of MAM. There are menus of food-based products and interventions that can be used; more clarity on which approach or combination of approaches in a given context is most effective is an essential next step in understanding how to scale up interventions for the treatment and prevention of MAM.

The life-cycle approach provides entry at various points on the continuum to improve nutrition. Yet, as noted by Bhutta, one of the “nutrition blind spots” has been care of adolescent girls and women before pregnancy [19]. The Reproductive, Maternal, Newborn and Child Health consensus provides a framework for addressing some of the links from preconception to prenatal to neonatal outcomes [23]. Rigorous applied projects in a number of developing-country contexts would provide the research to understand the critical elements along each of these pathways.

An exciting but emerging area is the potential to employ nutrition-sensitive development as a vehicle for improving nutrition during the first 1,000 days. To date, much of the research on indirect ways to enhance nutrition has involved exploring ways to link agriculture to nutrition. The results from a series of meta-analyses suggest only a modest effect of agriculture on nutrition [25]. This is not to suggest that agriculture is not important, but rather that there needs to be greater clarity on how the range of interventions included under the “agriculture” umbrella is expected to bring about a significant impact on nutrition. Even more daunting is the challenge of ascertaining how multiple sectors collaborate in achieving specific, agreed-upon nutrition goals.

Next steps

Action on the global agenda for improving nutrition cannot wait. The enormous visibility provided by SUN and other initiatives has produced great momentum. But the challenge is to produce results demonstrating that direct and indirect interventions, as implemented, improve nutritional status. Some short-term and medium- or longer-term actions are warranted.

First, communication and sharing of results is essential. Many of the most promising approaches often do not appear in the peer-reviewed literature, or if they do, there is a long time lag. The energy around nutrition, and specifically around MAM, should be harnessed. One easy way to achieve this is to establish a community of practice (more detail on this is provided by Jackson and Ashworth [24]). Mechanisms already exist that could be leveraged to provide a platform for information-sharing and problem-solving. One example is the Essential Nutrition Network, which provides a well-established venue for dialogue.

The global community can no longer accept the excuse that “information does not exist” or the existing evidence is “good enough.” Prevention and treatment of MAM have long been relegated to second-class status in many quarters. A rigorous investment in improvements in data quality, program designs, elucidation of the various delivery systems, and the real cost of programming is long overdue. The *Lancet* Series of 2013 made it clear that the management of MAM represents one of the world’s known efficacious targeted interventions to tackle the intolerable burden of child malnutrition [20].

Conflicts of interest

The authors declare that they have no conflicts of interest.

Authors' contributions

Eileen Kennedy conceptualized the paper and prepared the first draft; Patrick Webb contributed to the text and provided edits; Francesco Branca, Zulfigar Bhutta, and Rebecca Brown contributed edits.

Acknowledgments

The authors would like to thank Lauren Jayson for her help in editing and formatting an earlier draft.

References

- Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, Mathers C, Rivera J. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet* 2008;371:243–60.
- Bezanson K, Isenman P. Scaling Up Nutrition: A framework for action. *Food Nutr Bull* 2010;31:178–86.
- Black RE, Alderman H, Bhutta ZA, Gillespie S, Haddad L, Horton S, Lartey A, Mannar V, Ruel M, Victora CG. Maternal and child nutrition: building momentum for impact. *Lancet* 2013;382:372–5.
- National Programme Guide. Addis Ababa: Government of the Federal Democratic Republic of Ethiopia, 2013.
- Uganda Nutrition Action Plan 2011–2016: Scaling up multi-sectoral efforts to establish a strong nutrition foundation in Uganda's development. Kampala: Government of Uganda, 2012.
- Multi sectoral nutrition plan for accelerating the reduction of maternal and child under nutrition. Kathmandu, Nepal: National Planning Commission, 2012.
- United Nations Children's Fund/World Health Organization/World Bank. World Bank joint child malnutrition estimates. Washington, DC: World Bank, 2012.
- Gross R, Webb P. Wasting time for wasted children: severe child undernutrition must be resolved in non-emergency settings. *Lancet* 2006;367:1209–11.
- World Health Organization. Update on management of severe acute malnutrition in infants and children. WHO: Geneva 2013. Available at: http://apps.who.int/iris/bitstream/10665/95584/1/9789241506328_eng.pdf. Accessed 9 December 2014.
- de Onis M, Dewey K, Borghi E, Onyango A, Blössner M, Daelmans B, Piwoz E, Branca F. The World Health Organization's global target for reducing childhood stunting by 2025: rationale and proposed actions. *Matern Child Nutr* 2013;9(suppl 2):6–26.
- Branca F. The global crisis of MAM. Presentation at IAEA Symposium: Understanding Moderate Malnutrition in Children for Effective Interventions, May 26–May 29, 2014. Vienna, Austria, 2014.
- Schoonees A, Lombard M, Musekiwa A, Nel E, Volmink J. Ready-to-use therapeutic food for home-based treatment of severe acute malnutrition in children from six months to five years of age. *Cochrane Database Syst Rev* 2013;6:CD009000.
- Picot J, Hartwell D, Harris P, Mendes D, Clegg A and Takeda A. The effectiveness of interventions to treat severe acute malnutrition in young children: a systematic review. *Health Technol Assess* 2012;16 (19): 1–100.
- Lazzerini M, Rubert L, Pani P. Specially formulated foods for treating children with moderate acute malnutrition in low-and middle-income countries. *Cochrane Database Syst Rev* 2013;6:CD009584.
- Lenters LM, Wazny K, Webb P, Ahmed T, Bhutta ZA. Treatment of severe and moderate acute malnutrition in low- and middle-income settings: A systematic review, meta-analysis and Delphi process. *BMC Public Health* 2013;13:S23.
- Webb P. How strong is our evidence for effective management of wasting? A review of systematic and other reviews. *Food Nutr Bull* 2015;36:S65–71.
- de Pee S, Grais R, Fenn B, Brown R, Briend A, Frize J, Shoham J, Leroy J, Kiess L. Prevention of acute malnutrition: distribution of special nutritious foods and cash, and addressing underlying causes—what to recommend when, where, for whom, and how. *Food Nutr Bull* 2015;36:S24–9.
- Brundtland G. Presentation at World Ecology Award Ceremony, 2001. University of Missouri, St. Louis, MO.
- Bhutta ZA. Maternal malnutrition in the context of MAM. Presentation at IAEA Symposium: Understanding Moderate Malnutrition in Children for Effective Interventions, Vienna, Austria, May 26–May 29, 2014.
- Bhutta ZA, Das JK, Rizvi A, Gaffey MF, Walker N, Horton S, Webb P, Lartey A, Black RE. Evidence-based interventions for improvement of maternal and child nutrition: What can be done and at what cost? *Lancet* 2013;382:452–77.
- Kielmann AA, Taylor CE, DeSweemer C, Ubero IS, Takulia HS, Masih N, Vohra S. The Narangwal experiment on interactions of nutrition and infections. 2. Morbidity and mortality effects. *Indian J Med Res* 1978;68:21–41.
- Imdad A, Bhutta ZA. Effect of balanced protein energy supplementation during pregnancy on birth outcomes. *BMC Public Health* 2011;11:S17.
- World Health Organization/Aga Khan Foundation. Essential interventions, commodities and guidelines for reproduction, maternal, newborn and child health. Geneva: WHO/Aga Khan Foundation, 2011.
- Jackson A, Ashworth A. Capacity-building in the management of moderate acute malnutrition. *Food Nutr Bull* 2015;36:S47–52.
- Webb P, Kennedy E. Impacts of agriculture on nutrition: nature of evidence and research gaps. CRSP Research Brief #4. Boston: Tufts University, 2012.