

A review of global progress toward the Millennium Development Goal 1 Hunger Target

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Abstract

Background. The hunger component of the first Millennium Development Goal (MDG) aims to reduce the proportion of people who suffer from hunger by half between 1990 and 2015. In low- and middle-income countries, progress has been mixed, with approximately 925 million people hungry and 125 million and 195 million children underweight and stunted, respectively.

Objective. To assess global progress on the hunger component of MDG1 and evaluate the success of interventions and country programs in reducing undernutrition.

Methods. We review global progress on the hunger component of MDG1, examining experience from 40 community-based programs as well as national efforts to move interventions to scale drawn from the published and gray literature, alongside personal interviews with representatives of governments and development agencies.

Results. Based on this review, most strategies being implemented and scaled are focusing on treatment of malnutrition and rooted within the health sector. While critical, these programs generally address disease-related effects and emphasize the immediate determinants of undernutrition. Other major strategies to tackle undernutrition rely on the production of staple grains within the agriculture sector. These programs address hunger, as opposed to improving the quality of diets within communities. Strategies that adopt multisectoral programming as crucial to address longer-term determinants of undernutrition, such as poverty, gender equality, and functioning food and health systems, remain underdeveloped and under-researched.

Conclusions. This review suggests that accelerating progress toward the MDG1 targets is less about the development of novel innovations and new technologies and more about putting what is already known into practice. Success will hinge on linking clear policies with effective delivery systems in working towards an evidence-based and contextually relevant multisectoral package of interventions that can rapidly be taken to scale.

Key words: Determinants, food systems, hunger, MDG1, poverty, undernutrition

Background

At the Millennium Summit in September 2000, the largest gathering of world leaders in history adopted the UN Millennium Declaration, committing their nations to a bold global partnership to reduce extreme poverty and address a series of time-bound health and development targets [1]. Among these Millennium Development Goals (MDGs) is a commitment to reduce the proportion of people who suffer from hunger by half between 1990 and 2015 [2].

In many settings, progress toward the MDG1 Hunger Target has been elusive, and the challenge of global food security remains one of the most pressing issues of our time. Problems are most severe in the developing world, where the proportion of underweight children under 5 years of age declined only marginally from 31% to 26% between 1990 and 2008 based on a subset of 86 countries with trend data for the period 1990 and 2008, covering 89% of the developing world's population [3]. In 2010, 925 million people were hungry and 129 and 195 million children under 5 years of age were underweight and stunted, respectively, with 90% of these children living in just 36 countries [3–5]. To make matters worse, many of the reductions in hunger witnessed during the 1990s have recently been eroded by the global food price and economic crises [6], which

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have together added an estimated 105 million to the ranks of the hungry in 2009 [7].

What these global figures hide is the diversity of experiences that exist within countries and regions of the world (fig. 1) [3]. While regional averages provide useful estimates, the situation of individual countries may vary significantly, particularly in Africa and Asia [6]. Furthermore, progress within countries may be linked to variations in geography, ethnicity, and religion, rural and urban settings, and socioeconomic strata [8]. In short, although challenges remain, the news is not all bad, and there is much that can be learned to re-energize programs and policies as we enter the final 5-year push to 2015.

Methods

In this paper, we review the most up-to-date information on global progress toward the hunger component of the first MDG. Specifically, we profile developing-country progress at the regional and country levels, present a typology for assessing policy and program strategies for addressing hunger, and summarize key lessons and future recommendations to accelerate progress toward the elimination of hunger.

Information for this review was drawn from over 150 studies published between 2000 and 2009 on nutrition and hunger among children in resource-poor settings. The PubMed, Medline, Web of Science, and Embase databases were searched using combinations of key words and Medical Subject Heading terms, including nutritional status, hunger, MDGs, dietary diversity, multisectoral approaches, diet quality, underweight, stunting, and wasting. Studies published in peer-reviewed journals in English were examined. The gray literature, alongside a series of personal interviews

with representatives of government and country-level programs, was also studied. In a second phase, snowballing was used to identify additional relevant studies from the bibliographies of all relevant papers identified in the initial search.

Only studies and literature that reported the nutritional status of children under five as underweight, stunting, or wasting were included. The search was restricted geographically to studies from sub-Saharan Africa, South and Southeast Asia, and Latin America and the Caribbean. The review was also restricted to low- and middle-income countries with a certain degree of food insecurity, as measured by the Food and Agriculture Organization (FAO) MDG1 target. Other indicators of hunger and food insecurity, such as the Global Hunger Index (GHI), were not used in this review.

Results

Regional and country-level progress toward the MDG1 Hunger Target (panel 1) [9–19]

Progress in reducing the proportion of children who are underweight

In many low- and middle-income countries, progress toward reducing the proportion of children who are underweight has been encouraging. Of the 117 countries analyzed by UNICEF, more than half (63 in total) are on track to meet the target [3]. The greatest gains have been in Central and Eastern Europe–Commonwealth of Independent States, East Asia, and the Pacific [20]. Latin America and the Caribbean also made solid progress, with levels declining from 11% to 6% between 1990 and 2008, fueled by major improvements in Mexico [20].

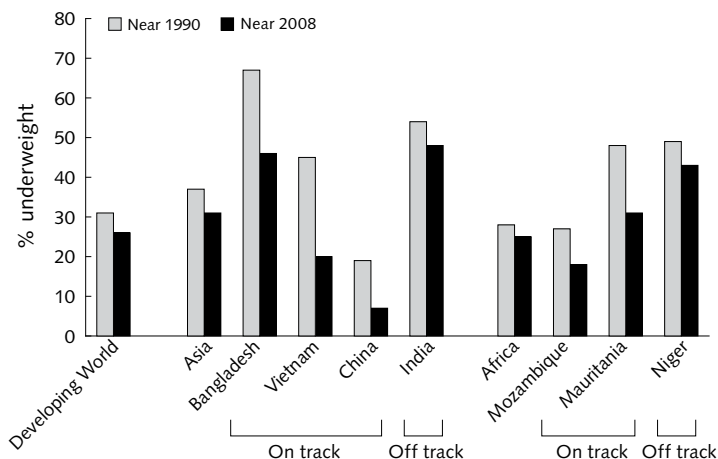


FIG. 1. Variable progress toward reducing the proportion of children underweight. Source: UNICEF 2009[3]

PANEL 1. Measuring hunger and undernutrition

Hunger refers to insufficient food quantity, where the minimum caloric intake is not met [9].

Undernutrition refers to a diet of insufficient quality of nutrients required to improve birthweight, growth, cognitive development, and mortality [10–14].

The underweight prevalence indicator is the proportion of children under 5 years of age falling below -2 SD (moderate and severe) from the median weight-for-age of the reference population. The reference population is the WHO Child Growth Standards, based on a cohort of 8,000 children from Brazil, Ghana, India, Norway, Oman, and the United States [15].

Additional anthropometric indicators include **stunting** (height-for-age; a measure of chronic undernutrition) and **wasting** (weight-for-height; a measure of acute undernutrition). The underweight indicator was chosen as one of the MDG1 targets as a single composite measure, as it was felt to capture aspects of acute and chronic undernutrition combined. Recent recommendations advocate that countries report stunting as an indicator of endemic poverty [16] and as a measure that more accurately reflects nutritional deficiencies as well as sickness that occurred during a child's critical growth periods [3].

The proportion undernourished indicator is a complex estimation of dietary energy consumption on a per-person basis as established and monitored by FAO. This indicator is estimated by the daily dietary energy supply per capita for a country derived from its food balance sheet averaged over 3 years. The variance is derived on the basis of food consumption or income data from household income and expenditure surveys. The proportion of undernourished in the total population is defined as that part of the population lying below a minimum energy requirement after taking into account a country's sex and age distribution, assuming the minimum acceptable body weight for given height for all sex-age groups and a light activity levels for adults [17, 18]. These estimates are difficult to collect at the field level, and it remains questionable how accurate a picture these data capture [19].

The experience in Asia varies widely. In South Asia, the prevalence of underweight children declined just marginally from 54% to 48% between 1990 and 2008, but with such high prevalence levels, attaining the target will be very difficult. In India, progress has been slow, and the country has the highest number of children who are stunted worldwide [3]. India, Bangladesh, and Nepal are 3 of the 10 countries with the greatest proportion of underweight children worldwide. Conversely, in East Asia, countries such as China, Cambodia, Thailand, and Vietnam are all on track to meet the MDG1 [3].

In sub-Saharan Africa, underweight prevalence decreased from 32% to 26% from 1990 to 2008, a level of decline too slow to meet the MDG1 target. Of the 20 countries classified as making no progress at all, most are in Africa, with the highest underweight prevalence

found in Burundi, Chad, Eritrea, Madagascar, and Niger [3]. Despite limited progress overall, many countries in the region are well on track, including Angola, Botswana, Congo, Ghana, Guinea-Bissau, Mozambique, São Tomé and Príncipe, and Swaziland [20].

Progress in reducing the proportion of the population who are undernourished

Countries with the highest proportion of the population undernourished are in Asia and the Pacific as well as sub-Saharan Africa, mirroring trends for underweight prevalence [21]. The proportion of undernourished in developing countries decreased from 20% to 17% (a decrease in absolute numbers of 9 million) in the 1990s, but both the proportion and the absolute numbers have reversed course and increased in 2008 due to the food price crisis, which has severely impacted the sub-Saharan Africa and Oceania regions [6]. Sub-Saharan Africa has the highest proportion of undernourished, at 29%, followed by South Asia, including India, at 22% [6].

Strategies for addressing hunger and undernutrition

Although a wide range of interventions to eliminate hunger and undernutrition have been established, a policy-practice gap exists in many countries, and fully integrating evidence-based interventions within effective delivery systems that can achieve high levels of coverage remains a major challenge [22, 23]. The following typology is put forward to characterize policies and programs that address the MDG1 Hunger Target (fig. 2).

Prevention- and treatment-based approaches

A range of proven, cost-effective interventions for addressing child and maternal undernutrition have been well described [24]. The interventions listed in figure 3 were drawn from research in 36 countries that account for 90% of the global burden of child undernutrition [4, 24]. In children, the period from pre-pregnancy to 2 years of age represents a critical "window of opportunity" as a period of rapid growth where damage done is potentially permanent. Reducing hunger and undernutrition during this period affects both child growth and cognitive development [25]. Estimates suggest that developing countries spend US\$30 billion per year on premature illness and death felt to be the direct result of hunger [26].

There are a number of examples of countries and programs where the bundling of various components of this package has been linked to substantial gains. Peru's Good Start to Life program has generated encouraging improvements in child growth and the reduction of iron and vitamin A deficiency by introducing a range of prevention interventions alongside a participatory problem-solving approach with communities and

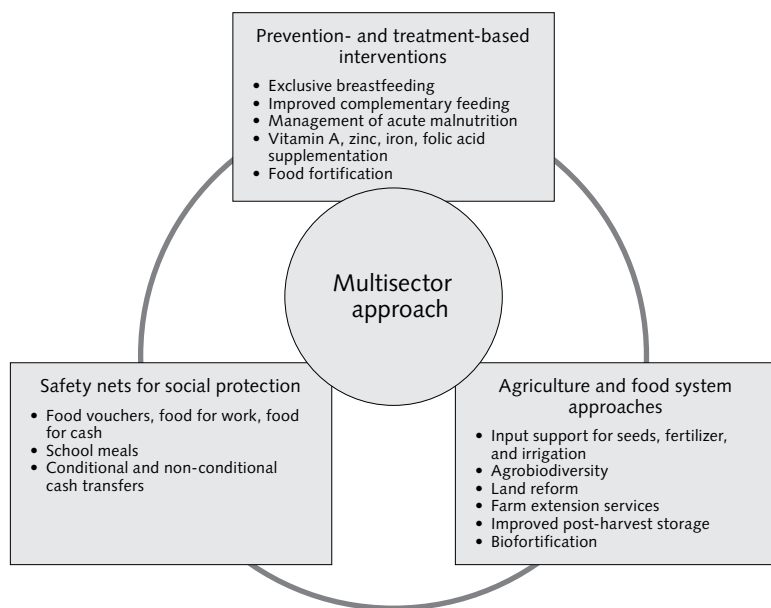


FIG. 2. Typology of strategies and examples for addressing hunger and undernutrition

Prevention-based interventions	Exclusive breastfeeding: < 6 months of age Improved complementary foods and practices: 6 to 24 months of age Vitamin A supplementation: 6 to 59 months of age Improved nutrition, sanitation, and hygiene practices for the household Iron and folic acid supplementation: pregnant women Iodized salt: households Fortification of staple foods, complementary foods, and condiments
Treatment-based interventions	Treatment of severe acute malnutrition with ready-to-use therapeutic foods (RUTF): < 59 months of age Deworming: < 59 months of age Zinc supplementation complemented with oral rehydration solution for the management of diarrhea: < 59 months of age

FIG. 3. Evidence-based prevention and treatment interventions for child and maternal undernutrition [24]

institutions (**panel 2**) [27]. There are also examples of successful treatment programs, such as the Community-Based Management of Acute Malnutrition (CMAM) program in Malawi (**panel 3**) [28–31], which has demonstrated that treating severely malnourished children with ready-to-use therapeutic foods (RUTF) can be done even in the most rural landscapes. Many countries are scaling up CMAM, with 42 country-wide action plans in Africa, Asia, and the Middle East [3], and with efforts in Malawi, Ethiopia, and Niger demonstrating early signs of success [32–34]. Finally, programs such as the Baby-Friendly Community Initiative (BFICI), a village-based mother support group model designed to address infant and young child feeding (IYCF) practices in Cambodia and the Gambia, have made significant impacts on breastfeeding practices in the countries [3, 35]. Although these improvements cannot be attributed solely to BFICI, programs

promoting improved IYCF practices that include these initiatives as part of a comprehensive communication effort show considerable promise [35].

Conversely, experience from elsewhere has been more mixed. A recent evaluation of an Integrated Management of Childhood Illness (IMCI) program in Bangladesh [36] and an Accelerated Child Survival and Development Program (ACSD) in Benin and Mali, which embed prevention and treatment interventions for undernutrition with health interventions, including the delivery of vaccines and insecticide-treated nets (ITNs) for the prevention of malaria, have had limited success in increasing child survival [37]. The reasons for the lack of success in West Africa were felt to include low levels of coverage for interventions for malaria and pneumonia, poor implementation of interventions to reduce neonatal deaths, and low priority of interventions effective in combating undernutrition in

program plans. Furthermore, immediate and exclusive breastfeeding up to 6 months of age was promoted more heavily in comparison areas than in the ACSD focus areas [37].

Similarly, Bangladesh's Integrated Nutrition Project (BINP) was the first large-scale government initiative in nutrition [38]. With an investment of \$65 million from World Bank credit [39], BINP expanded a community nutrition intervention originally done by the Bangladesh Rural Advancement Committee (BRAC) to reduce child malnutrition through growth monitoring and supplementary feeding among children aged 6 to 24 months, alongside supplementary feeding for pregnant women to increase pregnancy weight gain and reduce the incidence of low-birthweight babies. Early evaluations found that although nutrition-related knowledge and delivery and use of micronutrients, vitamin A, iron-folic acid, and iodized salt improved in the communities with BINP, evidence to support an impact on child nutritional status, weight gain during pregnancy, or birthweight has been limited [39]. Whether this was due to a true lack of impact on outcomes per se or to weaknesses in the evaluation designs and the data remains unclear [38].

Although prevention and treatment programs that bundle proven interventions can be effectively implemented at a modest scale, translating these gains into national programs with high quality and coverage has proven more challenging. Sound policies, alongside fostering ongoing engagement of stakeholders and participants, seem to have equal bearing on success as the technical content of interventions and programs

PANEL 2. Good Start to Life in Peru

Peru is currently on track to meet the Hunger Target of the MDG1. The proportion of the population who are undernourished has decreased from 28% to 15% since 1990, [21] and the prevalence of stunting remains high at 30% [20]. The Good Start to Life program was initiated in 2000 in four regions of Peru and covered approximately 75,000 children under 3 years of age and 35,000 pregnant and lactating women. The program consisted of a series of nutrition, hygiene, and health interventions, similar to those recommended in **figure 3** [24]. The aims of the initiative were to promote growth and development of children, antenatal care, adequate diets for pregnant and lactating women, and exclusive breastfeeding during the first 6 months, alongside safe complementary feeding, early stimulation of the child, control of iron and vitamin A deficiency, iodated salt intake, and personal and family hygiene [24]. Participatory processes to problem solving and delivery were put into place to build capacity at both the individual and the institutional levels, mobilizing human, economic, and organizational resources. After 4 years, the program was associated with a decrease in the prevalence of stunting from 54.1% to 36.9%, a decrease in the prevalence of iron-deficiency anemia from 76.0% to 52.3%, and a decrease in the prevalence of vitamin A deficiency from 30.4% to 5.3% [27].

[40]. Innovative partnerships between governments, the private sector, and civil society are also needed to improve affordable access to nutritious products such as RUTF among vulnerable populations.

Agriculture and food system approaches to the MDG1

Agriculture and food system approaches enhance food availability and diet quality through improved local production, better crop storage and enhanced market access, and efforts to further agricultural biodiversity. At least half of the world's food-insecure people are poor smallholder farmers living in low-income countries cultivating on marginal lands without access to productivity-enhancing technologies [41]. These farmers, most of them operating on less than 2 hectares of land, produce the food they need for their own survival [42]. Small farms provide over 90% of Africa's agricultural production [43], and women produce 60% to 80% of the food that is consumed locally in developing

PANEL 3. Community-based management of acute malnutrition in the Peanut Butter Project in Malawi

Severe acute malnutrition (SAM) affects 20 million children under 5 years of age each year and contributes to 1 million child deaths per year [28]. Moderate acute malnutrition contributes more to the overall burden of disease, as it affects many more children [29]. Community-Based Management of Acute Malnutrition (CMAM) is an innovative, community-led public health model to address acute malnutrition in developing countries. Previously used in emergency settings [30], the approach sensitizes the community to detect signs of SAM and engage in active case finding, then providing home-based treatment for those without medical complications with ready-to-use therapeutic foods (RUTF) or other nutrient-dense foods [28]. If properly combined with clinical care for those malnourished children with medical complications and implemented on a large scale, CMAM could prevent the deaths of hundreds of thousands of children [28].

The Peanut Butter Project works in a rural setting outside of Blantyre, Malawi, an area that lacks overall healthcare facilities. Village health aides are trained in screening, diagnosing, and basic treatment of acute malnutrition at the household level. Caretakers and children come to the rural center for assessment, and if the child is found to be malnourished after screening with measurement of mid-upper-arm circumference, a 2-week supply of RUTF is provided, continuing for 8 weeks if needed [31]. A project evaluation found that of 826 malnourished children enrolled, 775 (94%) recovered, 13 (1.8%) remained malnourished, 30 (3.6%) defaulted, and 8 (0.9%) died [31]. The project demonstrated that with minimal resources, treating children who suffer from SAM can be achieved with village health workers and therapeutic food. This approach will not work in all settings, particularly if a functional government-supported rural health worker program or locally made foods are not readily available. However, it does provide an example of how action can be taken even in resource-constrained settings.

Food Production	Livelihoods	Infrastructure
Improve smallholder access to productivity-enhancing inputs through subsidies, credit, and support for agro-dealer networks	Support agribusiness and agroprocessing technologies to increase incomes	Improve natural resource management: soil improvement, water conservation, biodiversity protection, greenhouse gas reductions
Improve agricultural extension services, especially for women farmers	Diversify beyond staple food production towards higher-valued nutrition and market-directed commodities	Invest in rural market infrastructure, including rural roads and electrification
Expand irrigation and water harvesting and improve water use efficiency	Improve access to financial services: rural microfinance, community saving groups, and insurance mechanisms	
Decrease post-harvest storage losses in both quantity and quality		
Improve conservation strategies and promote agrobiodiversity		

FIG. 4. Areas of investment and interventions to improve food productivity and livelihoods

countries [44]. Simple interventions long taken for granted in much of the world, such as improved seeds, fertilizers, and agricultural extension training, are unavailable to subsistence farmers in hardest-hit regions such as sub-Saharan Africa [9], despite their well-documented potential to triple crop yields [45].

Enhancing the productivity of food systems tackles both the supply-side and the demand-side dimensions of hunger. On the supply side, farming diverse nonstaple crops with high nutritional value has the potential to make rich sources of micronutrients more widely available to entire communities [46]. On the demand side, raising smallholder agricultural productivity contributes to increasing household income, allowing families to purchase more and better-quality food. Furthermore, by extending the value chain toward local agrobioprocessing, these activities can increase the presence of high-quality nutritionally improved or fortified foods in the local markets. Interventions to improve food productivity and livelihoods in these settings have been well defined (fig. 4) [41, 47].

Agricultural and food system strategies often fall outside the traditional scope of clinical nutrition, and as such have a limited evidence base to support causal links between the introduction of programs and improvements in maternal or child health outcomes [48]. However, observational data from China, Japan, South Korea, and Taiwan have suggested a strong relationship between land reform initiatives and enhanced food security [42, 49]. In some developing countries,

such as China, where major progress has been made in reaching the MDG1 Hunger Target, there has been a concerted effort to improve the productivity of smallholder farmers and promote a more equitable distribution of land [42]. Similarly, Malawi, once facing famine and reliant on food imports, has become a net exporter since the introduction of a national input subsidy program (fig. 5) [10] that dramatically expanded access to fertilizer (panel 4) [42, 45]. Finally, community-level programs in South and Southeast Asia that enhance livestock production and crop diversity among rural homesteads (panel 5) [50, 51] have

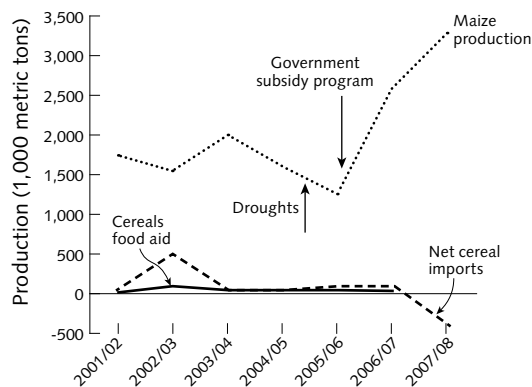


FIG. 5. Maize production and cereal trade in Malawi 2001–08. Source: FAO Stat 2010 [21]

provided encouraging evidence that such strategies can be effective vehicles for improving income, food security, and nutrition.

A number of major global initiatives have recently emerged to expand the scope of agriculture- and food-based approaches to addressing poverty and food security. The G8 nations, alongside leading international organizations, recently committed US\$20 billion to help farmers in poor countries boost productivity and food security. With this initiative, the United Nations recently established the High-Level Hunger Task Force for Food Security to “ensure a coherent system-wide response to both the causes of this crisis and its overwhelming adverse consequences among the world’s most vulnerable populations” [52]. The Scaling Up Nutrition (SUN) global initiative is a framework [53] agreed on by many stakeholders to address undernutrition globally through direct nutrition-specific interventions focusing on pregnant women and children under 2 years of age, as well as a broader multisectoral approach that promotes agriculture and food security to improve the availability of, access to, and consumption of nutritious foods, by improving social protection and ensuring access to healthcare [54]. On the agriculture front, the Alliance for a Green Revolution in Africa (AGRA) was established in 2006 with the purpose of achieving a food-secure and prosperous Africa through the promotion of rapid, sustainable agricultural growth based on smallholder farmers [55]. Lastly, the Consultative Group on International Agricultural Research (CGIAR) is currently undergoing a major reform as a renewed effort to direct agricultural research that will ultimately contribute to poverty reduction, food and nutrition security, and economic development.

PANEL 4. Staple crop input subsidies in Malawi

Production of maize, the main staple of the diet, by smallholder farmers in Malawi is not normally sufficient to meet annual consumption requirements. With droughts and crop failures, food insecurity can be devastating, and prior to 2005 Malawi was a net maize importer. In mid-2005, the Government of Malawi responded to severe hunger among its population with a national scheme to subsidize improved seed and fertilizer [45]. The scheme involved the distribution of fertilizer vouchers (not more than two per household) and maize seed vouchers that enabled most smallholder farmers to purchase fertilizer and seed at about one-quarter of the market cost. With the national subsidy scheme, food production has exceeded national demand for four consecutive years. In 2008, despite food price increases, Malawi was able to contain food prices because of the strong maize subsector. In 2007 and 2009, Malawi exported maize [42] (fig. 5) [21]. These data show promising results of a national-scale food security program put into place over several years, due to a willing and committed government dealing with massive food shortages. Nationally, the proportion of undernourished decreased from 45% in 1990 to 29% in 2006 [42].

Although such an ambitious agenda has many important merits, a comprehensive strategy to address undernutrition will also require countries to increase the availability and reduce the cost of nutritious food beyond just staple crops and cereals. Agrobiodiversity interventions that aim to increase the nutritional content of traditional foods, contribute to better livelihoods, and enhance the market value of these “specialized foods” are providing an important boost for rural farming communities [48], as demonstrated in Kenya (panel 6) [56, 57]. Finally, enhancing food security among marginal groups who are not smallholder farmers, including pastoralists and fishing communities, the urban poor, and vulnerable households who rely primarily on purchased foods, is equally important [41, 58].

Safety nets for social protection

Communities and populations living on the fringes or those in areas susceptible to natural disasters, in conflict zones, or in war-torn countries often have needs that are unaddressed by conventional interventions. “Safety nets” are social protection interventions that are tailored to meet the needs of these vulnerable groups.

There are a number of types of safety net interventions. Some provide a substitute for income and may include cash and in-kind transfer programs, subsidies, and labor-intensive public works programs. They may provide mechanisms to ensure access to essential public services, such as school scholarships and fee waivers for healthcare services [59]. Other safety nets

PANEL 5. Homestead food production in South Asia

South and Southeast Asia remain regions with some of the highest prevalence rates of underweight and stunting among children in the world [21]. To enhance food and nutritional security, Helen Keller International introduced its homestead food production program (HFP) in Bangladesh, Cambodia, Nepal, and the Philippines. The program integrates animal husbandry with home gardening with the aim of enhancing consumption of micronutrient-rich foods. Between 2003 and 2007, the HFP program was implemented in 30,000 households in these four countries where micronutrient malnutrition is a serious public health problem. A program evaluation documented significant improvements in dietary diversification and in animal-food consumption (an increase in consumption of protein-rich liver and egg) and reduction in the prevalence of childhood anemia [50]. The findings from Bangladesh and Cambodia showed significant improvements in household income from the sale of products from home gardens and animal husbandry. Women’s participation in these programs translated to further gains in child health and education [51]. The HFP model has recently been enhanced to include interventions to improve child growth through improved breastfeeding and complementary feeding. Emphasis will also be placed on further adapting the model to urban areas, due to the rapidly growing urban populations of Asia and Africa.

aim to enhance food access, for example by providing public works employment paid in food, by increasing purchasing power (through the provision of food stamps, coupons, or vouchers), or by providing food-assistance interventions (through the direct provision of food to households or individuals). Among the most common types of food-based safety net modalities are supplementary feeding, food vouchers or stamps, food for work or assets (**panel 7**) [60–63], and conditional cash transfers (**panel 8**) [64–66]. The MERET (Managing Environmental Resources to Enable Transitions to More Sustainable Livelihoods) program in Ethiopia works with chronically food-insecure communities on projects to rehabilitate the natural environment and to create productive assets in exchange for food or cash. Not only are landscapes preserved or restored, but many households, as a result of the food or cash, have improved food security.

There is evidence to suggest that food and cash transfers can improve the lives of those who are poor, particularly in households who suffer from a food security shock [39, 67]. Cash transfer programs can be applied to households as a unit because they meet poverty or vulnerability criteria. Alternatively, they are provided in the presence of vulnerable groups within households such as children, girls, or fostered orphans. Cash transfers can be unconditional (given without obligations) or conditional (tied to obligations of recipients to participate in work, training, education, health, nutrition, or other services or activities). Although evidence for the impact of pure cash transfers on improvements in health is mixed [68], conditional cash transfers have been demonstrated to increase the likelihood that households will take their children for preventive health checkups [67, 69], with well-designed evaluations also demonstrating improvements in nutritional

PANEL 6. Leafy green vegetable promotion in Kenya

Sub-Saharan Africa has an enormous variety of leafy vegetables, estimated to include between 800 and 1,000 species. However, few of these are commonly consumed [56]. In Kenya, for example, only about 10 of 210 species find their way to markets. Working with 300 resource-poor vegetable farmers on the outskirts of Nairobi in periurban areas, Bioversity has inventoried leafy vegetable species and identified the key issues hindering their cultivation, conservation, and marketing. Other activities include nutritional and agronomic studies, distribution of seeds to farmers, and dissemination of local recipes featuring leafy vegetables. With support and training from the project, farmers on the outskirts of Nairobi soon began growing leafy vegetables. The largest supermarket chain in Kenya agreed to sell the vegetables. The vegetables quickly became fashionable and shed their lower-class status; they are now the most consumed vegetables in the country. Produce delivery to market outlets increased from 31 to 400 tons/month during the 3-year phased project [57]. There was a 2- to 20-fold increase in incomes of the 300 monitored farmers [57].

outcomes [70], such as in Mexico (**panel 8**) [64–66].

Multisectoral approaches

The achievement of food security depends upon three distinct but interrelated processes. The first is food

PANEL 7. Food for Work Program in Ethiopia

Ethiopia is one of the poorest countries in the world, with natural resource degradation being one of the most serious development challenges. MERET (Managing Environmental Resources to Enable Transitions to More Sustainable Livelihoods) is a joint program between the Ethiopian Government and the World Food Programme aimed at addressing this challenge. It aims to build communities' resilience against shocks and improve the livelihoods of rural households, particularly those headed by women. Chronically food-insecure communities participate in projects to rehabilitate the natural environment and create productive assets. This involves participation in income-generating activities aimed at improving livelihoods while using local natural resources in a sustainable manner [60]. As a result of the MERET program, 300,000 hectares of land have been restored [61], with 1 million people benefiting annually, in 600 communities across Ethiopia. MERET has helped to improve food security because the soil and water conservation has facilitated diversification of agricultural production, including the cultivation of a wide variety of cash crops—especially fruits and vegetables, some of which were kept for consumption, but most of which were sold—and increased productivity and food availability. All of these households continued to produce teff, maize, and sweet potatoes as well. Some participants were double- and triple-cropping as a result of MERET, and some said they had increased use of high-yielding seeds [62]. In 2005, 41% of MERET households claimed that the number of months per year that they experienced a food deficit had declined by two or more as a result of the project [63].

PANEL 8. Conditional Cash Transfer program in Mexico

The Mexican Oportunidades program was one of the first conditional cash transfer programs in a developing country. It offers bimonthly direct cash transfers to women to improve the quality, quantity, and diversity of food in the household. In order to address undernutrition, Oportunidades offers nutritional supplements to infants between 6 and 23 months of age, undernourished children between 2 and 5 years of age, and breastfeeding and pregnant women. The supplement is a milk-based fortified food providing 20% of calorie requirements and 100% of micronutrient requirements, including zinc, iron, and vitamins A and C [64, 65]. In order to address education and health, the program offers educational grants and incentives for remaining in and finishing school, as well as basic medical services and health education. By 2008, the program assisted 5 million families in 93,000 districts in all of the country's most marginalized municipalities [66]. Evaluations found that the program has had a positive effect on childhood growth, with an increase in mean growth of 16% or 1 cm per child per year in the critical period of 12 to 36 months [64, 66].

availability, which refers to ensuring that food of sufficient quantity and diversity is available for consumption from the farm, the marketplace, or elsewhere. The second is food access, which refers to households having the physical and financial resources required to obtain these foods. The third is food utilization, which implies the capacity and resources necessary to use food appropriately to support healthy diets. This might include access to potable drinking water and adequate sanitation; knowledge of food storage, preparation, and the basic principles of good nutrition; proper child care; and illness management [71, 72].

A multisectoral approach brings together a coherent range of strategies with the aim of enhancing food and nutrition security. These necessarily include interventions in agriculture and business development, healthcare, clean water, hygiene and sanitation, basic infrastructure, gender equality, and education

(**fig. 6**) [9, 39, 72–76]. Such approaches highlight the interdependence of the MDGs and the bidirectional relationships that exist between hunger and nutrition and a host of other health development challenges.

At the national level, there is substantial experience highlighting the potential importance of these comprehensive approaches to improving food security. Both Ghana and Vietnam have made substantial progress toward the MDG1 hunger goal in agricultural growth, diversification, and strong economic gains. The proportion of those undernourished has decreased from 34% to 9% since 1990 in Ghana, meeting the MDG1 target. Although progress has been made, stunting remains high at 28% [20]. In Vietnam, the proportion of those undernourished was reduced from 28% to 14% from 1990 to 2008, already achieving the MDG target of halving hunger [3, 21]. Accelerated gains were attributable to success on a number of other fronts,

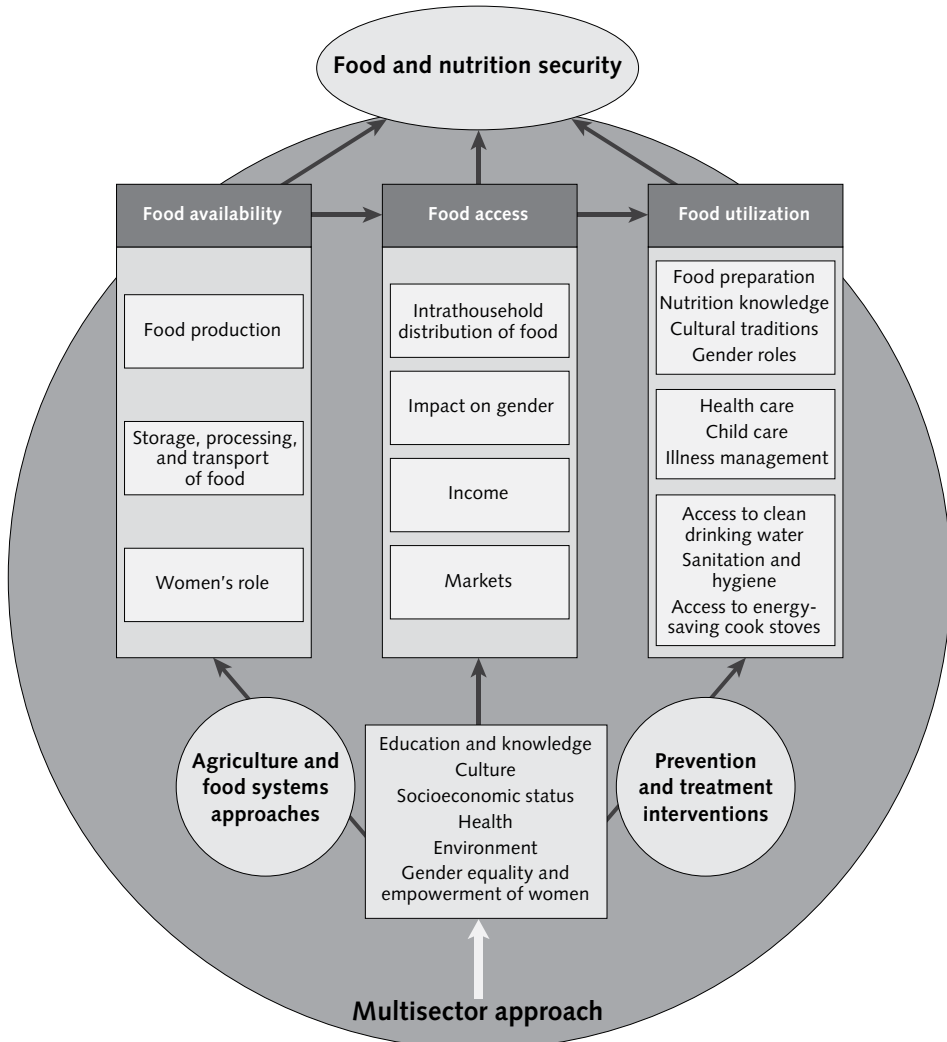


FIG. 6. Multisectoral approach to improving food and nutrition security

including improvements in health and sanitation, land reforms, and policy initiatives with varying degrees of coordination and effectiveness. Conversely, India's stellar economic growth has not, on its own, translated into reduction in undernutrition in the face of pervasive gender inequalities and poor access to basic services (**panel 9**) [77–79].

The design and evaluation of complex multisectoral interventions to improve child nutrition and health remain at an early stage of development. However, programs such as the Millennium Villages, an integrated rural development project, are beginning to have an impact on child stunting in poverty-stricken areas such as rural sub-Saharan Africa (**panel 10**) [80]. Better understanding of implementation challenges, the relative contribution of various components of multi-sectoral packages, how they might be locally tailored to diverse agroecologic zones and farming systems, issues of sustainability and scale, and how to maximize potential synergies through such approaches remain important questions for future operational research.

Conclusions

Lessons learned: A hunger roadmap for 2015

As the 2015 horizon approaches, what can be learned from the case studies profiled in this review that might assist countries that are currently off-track in meeting the hunger component of the MDG1 target? Furthermore, based on the global experience of the past two decades, what are the critical implementation messages for rapidly accelerating progress toward eliminating hunger and undernutrition?

PANEL 9. Multisectoral growth is reducing poverty, but nutrition remains stagnant in India

The case of India is more complex and draws attention to the fact that economic growth alone is an insufficient catalyst for reducing hunger. Issues of equity, ensuring the status and rights of women, land tenure, employment diversification, and the concurrent development of public health programs and systems remain critical barriers to the achievement of better nutritional outcomes. As a complex, “long-wave” event, undernutrition will inevitably require an appropriate combination of quick wins and longer-term approaches. In the Indian context, this process must be founded on a solid policy platform that is mirrored by a commitment of resources. Such an approach would draw together quick wins to attain rapid gains with wider food security initiatives that include local production of fortified foods, land reform, and agricultural diversification [77]. Finally, for sustainable gains to be achieved, these objectives should be aligned with strategies to address wider vulnerabilities, such as social exclusion and the status of women, poor access to education, and expanding coverage with essential primary healthcare interventions [78, 79].

Clear policy and visible leadership

The experiences of countries as diverse as Vietnam, Ghana, and Malawi all highlight the importance of a clear national policy direction. Nutrition policies either can be embedded centrally within the Poverty Reduction Strategy Policies (PRSPs) or can be stand-alone initiatives linked to the overall development vision for countries moving forward. There is plenty of evidence to suggest that in the absence of clear policy, rapid gains are much more limited. A review of PRSPs in 40 countries where malnutrition is high demonstrated that although most of the policies mentioned nutrition, very few made significant attempts to formally incorporate nutrition into the actual strategic priorities [39].

Central coordination

Both nutrition and hunger fall within a broader mandate that necessarily includes agriculture, health, education, water and sanitation, and other departments. This poses clear challenges to leadership and

PANEL 10. Millennium Villages in sub-Saharan Africa

The aim of the Millennium Villages Project is to accelerate progress toward the MDG targets, including MDG1—to eradicate extreme poverty and hunger. The Millennium Villages are situated in “hunger hotspots,” where at least 20% of children are malnourished and where severe poverty is endemic. The countries where Millennium Villages are located are Ethiopia, Ghana, Kenya, Malawi, Mali, Nigeria, Rwanda, Senegal, Tanzania, and Uganda. They were chosen to reflect a diversity of agroecologic zones, representing the farming systems found in over 90% of sub-Saharan Africa, and are demonstration and testing sites for the integrated delivery of science-based interventions in health, education, agriculture, and infrastructure [75]. Within the project, hunger and undernutrition are being addressed with an integrated food- and livelihood-based model that delivers a comprehensive package of health and development interventions [79]. The aim of the model is to demonstrate the elimination of undernutrition in a diverse range of sub-Saharan African contexts. The model draws together interventions at a number of levels, including prevention and treatment interventions directed at young children and pregnant and lactating mothers; education- and behavior change-based interventions to improve health, nutrition, school attendance, and learning outcomes among primary schoolchildren; and household-, community-, and livelihood-based interventions to increase agricultural production, foster dietary diversity, and enhance livelihood security to address longer-term nutritional needs. In the project's initial site in rural Kenya, the levels of underweight and stunting among children under 2 years of age decreased dramatically in just 3 years, from 26% to 3.9% and from 62% to 38%, respectively. Among children under five, the level of vitamin A deficiency dropped by half, from 70% to 33% [80].

coordination. Too often, no single entity or team takes primary responsibility for working at the nexus of research, policy, and program development [3]. Given these realities, one national plan, one budget, one framework, and one reporting mechanism should be in place for a harmonized, streamlined effort [81]. Even in decentralized systems, a chain of command must exist up to the national level where management and information systems should reside. International organizations should play an active role in supporting national governments by providing tools and technologies, capacity, and resources to address hunger and undernutrition in the context of a wider, locally owned development strategy.

Accountability

Accountability will be essential in the next 5 years; however, it will also be important to understand who should be held accountable and for what. Accountability comes from the bottom up but also from the top down. Communities and end users themselves should be held accountable, as they will be key partners. Local to national governments must also be accountable alongside those groups and organizations that are providing services, whether it is sanitation and hygiene or capacity-building. However, with the increased evidence and push for rapid scale-up of nutrition interventions across the developing world, there is a need to ensure that the governments themselves are held accountable. As the SUN Road Map of 2010 stated, "Accountability for actions to improve nutrition rests with Governments, and is held jointly by three inter-governmental bodies—the Committee on World Food Security (CFS), the World Health Assembly (WHA) and the Economic and Social Council (ECOSOC) of the United Nations General Assembly" [53]. This will require more tightly regulated coordination, with performance-based allocation systems in place such as the Global Fund for AIDS, Tuberculosis and Malaria or the recent Global Agriculture and Food Security Program (GAFSP) have established.

Adequate financing

Many governments underinvest in programs to reduce hunger and undernutrition and fail to provide the minimal investments in agriculture and health required for sustained growth [41, 82]. In countries that cannot afford to provide these goods, international development assistance will remain a necessary, temporary bridge. Taking steps to redress gaps in budgetary allocations in line with locally relevant priority areas will be essential if gains in reducing hunger and undernutrition are to be achieved [26].

Comprehensive and context-relevant approach

This review highlights four distinct approaches to addressing hunger and undernutrition. Although the relative weight of any single approach may vary from country to country, all are important to consider in countries where progress toward the hunger component of MDG1 remains constrained. There is emerging consensus on what the minimum contents of the "nutrition basket" should be. However, local context and local processes remain all-important. Countries must determine contextually relevant priorities that integrate technical prevention and treatment interventions with wider efforts to enhance agricultural productivity, food security, and dietary diversity. Within many countries, coverage gaps will remain among vulnerable groups, and securing safety nets through the use of conditional cash transfers or food- or cash-for-work programs will be inevitable [26]. Poverty and hunger hotspots within countries should be a top priority, as should pregnant women, mothers, and children under 5 years of age, with a special emphasis on children under two.

Finally, strengthening the systems required to extend coverage with essential interventions will require sufficient attention to the process side of the delivery equation. The case studies in this review suggest that this is often neglected yet plays a critical role underpinning program success. How communities are engaged and mobilized, how international partnerships and national stakeholders are coordinated, and how health and agricultural extension workers facilitate intervention delivery are as important to achieving rapid hunger and nutrition gains as the technical content of specific interventions.

Nutrition and the wider MDG context

Although nutrition-specific interventions remain the backbone of an effective response to hunger, there is a need for a comprehensive response to be firmly embedded within the wider MDG agenda. Durable gains will hinge on concurrent steps to reduce poverty, improve access to education, empower women and girls, and facilitate access to basic infrastructure, including safe water and sanitation, energy, transport, and communication. High levels of undernutrition in India, which persist despite a strong economic engine, attest to the importance of applying this wider lens. Working on multiple fronts simultaneously has the potential to leverage synergies and catalyze gains that extend beyond those achieved through sector-specific programs working in isolation. Although multisectoral approaches may seem difficult and unwieldy, it is time for the global community to take on the challenge as we move forward toward 2015.

Measuring progress

Accurate and timely information on hunger, vulnerability, and nutrition is the cornerstone of a broad-based hunger and nutrition strategy. Regularly updated and well-collected data are crucial for identifying coverage gaps and generating information on how and where to intervene. It is imperative that partnerships be developed to support nationally led monitoring systems to measure, provide feedback to, and appropriately hone and refine program activities. Building this capacity should be the central goal of both national government- and donor-funded activities and should be done at the beginning of policy crafting and implementation. In high-risk countries, more frequent updates from nutrition surveys conducted every 3 to 5 years will be essential if the 2015 targets are to be achieved. This is especially important in high-risk settings, among vulnerable groups, or to assess the effectiveness of programmatic innovations. Utilizing simple, free, and open-source technologies such as SMS-based applications with mobile phones can revolutionize data collection systems in low-resource settings. Indicators such as mid-upper-arm circumference (MUAC) can also be measured for rapid, cost-effective detection of acute malnutrition. It is clear that the proportion of children under 5 years of age who are underweight and the proportion of the population who are undernourished may not be the best indicators to assess hunger and food security. Stunting provides a much better indicator of longer-term determinants of hunger, poor nutrition, and poverty and should be measured and reported routinely in program and national assessments.

Scaling up

Although the evidence for what improves child and maternal undernutrition has been in the works for years among the scientific community, the global nutrition community only recently came to agreement on “what works.” The *Lancet* series was the kickstarter, with the Scaling Up Nutrition process following. Only in 2010 was a Framework for Scaling Up Nutrition

presented and agreed upon by over 100 organizations. These key interventions are critical but not enough, and they are certainly not scaled at the national or international levels. Furthermore, how social safety nets and multisectoral approaches impact nutritional outcomes is not straightforward, as they have not been as widely researched and scaled. Why is this? The direct nutritional approaches, as shown in the *Lancet* series, involve one or two development sectors. The more multisectoral or social safety net “nutrition-sensitive” approaches involve many sectors. A multisectoral approach requires integration with “food security (including agriculture), social protection (including emergency relief) and health (including maternal and child health care, immunization and family planning),” at a minimum [53]. There will need to be a major reshifting across sectors of government to include nutrition indicators and nutrition consequences in policies and processes across governments, donors, multi- and bilaterals, and interagencies.

In summary, this review affirms that through energetic and engaged national leadership and with the support of robust international partnerships, rapid progress in reducing levels of hunger and undernutrition is attainable. Accelerating progress toward these targets is less about the development of novel innovations and new technologies and more about putting what is already known into practice. Success will hinge on linking clear policies with effective delivery systems for an evidence-based and contextually relevant package of interventions that can rapidly be taken to scale. Persistent hunger and undernutrition remain an inexcusable unfinished agenda, and successfully closing the few remaining gaps is a precondition for wider global progress toward achieving the MDGs.

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