Hunger and Food Insecurity[1]

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Draft chapter 28 in David Brady and Linda M. Burton, editors,
The Oxford Handbook of Poverty and Society (Oxford: Oxford University Press, forthcoming)

Introduction

One consistent message across all of the available global-scale measures is that food insecurity is overwhelmingly concentrated in the developing countries. By the United Nations Food and Agriculture Organization's (FAO) estimates, only 16 million of the world's 868 million food insecure individuals – just 2 percent of the global total – live in developed countries (FAO 2012). Food insecurity nonetheless exists in wealthy countries. For example, in any given year, the U.S. Department of Agriculture estimates that 10-15 percent of U.S. households are food insecure, with approximately one-third of these households experiencing moderate to severe hunger. Indeed, rates of household food insecurity and 'very low' food security have both increased considerably during the recent recession and 'jobless recovery'. The most recent USDA estimates are that the share of (very) food insecure households in the United States increased from 10.1 (3.0) percent in 1999 to 14.5 (5.4) percent in 2010 (Coleman-Jensen et al. 2011). Since the 2008 economic downturn, the number of food insecure individuals in the United States has held steady at roughly 50 million; at that scale, food insecure Americans would comprise the 25th most populous nation on Earth if they were a country unto themselves. So while the prevalence of food insecurity is overwhelmingly larger in the developing countries, even the wealthiest and most powerful nations still face considerable challenges in eradicating domestic poverty and food insecurity.

Food insecurity remains widespread today in large measure because extreme poverty remains widespread, and vice versa. But the relationship between poverty and food insecurity is complex and bidirectional. Food insecurity, especially that manifest in malnutrition that results in ill health and lethargy, contributes to individuals remaining trapped in poverty (Thomas and Strauss 1997). In turn, poverty contributes to poor nutrition and health.

In the past ten to fifteen years, numerous researchers have found that early experiences of food insecurity can have a lasting impact on people's lives, and even on their children's lives. In a review of maternal and child undernutrition, Bhutta et al. (2008: 340) write "height-for-age at 2 years was the best predictor of human capital and … undernutrition is associated with lower human capital. We conclude that damage suffered in early life leads to permanent impairment and might also affect future generations." Krishna (2007) documents how poor health, commonly associated with undernutrition, can lead to chronic impoverishment. Victora et al. (2008: 340), reviewing findings on maternal and child undernutrition and human capital and risk of adult diseases, find "undernutrition [at two years of age] was strongly associated … with shorter adult height, less schooling, reduced economic productivity, and – for women – lower offspring birth weight."

Prenatal insults experienced in utero, such as maternal undernutrition, illness, or smoking or drinking habits, can result in lasting health effects, disability, and lower educational attainment and adult wages for unborn children. The fetal origins hypothesis – also known as the Barker hypothesis for Barker's (1992) work linking undernutrition of pregnant women with the later health of their adult children – posits that the effects of the in utero environment are lasting and can be latent for many years. In a recent review of findings, Almond and Currie (2011) write that much of the findings are associational rather than causal although this is changing rapidly as evidence mounts. Furthermore, undernutrition in the early years may impact future generations as, for example, children born to

[1] This chapter draws significantly on Barrett (2010), Barrett and Lentz (2010) and Lentz and Barrett (2012).

mothers who were themselves undernourished as children are more likely to suffer low birthweight (Victora et al. 2008; Berhman et al. 2009).

This intergenerational transmission of undernutrition is closely related to the concept of nutritional poverty traps. A nutritional poverty trap occurs when individuals' physical work capacity declines more rapidly than wages once the wages (and the nutrition it can buy) falls below a critical level. Thus, in equilibrium there will be some critical asset holding such that those with at least that level obtain employment and reach a non-poor standard of living, while those below that critical level will remain mired in poverty and malnutrition (Dasgupta and Ray 1986, 1987; Dasgupta 1993, 1997).

Yet, the causes of food insecurity are many. Not all food insecurity is related to household-level poverty. Over 25 percent of Indian children living in households from the highest income quintile had weight – for – age lower than two standard deviations below the reference group mean, a measure of wasting (Gwatkin et al. 2003, reported in Horton et al. 2010). Indeed, food insecurity remains stubbornly high in the face of increasing income and falling poverty rates in some places (e.g., India), but has fallen dramatically with increases in income and reductions in poverty in other countries (e.g, China). Micronutrient (vitamin and mineral) deficiencies, for example, can be related to cultural beliefs about the appropriateness of certain foods, a lack of information on what is required for a healthy diet, or due to weak bargaining power within the household.

In the remainder of this chapter, we first discuss concepts and definitions related to food security. We then review the major approaches to measuring food insecurity and discuss both why measurement matters and why it remains so challenging. We provide a historical overview of hunger and food insecurity before turning to a discussion on the causes of hunger and food insecurity. Lastly, we discuss interventions intended to reduce hunger and food insecurity and indicate directions for future research.

Concepts and Definitions

One of the most tangible manifestations of poverty is a diet insufficient to keep someone healthy. The term 'hunger' is popularly used as shorthand for this condition. But more precisely used, however, 'hunger' refers specifically to the physical discomfort caused by a lack of food. Because this is both a relatively narrow measure of nutritional deprivation and a difficult one to measure, policymakers and scientists more commonly focus on the broader concept of 'food insecurity' and its complement 'food security'.

Food security is inherently unobservable and difficult to define, but both intrinsically and instrumentally important. Humans have a physiological need for the nutrients supplied by food. Many development programs, projects and policies therefore include food security objectives. But food is also a source of pleasure apart from its physiological necessity. Since both biological needs for food and psychic satisfaction from food vary markedly among and within populations, it is difficult to pin down precise, operationalizable measures of food security. Moreover, the concept of food security encompasses more than current nutritional status, capturing as well vulnerability to future disruptions in one's access to adequate and appropriate food (Barrett 2002). This forward-looking, uncertainty-based dimension of food security adds further complexity to the concept.

This complexity has given rise to scores, if not hundreds, of different definitions of the term "food security". Definitions have evolved with thinking about the proximate manifestations and direct and indirect causes and consequences of food insecurity. But there remain much variation and imprecision in these terms as used in practice.

The most commonly used definition was agreed upon at the 1996 World Food Summit and holds that food security represents "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food

preferences for an active and healthy life." Food insecurity exists when this condition is not met. Of course, by that standard, the world has only known food insecurity.

Food security is commonly conceptualized as resting on three pillars: availability, access, and utilization. Some analysts add a fourth pillar, stability, to this listing. As Webb et al. (2006) note, these concepts are inherently hierarchical, with availability necessary but not sufficient to ensure access, which is in turn necessary but not sufficient for effective utilization, none of which ensure stability of food security over time.

Availability reflects the supply side of the food security concept. In order for all people to have "sufficient" food, there must be adequate availability. While adequate availability is necessary, however, it does not ensure universal access to "sufficient, safe and nutritious food", so it is not a sufficient condition for food security.

Hence the second pillar of the food security concept: access. Access is most closely related to social science concepts of individual or household well-being: what is the range of food choices open to the person(s), given their income, prevailing prices, and formal or informal safety net arrangements through which they can access food? As the Nobel Laureate Amartya Sen (1981, p. 1, emphasis in original) famously wrote "starvation is the characteristic of some people not *having* enough food to eat. It is not the characteristic of there *being* not enough food to eat. While the latter can be a cause of the former, it is but one of many *possible* causes." Access reflects the demand side of food security, as manifest in uneven inter- and intra-household food distribution and in the role that food preferences play, reflecting socio-cultural limits on what foods are consistent with prevailing tastes and values within a community. Access also underscores problems of uninsured risk exposure and recourse to safe coping mechanisms to mitigate the effects of adverse shocks such as unemployment spells, price spikes or the loss of livelihood-producing assets. Through the access lens, food security's close relationship to poverty and to social, economic, and political disenfranchisement comes into clearer focus for those who look for such mechanisms as structural explanations of human deprivation. But because access is an inherently multidimensional concept, its measurement is especially troublesome and commonly proxied by simple indicators such as per capita income.

Utilization reflects concerns about whether individuals and households make good use of the food to which they have access. Do they consume nutritionally essential foods they can afford or do they choose a nutritionally inferior diet? Are the foods safe and properly prepared, under sanitary conditions, so as to deliver their full nutritional value? Is their health such that they absorb and metabolize essential nutrients? While undernutrition reflects insufficient dietary energy (caloric) intake utilization concerns foster greater attention to dietary quality, especially micronutrient deficiencies associated with inadequate intake of essential minerals and vitamins (NRC 2005).

Stability captures the susceptibility of individuals to food insecurity due to interruptions in availability, access, or utilization. The temporal aspect of stability links to the distinction between chronic and transitory or acute food insecurity. Chronic food insecurity reflects a long-term lack of access to adequate food, and is typically associated with structural problems of availability, access, or utilization. Transitory or acute food insecurity, by contrast, is associated with sudden and temporary disruptions in availability, access or, less commonly, utilization. The most common transitory food insecurity is seasonal, recurring quite predictably, especially among rural populations during the period preceding harvest, when grain stocks run low and food prices typically hit annual peaks (Devereux, Vaitla, and Hauenstein-Swan 2008). Some transitory food insecurity is regular but not periodic, as in the case of regular droughts that routinely strike semi-arid regions. The most serious episodes of transitory food insecurity are commonly labeled "famine," which is itself an elusive concept typically, but not always, associated with a critical food shortage, mass undernutrition or starvation, and excess mortality (Devereux 1993; Ravallion 1997).

Measurement

Thus defined and conceptualized, food security – and its complement, food insecurity – is inherently unobservable. In practice, therefore, analysts use proxy measures across different levels of aggregation, such as food availability at the national or regional level, food expenditures, coping strategies index and dietary diversity measures at the household level, and hunger, undernutrition, underweight and malnutrition at the individual level. Researchers from different disciplines naturally gravitate toward different measures, which implicitly emphasize distinct dimensions of the food security challenge.

All measures have their flaws. Food availability neglects waste and the inevitably unequal distribution of food within a population. Access measures such as the coping strategies index (Maxwell 1996; Maxwell et al. 1999; Maxwell et al. 2003) and food expenditure and dietary diversity measures (Arimond and Ruel 2004) rely on household or individual responses to questions about approaches to respond to shocks and past consumption, respectively, to understand the distribution of food insecurity. Other access measures use income, consumption or expenditures as proxies of food insecurity. Yet, access and availability measures generally ignore micronutrient (i.e., mineral and vitamin) shortfalls that affect a far greater number of people and are strongly linked to a range of disabilities, diseases and premature mortality. Various anthropometric measures – such as weight-for-height, weight-for-age or mid upper-arm circumference – are commonly used, especially for children, with measures at least two standard deviations below global reference values widely interpreted as signaling serious problems of wasting (low weight-for-height), underweight (low weight-for-age) or stunting (low height-for-age). These measures are the joint product, however, of nutrition and health status, thus identified problems are often due to factors unrelated to nutrient intake. Malnutrition refers to the ensemble of undernutrition, overweight and obesity and micronutrient (mineral and vitamin) deficiencies, thereby reflecting the full "triple burden" of nutritional problems faced by many poor communities (Pinstrup-Andersen 2007). Overweight and obesity are commonly measured using the body mass index, a measure widely acknowledged as flawed because it fails to control for body frame type or the distribution of weight between fat and muscle.

Measurement matters for at least three major reasons. First, each measure captures and neglects different phenomena intrinsic to the elusive concept of food security, thereby subtly influencing prioritization among food security interventions. Historically, reliance on national food availability estimates has predictably focused attention on food aid shipments and agricultural production strategies to increase food supplies in the short and long term, respectively. Over roughly the past quarter century, Sen's (1981) core thesis – that food access accounts for most food insecurity – has focused increased attention on individual-specific income, hunger and anthropometric data, which naturally reinforces food security strategies based on poverty reduction, food price and social protection policies.

Second, observational data necessarily report on the past. But policymakers are most interested in the likely future effects of prospective interventions. Given its "at all times" element, an ideal food security indicator would reflect the forward-looking time series of probabilities of satisfying the access criteria (Barrett 2002). The degree of stability of observed measures over time and their predictability affects analysts' ability to translate estimates into defensible prescriptions on behalf of those whose food security is most tenuous.

Third, insofar as food insecurity measures diagnostically inform actions, they must be readily associated with targetable characteristics of vulnerable households and individuals and remediable causal factors that lead to food insecurity. National-level measures inherently lend themselves only to addressing national-scale food availability shortfalls, not intra-national access and utilization concerns. The research frontier today therefore revolves around the development of cross-nationally comparable, longitudinal monitoring and analysis at household and individual level. Over the past decade or so,

research has moved increasingly towards survey-based measures to improve the disaggregated identification of food insecure subpopulations and their targetable characteristics and behaviors.

The most widely cited food insecurity figures are the "undernourishment" estimates generated by the Food and Agriculture Organization of the United Nations (FAO), derived from national-level food balance sheets and strong assumptions about the intra-national distribution of food across individuals. Alternative measures, such as those reported to Congress each year by the US Department of Agriculture (USDA), often differ radically from FAO estimates. For example, in October 2012, FAO estimated that the number of undernourished people in developing countries at 852 million (FAO 2012). A few months earlier, USDA estimated a figure of 802 million food insecure people living developing countries (Rosen et al. 2012). And the FAO estimate for Asia was nearly thirty percent higher than USDA's (563 vs. 398 million) while that for Sub-Saharan Africa was more than one-third lower (239 vs. 357 million). Such discrepancies make even macro-scale geographic targeting difficult for policymakers.

The global figures mask considerable heterogeneity among and within regions, especially in trends. In China and Southeast Asia, scores of millions fewer people suffer undernutrition than a generation ago due to broad-based, rapid economic growth. In other regions, including South Asia, and parts of east and southern Africa, undernutrition rates have fallen even while the number of undernourished has increased due to population growth. And in some regions, such as, central Africa, both numbers and rates have increased.

These measures also ignore how membership in the ranks of the food insecure changes over time. The FAO's newly revised 2012 measure defines undernourishment as energy deficiency lasting over a year (FAO 2012). As a result, they ignore the suffering of those who experience transitory periods of food security but know they face a significant likelihood of being food insecure again in the near future. The 'churning' of those who experience transitory food insecurity means both that the FAO measures, which capture only chronic, but not seasonal or periodic food insecurity, and other cross-sectional estimates underestimate the population that is at significant risk of experiencing food insecurity over any multi-year period.

Continued reliance on contested national food availability measures reflects the limited availability and timeliness of household and individual data collected in nationally representative surveys, especially in the low-income countries in which food insecurity is most widespread and severe. A growing literature proves the value of survey data that capture objective dietary, economic and health indicators as well as subjective measures of adequacy, risk exposure and sociocultural acceptability (Bickel et al. 2000; Frongillo and Nanama 2006; Smith, Alderman, and Aduayom 2006; Wunderlich and Norwood 2006). Food security measures based on household and individual data routinely generate higher estimates of food insecurity than those derived from more aggregate data. The differences seem attributable not only to differences in intra- and inter-household nutrient distribution but also in the resulting estimates of nutrient availability. Not surprisingly, survey-based estimates of food insecurity are more strongly correlated with poverty estimates, the most convincing of which are likewise generated from household survey data.

Beyond the increased precision that more disaggregated evidence allows, individual and household-level survey-based measures permit reasonably accurate prediction of who is most likely to be affected adversely by potentially harmful shocks, such as food price increases, drought or slumping demand for wage labor. Survey data-based predictions of community-level variables, such as child undernutrition, can even underpin catastrophe insurance contracts that trigger payouts when most needed (Chantarat et al. 2007). By contrast, aggregate food availability is a poor predictor of other food insecurity indicators. As but one striking example, the FAO's estimate of the world's undernourished population has increased by 9% globally in spite of its rise of a 12% rise in global food production per capita since 2007 (Barrett 2010).

Nonetheless, even when agencies utilize the same data, they may come to different conclusions about the need for assistance. For example, in 2012 in the Sahel, the United Nations World Food Programme and the Famine Early Warning System Network reached contrasting conclusions about the severity of food insecurity due to differences in measures (food security vs. malnutrition), and in whether measures should capture acute or acute and chronic conditions, among other factors (Amaral et al. 2012). While variations in assessments are not uncommon, large and persistent differences, such as those observed in the Sahel, can create confused messages and ultimately slow assistance where needed.

Although the most severe food insecurity is typically associated with disasters such as drought, floods, war or earthquakes, most food insecurity is not associated with catastrophes, but rather with chronic poverty (Barrett 2010). The rapidly growing global population affected by disasters is merely a modest fraction of the undernourished, who in turn represent a minority of those living in poverty at any given time. While good data remain elusive, it is widely believed that only a small fraction of hunger-related deaths worldwide are caused by humanitarian emergencies while the vast majority are associated with chronic or recurring hunger and malnutrition. Similarly, in every country, rates of child stunting – reflecting chronic undernutrition – far exceed those of child wasting – indicating short-term, acute undernutrition – with the difference greatest in the poorest countries (Figure 1, data from UNICEF 2012).

What also comes through clearly in the best-statistical-fit curves depicted in Figure 1 is the negative-but-weak relationship between per capita gross national income and both stunting and wasting measures. While the chronic indicator, stunting, has a steeper negative slope than does the more transitory measure, wasting, at very low levels of national income, the dispersion around both curves is considerable and the slope is close to zero once countries hit the 'upper middle income' range, defined by the World Bank as over roughly $4,000 per capita. This suggests that income growth is only weakly correlated with improvements in child nutritional status and almost exclusively over the low income and lower middle income ranges. This underscores the importance of distributional concerns to patterns of food security.

Because most food insecurity is seasonal or regular but aperiodic – i.e., associated with temporary unemployment, episodes of ill health, or other recurring adverse events – people anticipate such possibilities. They engage in precautionary behaviors to try to mitigate their risk. Hence the empirical regularity that perceptions-based survey measures consistently find food insecurity rates several times higher than related hunger or insufficient intake measures (NRC 2005). Food insecurity remains widespread today in large measure because poverty and economic vulnerability remain widespread, and vice versa (Dasgupta 1997; Carter and Barrett 2006).

Perceptions data may not suffice to capture utilization problems, such as those associated with micronutrient malnutrition. The prevalence of micronutrient deficiencies is imprecisely known; very rough estimates suggest that iodine, iron, vitamin A and zinc shortfalls alone affect at least 2 billion people, disproportionately women and children. This leads to increased risk of both chronic and infectious disease, aggravates diseases' effects, and leads to irreversible loss of cognitive and physical function, especially during the crucial one thousand day period from conception until the child reaches age two, during which children are biologically vulnerable and thus heavily dependent on caregiver knowledge to utilize foods appropriately (Darnton-Hill et al. 2005 World Bank 2006; Horton, Alderman, and Rivera 2008). These irreversible effects contribute to persistent poverty, reinforcing the consequences of food insecurity.

To summarize, a range of measures of food insecurity exist, many of them inconsistent with one another. Over time, experts have come to favor survey-based measures, especially those that incorporate perceptions measures that more comprehensively reflect the psychology and expectations of food security, not just past dietary patterns, thereby reflecting increasingly nuanced understandings

of food insecurity. But the considerable difficulties and expense involved in fielding large-scale, regular individual and household nutrition and food security surveys precludes their use in generating large-scale measures of food insecurity. Coarse approximations based on intrinsically contestable methods therefore continue to dominate the global policymaking discourse about hunger and food insecurity.

Historical Overview of Hunger and Food Insecurity

For most of human history, lives were short and unhealthy due in large measure to insufficient nutrient intake. Thomas Malthus' (1798) well-known explanation for this predicament was that human population growth routinely overtaxed the capacity of the Earth to provide sufficient food, leading to routine food insecurity and regular famines.

Since the 18th century, however, a few dozen countries have enjoyed an unprecedented escape from hunger and premature death due largely to dramatic advances in food availability and associated income growth broadened access to a satisfactory diet. Synergistic interactions arise as increased consumption requires increased food production, which becomes more feasible as people grow bigger, stronger, healthier and more energetic because they eat more – of course, only up to a point now commonly exceeded in an era of exploding obesity. The reinforcing feedback between nutritional status and productivity points to a nutritional poverty trap. Several scholars argue that the escape from the nutritional poverty trap helped to catalyze the unprecedentedly rapid and widespread advance of living standards over the past 300 years (Dasgupta 1993, 1997; Fogel 2004).

Much of this progress traces back to increased food availability made possible by agricultural technological change associated with plant breeding, improved agronomic practices such as intercropping and crop rotations, irrigation, and the emergence of mechanical implements and chemical fertilizers. As a direct result, food security has often been equated with food availability indicators, typically measured in terms of satisfaction of dietary energy requirements, i.e., calories per person per day. Indeed, at the time of the World Food Conference of 1974, food security was widely viewed as a problem of insufficient and unstable production. And because domestic food production represents the overwhelming majority of food availability in virtually every country, increased variability in domestic food production significantly increases national-level food consumption instability (Diakosavvas 1989).

Such measures create an inherent conceptual link to food self-sufficiency, i.e., whether a country produced enough food to feed its population adequately. However, self-sufficiency implies letting the domestic market equilibrate local demand and supply, which can lead to high prices and widespread hunger for countries with poor endowments of fertile land and plentiful water. Strictly availability-based measures pay scant attention to the economic (in)efficiency or environmental consequences of producing one's own diet rather than trading internationally for food according to economic laws of comparative advantage based on natural resource endowments.

Moreover, distributional problems commonly lead to food insecurity despite sufficient aggregate food availability. This is true at the national level as well as the household and individual levels. Although food is plentiful at the global level, food availability is insufficient in some poor countries, especially without significant external assistance. International trade is helpful, but of limited use in relieving aggregate food insecurity in some low-income countries because limited export earning and international borrowing capacity constrain current account deficits.

Over the past quarter century, the major shift in thinking about food insecurity has therefore been towards the close linkage between poverty (rather than low agricultural productivity) and food insecurity. Put differently, emphasis is on consumption rather than production. This second generation of thinking on food security, focused more on the demand side and on issues of access by vulnerable people to food, stems directly from the pathbreaking work of Sen (1981). Ironically, Sen explicitly eschewed the concept of food security, focusing instead on the "entitlements" of individuals and households. Sen's seminal work helped shift the focus from supply side issues associated with

aggregate food availability toward the levels of individual and household access to food, and thus to the role of (perhaps idiosyncratic) demand failure brought about by lost employment, adverse movement in the terms of trade, production failure, termination of transfers, or other forms of "entitlement failure". Sen's concept of "entitlements" represents the commodity bundles that a person can rightfully make her own, through production, trade, or transfers. Sen (1981) explains hunger as the failure of an individual's entitlements to provide a commodity bundle offering sufficient nutrients, and famine as the result of widespread entitlement failures. Sen thus placed increased emphasis on not only traditional economic variables of incomes and prices, but equally on human rights and on the legal institutions of the state, as well as the moral and social norms of cultures.

The entitlements approach has been critiqued by some as apolitical, ahistorical, excessively legalistic and economistic (de Waal 1990; Baro and Dubel 2006). Most recent analysts have encouraged efforts to incorporate power and vulnerability into conceptualizations of food insecurity, although these have gained little traction, not least of which because of the added layers of measurement challenge these concepts introduce. One consequence has been increased focus on understanding the proximate threats to food security in an integrated fashion. The emergent third generation view of food security builds on food availability and entitlements as a summary of food access. Chambers (1989, p. 1) identifies two dimensions of food insecurity: "an external side of risks, shocks and stress to which an individual or household is subject; and an internal side which is defenselessness, meaning a lack of means to cope without damaging loss". Individuals with excessive risk exposure and without access to noninjurious coping mechanisms are the most food insecure. Both risk exposure and the availability of noninjurious coping mechanisms depend heavily on structural patterns of control of (financial, human, and natural) resources and on access to markets, technologies, and finance. Food security is thus closely related to poverty and to social, economic, and political disenfranchisement (Drèze and Sen 1989).

Causes of Hunger and Food Insecurity

Many factors can result in availability, access, or utilization failures. Indeed researchers have identified sources of food insecurity ranging from macro-structural factors, such as globalization or episodes of widespread unemployment or high food prices, to micro-level factors, such as household bargaining power (Hoddinott and Haddad 1995; McMichael 1995; Scanlan 2009). In many instances food insecurity is likely the result of a complex combination of availability, access and or utilization failures. Devereux (2009), for example, argues that famines – the most severe form of food insecurity - cannot be attributed to a single cause, and that famines result from a varying mix of production failures (e.g., due to natural disasters or environmental changes), exchange failures (i.e., market failures or poverty) and response failures (i.e., accountability failures by governments and international agencies).

Production failures, trade barriers, poor governance, etc. may result in availability failure, meaning that adequate and appropriate food cannot reach the target population. Likewise, conflict, poverty, inaccessible markets, information failures, liquidity constraints, or sociocultural norms, etc. may limit food access for an entire community, for a household or for an individual within a household. Utilization failures may be due to poor health, poor sanitation, or lack of knowledge about food preparation or nutrition. Stability is commonly interlinked with access, as the intent of the stability pillar is to ensure continuous access. For example, food price spikes can undermine stable access to food. Chronic food security is generally linked to structural problems while acute food insecurity is typically associated with rapid onset shocks. In complex emergencies, individuals suffering from chronic or seasonal food insecurity may suddenly face acute food insecurity. Already weak coping mechanisms may collapse and individuals' nutritionals status can face a rapid and precipitous decline.

Yet, most food insecurity is due to chronic or seasonal poverty, not due to catastrophic events, such as earthquakes, floods or war that disrupt food production and distribution at scale, although these events can result in episodes of severe food insecurity (Barrett 2010). Devereux et al. (2008) point to

regular seasonal shortages and associated price increases as a source of food insecurity for landless laborers and smallholder farmers. Krishna (2004) highlights the sizeable entry and exit of households into and out of poverty in India. Wilde and Nord (2005: 430-431) find that US food stamp eligible households "do not come in constant 'secure' and 'insecure' varieties. Instead, it appears that unobserved hardships strike from time to time, with large effects both on [food stamp] program participation and food security".

When faced with dire choices, individuals or households may choose food insecurity rather than losing assets, such as seed stock, livestock, or land (de Waal 1989; Conway 1998; Hoddinott 2006). While this strategy protects productive assets, it puts at risk the nutrition of the most vulnerable family members. Malnutrition during the first thousand days from a start of a woman's pregnancy until her child's second birthday can have lasting consequences (Victora et al. 2008). Further, different household members may make different choices about how to allocate resources. Hoddinott and Haddad (1995) find that in Côte d'Ivoire mothers' control of income is associated with increased spending on food. In one of very few studies from a developed country, Kenney (2008) finds that U.S. children are less likely to be food insecure if their mother controls the household's pooled income than if their father does or both parents jointly control income. Yet, this is not universally the case. Cultural rules regarding parental responsibility shape these outcomes (Kenney 2008). For example, in Bangladesh, increases in fathers' income led to increased spending on food, but increased income for mothers did not. And among pastoralists in northern Kenya and southern Ethiopia, Villa et al. (2011) find that male household heads adjust their own diets to buffer family members' dietary diversity against adverse income shocks.

Interventions to reduce hunger and food insecurity

Given the strong, bidirectionally causal relationship between poverty and food insecurity, food assistance programs expressly aimed at reducing hunger and undernutrition are commonly viewed as an important element of holistic poverty reduction strategies in addition to their more direct role addressing food insecurity. Food assistance encompasses any publicly financed direct food, cash, or voucher transfers, or food subsidies that serve as de facto transfers, for the purpose of increasing the quality or quantity of food consumed, so as to improve recipients' health and nutritional status.

Carefully designed food assistance programs, and related nutritional interventions, have been identified by the Copenhagen Consensus (2008) as among the highest return investments available worldwide. But, as Barrett (2002: 2105) writes "[t]he impulse to action is strong but does not guarantee success. Most nations have implemented food assistance programs of some sort, but many of these have proved expensive, ineffective, or both." One of the key reasons is that food assistance programs are quite small relative to the broader, commercial and semi-subsistence food systems on which people rely for daily nourishment. Therefore, any public food assistance policy or program must be designed to integrate effectively with the private food production and distribution system.

International food aid receives disproportionate attention. International food aid deliveries are actually quite modest relative to private and domestic sources of supply. Globally, 85-90 percent of global cereals production is consumed in the country in which it is grown in any given year; only 11-12 percent of global food production is internationally traded in any given year even though trade has been growing faster than output over the past 40 years (Lentz and Barrett 2012). International food aid is far smaller still, amounting to less than one-quarter of one percent of total food production and only 1.9 percent of commercial international food trade. Moreover, most international food aid is now purchased primarily in developing countries, not in donor countries, with much of it bought in surplus regions of the recipient country under "local purchase" programs (Lentz et al. forthcoming). Even the poorest countries rely heavily on their own agricultural production systems and on regional trade networks to satisfy food demand.

Global food aid amounts to less than $5 billion annually now, as compared to, for example, nearly $90 billion spent by the United States government each year on public feeding programs (school breakfast and lunch programs, Supplemental Nutrition Assistance Program, etc.). And even in the countries with the largest food assistance programs, these are small compared to the broader food economy. For example, India's targeted public distribution system comprised only about 16 percent of total foodgrains produced in 2009-2010 (Government of India 2011) while the United States' domestic food assistance programs account for less than ten percent of a food economy of more than $1 trillion annually. For this reason, the performance of the domestic private food production and distribution systems matter more to food security than do national public food assistance policies and programs, which in turn matter more than international food aid. In designing and evaluating food assistance policy, it is crucial to keep this ordering of the key sources of populations' diet firmly in mind.

Food assistance policies and programs can nonetheless provide essential social protection, filling in the gaps left by the private (for-profit) food system and informal (not-for-profit) social safety nets so as to ensure the food security of vulnerable individuals, households and communities. A growing literature underscores the importance of social protection for economic growth and poverty reduction (Carter and Barrett, 2006, 2007; Alderman, Hoddinott, and Kinsey 2006; Barrett, Carter, and Ikegami 2011). The safety net provided by food assistance and other social protection programs reduces individuals' and households' catastrophic risk exposure and encourages savings, investment and adoption of improved technologies, all of which contribute to increased incomes and enhanced food availability and access.

In order for government agencies and civil society institutions to offer effective food assistance programs, they must have the clear legal obligation and political commitment to protect the fundamental human right to food, as enshrined in the International Covenant on Economic, Social and Cultural Rights, as well as adequate resources to implement such protection. Effective, direct food security interventions depend on targeting of the vulnerable subpopulation(s) and of the causes of insecurity, as well as prompt response. Where data collection is timely, causal factors can be robustly associated with food insecurity measures, and where predictive models have demonstrable accuracy, preventive measures can substantially reduce unnecessary human suffering. The long-term consequences of crises can be limited where appropriate policies and institutions are already in place, such as social protection schemes to cushion people in times of adversity and early childhood health programs to protect the most vulnerable from even short-lived interruptions in essential nutrient intake.

Automatic stabilizing and safety net programs are important means of circumventing inconsistent or inadequate government and donor response. Political and economic elites are rarely severely affected by crises, nor do they suffer chronic food insecurity. Because they rarely face intense, immediate political pressure, slow, halting or incompetent government and donor response is a recurring problem. For example, the median delivery time for emergency food aid from the United States, the main global food donor, is nearly five months due to legislative restrictions on procurement and shipping (Barrett and Maxwell 2005). And even prescient early warning systems often go unheeded (Lautze et al. forthcoming).

For example, in the Niger crisis of 2004-5, below-normal rains and anticipated locust attacks led to a low cereals harvest that elicited prompt government and United Nations appeals for emergency assistance in November 2004. But global response was anemic. By July 2005, the Niger situation was finally attracting graphic global media coverage that led to a significant global response, much of which arrived with the next harvest. These delays are both deadly and expensive. In Niger, quite apart from the still unclear human health toll and lives lost to delays, the cost per beneficiary for World Food Programme deliveries more than tripled from February to August 2005, from $7 to $23, due to far greater need for supplemental and therapeutic foods instead of cheaper, bulk commodities, and the need for airlift and other quicker, but more expensive logistical support (Chantarat et al. 2007). Poorly

conceptualized or implemented relief programs can adversely affect communities, leaving them more vulnerable to food insecurity by displacing commercial food trade, affecting local prices, or distorting incentives and behaviors. Hence the need for pre-arranged financing facilities, social protection programs such as employment guarantee schemes, and other ready-made responses to emergent food security crises.

Perhaps the most important factor determining the efficacy of food security interventions is the quality of targeting (Lentz and Barrett 2008). Does assistance reach intended beneficiaries? Good targeting is exceedingly difficult. Even so-called "self-targeting" designs, such as public employment schemes that pay below-market wages or subsidization of inferior foods not desired by the food secure, experience leakage (Barrett and Clay 2003; Coady, Grosh, and Hoddinott 2004). The neediest individuals are not always easily identified, even in participatory or community-based targeting efforts, for example, due to social isolation or discrimination. Further, the need for political buy-in often leads to targeting a broader population for food assistance programs (Pinstrup-Andersen 1993).

Effective targeting is usually based on a mixture of geographic indicators, observable individual or household characteristics, program restrictions (such as work requirements), or community consultations (Coady et al. 2004). Identifying the most needy prospective recipients and the optimal form of assistance involves tradeoffs across time, efficacy, and cost and commonly requires triangulation using multiple indicators across time and levels of aggregation. In responding to transitory food insecurity associated with sudden natural disasters (e.g., earthquakes, hurricanes), careful and expensive data collection may be inappropriate, especially for short-lived interventions. By contrast, careful targeting is essential for long-term programs that address more common chronic food insecurity.

The greatest food security gains typically come indirectly, however, through policies that promote poverty reduction through asset building, employment creation and productivity growth among the poor, as well as safety nets to safeguard the vulnerable non-poor. Where food availability remains limiting, as is true of dozens of low-income countries, efforts to boost crop productivity, especially of micronutrient-rich foods, and improve food marketing systems merit prioritization. Hence the resurgence of interest in pursuing a new Green Revolution to end hunger, especially in sub-Saharan Africa and South Asia (Conway 1998; Cullather 2010; AGRA 2013). The original Green Revolution led to improved food security for urban populations, primarily due to lower cereals prices; however, its impact on the rural poor was mixed, with some farmers and landless laborers experiencing increased hunger (Conway 1998). Conway (1998) argues that future efforts to improve productivity should incorporate conservation techniques and pay more attention to distributional effects. The Alliance for a Green Revolution in Africa (AGRA), a novel partnership between the Gates and Rockefeller Foundations, aims to sustainably strengthen agricultural value chains, focusing on breadbasket areas within Africa. Yet, there remain disputes as to whether a new Green Revolution can improve food security. Cullather (2010) warns that although the Green Revolution is commonly portrayed as a technocratic approach it was, in fact, a highly political undertaking. He argues, "tantalizing one-time solutions distract from the inequities of power that perpetuate poverty and hunger" (Cullather 2010: 270).

Food insecurity and broader concerns about the role of food in people's lives can also catalyze social movements. Examining recent social movements such as Food Sovereignty, Slow Food, and Fair Trade, McMichael (2009) writes that peasants have mobilized to advocate for biodiverse and sustainable agriculture and against industrial agriculture. These peasant movements arose in response to "the human and ecological wake created by the 'globalisation' of the corporate food regime" (McMichael 2009: 148). The Right to Food movement advocates for reform of both short-term and long-term food security interventions and repositions beneficiaries as rights-holders, and donors and participant governments as duty-bearers (De Schutter 2009). The Right to Food movement in India, through legal action and campaigning, has played a major role in shaping Indian social protection programs, including the establishment of the 2005 National Rural Employment Guarantee Act and the 2005 Right to

Information Act (Devereux et al. 2008). Other social movements seeking to change to underlying structural factors, such as the Brazilian Landless Workers Movement (MST), may indirectly impact food security by increasing assets, income, or access to services.

Future directions for research

There is a great deal that we do not yet understand about food security. At the most basic level, simply measuring food insecurity in an accurate and timely fashion remains challenging. Developing and assessing innovative measurements, such as dietary recall or subjective perceptions, and innovative measurement techniques, such as the use of sentinel sites, will continue to be important areas for future research (Barrett 2010; Headey and Ecker forthcoming).

A second, related research frontier concerns comparative impact evaluation. Despite the enormous sums spent on food assistance programs and policies over the years, there exists relatively little rigorous evidence comparing among interventions so as to establish what works best for which objective and, therefore, what should be the highest priority interventions given scarce resources. Moreover, there are relatively few studies that offer long-term results so as to establish long-run payoffs as well as those during a short period of program evaluation (Hoddinott et al., 2008; Behrman et al., 2009). Finally, it is difficult to do benefit-cost analysis effectively in the absence of clear counterfactuals and solid methods for controlling for non-random placement and selection effects. Because most food insecurity interventions are expressly targeted at those most vulnerable to food insecurity, failure to control adequately for such effects automatically biases the estimated impacts of any intervention in the direction of finding no or adverse effects. There is a pressing need for more careful attention to both confounding variables and explicit comparison among alternative interventions in empirical work on food insecurity.

Yet, social protection and food assistance programs remain critical means to address food insecurity. Clear analyses of what food security interventions work in what institutional and cultural context – and whether such approaches are replicable – can contribute to a relatively small literature of carefully documented findings. For example, the small but growing body of evidence of the causal link between nutritional status during the first thousand days and long-term outcomes, has the potential for major implications in the design and implementation of effective social protection policies (Almond and Currie 2011). Policymakers and researchers are just beginning to grapple with how to translate research findings on the first thousand days into practice.

Furthermore, the link between poverty and food security indicates that poverty alleviation efforts can mitigate food insecurity, especially for lower-income individuals and households. This emerging understanding is reflected in the recent interest in harnessing smallholder agricultural growth for nutrition. Whether a new Green Revolution could be the means to achieve improved smallholder nutrition in an environmentally sustainable and equitable manner is similarly emerging as an important area for research. The links between poverty alleviation and food security also create an opportunity to examine potential knock-on effects of poverty alleviation programs and policies, or of related social movements, on food insecurity as well as the limits of these factors to address food insecurity, perhaps resulting from distributional inequities, political power, or behavioral and cultural practices.

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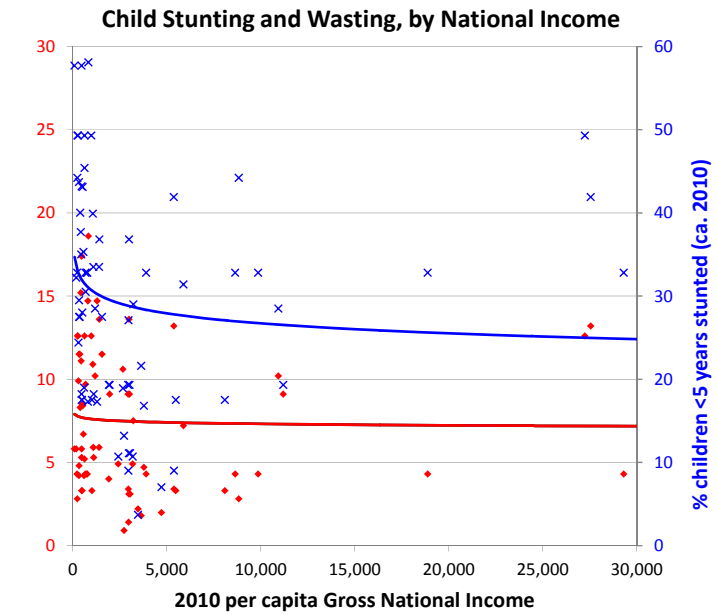

Data source: UNICEF (2012)

Figure 1: National rates of child wasting and stunting, by per capita income