

# Malnutrition Is Still a Major Contributor to Child Deaths

## But Cost-Effective Interventions Can Reduce Global Impacts

by F. James Levinson and Lucy Bassett

Malnutrition continues to be one of the world's most serious development problems. Exacerbating the consequences of infectious disease, malnutrition contributes to about 6 million deaths annually of children under 5. While low- and middle-income countries (LMICs) bear the brunt of the problem, malnutrition affects both rich and poor countries, particularly the poorest in each nation. In developed countries, obesity and resultant diet-related non-communicable diseases (NCDs), such as diabetes and heart disease, have become widespread, reducing productivity and increasing health care costs. Increasingly, LMICs suffer from a “double burden” of pervasive undernutrition and deficiencies in key vitamins and minerals (micronutrients) along with growing rates of obesity and NCDs.

Poor nutrition during fetal development or in early childhood causes severe and irreversible cognitive and physical damage. Malnutrition often

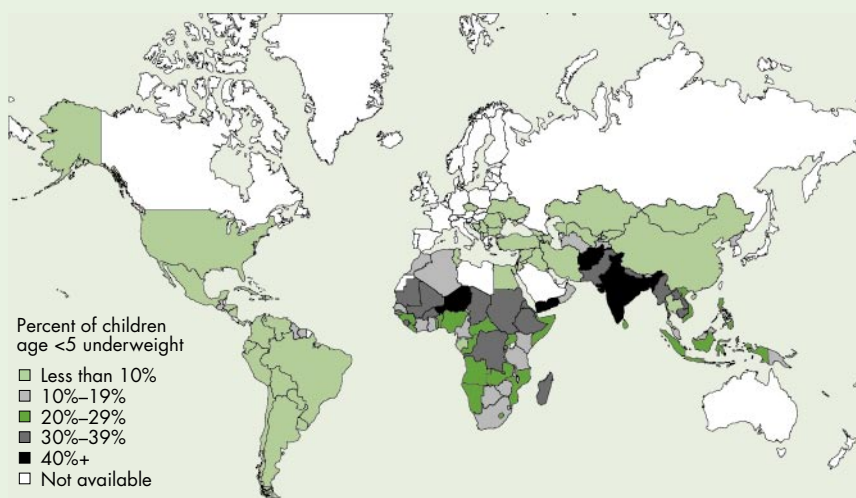
increases susceptibility to disease, while ill health exacerbates poor nutrition. For countries ravaged by the HIV/AIDS epidemic, malnutrition appears to increase vulnerability to infection and render antiretrovirals less effective.

Poverty and malnutrition are intrinsically linked. Productivity losses, poor cognitive development, and increased health care costs in malnourished populations lead to significant economic losses at both the individual and national level. Improving nutrition, therefore, can boost mental and physical productivity, improve health status, and help alleviate poverty.

A wide spectrum of cost-effective interventions at the national, subnational, and community levels have been undertaken to redress malnutrition. Interventions ranging from those designed to improve food intake or reduce nutrition-inhibiting infection to those addressing underlying determinants of malnutrition can contribute to accelerating global progress in eliminating malnutrition.

Figure 1

### REGIONAL PREVALENCE OF UNDERWEIGHT AMONG CHILDREN UNDER AGE 5



SOURCE: Carl Haub, 2007 World Population Data Sheet (Washington, DC: Population Reference Bureau, 2007).

### What Is Malnutrition?

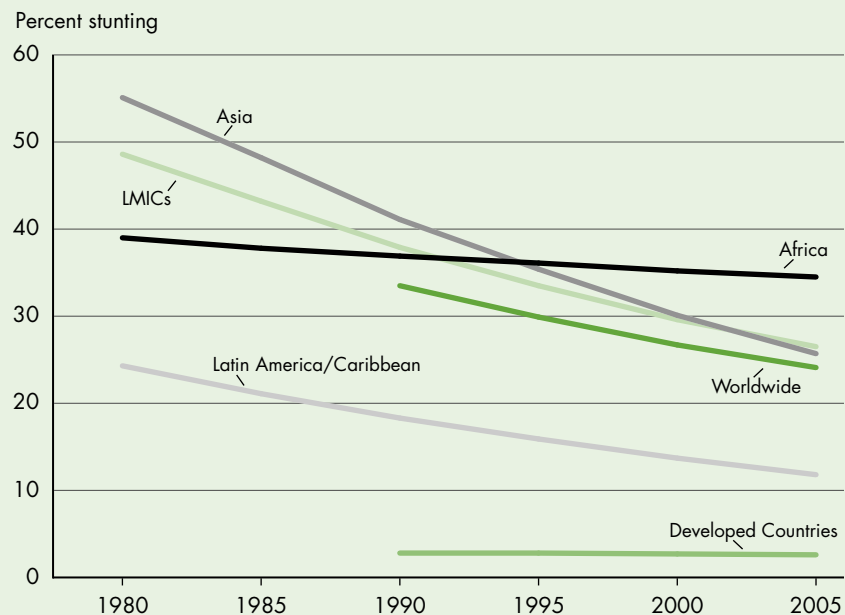
Malnutrition can take the form of undernourishment or overnourishment, characterized by a shortage or surplus of calories and/or specific nutrients.

### Undernutrition

Child undernutrition is measured as low height for age (stunting), low weight for age (underweight), and low weight for height (wasting). Stunting, or chronic malnutrition, is the failure to reach one's biological potential for growth, and indicates long-term undernutrition. Wasting indicates significant recent or current weight loss, often resulting from severe disease or emergency conditions. Underweight can imply stunting or wasting. Each of these can be categorized as mild, moderate, or severe. Among LMICs, roughly 30 percent (182 million) of all children are stunted or underweight, but regionally there is significant variation (see Figure 1).<sup>1</sup>

Figure 2

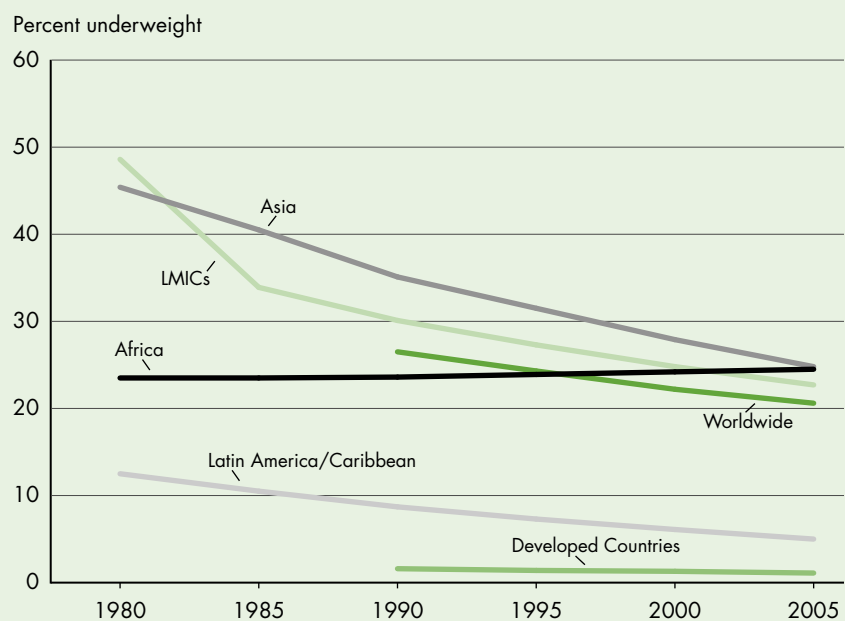
## REGIONAL TRENDS IN PRESCHOOL STUNTING PREVALENCE



SOURCE: United Nations Standing Committee on Nutrition (SCN), *Fifth Report on the World Nutrition Situation: Nutrition for Improved Development Outcomes* (Geneva: SCN, 2004).

Figure 3

## REGIONAL PREVALENCE OF PRESCHOOL UNDERWEIGHT



SOURCE: United Nations Standing Committee on Nutrition (SCN), *Fifth Report on the World Nutrition Situation: Nutrition for Improved Development Outcomes* (Geneva: SCN, 2004).

Aggregate stunting and underweight rates have fallen in the last decades, but progress has been uneven across regions (see Figures 2 and 3). Despite dramatic reductions in stunting in Asia, in some Indian states stunting rates remain between 50 percent and 60 percent; in sub-Saharan Africa, underweight is on the rise.<sup>2</sup>

### Overnutrition

Overweight and obesity are measures of excess weight relative to height for children and adults (measured by body mass index (BMI), or weight/height<sup>2</sup>). The alarming worldwide increase in overweight and obesity, known as the “nutrition transition,” is due primarily to increased intake of fats and processed carbohydrates and reduced physical activity (see Figure 4).<sup>3</sup> Individuals experiencing intrauterine growth retardation or stunting in the first two years of life face a higher risk of obesity and/or NCDs in adulthood: diabetes, hypertension, stroke, cardiovascular disease, and some forms of cancer.

NCDs, often precipitated by poor nutrition, presently account for 60 percent of global deaths and 46 percent of the global burden of disease—the overall impact of diseases and injuries at the individual and societal level. By 2020, NCDs and obesity are predicted to cause 73 percent of all deaths and 60 percent of all disease. Today, about 1.1 billion adults are overweight and 300 million obese. Among school-age children, 155 million are overweight and 40 million are obese.<sup>4</sup>

### Maternal Nutrition

Maternal nutritional status is intimately related to reproductive health. Malnourished mothers suffer higher rates of morbidity and mortality, and are more likely to experience poor pregnancy outcomes, such as low birth weight, birth defects, hemorrhage, eclampsia, and other high-risk deliveries, all of which influence infant survival and child development.<sup>5</sup> Although a mother’s energy and nutrient needs increase during pregnancy and lactation, mothers in many LMICs actually consume less food during pregnancy (“eating down”), often out of fear of labor complications resulting from a larger fetus. This can cause insufficient pregnancy weight gain and micronutrient deficiencies, which, in turn, affect child outcomes.

## Micronutrient Deficiencies

Deficiencies in key vitamins and minerals—especially iron, vitamin A, zinc, and iodine—are associated with disease prevalence and severity. Iodine deficiency disorders can result in irreversible mental retardation, goiter, reproductive failure, and increased child mortality.<sup>6</sup> Iron deficiency affects pregnancy, impairs cognitive development, and reduces work productivity.<sup>7</sup> Severe iron-deficiency anemia increases the probability of disability and death among women of childbearing age. Vitamin A deficiency weakens immunity and leads to infection, a range of eye problems including blindness, and an increased risk of childhood disease and death. Vitamin A deficiency can increase child mortality by an average of 23 percent.<sup>8</sup> Zinc deficiency adversely affects physical and reproductive growth, and neurodevelopment.

Despite progress in the mid-1980s to address micronutrient deficiencies, they persist. Worldwide, 2 billion people suffer from deleterious effects of micronutrient deficiencies: 37 percent suffer from anemia, 35 percent are at risk for iodine deficiency, and 20 percent are at risk for zinc deficiency. Vitamin A deficiency affects 25 percent of preschool-age children and 18 percent of women.<sup>9</sup>

## Why Does Malnutrition Matter?

### Disease-Nutrition Interaction

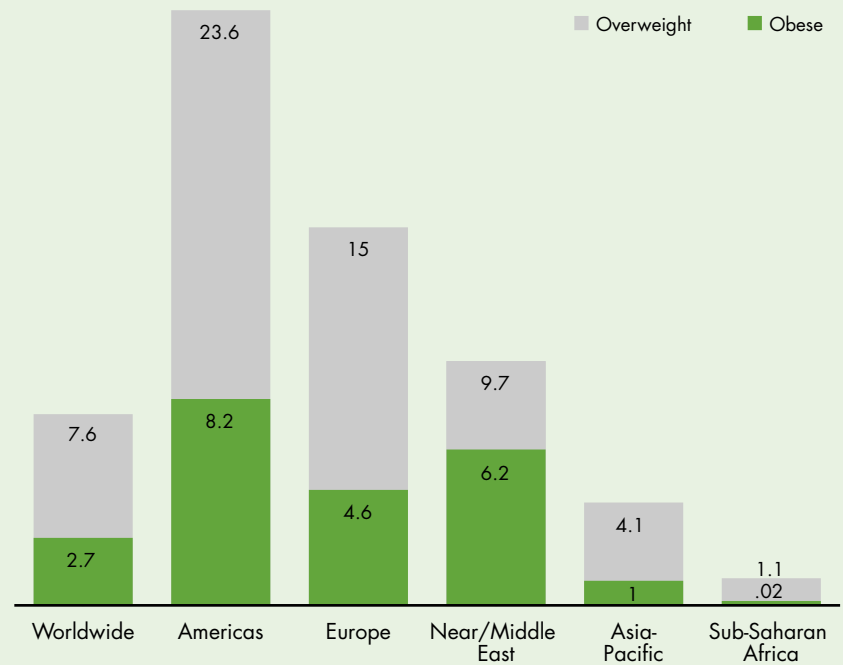
Malnourished children suffer from impaired immunity, which increases the likelihood of infection, disease, and death. Disease, in turn, can cause poor nutrient absorption, altered metabolism, and lack of appetite, leading to inadequate nutritional intake. In fully 56 percent of all child deaths, undernutrition is a contributing factor; 83 percent of these deaths are associated with mild or moderate rather than severe malnutrition.<sup>10</sup> Eliminating malnutrition would remove one-third of the global burden of disease and increase child survival.<sup>11</sup>

### Economic/Productivity Concerns

The cost of malnutrition is high, both for individuals and nations. Malnutrition implies high budget outlays for health services and lost gross domestic product (GDP) as a result of diminished productive potential. Low- and middle-income countries lose an average of 0.6 percent of GDP to iron

Figure 4

## PERCENT OVERWEIGHT AND OBESE AMONG SCHOOL-AGE CHILDREN



SOURCE: United Nations Standing Committee on Nutrition (SCN), "Overweight and Obesity," *SCN News* 29 (Late 2004-Early 2005).

deficiency in adults. Including iron-deficiency induced damage to children's cognitive and motor development brings the economic loss to 4 percent of GDP.<sup>12</sup> The estimated economic cost of obesity to LMICs is 2 percent to 5 percent of GDP.<sup>13</sup> Early childhood stunting is closely associated with poor cognitive and educational performance in children.<sup>14</sup> Low birth weight has been shown to reduce IQ scores by 5 points; stunting reduces IQ by 5 to 11 points; and iodine deficiency reduces IQ by 10 to 15 points.<sup>15</sup>

While the human and societal costs of malnutrition are large, the costs of addressing the problem proactively are small and the benefits are dramatic. Beyond reducing mortality, decreased malnutrition can lead to higher school completion rates, better learning outcomes, and, in turn, higher wages. A 1 percent increase in height has been associated with a 4 percent increase in total wages. Eliminating anemia would contribute to an estimated 5 percent to 17 percent increase in lifetime earnings, representing as much as 2 percent

of GDP in the worst affected communities. The World Bank estimates that preventing micronutrient deficiencies would increase GDP by at least \$2.5 billion per year in India and China.<sup>16</sup>

### What Causes Malnutrition?

The immediate causes of malnutrition are inadequate dietary intake and disease. Underlying causes include inadequacies in access to food; in health services and a sanitary environment; and in people's caring practices for their children, eating behaviors, and personal hygiene.

The risk of malnutrition is especially high during fetal development and during a child's first two years. With children's growth rates, nutritional requirements, and susceptibility to infection at their highest during this time, adverse conditions are more likely to slow growth and cognitive development, and the resulting damage is largely irreversible. Interventions during this period have the highest potential for impact (see Figure 5).

### Solutions

Economic growth alone cannot reduce malnutrition in the short or medium term. According to one study, each percentage point of GDP growth accounted for about a 0.1 percent annual reduction

in underweight.<sup>17</sup> At this rate, eliminating malnutrition would take many decades and would leave many countries far short of attaining the first Millennium Development Goal, which seeks to halve hunger and malnutrition by 2015.

The following interventions, however, can significantly accelerate progress in reducing global malnutrition.

### Growth Monitoring and Promotion and Behavior Change Communication

Growth monitoring and promotion programs involve the regular weighing of young children to identify growth faltering—an early sign of malnutrition—before it becomes serious. Effective programs depend on a mother's understanding of the importance of adequate growth and initiation of improved feeding and care practices.

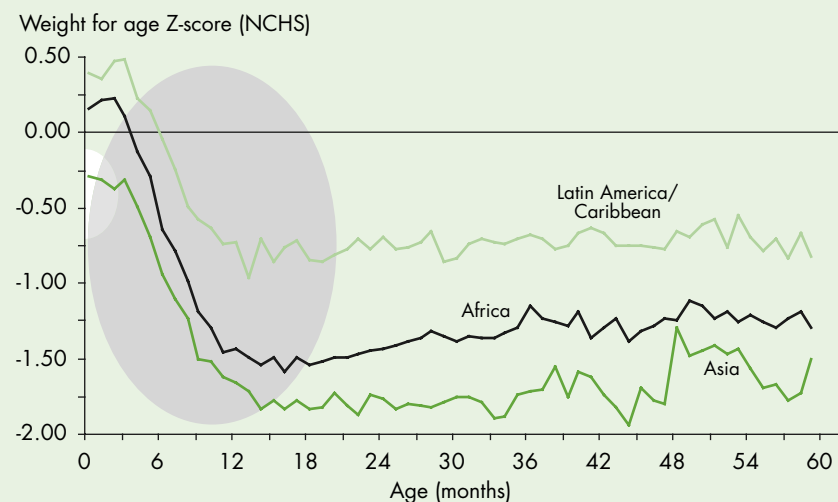
When accompanied by successful behavior change communication, growth monitoring and promotion programs have the potential to bring about a 3-percentage point reduction in stunting per year (when observed over five years).<sup>18</sup> These programs identify deleterious caring and feeding practices and sensitively help caretakers improve such practices expeditiously in ways that do not require additional food or resource investments. Improved practices can include six months of exclusive breastfeeding and continued breastfeeding during bouts of infant diarrhea and other illnesses. Behavior change communication programs emphasize the benefits of new practices and help people overcome the practical, social, and cultural constraints that limit the adoption of these practices.

Community-based nutrition programs such as Honduras' flagship program, *Atención Integral a la Niñez-Comunitaria*, and similar efforts in Madagascar, Indonesia, Bangladesh, India, Senegal, and elsewhere, have combined growth monitoring and behavior change activities with preventive health and in some cases food supplements at a cost ranging from US\$11 to \$18 per child per year. This is significantly cheaper than food supplementation (about \$36 to \$172 to provide 1,000 kcal/day) or early child development/child care programs with food (\$250 to \$412 per participant per year).<sup>19</sup>

More generally, education, and particularly women's education, can have a powerful impact on changing nutritional behaviors. A study of 63 LMICs found that improvements in women's

Figure 5

### THE WINDOW OF OPPORTUNITY FOR ADDRESSING UNDERNUTRITION



SOURCE: World Bank, *Repositioning Nutrition as Central to Development: A Strategy for Large-Scale Action* (Washington, DC: World Bank, 2006), based on Roger Shrimpton et al., "The Worldwide Timing of Growth Faltering: Implications for Nutritional Interventions," *Pediatrics* 107, no. 5 (2001).

education were associated with a roughly 50 percent reduction in child malnutrition between 1970 and 1995.<sup>20</sup>

### **Food or Cash Provisions**

Many governments provide food or cash transfers as a safety net for low-income families, or more broadly, during emergencies for purposes of social welfare and nutritional improvement. Transfers frequently take the form of commodity distribution programs using food surplus or food aid supplies for households and individuals meeting means-test criteria. Some countries make freely available lower-status commodities, which only the poor would purchase, such as sorghum in Bangladesh, coarse *baladi* bread in Egypt, and simply packaged edible oil in Tunisia.

Where governments have the capacity to employ means tests and to register and reimburse retailers, food stamps or food coupon programs are the common distribution mechanism and “smart cards” are increasingly used to enhance program management. Since 1972, the U.S. government has also operated the Special Supplemental Nutrition Program for Women, Infants and Children (WIC), which subsidizes the purchase of particular nutritious foods and provides counseling for 7.5 million economically eligible pregnant or postpartum women and for children under 5. These programs have been found to have positive impacts on nutritional status.<sup>21</sup>

Given the high proportion of income spent on food by low-income households in LMICs, and the logistical and administrative difficulties of managing food programs, some governments have provided cash payments to eligible households rather than food. One such program, the conditional cash transfer, has become, in a growing number of countries, a staple of broader social protection policies designed to reduce poverty and vulnerability. This transfer program pays poor families to participate in certain activities, usually associated with education and health, and may also include conditions that address knowledge about appropriate child care and eating habits.

Food-for-work or cash-for-work programs, designed as employment of last resort for particularly needy households and individuals, have also been frequently utilized by LMICs and by industrialized countries during economic depressions to provide a nutritional safety net. Those engaged in these

programs generally help build needed infrastructure, such as roads.

Nutrition projects in many countries provide food supplements for young children and pregnant and lactating women. Nutrient-dense supplements have sometimes been targeted specifically to young children and pregnant women at nutritional risk. Where such supplements are produced locally, effective and feasible means have been found to fortify them with micronutrients.

Food supplements also are frequently provided in primary schools. School meals have been found to increase enrollment and attendance in many countries, and, in combination with other school nutrition and health inputs, such as micronutrients and deworming, can increase returns on educational investment.<sup>22</sup>

### **Micronutrient Interventions**

Addressing micronutrient deficiencies is not only highly cost-effective, but is also among the more manageable community-based interventions. The Copenhagen Consensus, a set of international priorities developed in 2004 by a panel of leading international economists using cost-benefit criteria, identified addressing micronutrient malnutrition as its second highest priority, preceded only by combating HIV/AIDS.

National programs to reduce micronutrient malnutrition have used two primary strategies: supplementation and food fortification, with some additional attention to dietary diversification and genetic modification of food crops to boost micronutrient content, as with Golden Rice fortified with vitamin A. Iodized salt is the most common fortified food, but also recommended is fortification of food staples including sugar and wheat flour and the micronutrient enrichment of locally prepared food supplements in community-based programs. Successful fortification programs utilize appropriate food commodities that are regularly consumed and centrally processed to ensure quality. Since 1990, access to iodized salt in LMICs has increased from 20 percent to 70 percent.<sup>23</sup> Thanks to this wide accessibility, the severe effects of iodine deficiency—cretinism and endemic goiter—are now rare.

International best practices in micronutrient supplementation prioritize vitamin A supplementation for children ages nine to 60 months (two

doses yearly), and iron-folate supplementation for women who are pregnant or in the early months of lactation (daily) and for adolescent girls (weekly). In Nicaragua, iron supplementation resulted in a 33 percent decrease in anemia prevalence among pregnant women and a 6 percent drop among children under 5.<sup>24</sup> Randomized trials have shown the positive effects of zinc supplementation in the prevention and treatment of acute diarrhea and pneumonia.<sup>25</sup>

An increasingly popular means of providing micronutrients to young children who are unable to swallow tablets and who are averse to syrups, is Sprinkles, inexpensive powdered micronutrients in single-dose packets that are sprinkled onto foods. Sprinkles provide full daily micronutrient requirements for only 88 cents per child per year, are well accepted by mothers and children, and have been found effective in reducing anemia.<sup>26</sup>

### **Addressing the Nutrition Transition**

Solutions to overweight and obesity often focus on promoting physical activity; on changing eating habits to less processed foods lower in fat, sugar, and salt; and on food policy. Brazil's national school meals program requires that 70 percent of foods must be unprocessed or minimally processed to mitigate the effect of processed carbohydrates on stimulating appetite. Finland, which earlier had the world's highest heart disease rate, used positive incentives such as intercity cholesterol-cutting competitions, set aside urban areas for exercise, and subsidized physical activities. Today Finnish men are living seven years longer, and women six years longer than in the 1970s.

### **Nutrition Interventions in the Presence of HIV and Malaria**

While HIV/AIDS infections have particularly devastating impacts in countries with high rates of malnutrition and limited access to medical treatment, some nutrition interventions have been found to increase survival rates. Appropriate infant feeding practices can limit mother-to-child transmission of HIV, occurring in an estimated 30 percent of infants born to HIV-positive mothers. WHO/UN recommendations advocate for replacement feeding by HIV-infected mothers when replacement milk is acceptable, feasible, affordable, sustainable, and safe; otherwise, breastfeeding is recommended during the

first months of life. In Tanzania, an integrated set of infant feeding counseling tools—a brochure on feeding methods, question-and-answer guide for counselors, and a counseling card on risk of transmission—has been socially and culturally acceptable.<sup>27</sup>

While the importance of micronutrients in the prevention and treatment of childhood infections is well known, evidence is emerging that micronutrient interventions may also slow the progression of HIV to AIDS.<sup>28</sup> Research is underway to assess the possibility of increased effectiveness and/or decreased side effects when micronutrient supplementation is added to antiretroviral therapy.<sup>29</sup>

Despite the noted benefits of micronutrient supplementation, there is evidence that iron supplementation can exacerbate malaria among young children.<sup>30</sup> Revised WHO guidelines now recommend that in place of universal supplementation, iron and folic acid supplementation in malaria-endemic areas target only those who are anemic and at risk of iron deficiency.<sup>31</sup>

### **Why Isn't More Being Done?**

Many explanations have been offered for the inadequacy of national and international responses to malnutrition, among them: the concentration of malnutrition among low-income populations with minimal political power; the limited physical visibility of many nutritional deficiencies (“hidden hunger”); the absence of adequate explicit local demand for nutrition services; the absence of a sectoral “home” for nutrition among government departments or ministries; and the failure by many policymakers at both the global and country levels to understand the nature and magnitude of malnutrition, its social and economic consequences, and the availability of cost-effective solutions.

### **Prerequisites for Adequate Responses**

Addressing malnutrition, particularly in LMICs, requires, ideally, a combination of equity-oriented development policies and the design and implementation of cost-effective interventions discussed above. These must be coupled with effective support systems such as capacity building, supervision, operations research, and monitoring and evaluation, and require adequate local ownership. Such program implementation requires, in turn, that nutrition have a more prominent position on the policy agenda of governments, development agen-

cies, and the private sector. Organizing multisectoral efforts to achieve the first Millennium Development Goal may be an effective way to raise the profile of nutrition. External factors such as a natural disaster or economic crisis, or the emergence of a charismatic champion, have precipitated effective nutrition action even where nutrition has otherwise failed to emerge as a development priority.

### Recommended Actions

All countries should encourage economic growth while promoting policies that will improve the well-being of the poor. Even with economic growth, however, a number of measures specific to nutrition are essential if the nutritional status of the world is to improve over the next decade.

#### For Low- and Middle-Income Countries

##### Short term:

- Incorporate growth monitoring and promotion, nutrition-related behavior change communications, and micronutrient supplementation into existing health services.
- Expand and complete the task of universal salt iodization in all countries and ensure that these become permanent and self-sustaining measures.
- Provide appropriate nutrition counseling in emergencies and in areas with high rates of HIV and/or malaria.

##### Medium term (2-5 years):

- Mount community-based nutrition projects targeted to young children, pregnant women, and adolescent girls, combined where possible with early childhood education.<sup>32</sup>
- Develop conditional cash transfers, food stamp programs, or other safety nets.
- Fortify commonly consumed, centrally processed foods such as cereal flours, cooking oils, and condiments with needed micronutrients.

##### Long term (6-10 years):

- Expand female education.
- Promote the application of technologies to enhance the micronutrient content of staple food crops where appropriate.

#### For High-Income Countries and “Nutrition Transition” Countries

- Introduce diet and exercise-related motivational programs in schools, workplaces, and communities.
- Improve meal programs and monitor food purchase options in schools, and improve food labeling.
- Consider intercity cholesterol-cutting competitions.

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