Malnutrition: Future Challenges and Lessons from the Past

Harold Alderman[1] and David E. Sahn[2]

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[1] International Food Policy Research Institute (IFPRI), Washington, DC
[2] Cornell University, Ithaca, NY

1. Introduction: Past progress and future challenges

Thirty years ago the world was gripped by the Ethiopian famine that led to an estimated half million deaths (de Waal 2002). This was one in a series of devastating famines that killed millions of people in the last 50 years, including over 3 million deaths in North Korea in the latter half of the 1990s, due to a combination of weather and government policy; millions of people who died from famine in Cambodia in 1979, as a result of the brutality of the Khmer Rouge government; the great Sahelian famine from 1968 to 1972 that resulted from drought; and more recently the starvation and disease that has afflicted the Democratic Republic of Congo, due to the civil strife around the beginning of the 21st century. The calamity in Ethiopia, as well as others resulting from drought, war and conflict, ill-advised government food policies, or, more often, a combination thereof, have occurred despite that the fact that food production and supply at global, and often regional, levels have more than kept pace with the rapid growth in the world's population. This growth in supply defies the apocalyptic fears of Malthus (1798) in his "An Essay on the Principle of Population" that famine was inevitable on a massive scale, and echoed by Ehrlich (1968), following a drought in North India in 1965 and 1966. Indeed, Malthus failed to foresee the remarkable increase in agricultural productivity, resulting from technological change and embodied in the Green Revolution and, more recently, the development of biotechnology.[3] Despite these remarkable successes, famine has occurred due to

[3] In addition, Malthus failed to anticipate the reductions in marketing and related transactions costs due to progress in transportation and communication that allowed for intercontinental trade in grain, as well as relatively rapid relief efforts on a global scale.

what Amartya Sen (1981) argued were inequalities in access, as embodied in his capabilities approach to understanding human deprivation and, thus, human rights and freedom.

Although the horror of intermittent famine induced by social and economic factors has garnered a great deal of public attention, the reality is that even without famine induced by war, drought or bad policy, widespread chronic malnutrition is the norm; year after year, decade after decade, chronic undernutrition grips many of the poorest countries of the world. It is these persistently high levels of malnutrition that is the focus on this paper. Most recent estimates from 2014 indicate that there are 159 million, or approximately 30 percent of children under the age of 5 years, who are stunted—a measure of chronic and long-term malnutrition (World Bank 2016a). This failure to grow is considered the best indicator of the general health status of children and is strongly correlated with early death and a range of deleterious functional consequences, both contemporaneous and over the life course. As we will discuss in more detail below, these consequences include a higher probability of impaired cognitive performance as children and as adults, reduced lower physical productivity, and lower earnings.[4]

The doggedly high levels of stunted children persist despite the fact that their numbers have decreased greatly from 255 million in 1990, when the prevalence rate for stunting for a child under 5 years of age was around 50 percent. The decline in the number of stunted children has occurred throughout the world, but has been most dramatic in countries of East Asia and the

[4] There are a range of other nutritional indicators that capture different aspects of undernutrition, such as wasting, a measure of acute malnutrition;, and underweight, which is a composite measure of stunting and wasting.

Pacific, where the number of malnourished children have declined from 81 to 16 million. The next best performing region for the reduction of child stunting has been South Asia, where the numbers of stunted children fell from 100 to 65 million. The news from West and Central Africa is most discouraging, with the numbers of stunted children increasing from 20 to 28 million (Table 1).

Table 1: Stunting—Regional Numbers of Children Affected and Share of Total Number

	1990		*2014*	
Region	millions	*Share of total*	*millions*	*Share*
Sub-Saharan Africa (West & Central)	19.9	7.9	28	18.2
Sub-Saharan Africa (Eastern & Southern)	23.6	9.4	26.9	17.5
South Asia	100.1	39.9	64.6	42.1
East Asia & Pacific	81.1	32.3	15.9	10.4
Latin America & Caribbean	12.6	5.0	5.5	3.6
Middle East & North Africa	13.4	5.4	9.6	6.3
CEE/CIS			3.1	2.0
Total		100		100

Source: UNICEF (2015).

Beyond stunting, there are two other widely used measures of protein/calorie malnutrition: that of wasting, as measured by the weight-for-height of the child, and the closely related share of children who are underweight, measured by weight-for-age, which in fact is a composite indicator of stunting and wasting. For all these indicators, there are clear and deleterious consequences. A recent study by Olofin et al. (2013), for example, estimated that the odds ratio for under-5 mortality of children with any of the three most common measures of undernutrition is highest for wasted children (those with low weight-for-height) followed by underweight (low weight-for-age), and then by stunting (low height-for-age), although all three common measures of undernutrition were associated with the deaths among the 53,000 children in their study. They also found that although severe undernutrition—more than 3 standard deviations (SD) below WHO (2006) medians for well-nourished populations—was associated with the greatest risk of child mortality; risks were still elevated for children with undernutrition 1 to 3 SD below the respective references. This point was also made with earlier data by Pelletier et al. (1995), who pointed out that because there are far more children with moderate underweight, 83 percent of their estimate of the contribution of underweight to mortality came from mild (1 SD below) to moderate (2 SD below) underweight rather than severe underweight.

While various measures of linear growth and weight gain have been the core objectives and indicators of nutrition policies and programs, during the 1970s and 1980s the prevailing concern, especially among economists, was that of food security. This likely reflected a combination of data limitations, as well as the growth and importance of food-related interventions, such as food aid and food stamps (in the US), and the active intervention of policymakers in food markets. Although many of these food-related programs and policies were motivated by concerns other than nutrition, such as the promotion of agriculture or the provision of cheap wage goods to urban consumers, economists in the 1970s and 1980s nonetheless often focused on food intakes and food security concerns of the poor and vulnerable groups. For example, Reutlinger and Selowsky's (1976) influential monograph on malnutrition and poverty focused on the gap between calorie intakes and requirements. This attention to calorie intakes already accommodated a shift from an earlier concern about a protein gap that was motivated by statistical analysis indicating that diets adequate in calories usually also meet protein needs

(Sukhatme 1974). As better household data became available in the 1980s and 1990s, using Living Standards Measurement Studies, Demographic and Health Surveys, and Multiple Indicator Cluster Surveys, empirical analysis was adapted to a more comprehensive conceptual model that indicated inadequate food access as one of three underlying determinants of undernutrition, the other two being inadequate care and insufficient health and sanitation contributing to synergistic effects of infection and disease in causing malnutrition (UNICEF 1990). This model has been modified—for example, in Black et al. 2013—and incorporated into an economic model of health production (see below), but the basic point that nutrition is broader than nutrient consumption is now a consensus view.

Moreover, the 1980s and 1990s witnessed a greater appreciation of the fact that addressing concerns over food access as measured using indicators of macronutrient (protein and energy) intake was not sufficient. Instead, there was an emerging appreciation of the role of micronutrients such as vitamins and minerals, and an awareness that these deficiencies were often left unresolved, even when protein and energy intakes were sufficient. Moreover, new survey data showed that micronutrient deficiencies afflict large shares of the global population. Thus, new policy initiatives were required to address the fact that, generally, the causes and potential responses to micronutrient deficiencies differ from stunting (and underweight), resulting in a low correlation between these nutritional indicators. Most common is iron deficiency, which afflicts more than one and a half billion people worldwide (WHO 2008). Around 47 percent of preschool age children and around 42 percent of women worldwide suffer this affliction. Regional estimates indicate an even worse scenario: in Africa and Southeast Asia, two-thirds of preschoolers are afflicted with anemia, and the prevalence among pregnant women is 57 percent and 48 percent, respectively, in the two regions. Micronutrient deficiencies also include vitamin A deficiency, which affects 250 million preschool-age children, resulting in blindness in between 250,000 and 500,000 children, with half of them dying within a year of losing their vision (WHO 2016); and iodine deficiency disorders, which contribute to cognitive impairment among children. Estimates suggest that nearly 30 percent of children, or around 240 million worldwide, have insufficient iodine intake, and among these, 5 percent have intakes that are severely deficient (Andersson and Zimmermann 2012).

Despite considerable progress, there remain challenges in addressing problems of undernutrition, as well as the startling increase in the prevalence of overweight adults, and to a lesser extent, children. In 2014 there were a staggering 1.9 billion overweight adults, nearly a third of whom were obese. Among the under-5 population, the numbers of those who are overweight has increased from 31 to 41 million. The problem of overweight, in turn, is strongly associated with the growing epidemic of noncommunicable diseases (NCDs), such as cardiovascular disease, diabetes, and cancers. So, although most of this paper concerns problems of undernutrition, it is also the reality that the two types of malnutrition jointly exist in the same countries, communities, and even the same households. In part, this reflects that the many of the causes of overweight and undernutrition are either the same or similar and are linked with poverty and lack of education or knowledge, as well as food markets that lack a reasonably priced diversity of fruits, vegetables, and other healthy food options. As we will discuss, however, while undernutrition and overnutrition can jointly result from changes that are occurring in the local and global food systems, addressing their causes can be quite different and require different policy responses. Perhaps more important, however, is the evidence that we will present that the same in utero and early childhood stress may lead to stunting as a child and later contribute to an increase in the risk of overweight and obesity as an adult, suggesting that the fight against over- and undernutrition needs to be tackled simultaneously.

In the remainder of this paper, we discuss in Section 2 the relationship between economic growth, incomes, and chronic undernutrition. Section 3 will present a model, and discuss the determinants of malnutrition and their policy implications. This will include a brief presentation of a conceptual framework that introduces the nutrition production function and the concept of the critical period for investing in nutrition. Section 4 will then discuss the evidence in support of greater investments to reduce undernutrition in developing countries, followed by Section 5 in which we discuss what we know about nutrition-sensitive interventions. Section 6 then addresses briefly the growing problem of overweight and non-communicable chronic disease. In Section 7, we conclude, briefly focusing on emerging challenges and priorities.

2. Economic growth, incomes and undernutrition

Cross-country evidence from Africa indicates a strong relationship between Gross National Income (GNI) per capita and malnutrition (Figure 1), despite considerable deviations around the fitted line. This applies to both stunting, as well as micronutrient deficiencies.[5] Similar patterns are observed in other regions of the world, but such curves are not necessarily constant over time. For example, there is an upward shift in the curve that depicts the relationship between

[5] Alderman and Linnemayr (2009) show that the prevalence of anemia, an important biomarker for iron deficiency anemia, decreases at approximately one-quarter of the rate of GNP growth.

GDP and stunting over the decades. This illustrates that better nutritional outcomes are associated with the same levels of income at present than in the past.[6] This is presumably due to a combination of technological change, price trends, and improved policies and programs addressing chronic malnutrition at any given level of GDP per capita.

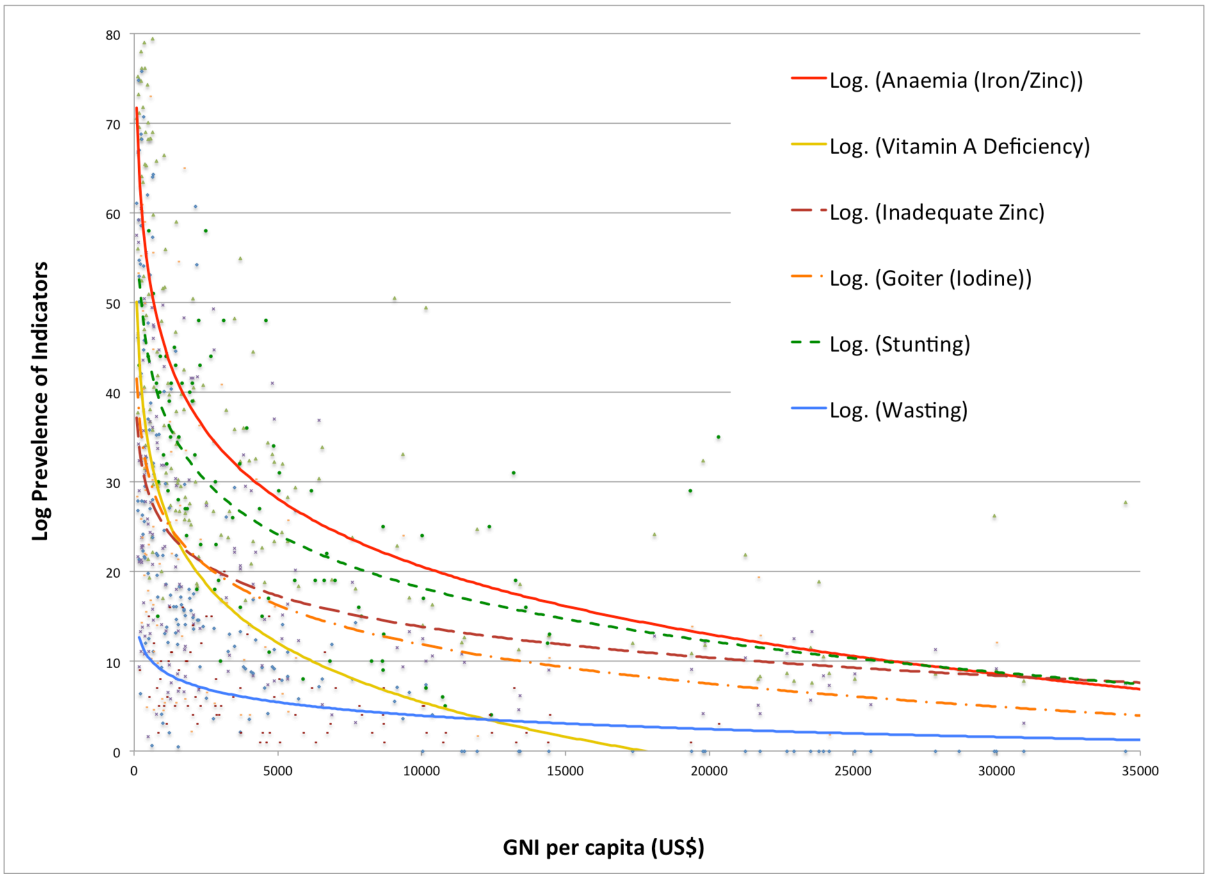


Figure 1. Relationship between GNI per capita and malnutrition for Africa.

Source: Barrett and Bevis (2015).

[6] This is discussed in the case of nutrition by Haddad et al. (2003). The same phenomenon is also found in terms of life expectancy where, over time, higher life expectancy is found for a given level of GDP (Preston 1975; Deaton 2003).

One important caveat is that the relationships shown are not necessarily causal, both because other factors may be jointly contributing to economic growth and reductions in malnutrition, and because the direction of causality in the association between malnutrition and economic performance may operate in both directions. However, can we draw inferences from the cross-country evidence about how economic growth within a country will translate into reductions in malnutrition? This is a particularly complex question, since it requires consideration of both the incidence or the distribution of the benefits of economic growth and of reductions of malnutrition, which may not be the same.

A number of studies have explored the impact of changes in GDP on nutritional outcomes. Smith and Haddad (2015) used household survey data to look at the relationship between changes in GDP per capita and share of the population that are stunted over long-term spells for a large number of countries. Their results indicated that the long-run elasticity of stunting relative to improvements in GDP per capita is 0.63, quite close to what has been observed based on cross-country comparisons above, but also similar to long-term elasticity estimates from Ruel et al. (2013) and Headey (2013). Moreover, these cross-country results are similar to those observed, using household expenditures instrumented by assets (Haddad et al. 2003).

These high long-run elasticities, of course, capture a range of factors that influence nutrition such as infrastructure (including access to clean water and health facilities), levels of education, and governance, all of which are expected to change with income, but often with a substantial lag. Thus we are also interested in an equally pertinent consideration of how changes in malnutrition respond to changes in household incomes over a shorter-term period, for example, looking at spans of 5 years rather than 10 to 20 years. Smith and Haddad (2015) also estimated such a parameter, which they report to be a far more modest 0.17. Alderman et al. (2013) suggest more modest gains: a doubling of GDP per capita would reduce stunting by 14.8 percentage points and reduce the share of children who are underweight by only 11.4 percentage points, implying an elasticity of only 0.11. The report further points out that examining individual country experiences shows a great deal of heterogeneity in terms of the relationship between GDP growth and nutritional improvement, and they conclude as follows: "The overall takeaway finding from this analysis is that growth has in and of itself little impact on reducing chronic malnutrition." (2013, 52). This conclusion is perhaps no more relevant than in India, where around one-third of the world's stunted children reside (Alderman et al. 2013, p. 50). Subramanyam et al. (2011) reported that changes in state-level rates of malnutrition are only weakly related to state economic growth.

In considering this assessment, there are undoubtedly many explanations. One is that although GDP growth's impact on nutrition remains important over the long term, improvements in GDP per capita may not lead to household-level increases in incomes, especially among those households where malnutrition is most likely. That is, income growth measured using GDP figures may not inform about the distribution of aggregate income growth. The growing concern over the lack of inclusive, or pro-poor, growth is now well documented (AfDB 2012; Ravallion 2004) and clearly represents a formidable policy challenge. Therefore, to the extent that the growth incidence curves suggest that income growth is more concentrated among households at the upper end of the income distribution, GDP growth may not result in substantial improvements in the material level of well-being of households who are most likely to be poor and where malnutrition is most prevalent. However, despite the variation across countries, there is appreciable evidence that growth does lead to commensurable reductions in poverty (Ravallion 2001; Dollar and Kraay 2002; Ravallion 2013; Dollar et al. 2015). Thus, growing inequality does not seem to be the main explanation for the modest tracking of nutrition and GNP growth.

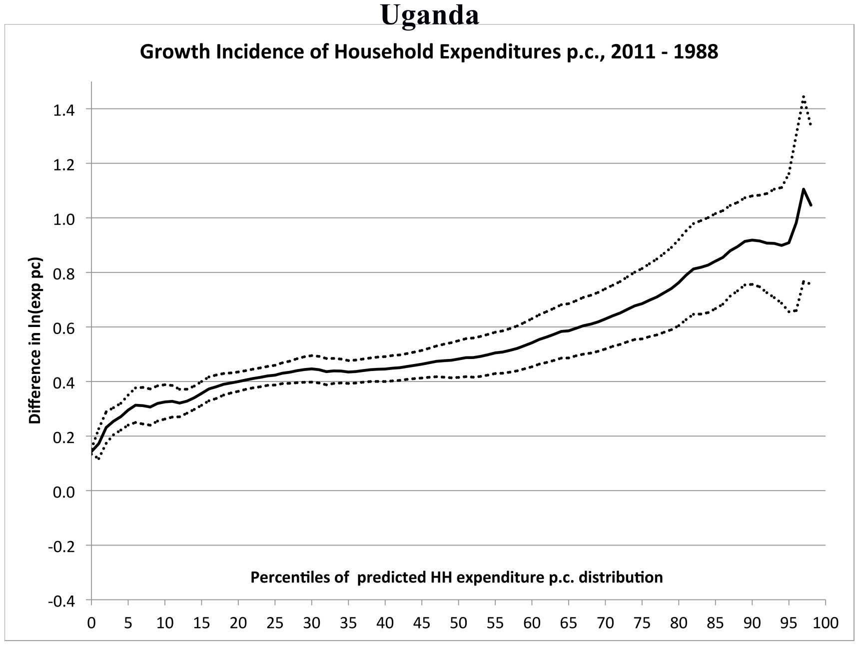
Since evidence from the relationship of expenditures and nutrition using household surveys shows that, even among countries that have witnessed substantial reductions in the number of the poor, these efforts often have not reduced undernutrition, we need to look further at the income and nutrition nexus. Country experiences suggest that the ability to move individual households out of income poverty is neither necessary nor sufficient to eliminate the scourge of undernutrition. As we will discuss more in the next section, this is actually not unexpected, given that commodities, especially food, are of limited importance in the nutrition production function; a household that has been able to achieve a moderate increase of income may not necessarily be able to change access to quality health services or the sanitation environment. Thus, higher incomes of the poor may not alter other behaviors, practices, and access to services and market goods that, in the short term, are critical to improving nutritional outcomes, especially for children. The remainder of this chapter addresses these services and behaviors.

One descriptive analysis that points to the lack of consistency between the distribution of benefits of economic growth on poverty and nutritional outcomes is found in the work of Sahn and Younger (2016), who compare the incidence of income growth and nutritional improvement using standardized heights. The comparison for growth incidence curves for income with those for children's heights is illustrated in Figure 2 for Uganda. The top panel shows that, over a two-decade period, expenditure per capita increased throughout the distribution, but the increase was concentrated at the higher end of the expenditure distribution. The lower panel, in contrast, shows that the distribution of height gains has been fairly uniform across the height distribution in Uganda. Overall, the results from studying nine countries in Africa, Asia, and Latin America led to three conclusions: (1) distributions of income growth differ from those for gains in nutrition; (2) improvements in nutrition tend to be more concentrated among those at the lower end of the income distribution than is the case with growth in incomes; and (3) we cannot predict what the nutritional improvement curves will look like based on the (income) growth incidence curves that economists and those concerned with income inequality usually examine. Thus, these findings add further evidence that improvements in nutrition are often weakly linked with income growth in the aggregate, but the benefits of income growth in terms of material well-being and nutrition are not necessarily expected to accrue to the same households.

3. Determinants of nutritional outcomes

In this section, we will discuss two related issues: first, is the underlying nutrition production function that provides insight into the role of inputs in determining nutritional outcomes, and second, that there are "critical periods" in the determinants of nutrition that persist across the entire life course. In combination, these two issues provide insight into the weak relationship between short- and medium-term improvements in income and reductions in stunting and underweight, as well as provide guidance on the types of investments and policies that help realize the goal or reducing undernutrition without waiting decades for GDP growth to change

Uganda



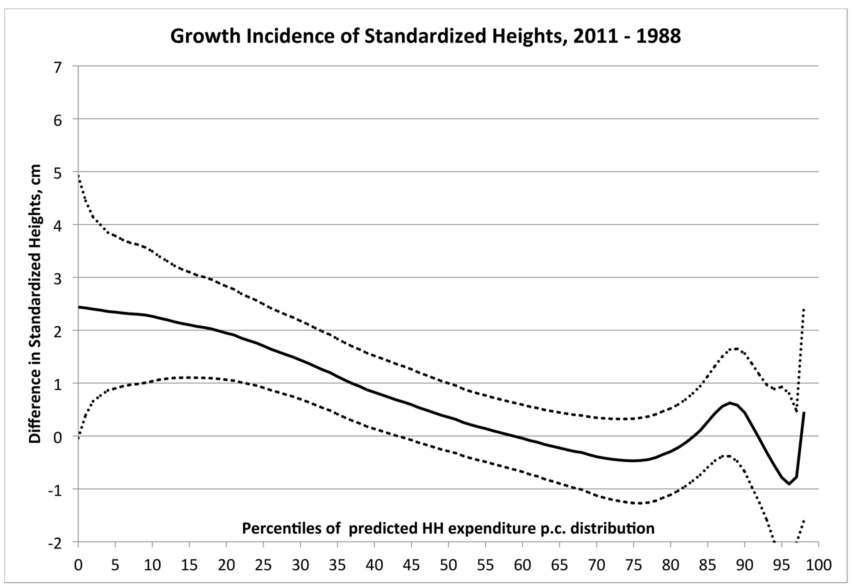


Figure 6.2. Growth incidence curve for Uganda, 1998–2011 (top), and growth incidence of standardized heights for Uganda, 1998–2011 (bottom).

Source: Authors' calculation, Uganda Integrated Household Survey, Uganda Panel Household Survey, and Demographic and Health Surveys.

the economic and social landscape of the poor communities where the malnourished are concentrated.

3.1 Nutrition production function

A simple nutrition production function, which follows Grossman's (1972) model of health (or nutrition) as a stock variable, can be conceptualized as follows:

$$N_{it} = N(N_{it-1}, Z_{it}^{f}, Z_{it}^{nf}, C_{it}, T_{it}^{H}, E_{it}, M_{it}, BF_{it}, HB_{it}, S_{t}) \quad (1)$$

Current nutritional status, N_{it} (e.g., stunting or underweight), is determined by the previous period's nutrition stock, N_{it-1}, as well as a vector of nutrients consumed from foods, Z_{it}^{f}; nutrient consumption from non-foods, for example, in the form of micronutrient supplementation programs such as the distribution of vitamin A capsules, Z_{it}^{nf}; other consumption goods, such as shelter and the general living/housing environment, C_{it}; time devoted to the maintenance of health, T_{it}^{H}; the education of person, E_{it} (or her/his caregivers); consumption of medical and related preventative health services, M_{it}; the duration/intensity of breastfeeding (for children under 36 months), BF_{it}; a range of other health behaviors, such as smoking, alcohol consumption, and sex (generally for adults), HB_{it}; and the sanitary environment, including water quality and access to latrine and toilets, S_{t}. There is also the role of genetics, which affects the initial endowment of health and other physical attributes, η_{i}.

From the list of inputs, we can see that the vector of nutrients, or even food commodities consumed, is one of a long list of inputs that affect nutritional outcomes. Often more salient are the behaviors at the household or individual level that may be far more important than inadequate nutrients in determining the risk of malnutrition. These include inputs such as breastfeeding behavior,[7] the quality of child care and nurturing behaviors, the sanitary and home environment, the availability and utilization of sanitary facilities, and access to clean and or plentiful water, as well as factors such as provision of micronutrients through supplementation programs, all of which will be discussed in greater detail below.

Another key element of this model is that through backward recursion, current nutrition is functionally related to all inputs during previous periods; left unanswered is the question of to what extent do prior periods affect current outcomes, and the magnitude of path dependence across time.[8] This point relates to the second issue highlighted previously—specifically, whether there are critical periods in a person's past that play a particularly important role in terms of explaining nutritional outcomes in the current period.

There is a prevailing view that the period from pregnancy through 24 months of age represents the most critical period in the health and nutrition over the life course. Compelling evidence of this is found in Figure 3, which shows the relationship between growth faltering and age, a

[7] For a comprehensive discussion of the importance and role of breastfeeding, see Victora et al. (2016).

[8] For a further discussion of this point, see Strauss and Thomas (2008); Alderman et al. (2015); and Alderman and Sahn (2015).

phenomenon that takes place primarily during the first 24 months of life[9] (Victora et al. 2010). Thereafter, little recovery during childhood is evident. Although this figure highlights the vulnerability of infants and very young children to stunting, and its persistence throughout the child's life, there is also a growing body of evidence that suggests that the critical period in a child's life extends back to the period in utero. This has been long established for certain specific nutrient deficits, such as folate and iodine, where such deficits in pregnant women are associated with birth defects. More recently, there is evidence that more general economic shocks that affect women during pregnancy may contribute to long-term health effects among their children. Thus, women who face in utero shocks may have smaller and less healthy babies—smaller in stature and experiencing more adverse long-term health problems (Almond and Currie 2011).

Although as noted earlier, the focus on this paper is primarily on the challenges associated with undernutrition, epidemiological evidence also points to in utero stress associated with malnutrition, as well as events such as famine, as a contributors to chronic diseases later in life, and particularly those associated with overweight and obesity (Gluckman et al. 2009; Black et al. 2013). Thus, the dichotomy of distinguishing between under- and overnutrition may in fact be a false one; instead, the etiology of diseases and early death and disability in both those suffering from undernutrition and chronic disease may be found in similar economic shocks and hardships that adversely affect the health and nutrition of pregnant women and their young children.

[9] Of particular concern is the risk of infection during the weaning period when exposure to pathogens increases probability of infection. This risk of diarrheal and other infectious disease is particularly acute among children who are not breastfed.

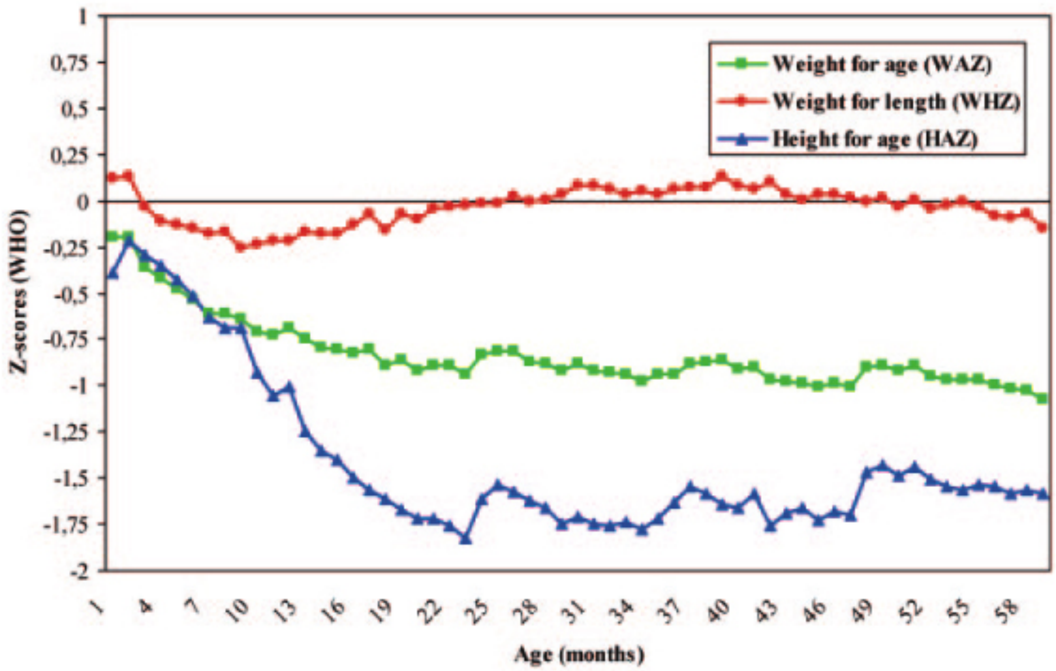


Figure 3. Relationship between growth faltering and age.

Source: Victora et al. (2010).

A complete understanding of the most sensitive periods in the development of a fetus, and whether, in turn, the neonatal or post-neonatal periods are most critical in terms of outcomes such as birthweight, risk of death, and functional consequences that will adversely affect cognitive and physical abilities is far beyond the scope of this paper. What is clear, however, is that timing matters in terms of risks, and thus the nature and impact of interventions should be time-sensitive as well.

The discussion of the production function and the concept of critical periods provide considerable guidance in terms of where policymakers should focus their attention and resources in combating malnutrition. One obvious lesson is to target programs to women of childbearing age, regardless of whether or not they are pregnant. How to do so, and what elements in the production function are most important is an empirical, but difficult, question to answer. This in part stems from the fact that the inputs in the production function are endogenous, and for the most part, a matter of choice among households and mothers. For example, consider that in Equation (1), a key input is the production of the vector of nutrients, represented as follows:

$$Z_i^f = Z(P_f, R, E_M, T_M^P, S, \eta_i) \qquad (2)$$

In Equation (2), P_f represents the prices of food and R, food related transfers. Although nutrient production is primarily a function of food consumption, the mother's skill or education level, E_M, along with time spent processing and preparing food, T_M, all affect her ability to extract nutrients from raw food inputs. For the youngest household members, especially those that are being breastfed or who are simply consuming a few hundred calories during and shortly after the weaning period, nutrient consumption from food, Z_{it}^f, is likely to be of relatively low importance in determining their nutrition, and to the extent it is, it is likely that food prices, P_f, play a relatively small direct role.

There is also a range of other input demand functions, similar to Equation (2), for the other parameters in the nutrition production function shown in Equation (1). While identifying these models and thus estimating structural parameters is extremely difficult, it is nonetheless the case that we can learn from the conceptual model that income, and even food consumption, is just one of many determinants of nutritional outcomes, especially of pregnant women and young children. As such, conflating food consumption, availability, or prices with nutritional outcomes is likely not appropriate. Additionally, it is likely the case that this production function looks very different for different outcomes. For example, iodine deficiency can be relatively quickly and easily addressed by the fortification of salt, regardless of any other policy measures that affect inputs in the production function. Likewise, biofortification with vitamin A can do the same; and both of these micronutrient deficiencies can also be addressed by supplementation, albeit at different costs. It is also the dynamic element of the production function where current nutritional status depends on all current and prior inputs, however, that provides the basis for focusing on prenatal and early childhood, as previously discussed. The challenge is to gather and understand the evidence regarding the types and nature of policies that will affect nutrition outcomes, both current and future, a subject to which we next turn.

A key issue regarding the timing of interventions comes from recent research that has challenged the view that there is no catch-up growth in stature after a child reaches his or her second birthday (Prentice et al. 2013). For example, studies with the Young Lives data (a longitudinal set of cohort surveys of about 2,000 children per country, born in 2001 in Ethiopia, the Andhra Pradesh state in India, the Philippines, and Vietnam) indicate that there is considerable variation in terms of the persistence of stunting as children age, even without any major changes in the economic or environmental conditions in which the child resides. Likewise, evidence suggests that those children that recover from growth faltering have higher cognitive skills at later ages (Crookston et al. 2013). In fact, those who catch-up later in childhood from early episodes of stunting have cognitive scores similar to those who never witnessed growth faltering. There is, however, little evidence as to what interventions can effectively influence growth after a child's second birthday. Moreover, catch-up may have some risks; for example, weight gain on small frames has been associated with subsequent obesity and adult chronic diseases (Monteiro and Victora 2005).

4. Economic benefits of investing in nutrition

There are two broad categories of benefits from improved nutrition: reduced infant and child mortality and improved productivity of survivors. Improved mortality has a unique status among nutrition outcomes, since unlike stunting or underweight, it is a matter about which the consequences are final and unambiguous in terms of a tragic and irreversible impact. However, establishing priorities for investment or integrating mortality with other outcomes such as improved development for survivors is problematic as, unlike the case of enhanced productivity, there is no clear way to place reduced mortality in a monetary metric. Indeed, many consider averting mortality to be a separate outcome that is integral to basic human rights and not one for which a monetary value should be assigned and aggregated with other deleterious outcomes that are manifestations of nutritional deficits. It is still possible, of course, to assess the relative cost-effectiveness of approaches to saving lives, even if benefits cannot be estimated in terms of dollars.

Nevertheless, a wide range of approaches to assigning monetary values of reduced mortality is in the literature. There are three main approaches that have common application. One is designed to measure foregone earnings associated with the loss of life from mortality earlier than would be expected, if death were not premature relative to the expected duration of labor market participation in an otherwise healthy individual. One flaw in the application of this technique is that forgone earnings are usually calculated without subtracting either the resources that would have been required for educating the individual or the value of consumption for that individual. A second methodology involves calculating the value of a statistical life (VSL). The calculated differences in wages for risky occupations are compared to wages offered at similar levels of education and experience in other employment (Viscusi and Aldy 2003). Like the first approach, this method will tend to assign a higher value to a life in countries with higher incomes (Hammit and Robinson 2011). A third approach relies on what is often referred to as "revealed" behavior of governments (Summers 1992). This involves estimation of the amount of money that countries spend to reduce mortality. This is rarely employed. One reason is that it will generally provide estimates that are lower by orders of magnitude than those of the other methods noted here. That being said, all have their detractors, and should be used with caution; and when such estimates are provided, it is important that there be transparency in terms of how they are derived and the limitations in terms of their interpretation.

Productivity gains reflect nutrition during the life cycle (prenatal through adult life), and although higher productivity is often associated with greater stature, many pathways from nutrition to productivity have mediating mechanisms that are unrelated to height. For example, maternal iodine status influences IQ. However, it would be difficult if not impossible to design an ethical randomized control trial to understand this causal relationship with any precision. That being said, a meta-analysis of observational data indicates that individuals with iodine deficiency had, on average, IQs that were 13.5 points lower than comparison groups (Grantham-McGregor et al. 1999). Consistent with this evidence, Field et al. (2009) showed that a decade and a half after mothers in Tanzania received iodine supplementation, their children had, on average, 0.35–0.56 years of additional schooling, with the impact greater for girls.

Prenatal iron also affects IQ and schooling without necessarily affecting stature. Nepalese children, aged 7–9 years—whose mothers received iron–folate supplements during pregnancy—exhibited improvements at age 7 in working memory, inhibitory control, and fine motor functioning (Christian et al. 2010). Similarly, breastfeeding, one of the most widely advocated nutrition practices, contributes to a reduction in the mortality of breastfed children in low-income settings. Moreover, while breastfeeding may have little direct impact on stature or weight, there is evidence that it does influence IQ (Victora et al. 2016).

Many of the productivity gains from improved nutrition, nevertheless, are associated with stature. For example, a longitudinal study from Guatemala found that individuals who received nutritional supplements as children earned on average 44 percent higher wages when they were between 25–42 years old than a control group. Treating stunting as endogenous, Hoddinott et al. (2013a) found that an individual stunted at age 36 months had 66 percent lower per capita consumption as an adult. While few studies have followed a randomized trial for as many decades, the impact of height for age in childhood on the timing of school entry and years of schooling attained is well documented. For example, children who were unfortunate to be two years old during a drought in Zimbabwe were more malnourished than their siblings and also had fewer years of schooling, leading to a 14 percent reduction in lifetime earnings (Alderman et al. 2006). Similar evidence using drought to control for parental decisions on schooling, as well as the fact that poorer communities in Tanzania have higher risks of both malnutrition and inadequate schooling, showed that malnutrition both delays school entry and reduces total schooling (Alderman et al. 2009). Yamauchi (2008) used policy changes in South Africa to show that improving children's nutrition significantly lowers the age when they start school, increases grade attainment, decreases grade repetition, and improves learning performance in the early stage of schooling. Further evidence was presented by Glewwe and Jacoby (1995) who, using food price differences to instrument for endogenous nutrition, showed that children in Ghana with low height-for-age were more likely to have delayed school enrollment. Even if —as their study found—the total years of schooling are unaffected, the delay in enrollment results in later entry into the labor force, which will, by itself, influence discounted lifetime earnings.

However, as Hanushek and Woessman (2008) noted, wages respond less to years of schooling than learning in school. This likely helps to explain the common observation that higher wages are associated with better nutrition, even after controlling for schooling attainment and even in high-income settings (Case and Paxson 2008). It is, however, a challenge to determine the degree to which height *per se* drives such findings, as opposed to cognitive skills that accompany growth. One study that explored this distinction was LaFave and Thomas (2016). This analysis used a longitudinal survey from Central Java and controlled for cognitive and non-cognitive skills in examining the role of stature in affecting wages, in a model that incorporated sectoral choice, occupation, and family background. Among the main findings was that the observed returns to height in terms of higher earnings persisted, even when controlling for other measures of human capital. And the magnitude of this effect was quite high: a 1 percent increase in height contributed to a 1.9 percent increase in hourly earnings; and this was observed in a model that controlled for both schooling attainment and cognition. A similar result was reported in a paper by Bossavie et al. (2015) that was conducted in Pakistan for a group of workers where the impact of heights on earnings was observed, even when Raven's scores and an index of non-cognitive skills were included in the model.

Another relevant study in Mexico looked at the impact of height on various labor market outcomes (Vogl 2014). Findings showed an increase in the probability of an individual working in a "brawn"-intensive occupation when an individual was taller. Specifically, each additional centimeter of height resulted in an increase of 0.63 percentage points in the probability of working in a physically demanding occupation, although, this fell to 0.26 when the regressions included Raven's score and other covariates that captured the conditions during childhood. Of greater significance is that an additional centimeter of height contributed to a 2.3 increase in earnings, although, when cognitive test scores are added to the model, there is a 13 percent reduction in the magnitude of the impact of height. The addition of other covariates that capture childhood conditions, as well as schooling, which affect sorting into different jobs, further reduced the returns to height, whereby each additional centimeter of height resulted in a 1.3 percent increase in earnings.

Earnings also respond to improved nutrition for adult workers, as well as to investment during childhood and adolescence. This is most clearly demonstrated in field experiments with supplementation to workers, such as a trial measuring the impact on the output of rubber workers in Indonesia (Basta et al.1979). A more recent study in Indonesia involving 17,000 adults found similar improved productivity for those receiving iron supplements (Thomas et al. 2006).

Although studies of wages and nutrition that control for endogenous choice of diets have indicated that earnings are lower when calorie consumption is low (Sahn and Alderman 1988), experimental evidence is more mixed. Randomized food supplementation of sugarcane cutters in Guatemala indicated that those living in treatment villages were not more productive than those in the control villages, although they were more active overall (Imminck and Viteri 1981). Another study in Kenya found a limited impact of food supplementation on the productivity of road workers (Wolgemuth et al. 1982).

Undernutrition also leads to incremental costs for the health of young children. Most direct are the costs for treating severe acute malnutrition and the infections that are common in such children (Bhutta et al. 2013). The cost of treating illness associated with malnutrition among children less than 5 years of age in Central America was $433 million, of which 91 percent were public costs and 9 percent, private expenses (Martinez and Fernandez 2008). Nevertheless, this study concluded that the health costs were only 6.5 percent of the total costs of malnutrition, the remainder being estimated consequences of reduced productivity.

An additional consequence of undernutrition is that the small stature of women increases the risk of complication in pregnancies (Toh-Adam et al. 2012; Özaltin et al. 2010). Where extensive services are available to save low-birthweight babies, the direct resource costs for these complications can be appreciable; where these services are unavailable, the consequences in terms of mortality or a new cycle of undernutrition are also considerable, albeit often not on any budget.

The economic value of improved nutrition is not restricted to productivity gains; improved nutrition also reduced medical expenses. Recent literature has focused on the costs of treatment for NCDs (de Olivera et al. 2015; Lehnert et al. 2013). However, even in the case of chronic disease among adults, the costs are not primarily the out-of-pocket or insurance costs for medical treatment; much of the cost are lost work hours due to NCDs (Popkin et al. 2006).

Estimates of the global or regional benefits of addressing malnutrition, as in Martinez and Fernandez (2008) and the Africa Union Commission et al. (2014), are incomplete without some indication of what it might cost to achieve such benefits. Bhutta et al. (2013) made such a calculation based on the evidence for a wide range of specific nutrition programs and drawing upon an array of meta-analyses and systematic reviews. This review paid particular attention to 10 promising programs and the costs of expanding coverage from existing levels to reach 90 percent of at-risk children in countries with in high burdens of malnutrition. Bhutta et al. also estimated that it would cost $9.6 billion annually to achieve this expansion. The projections by Bhutta et al. (2013) differed slightly from an earlier, similar exercise to establish the cost of scaling-up nutrition that was undertaken by the World Bank, but not at a substantive level. The earlier study estimated the total costs at $11.8 billion per year (Horton et al. 2010), a sum that included an estimated $1.2 billion for building capacity, as well as monitoring and assessment that is not assigned in the study by Bhutta et al. (2013). The two studies also differ some in the baseline coverage, from which scale-up is assumed to occur, as well as in some of the interventions included; Horton et al. (2010) included deworming and therapeutic zinc for diarrhea, which was not covered in the study by Bhutta et al. (2013). Conversely, calcium supplements and balanced energy protein supplements in pregnancy were only included among the components in the estimates of Bhutta et al. (2013).

Hoddinott et al. (2013b) took the logical step of combining estimates of costs of scaling up with estimates of the costs of not scaling up and provided global benefit–cost ratios. Such models have a role in advocacy, although they are necessarily reliant on a wide range of assumptions, including how costs might change as coverage increases and how the earnings of children reached in 2015, but who will work for decades in the future, should be discounted. While varying assumptions influenced the estimated benefit–cost ratios, similar global and regional estimates proved to exceed costs by an appreciable amount over a range of assumptions (Alderman et al. 2016). Nevertheless, benefit–cost and cost-effectiveness studies at the program level provide greater specificity. These also often indicate returns that are as high, or higher, than those in sectors considered to have more conventional productive investment. One example of this literature is Horton et al. (2009). However, it is beyond the scope of this chapter to review such studies of nutrition-specific investments. Instead, we now turn to a discussion of what are termed nutrition-sensitive investments.

5. Nutrition-sensitive interventions

Bhutta et al. (2013) projected that scaling up nutrition-sensitive interventions could diminish stunting globally by 20 percent and decrease child deaths in those countries by 15 percent—that is, program expansion could reduce, by a third, child deaths attributed to malnutrition. Although this result is sizable, it does not go far enough. Actions in "nutrition-sensitive" sectors will likely be additional critical components of any global strategy to eliminate undernutrition (Ruel et al. 2013).

These are interventions or programs that address the underlying determinants of fetal and child nutrition—food security; adequate caregiving resources at the maternal, household, and community levels; access to health services; and a safe and hygienic environment—and that incorporate specific nutrition goals and actions. They include programs in sectors such as agriculture, water, and sanitation, as well as social protection. The potential for nutrition sensitivity comes in part from their scale; most governments devote substantial resources to programs in these sectors. In addition, these programs are generally intrinsically targeted to the poor and often contain design features that can empower women.

The scale and targeting are particularly relevant to social protection since 1.9 billion people were enrolled in conditional or unconditional social safety net programs in 136 countries by 2015 (World Bank 2016b). Additionally, an estimated 375 million children participated in school meal programs annually at a cost of $75 billion in 2013 (WFP 2013). To a large degree, however, these programs are more successful at food security than nutrition security; in the absence of behavioral change communication and access to quality health services, they often do not decrease stunting. As reviewed elsewhere (Alderman 2016) and, hence, not covered here in detail, if social protection can incorporate such measures, it does have the potential to contribute to reduced malnutrition.

Programs to improve water, sanitation, and hygiene (WASH) are not as intrinsically targeted to the poor as are social protection programs, but they clearly have the potential to serve as components of a multisectoral program to improve nutrition. Emphasis on WASH has been heightened by recent studies of enteropathy, which, while reflecting similar environmental factors as diarrhea, is a distinct condition characterized by a subclinical change in the small intestine that interferes with nutrient absorption (Humphrey 2009). Additional motivation comes from evidence on the association of open defecation and stunting (Spears 2013; Spears and Lamba 2016). Although there are a number of evidence-based approaches to *treating* diarrhea, these are unlikely to address environmental enteropathy (EE), since diarrhea is episodic and enteropathy is nearly constant. A study in the Gambia found that children had diarrhea 7 percent of the days, but EE 76 percent of the time (Humphrey 2009). This puts pressure on finding *preventative* measures and, again, indicates that income growth at the household level may not be able to address major constraints. Despite some recent successes (Gertler et al. 2015), WASH interventions remain a challenge and an area ripe for innovation.[10]

Still, the nutrition-sensitive sector that has the most potential to address constraints to nutrition is agriculture and related food policy. Some of the interventions for food policy are oriented towards consumers and often have strong overlap with social protection. Generalized food subsidies to increase food security, while once widespread (Pinstrup-Andersen 1988) are less common, given their expense and the comparatively low share of total expenditures accruing to the poor. Similarly, food rations and in-kind distribution on quotas have become less common, in

[10] Ahuja et al. (2010) pointed out that addressing water supply has other benefits that indirectly influence nutrition, such as savings in the time expended for water collection.

part due to the tendency for leakage (Alderman 1988; Mehta and Jha 2014). Conversely, targeted cash transfers, either conditional or unconditional, have become a widespread means of increasing access to food. While such cash transfers have long been recognized as less distortive than subsidies, the current focus builds upon the evidence from PROGRESA, a well-documented large-scale pilot in Mexico, as well as improved technology for delivering and tracking cash. Nevertheless, nearly two decades after the introduction of PROGRESA, large in-kind food distribution programs remain active in as diverse setting as India, Egypt, and Indonesia. Similarly, the United States maintains an electronic food stamp program, the Supplemental Nutritional Assistance Program, that lies between in-kind distribution and cash assistance.

Looking at food policy from the standpoint of nutrition-sensitive agriculture, one notes a range of interventions, from investments to enhancing agricultural productivity and boosting global food supply, including biofortification, to producer price policy and very micro-focused interventions such as home gardens, all of which are critical for long-term reductions in poverty, hunger, and undernutrition. The specific pathways linking agriculture and nutrition include increases in farm productivity that remain the key to increasing wage and non-wage income in agriculture and livelihoods in rural areas. Moreover, agriculture is a key sector of employment and opportunities for women, providing for improved gender dynamics. Since women have traditionally had limited access to technology, inputs, extension, and output markets, increased investment in basic rural infrastructure and labor-saving technologies that recognize a woman's special vulnerabilities and opportunities are needed. Policymakers need to consider the importance of the gender dimension of research and investment in agriculture and related food systems, in pursuing food security and dietary diversity (both production and consumption diversity) at the household level.

While efforts to promote policies to achieve greater diversity, efficiency, healthiness, and a more dynamic food system are paramount, there is also the recognition that the share of labor in agriculture will have to decline, and that there will need to be a shift over time from smallholdings to larger scale agricultural enterprises. This will include many smallholders and marginal producers moving partially and gradually to working in different sectors to increase household incomes. It is a major challenge to manage this transition, especially as the demographic transition is still underway in parts of Africa. Thus, there is the recognition that youth under- and unemployment will not be easily remedied, even where investment is agriculture and food systems are prioritized. Beyond providing for livelihoods of rural households and empowering women, agriculture plays a critical role in providing low-cost wage goods to a rapidly expanding nonagricultural economy, especially in small towns and expanding urban megacities In addition to the central roles of trade and food marketing, food sector interventions also need to be focused on issues such as promoting food safety and reducing contamination of the food supply, for example, aflatoxin exposure.[11]

Biofortification is a uniquely nutrition-sensitive agricultural intervention because it focuses on breeding of staple crops that are rich in essential micronutrients. In addition, it has a clear pathway from field research to implementation at scale via intermediary steps of community

[11] Turner et al. (2005) showed that reducing aflatoxin exposure of pregnant women increased the height of their children.

trials. A relatively early example was the breeding of high lysine maize [opaque 2] in the 1970s to address the low-quality protein inherent in maize. The breeding was a success, but the extension was not: the yields were not as high as varieties already under cultivation, and the milling properties were less desirable for local consumption. The strategy since the '90s promoted by Harvest Plus, which focuses more on micronutrients, has adopted lessons from this experience (Saltzman et al. 2013).

For biofortification to be successful, four broad questions must be addressed: (1) can breeding increase the micronutrient density in food staples to target levels that will make a measurable and significant impact on nutritional status; (2) when consumed under controlled conditions, will the extra nutrients bred into the food staples be absorbed and utilized at sufficient levels to improve micronutrient status; (3) will farmers grow the biofortified varieties; and (4) will consumers buy and eat them in sufficient quantities?

The most well-documented example of biofortification is orange-fleshed sweet potatoes (Hotz et al. 2012). This research, however, has not addressed the question of whether behavioral change communication is a necessary component for impact, nor whether dissemination and expansion will be self-replicating without the extensive costs for introduction—well above $100 per beneficiary. Dissemination rates, then, are an essential element if biofortification is to be more cost-effective than conventional fortification or supplementation (Fiedler and Lividini 2014). In contrast to the behavioral change intensive introduction of sweet potatoes, iron-rich beans released in Rwanda were adopted by 500,000 households by 2014 in the country and have begun to spread to neighboring countries as well with little outreach.

Also, note that biofortification is achieved not only through plant breeding. For example, fertilization can increases zinc concentrations in crops and soils, as well as enhance yields in some soils. Selenium fertilization similarly increases concentrations in foods, although in this case food safety must be considered due to potential toxicity from excessive selenium. In other contexts, iodine deficiency has been addressed by adding it to water for agriculture.

While there are a vast number of opportunities in terms of agriculture and food systems policies and programs, as indicated by Pinstrup-Andersen (2013), these improvements are more likely to be achieved at scale through trade and research policies than by means of targeted projects, such as home gardens (Pinstrup-Andersen 2013).[12] This challenge of scaling up to realize the broadest possible impact, in fact, is a common theme of all the nutrition-sensitive interventions discussed here, regardless of their focus or sector of activity.

6. Overweight and chronic disease

[12] Meta-analyses and systematic reviews of home garden projects have found little evidence of impact of these programs on maternal or child nutritional status (anthropometry or micronutrient status), with the possible exception of vitamin A status (Ruel et al. 2013). While some recent studies have indicated a bit more promise in regards to dietary patterns and nutrition (Carletto et al. 2015), there is little evidence on the sustainability of such programs. Moreover, there is virtually no data on the cost-effectiveness of these projects, nor whether the training, seeds, and other inputs provided are fixed costs for introduction or variable costs for continued operation.

One of the unintended consequences of prosperity and a globalized food system that has altered the availability, prices, and preferences for food, has been a global epidemic of overweight and obesity. With over 2 billion people estimated to be obese or overweight, this problem, in sheer numbers, afflicts more than two times the numbers of people who are suffering from insufficient calorie intake. The proximate causes are relatively clear: increased intake of energy-dense foods that are high in fat and refined sugar; increasingly sedentary lifestyles; and food distribution and marketing systems that encourage consumption of, and ease access to, more processed foods from outlets ranging from modern supermarkets to more traditional small retail shops. While the global trend of increased obesity and related NCDs is well documented, the policy implications are less clear. Commonly, undernutrition and obesity are public health concerns in the same populations. For example, some children in Mexico weighed less than the reference for their age, yet still had a BMI indicative of being overweight or obese. These children can be considered both under- and "overnourished." Indeed, this observation prompted Lobstein et al. (2015) to ask whether the problem is overweight or "underheight." At the very least, then, programs to remedy undernutrition must take care not to put too much emphasis on weight gain. Conversely, anti-obesity campaigns must avoid unintended consequences for undernutrition.

Roberto et al. (2015) pointed to strategies to prevent overweight under the acronym NOURISHING. These steps include **n**utrition labeling, [providing] **o**ther health foods in public settings, **u**sing economic tools such as taxes, **r**estricting advertising, **i**mproving the nutritional quality of the food supply, **s**etting incentives, **h**arnessing the supply chain, **i**nforming people through public information campaigns, [providing] **n**utrition advice (such as counseling), and **g**iving nutrition education. There is some overlap of these approaches, but the set does point to supply- and demand-oriented steps. The last three can be considered behavioral change strategies, while the rest relate to the food system.

Evidence on the efficacy of these strategies is still limited. Moreover, as most of the consequences of NCDs occur later in life, the economic gains of many early life programs—other than those that simultaneously address undernutrition, such as antenatal care—are relatively small once future benefits are discounted in accord with standard economic practices. Taxation of sugary soft drinks or high fat snacks does raise revenue and, thus, in common with many fortification programs, does not directly enter government budgets as a program cost. Modeling exercises from settings as diverse as Australia and South Africa have indicated a potential for addressing obesity by taxation of sweetened beverages (Veerman et al. 2016; Manyema et al. 2016). Mexico has shown that, as predicted, consumers respond to price signals (Colchero et al. 2016). However, the net effect of such polices after substitutions in consumption are still unknown. Thus, there is an need for far more research, especially in developing countries, on how to reverse the tide of obesity and overweight through a combination of policies such as taxes and subsidies, other knowledge-based interventions such as school and nonschool-based nutrition education, food labeling and advertising, and more general food systems approaches, such as promoting easing access to healthier and more nutritious food choices.

7. Discussion and conclusion

In recent years, there has been considerable progress in reducing hunger and malnutrition. Future progress will likely be accomplished through a combination of continued economic growth and poverty alleviation, complemented by both nutrition-specific interventions (e.g., breastfeeding promotion, and micronutrient supplementation and fortification) and nutrition-sensitive programs (e.g., safety nets, food subsidies and related price policy, schooling, water and sanitation, and family planning). In considering these mechanisms, there is little doubt that the massive decline in malnutrition, witnessed in countries like China and other parts of Southeast Asia, was predicated on the rapid rates of growth that lifted hundreds of millions of people out of poverty. This growth also enabled the emergence of institutions that provide high quality nutrition-sensitive and nutrition-specific interventions at considerable scale. Although the dramatic improvement noted in some regions was undoubtedly facilitated by financial resources and investments in human capital and institutions that only a growing economy could provide, there is also considerable evidence that significant, albeit more modest, reductions in malnutrition have been achieved even in countries with slower prospects in terms of economic growth and poverty reduction. That is, the types of nutrition-specific and nutrition-sensitive interventions and policies discussed in this chapter provide considerable promise for success, regardless of the broader economic circumstances. That being said, there are inevitably a range of other important dimensions to the success of such strategies, ranging from the need for generous support from donor and international organizations, to a society that accords a high valuation to equity and well-being across dimensions such as health and education.

While reducing malnutrition is a core issue of human rights and thus requires no further justification, we also discuss at some length the productivity gains from addressing undernutrition, especially in light of the need to scale up programs to reach underserved communities. As of now, however, much of the available data is not sufficient to explore issues of heterogeneity of benefits or costs. Addressing this heterogeneity is complicated and pertains, for example, to interventions and policies designed to meet stochastic income and climatic shocks as they affect incomes and livelihoods, diet quality and diversity, and women's empowerment and time use. It also pertains to the challenge of climate change and related issues of sustainability.

Additionally, a broader set of tools will be required to understand the costs, not just of undernutrition, but of the rapid increase in nutrition-related, noncommunicable disease. Indeed, while we have prioritized in our paper the challenges and progress in combating the nutritional deficiencies that have long contributed to impaired function and shorter life spans, we also have stressed that nutritional deficiencies, especially early in life, are inextricably linked to our concerns about obesity and adult chronic disease. First, there is the association with weight gain and related health issues that afflict adults with small frames that are a result of childhood stunting (Uauy and Kain 2002; Yajnik 2004; Monteiro and Victora 2005). And likewise, many of the same types of deprivation and entitlement failures that contribute to a shortage of nutrient consumption also contribute to lifestyles and food choices that lead to the surging epidemic of noncommunicable disease. That being said, it is also the rising affluence in many countries—that is bringing down rates of stunting, underweight, and wasting—that also represents a risk factor to becoming overweight. Managing the transition to ensure more healthy lifestyles indeed seems to encounter many of the same challenges, in terms of defining appropriate policies and interventions and addressing issues of how to scale up such efforts effectively.

One final point is that we began this chapter discussing the ravages of famine that gripped humanity, especially in the 19th and 20th centuries, and made the point these horrendous events largely emanated from, to use the terminology of Amartya Sen (1981), entitlement failures associated with bad policy, civil conflict, and to a lesser extent, regional drought. We have not discussed any recent history of, or concerns over, global food shortages and the related issue of agricultural production failing to keep up with what seems to be ever expanding global demand, fueled by a rapidly growing population. We have instead focused on the role of entitlement failures in causing malnutrition, whether that be lack of access to adequate food and nutrients at the household or individual level, or other lack of basic services or knowledge that could prevent malnutrition. The absence of a Malthusian disaster, predicted more than two centuries ago, to materialize, however, is not just a matter of luck. Instead, not having to focus this chapter on agricultural production issues needs to be understood as a recognition of the remarkable success and paramount importance of investments in technology to ensure a healthy and sustainable agricultural sector, which has enabled us to focus on the more proximal determinants of malnutrition. Indeed, as we look back to put forth a framework for future action in terms of nutrition-specific and nutrition-sensitive programs and policies, there is no room for complacency regarding the inextricable links between agriculture and nutrition, and economic growth and poverty alleviation.

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