Child Food Insecurity: The Economic Impact on our Nation

A report on research on the impact of food insecurity and hunger on child health, growth and development commissioned by Feeding America and The ConAgra Foods Foundation

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FEEDING AMERICA

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INTRODUCTION

We know how to fix the problem of childhood hunger, and we have an opportunity now to build a prosperous future for us all by doing that. Over the past century Americans have built marvelous networks and systems of infrastructure that are necessary to our economy and quality of life. Through creativity, inventiveness, ingenuity and hard work we have made our country a model of success in many areas. For example, we have built a national power grid, telecommunication systems, water systems, transportation systems, and internet systems that are peerless, to list just a few. But we have not yet updated our food system to bring it fully in line with 21st century knowledge and needs.

In many ways the American food system reflects the best of our economic and social accomplishments. The U.S. food industry has achieved levels of productivity and organization that reflect state-of-the-art communication, transportation and management technologies. Its integration with the global economy involves feats of engineering and organization that are unrivaled. But in other very important ways we are still in the 1950s because we never completed the infrastructure investments needed to make sure that all American children always have enough healthy food to provide the solid foundation on which sharp minds and strong bodies are built. As a result, the U.S. economy has handicapped the minds and bodies of much of its workforce and placed severe constraints on its available pool of human capital.

Fortunately, American business leaders are unlikely to stand by idly while the hope and promise of a prosperous and successful future for our children and grandchildren slip away. Throughout our history we have rallied to meet the demands of many serious threats, and there are no compelling reasons why we cannot meet the challenges posed by child hunger.

This report summarizes results of research completed by Children's HealthWatch (formerly the Children's Sentinel Nutrition Assessment Program (C-SNAP)), and by many other researchers, on the impacts of food insecurity and hunger on children's health, growth and development. A large body of research literature, amassed over the past two decades, shows clearly that food insecurity and hunger together with other correlates of poverty, can dramatically alter the architecture of children's brains, making it impossible for them to fulfill their potential.

OBJECTIVES OF THE REPORT

In this report we present the results of Children's HealthWatch's recent research on the associations of food insecurity and hunger, as measured by the US Food Security Scale, with child health, growth and development. In addition, we place these research results within the context of other research on food security and hunger over the past ten years. Several important themes emerge from the research we describe. These include:

Child Hunger is a Health Problem

While every American is morally offended by the existence of childhood hunger, pediatricians and public health professionals see the tragic effects of this unnecessary condition graphically imprinted on the bodies and minds of children;

- Hungry children are sick more often, and more likely to have to be hospitalized (the costs of which are passed along to the business community as insurance and tax burdens);
- Hungry children suffer growth impairment that precludes their reaching their full physical potential,
- Hungry children incur developmental impairments that limit their physical, intellectual and emotional development.

Child Hunger is an Educational Problem

- Hungry children ages 0-3 years cannot learn as much, as fast, or as well because chronic undernutrition harms their cognitive development during this critical period of rapid brain growth, actually changing the fundamental neurological architecture of the brain and central nervous system,
- Hungry children do more poorly in school and have lower academic achievement because they are not well prepared for school and cannot concentrate,
- Hungry children have more social and behavioral problems because they feel bad, have less energy for complex social interactions, and cannot adapt as effectively to environmental stresses.

Child Hunger is a Workforce and Job Readiness Problem

- Workers who experienced hunger as children are not as well prepared physically, mentally, emotionally or socially to perform effectively in the contemporary workforce,
- Workers who experienced hunger as children create a workforce pool that is less competitive, with lower levels of educational and technical skills, and seriously constrained human capital.

"The healthy development of all children benefits all of society by providing a solid foundation for economic productivity, responsible citizenship, and strong communities."

Jack P. Shonkoff, MD, Director
Center on the Developing Child
Harvard University

Child Hunger Leads to Greater Health Care Costs for Families and Employers

- *Short-term: hungry children have greater odds of being hospitalized, and the average pediatric hospitalization costs approximately $12,000.*
- *Long-term: results of chronic undernutrition that contribute to high health care costs.*
- *Child hunger leads to greater absenteeism, presenteeism and turnover in the work environment, all of which are costly for employers. Child sick days are linked to parent employee absences, for instance.*

Child Hunger is Totally Preventable and Unnecessary in the USA

- *The federally-funded nutrition assistance infrastructure works: nutrition assistance programs provide the first-line defense against child hunger, if adequately funded.*
- *Good nutrition is just like a good antibiotic or vaccine in preventing illness. The Supplemental Nutrition Assistance Program—SNAP (formerly the Food Stamp Program), WIC, the National School Lunch and Breakfast Programs, Child and Adult Care Food Program, TEFAP and other public nutrition assistance programs are good medicine, but the dose is often not strong enough and the prescription is not for a long enough time period. Many families cannot overcome barriers to access these services which are crucial for health.*
- *Private food assistance programs guarantee that no child falls through the cracks by buttressing, complementing and supporting the public nutrition infrastructure—the Food Bank network makes up the difference in dose required and duration for which it is needed to cure the serious health problem of child hunger.*
- *Working together, in mutually supportive partnership, the national public and private food assistance systems can prevent and eradicate the unnecessary health problem of childhood hunger, if we the people choose to do so.*

- Doctors strongly support this approach to "vaccinating" our children against childhood hunger and to treating them effectively if and when this health problem does occur.
- Fixing the child hunger problem provides an opportunity to make strong, well-educated, healthy children into an engine for growth in the American economy.
- America's Business Leaders can play a central role in helping to make these investments happen.

BACKGROUND

Food is one of our most basic needs. Along with oxygen, water, and regulated body temperature, it is a basic necessity for human survival. But food is much more than just nutrients. Food is at the core of humans' cultural and social beliefs about what it means to nurture and be nurtured.

Food security—defined informally as access by all people at all times to enough food for an active, healthy life—is one of several conditions necessary for a population to be healthy and well-nourished.[1] Food insecurity, in turn, refers to limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire food in socially acceptable ways.[2]

Until the mid-1990s, lack of access to adequate food by U.S. households due to constrained household financial resources had been measured by questions assessing "hunger," "risk of hunger," and "food insufficiency." [3, 4, 5, 6, 7] In 1990, an expert working group of the American Institute of Nutrition developed the following conceptual definitions of food security, food insecurity and hunger, which were published by the Life Sciences Research Office (LSRO) of the Federation of American Societies for Experimental Biology.[8]

- **Food Security**: "Access by all people at all times to enough food for an active, healthy life. Food security includes at a minimum: (1) the ready availability of nutritionally adequate and safe foods, and (2) an assured ability to acquire acceptable foods in socially acceptable ways (e.g., without resorting to emergency food supplies, scavenging, stealing, or other coping strategies)."
- **Food Insecurity:** "Limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways."
- **Hunger**: "The uneasy or painful sensation caused by a lack of food. The recurrent and involuntary lack of access to food. Hunger may produce malnutrition over time…Hunger…is a potential, although not necessary, consequence of food insecurity."

These conceptual definitions were operationalized and a scale was developed to measure the operational conditions at the household level in the U.S. population under guidance and sponsorship of the National Center for Health Statistics and the U.S. Department of Agriculture in 1995-97. [9] Consisting of 18 questions, the U.S. Food Security Scale (FSS) is administered annually by the Census Bureau in its Current Population Survey (CPS) with results reported by USDA's Economic Research Service (ERS). These repeated cycles of the FSS now provide a time series of data on food security, food insecurity and hunger in the U.S. population for 1995-2007. [10]

Relatively recently, a Children's Food Security Scale (CFSS) consisting only of the eight child-referenced items in the larger 18-item FSS has been validated by USDA/ERS. The CFSS can be scored and scaled to more directly depict the food security status of children in a household. This child-referenced scale has also been shown to yield higher prevalence of child hunger when administered separately than is obtained from the household-level FSS.[11] The eighteen questions comprising the FSS are shown in Table 1, with the eight items that make up the CFFS in the lower section. Thresholds for the various household and child food security categories are also indicated.

Additional changes were recently implemented by USDA/ERS in the way results from the Census Bureau's annual administration of the FSS are reported.[12] These changes affect terminology used to label the most severe level of deprivation measured by both the household and children's scales by replacing the term "hunger" with the blander (some would say euphemistic) term "very low food security." [13] Because this change is relatively recent, and not uniformly accepted by scientists, policymakers or advocates, we have elected to use the original term "hunger" in this review when referring to the most severe category of food insecurity.

We also present material below that we hope will shed additional light on the meaning of the terms food security, food insecurity and hunger, and how these conditions are related. A goal of that discussion is to clarify what hunger is, and to provide readers with sufficient information about how it is measured to enable reasoned decisions whether the term "hunger" is useful in describing the most severe levels of food insecurity.

Table 1: Questions Comprising the U.S. Food Security Scale with Child Food Security Scale Questions in the Lower Section

1. "We worried whether our food would run out before we got money to buy more." Was that often, some times, or never true for you in the last 12 months?	Household Food Secure
2. "The food that we bought just didn't last and we didn't have money to get more." Was that often, some-times, or never true for you in the last 12 months?	(0-2 items affirmed)
3. "We couldn't afford to eat balanced meals." Was that often, some times, or never true for you in the last 12 months?	
4. In the last 12 months, did you or other adults in the household ever cut the size of your meal or skip meals because there wasn't enough money for food? (Yes/No)	
5. (If yes to Question 4) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months	Household Food Insecure Without Hunger
6. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? (Yes/No)	(3-7 items affirmed)
7. In the last 12 months, were you ever hungry, but didn't eat, because you couldn't afford enough food? (Yes/No)	
8. In the last 12 months, did you lose weight because you didn't have enough money for food? (Yes/No)	
9. In the last 12 months, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food? (Yes/No)	Household Food Insecure With Adult Hunger Only
10. (If yes to Question 9) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?	(8-10 items affirmed)
(Questions 11 - 18 are asked only if the household included children ages 0 -18 Yrs)	
11. "We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food." Was that often, sometimes, or never true for you in the last 12 months?	Child Marginally Food Secure
12. "We couldn't feed our children a balanced meal, because we couldn't afford that." Was that often, some-times, or never true for you in the last 12 months?	
13. "The children were not eating enough because we just couldn't afford enough food." Was that often, sometimes, or never true for you in the last 12 months?	Child Food Insecure Without Hunger
14. In the last 12 months, did you ever cut the size of any of the children's meals because there wasn't enough money for food? (Yes/No)	
15. In the last 12 months, were the children ever hungry but you just couldn't afford more food? (Yes/No	
16. In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food? (Yes/No)	Child Food Insecure With Hunger
17. (If yes to Question 16) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?	
18. In the last 12 months, did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)	

Relationship of Food Insecurity to Poverty

Food insecurity and hunger, as measured by the FSS, are specifically related to limited household resources.[14] Thus, by definition they are referred to as "resource-constrained," or "poverty-related" conditions. Financial resources available to households can include income earned by household members and additional resources derived from cash [a] and in-kind assistance provided by public and private safety-net programs, including public and private food assistance programs, housing subsidies, and energy assistance.[15,16,17,18]

The official definition of poverty for the U.S. population uses money income before taxes and does not include capital gains or noncash benefits (such as public housing, Medicaid, and SNAP). The definition is based roughly on historical estimates of the portion of an average household's income required to purchase a "minimally nutritious diet" (about 30% in the early 1960s). Poverty thresholds, set at three times the amount necessary to buy such a diet, are amounts of money estimated by the federal government to approximate statistical levels of necessity for families of different size and composition (i.e., number of people in the household, and number of children or elderly). Although the cost of living varies widely from state to state and region to region, poverty thresholds do not vary geographically. They are, however, updated annually for inflation using the Consumer Price Index (CPI-U), a broad national index of overall increases in aggregate consumer prices.[b] The official poverty threshold for families of four people, two adults and two children, was $21,027 in 2007. [19] All members of a household with income below this level will be categorized as being in poverty.

POVERTY IS THE MAIN CAUSE OF FOOD INSECURITY AND HUNGER.

- IN 2007, THE OFFICIAL POVERTY THRESHOLD FOR A FAMILY OF 4 WITH 2 CHILDREN WAS $21,027 PER YEAR
- IN 2007, 13.3 MILLION CHILDREN LIVED IN POVERTY
- IN 2006, 12.4 MILLION CHILDREN WERE FOOD-INSECURE

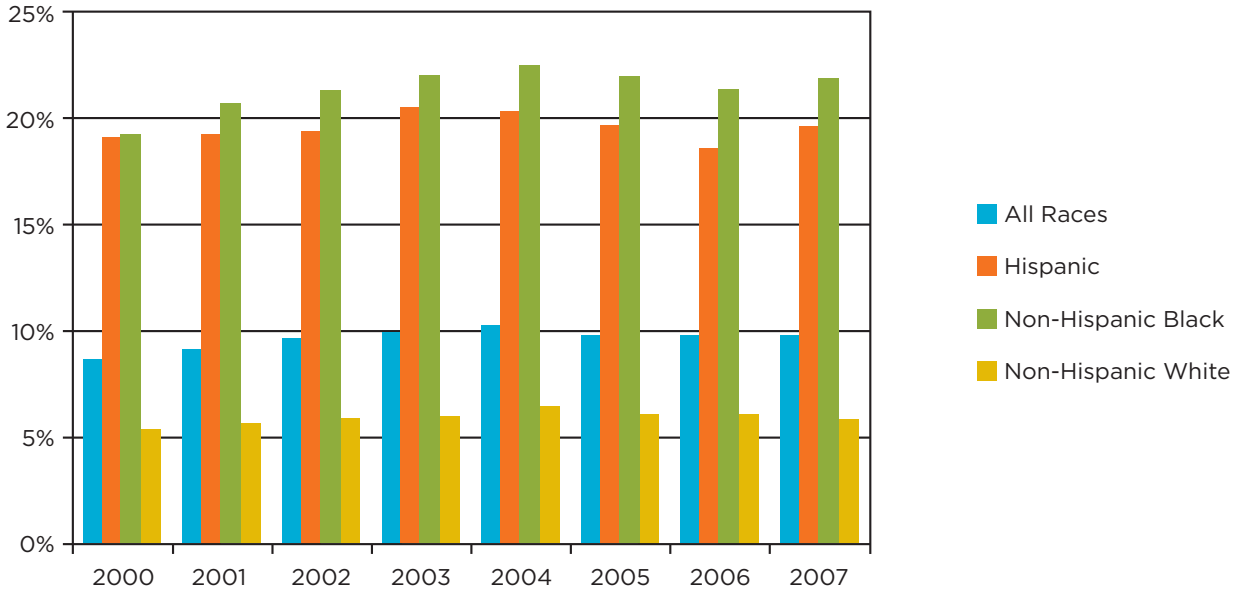
Both the definition of poverty and the poverty thresholds have been criticized on grounds that they do not accurately reflect families true financial resources, nor the amount of money families actually need to be economically self-sufficient.[20] Estimates of minimum income levels required for families to achieve basic economic self-sufficiency range around twice the federal poverty thresholds. [21]

Based on the official poverty definitions, in 2007 (the latest year for which data are available), 37.3 million people (12.5%) lived in households with incomes below the poverty thresholds in the U.S. Of these, 13.3 million were children under age 18 years, and 5.1 million were children under 6 years of age. Subpopulations with highest prevalence of poverty are people in female-headed households with no spouse present (28.3%), Blacks (24.5%), Latinos (21.5%) and children under age 6 years (20.8%).[22] From 2000 to 2004 the poverty rates for all major ethnic groups increased steadily, though they declined slightly from 2005–2006 and increased in 2007 (**Figure 1**).

[a] Most federal sources of cash assistance available to families and children are managed by agencies within the Department of Health and Human Services. Descriptions of these financial assistance programs can be found at http://www.dhhs.gov/children/#income, viewed June 25, 2007.

[b] Moreover, though an average U.S. family currently spends only about 12% of its total annual expenditures on food, implying a poverty threshold nearer eight (100% Ð 12%) times the cost of a minimally nutritious diet instead of three times, this "multiplier" has not been updated since its conception in the early 1960s. See "The Development of the Orshansky Thresholds and Their Subsequent History as the Official U.S. Poverty Measure," by Gordon M. Fisher (1992), at http://www.census.gov/hhes/www/povmeas/papers/orshansky.html, viewed July 13, 2007.

Figure 1: Proportion of U.S. Families with Incomes Below Poverty by Race/Ethnicity, 1999-2007*



* Includes households with and without children.
Source: U.S. Census Bureau Current Population Survey, various years.

Though the populations affected by poverty and food insecurity overlap, they are not identical. Not all poor people are food insecure and the risk of food insecurity extends to people living above the federal poverty level.[23] In 2007, the latest year for which data are available, 36.2 million people in the U.S. (12.2%) lived in food-insecure households, 24.3 million in households without hunger and 11.9 million with hunger (Figure 2). Of the 36.2 million food-insecure people in the U.S. in 2007, 12.4 million were children under 18 years of age. As with poverty, subpopulations with the highest prevalence of household food insecurity are Blacks (22.0%), Latinos (22.3%), people in households with children under 6 years of age (17.7%), and single-mother households (30.4%).[24]

In 2007, 39.9% of all people in the U.S. with incomes below the poverty thresholds were food insecure. Of all people with incomes equal to or above the poverty threshold but below 130% of poverty (gross income cutoff for SNAP in most states), 30.3% were food insecure, while 21.3% of all people with incomes equal to or above 130% but below 185% of poverty (gross income cutoff for WIC) were food insecure. Only 5.7% of all people with incomes at or above 185% of poverty were food insecure. These prevalence estimates suggest that for some families "safety net" programs, such as the national food assistance programs, housing and energy subsidies, and in kind contributions from relatives, friends, food pantries, or other charitable organizations, not included in the federal poverty calculations, may partly decrease the risk of food insecurity. Families that do not receive public benefits for which they are income eligible (either because of bureaucratic barriers or because the programs are not entitlements and are insufficiently funded to reach all who are eligible) may be more likely to be food insecure. Moreover, many families whose incomes exceed the eligibility cut-off for these programs may still be unable to avoid food insecurity without assistance if the costs of competing needs such as energy or housing are overwhelming. From 1999 to 2004 the prevalence of food insecurity increased steadily for all major race/ethnic groups, but declined in 2005 and increased among Hispanic households in 2006, and among all three groups in 2007 (**Figure 2**) on next page.

Figure 2: Proportion of U.S. Households that are Food Insecure by Race/Ethnicity: 1999-2005*

* Includes households with and without children.
Source: USDA/ERS Food Security in the U.S., various years.

Averaging data over the years 2005–2007, USDA/ERS calculated state-level estimates of the proportion of households in each state that was food insecure over this period. The lowest state-level household food insecurity prevalence was 6.5% in North Dakota; the highest was 17.4% in Mississippi. In 34 states more than 10% of all households were food insecure. The prevalence of food insecurity with hunger was lowest in North Dakota at 2.2% and highest in Mississippi at 7.0%. Eleven states had average prevalence rates of food insecurity with hunger of 5% or higher over this period.[25]

What are food security, food insecurity, and hunger, and how are they related?

Food Security: Food security is the condition of having regular access to enough nutritious food for a healthy life. In the United States, the concept of food security is assessed using the U.S. Food Security Scale, an official, government-sponsored evaluation instrument that captures food security at the household level. The Census Bureau administers the U.S. Food Security Scale annually in its national Current Population Survey, and the USDA Economic Research Service analyzes the data and publishes a report on Food Security in the U.S each year.

Food Insecurity: Food insecurity is the condition of not having regular access to enough nutritious food for a healthy life. High and low levels of food insecurity are differentiated based on the duration and severity of food insecure periods. In the U.S., having access to nutritious food requires that the food be physically present in the local food system (e.g. supermarkets; other food stores; markets; restaurants; and food vendors), and that households have sufficient financial resources to purchase it. Thus poverty is the major proximal cause of food insecurity in the U.S.

The Food Insecurity Continuum:

- On the least severe end of the spectrum, food insecurity manifests as household members' worries or concerns about the foods they can obtain, and as adjustments to household food management, including reductions in diet quality through the purchase of less-expensive foods. There is generally little or no reduction in the quantity of household members' food intake at this level of severity, but micro-nutrient deficiencies are common.
- As the severity of food insecurity increases, adults in the household often reduce the quantity of their food intake, to such an extent that they repeatedly experience the physical sensation of hunger. Because adults tend to ration their food as much as possible to shield the children in the household from the effects of food insecurity, children do not generally experience hunger at this level of insecurity, though their diets tend to be extremely poor in nutrients.
- In the most severe range of food insecurity, caretakers are forced to frequently reduce children's food intake to such an extent that the children experience the physical sensation of hunger. Adults, in households both with and without children, consistently experience more extensive reductions in food intake at this stage.

Hunger: Hunger, defined as the uneasy or painful sensations caused by a lack of food, occurs when food intake is reduced below normal levels. Hunger is both a motivation to seek food and an undesirable consequence of lack of food. Though experienced by everyone episodically, hunger becomes a social problem when the means of satisfying the drive to seek food, and of relieving the uncomfortable or painful sensations that accompany hunger, are not available or accessible due to lack of resources. Relevant questions about child hunger include:

- If an adult respondent to the FSS answers "Yes" to any of the following three questions, would you say the children in the household experienced hunger?
    1. In the last 12 months, did you ever cut the size of any of the children's meals because there wasn't enough money for food? (Yes/No)
    2. In the last 12 months, were the children ever hungry but you just couldn't afford more food? (Yes/No)
    3. In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food? (Yes/No)
    4. In the last 12 months, did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

Do Food Insecurity and Hunger Matter?

Food insecurity and hunger are intrinsically undesirable and harmful, that is they are undesirable and harmful in and of themselves. But even more important, for this report especially, they also are harmful to the human capital formation and accumulation of those who experience them. That harm ultimately leads to higher costs of several kinds, lost productivity, and constraints on success among American businesses.

Child food insecurity and hunger are especially harmful during the first 3 years of life, because this is the sensitive period in which the foundation is being laid that will support human capital formation throughout the school years, and on into adulthood. The kinds of nutrition, care, stimulation and love children receive during these critical first three years of life determine the architecture of the brain and central nervous system. These structures form the basic foundation on which each child's future is constructed.

Children's school readiness is built on growth, development and experiences during the first three years of life. Success in kindergarten builds on readiness achieved in years 0-3; success in grade school builds on growth, development and learning in pre-school and kindergarten, and so on.

"So the sobering message here is that if children don't have the right experiences during these sensitive periods for the development of a variety of skills, including many cognitive and language capacities, that's a burden that those kids are going to carry; the sensitive period is over, and it's going to be harder for them. Their architecture is not as well developed in their brain as it would have been if they had the right experiences during the sensitive period. That's the sobering message."

Jack P. Shonkoff, MD
Harvard University School of Public Health

Recent research has shown that each of these stages involves important human capital formation, and that each builds on the human capital accumulated during the previous stage. And while each stage is important, none is more important than the years 0-3. Those years, and the prenatal period, set the stage for the rest of a person's life, and they are the most vulnerable to stress and damage that can result from food insecurity and hunger. In the following section we summarize the basics of human capital theory and suggest that it provides a useful framework for considering why business leaders should care about child hunger.

AN ECONOMIC FRAMEWORK FOR CONSIDERING THE CONSEQUENCES OF FOOD INSECURITY AND HUNGER AMONG CHILDREN

Human Capital Theory

Human capital theory, developed and articulated by Gary Becker in the early 1960s, is a very useful framework for considering the economic consequences of childhood food insecurity.[26] Elaborated by a host of economists since, the theory envisions the unique capabilities and expertise of individuals as a stock of "human capital," useful to individuals and firms as an input into desirable work and activity. A person's human capital stock is a primary determinant of the kinds of employment they can successfully compete for, their consequent earning capacity, and lifetime earnings.

Initial Human Capital Endowment

Every individual is born with a particular human capital endowment comprised of their genetic material as expressed in interaction with the environments in which they grow and develop. This interaction begins during the prenatal period, when development is heavily influenced by maternal nutrition, stress, and healthcare, among other factors.

From conception until death, each person undergoes a continuous process of human capital formation and destruction. Early developmental periods, especially the periods of rapid brain and central nervous system (CNS) development during the first three years of life, are critical in determining a person's potential for human capital formation later in life. Circumstances that impair or interfere with health, growth and development during these periods can have lasting negative impacts on human capital formation throughout life.

The Role of Education in Human Capital Formation
In Becker's formulation of human capital theory, education is the primary vehicle for human capital formation. Other forms of human capital formation include training (on and off the job), experience (on and off the job), investments in health, outreach and extension programs, life experience,
migration, and the individual's search for understanding.

Health and the Enhancement, Preservation and Destruction of Human Capital
Human capital is a stock, in that it accumulates rather than flows (as income does). However, this particular stock is very dynamic. It can be increased by additional education, training, investments in health, improved nutrition, and adoption of a healthier lifestyle. Similarly, it can be diminished by injury and trauma, disease and illness, malnutrition, risky behavior, and unhealthy lifestyles.[27]

Factors influencing child health can both impair human capital formation and diminish human capital already formed. Examples of liabilities to human capital development in early childhood include:

- Malnutrition;
- Disease and illness;
- Injury and trauma;
- Inadequate or non-existent healthcare;
- Exposure to environmental toxins;
- Exposure to and/or victimization by violence;
- Chronic illness; and
- Familial stress.

Many risks to children's human capital are correlates of poverty and food insecurity.

Households as Producers
Household production theory, an elaboration of human capital theory, views each family as a production unit that uses inputs to produce things the household needs and wants for its collective satisfaction, utility or well-being. Each household combines resources, such as purchased goods, household labor, time, energy, and human capital, to produce things for consumption by family members.

Household Production of Human Capital
Human capital itself is a very important output produced by families via the household production process. Parents combine their human capital with other inputs (time, attention, books, toys, food, etc.) using care and interaction to nurture critical human capital formation in their children. Taking education as an example, children in turn build gradually upon their sum total of human capital to accumulate the stock necessary for school readiness: capacity for future learning and successful physical, social, and psychological adaptation to new environments.

These capacities are heavily determined by the extent and quality of parent-child interactions and the level of stimulation in the home environment (household inputs). Early deficits in household inputs can diminish human capital in young children, predisposing them to failure in school and diminishing their potential for forming and expressing future human capital as successful, productive members of the workforce and society.[28]

Food Security as Human Capital and Household Production Input
Food security, like health, is itself an important form of human capital, and a critical input into household production of other forms of human capital such as good health, cognitive, psychological and physical development and growth, self-confidence, social skills, and school readiness. Food secure families can access enough nutritious food to promote healthy growth and development, or human capital formation, in their children. Food insecurity, on the other hand, means a shortage or absence of inputs that are essential to the optimal formation of human capital in children.

Beyond impairments caused by inadequate food and nutrients, children in food insecure households also suffer ill effects due to the family stress that frequently accompanies, and is often caused by, food insecurity. Parental physical and mental health problems associated with food insecurity impair parent-child interaction, limit parents' elaboration of children's first efforts at speech, reduce quantity and quality of stimulation available in the home environment, and interfere with children's optimum human capital formation.

"The current economic and housing crises have made it absolutely imperative that we invest in young children today. To have the economy we want in the future, we must invest in children now to help them become productive, successful adults. In particular, research shows that children are likely to pay a steep price for the nation's housing crisis, because of the disruption it causes in their lives and their educational success."

Robert Dugger,
Managing Director,
Toudor Investment Corporation.
Advisory Board Chair,
Partnership for America's
Economic Success

CHILD FOOD INSECURITY AND HUNGER ARE HEALTH PROBLEMS

Food insecurity influences health and development through its impacts on nutrition and as a component of overall family stress. The condition of food insecurity includes both inadequate quantities and inadequate quality of nutrients available. At less severe levels of food insecurity, household food managers (usually mothers) trade off food quality for quantity to prevent household members, especially children, from feeling persistently hungry.[29] Several kinds of social infrastructures can influence the relationships between food insecurity and child health, growth and development by helping to prevent food insecurity from occurring, or by moderating its effects once it occurs.

Poor nutrition, and by extension food insecurity, has been shown to influence health and well-being throughout the life cycle, from the prenatal period on into elder years. [30, 31, 32, 33, 34, 35, 36] In addition, effects of food insecurity on adults in households with children can adversely impact those children in a variety of ways, including diminution of parents' energy for providing care and developmental stimulation. Parental (especially maternal) depression has been associated with food insecurity, and in many contexts, not limited to those involving food insecurity, such depression has been linked with adverse impacts on parenting, parent-child interaction and attachment, child growth, development, health and well-bring.[38, 39, 40, 41]

The Prenatal and Neonatal Periods
Adequate prenatal nutrition is critical for normal development of the fetal body and brain. Though a large volume of research has confirmed the importance of nutrition during the prenatal and neonatal periods,[42,43,44,45] far fewer studies have specifically addressed the role of food security per se for this part of the life cycle. Food insecurity has been associated with low birth weight deliveries,[46] and with a variety of psychosocial risk factors in moderate to high-risk pregnancies with observable dose-response relationships (increasingly higher psychosocial risks with increasing severity of food insecurity).[47] Evidence on the influence of food insecurity in prenatal development remains largely indirect, deriving from the large body of evidence for the critical role of healthful nutrition during this period.

It is noteworthy that a large number of recent studies have examined prenatal nutrition and care within a broader scope that includes birth spacing and nutrition and care between births.[48, 49, 50, 51, 52, 53] Motivated in part by persistently

high rates of low birth weight and preterm births in some U.S. subpopulations, a growing recognition of the limits of prenatal care alone in reducing these problems has emerged, with increasing attention being paid to preconception and internatal care.[54] Amid this emerging view of maternal health are expressions of concern about the effects of food insecurity on nutrition and health during the internatal period.[55] Of particular concern is the risk of food insecure mothers entering pregnancy with insufficient iron stores and with diets inadequate in folate. Poor iron and folic acid status have been linked to preterm births and fetal growth retardation respectively. [56] Prematurity and intrauterine growth retardation are critical indicators of medical and developmental risks which not only impact children's short-term well being but extend into adulthood where they have been linked recently to obesity, adult onset diabetes, and risk of cardiac disease.[57] A woman's diet inadequate in folate in the periconceptual period has also been clearly associated with neural tube defects and possibly with other birth defects.[58] For low-income mothers, especially Black, Latino and single mothers, food insecurity is a highly prevalent risk factor generally, including during internatal periods.[59, 60]

Low Birthweight

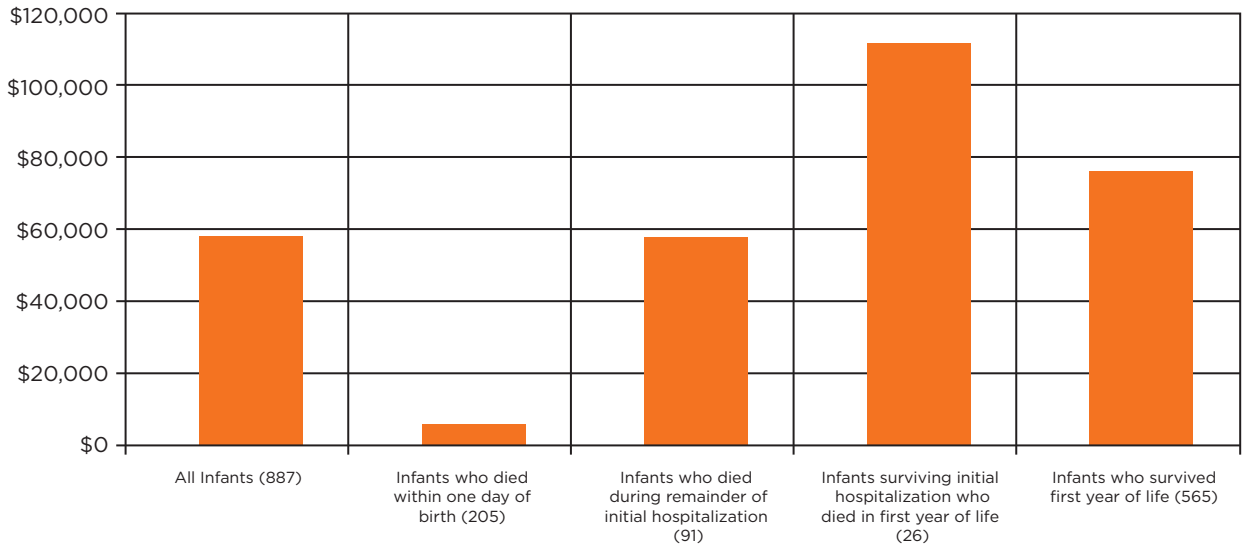
Overall fetal growth is significantly influenced by maternal nutrient intake. Birthweight, in turn, is strongly correlated with perinatal and infant mortality, with low birthweight heightening the risk of mortality.[61]

Low birthweight also has a long-term impact upon infant health and growth trajectories. Infants who are born small for gestational age remain shorter and lighter and have smaller head circumferences than their peers through early childhood.[62] Low birthweight is associated with poor long-term outcomes in areas including:

- **Adult Height**: A 10% increase in birthweight results in between .5 and .75 cm increase in adult height. Height is important as, in many cases, it is a proxy for social and health conditions early in life. Shorter stature correlates with shorter average lifespan, and it is believed that the underlying cause for this correlation is poor early-life conditions, including inadequate nutrition and infection. Shorter adult stature also correlates with lower adult socioeconomic status (SES) and education, which in turn influence earnings and type of employment.[63]
- **IQ at 18 years of Age**: Low birthweight is associated with lower age 18 IQ.[64]
- **Educational Attainment**: A 10% increase in birthweight increases a child's odds of graduating from high school.[65]
- **Adult Earnings**: Increased educational attainment increases an individual's expected earnings as an adult.[66]

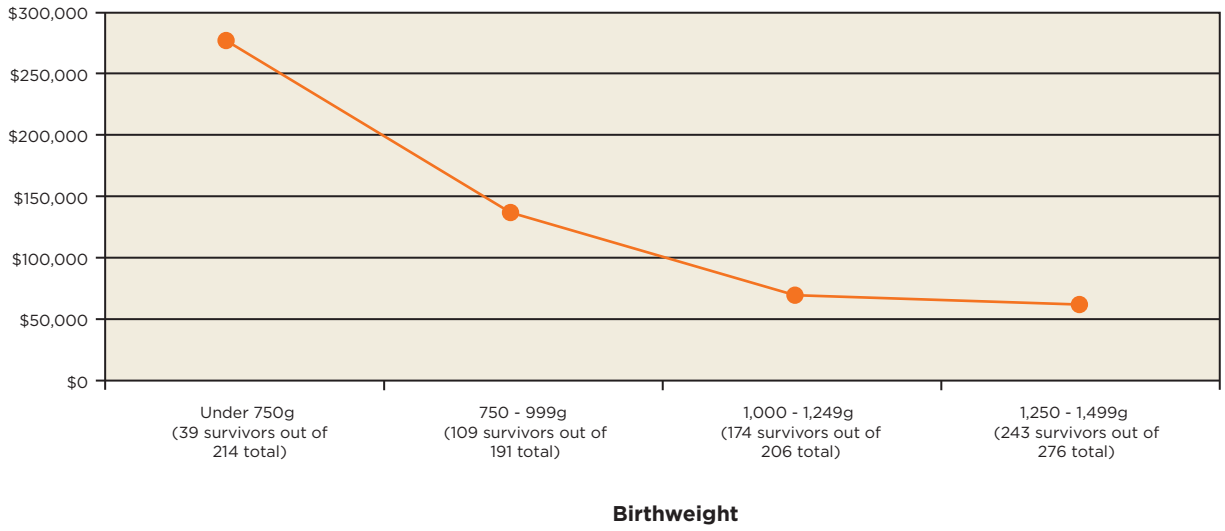
Treating low birthweight infants is a costly endeavor. The average aggregate cost of caring for a very low birth weight infant over his or her first year of life was $59,730.[67] The variations of cost can be seen in **Figure 3** below.

Figure 3: Average Cost of Caring for Very Low Birthweight Infants During Their First Year of Life.[68]



Infants who survive their initial hospitalization but die before their first birthday are the most expensive to treat ($112,120 on average).[69] Infants surviving to age one cost an average of $76,850, with the cost difference being driven largely by the cost of rehospitalization ($5,290 per infant). Infants who do not survive their initial hospitalization cost an average of $6,310 (those surviving one day) or $58,800 (those dying during the remainder of initial hospitalization).[70] The cost-effectiveness of treatments varies by the infant's birthweight, with the heavier infants having the best chance of survival, needing the least intervention, and therefore costing the least. This can be seen in **Figure 4** below.

Figure 4: Cost-Effectiveness of Treating Very Low Birthweight Infants Improves with Higher Birthweights.[71]



Note: Cost are in constant 1987 dollars, rounded to the nearest hundred

Preterm birth also has a negative impact on the employment behavior of the parents. Mothers of preterm or low birthweight babies took a longer maternity leave, reduced their hours at work, or left the workforce altogether to care for their child.[72] This decrease in productivity was average associated with a decrease in family income of 32%.[73] In a 1996 to 2001 study done in Toronto, researchers found that mothers from the lowest-income neighborhoods were 25% more likely to have a preterm birth than mothers in the richest neighborhoods, and 53% more likely to have an underweight baby at full-term.[74] As a result, the 32% decrease in family income due to loss of productivity from caring for a preterm or low birthweight baby creates a proportionally greater decrease in low income families who are at highest risk for preterm or low birthweight babies.

Beyond general growth delay, maternal undernutrition has significant effects on specific physical systems in the developing fetus. Severe food insecurity late in the gestational period impairs fetal body, organ, and cellular growth. The adrenals, placenta, and liver are most affected by maternal undernutrition; women who begin their pregnancies underweight and experience low pregnancy weight gain tend to give birth to children with disproportionately low weights for some body organs and small adrenal and liver cells, the classic physiological picture of undernutrition.[75]

Early Childhood: Ages 0-3 Years

A relatively large number of studies have examined associations between food insecurity and child health and development in this age group, many conducted by Children's HealthWatch.[c] An ongoing multi-site pediatric clinical research program, Children's HealthWatch has conducted household-level surveys and medical record audits at seven central-city medical centers, including acute and primary care clinics (Baltimore, MD; Minneapolis, MN; Philadelphia, PA and Washington, DC) and hospital emergency departments (Boston, MA; Little Rock, AR; and Los Angeles, CA) since 1998.[d] Primary adult caregivers accompanying children 0 to 36 months old seeking

care are interviewed by trained interviewers in private settings during waiting periods.[e] Children's weight and, if possible, length are recorded at the time of the interview.

The Children's HealthWatch survey instrument is composed of questions on household characteristics, children's health and hospitalization history, maternal health, maternal depressive symptoms, participation in federal assistance programs, energy insecurity, and changes in benefit levels. In addition, the Children's HealthWatch interview includes the U.S. Food Security Scale,[76, 77, 78] and recent cycles of data collection since July 2004 have added the PEDS (Parents' Evaluation of Developmental Status—a well-validated and reliable standardized instrument that meets the American Academy of Pediatrics standards for developmental screening).[79] These studies suggest complex relationships between food insecurity and participation of families with young children in public income maintenance and nutrition programs. They also indicate similarly complex relationships between participating in these programs and food insecurity, health, growth, and development of young children.

Food Insecurity and Adverse Health Outcomes in Young Children

By 2003 a large body of research literature had confirmed a range of adverse health and development outcomes associated with malnutrition in young children, and a few had found food insufficiency (a pre-cursor to the food security measures), hunger and risk of hunger related to poor health in children (ages < 18 years).[80, 81, 82, 83, 84] However, there were no studies directly examining whether food insecurity as measured by the new FSS is independently associated with bad health outcomes among children in this critical age group (0-3 years). Children's HealthWatch tested this hypothesis and found that, after adjusting for confounders, food-insecure children had odds of having their health reported as "fair/poor" (versus "excellent/good") 90% greater, and odds of having been hospitalized since birth 31% greater than similar children in food-secure households.[85] We also found a dose-response relation between fair/poor health status and severity of food insecurity, with higher odds of "fair/poor" health at increasingly higher levels of severity of food insecurity. In the overall Children's HealthWatch sample receipt of SNAP attenuated the effects of food insecurity on this outcome, but did not eliminate it.[86] These results were the first to show that food insecurity is independently associated with adverse health outcomes in children ages 0-3 years.

Child Food Insecurity Intensifies Adverse Effects of Household Food Insecurity

Many households with children are categorized by the FSS as food insecure at the household level, but since none of the child-referenced items are affirmed, the households can not be said to show specific evidence of child food insecurity per se. Typically, as has been shown elsewhere, adult caregivers in food-insecure U.S. households ration food in order to spare children from suffering the feeling of hunger, though this often results in detrimental overall reductions in the quality and variety of foods available in the household. [87, 88, 89, 90, 91, 92]

In the Children's HealthWatch sample of 17,158 caregiver-child dyads interviewed between 1998 and 2004, 10% reported household food insecurity only, and 12% household and child food insecurity, with child food insecurity measured by the CFSS (Table 1, page 5).[93] Compared to food-secure children, after adjusting for confounders, those with only household food insecurity (HFI) had significantly higher odds of fair/poor health (51% higher) and being hospitalized since birth (19% higher), while those with both household and child food insecurity (H&CFI) experienced even greater adverse effects (100% greater odds of fair/poor health and 23% higher odds of hospitalization respectively). The presence of CFI in addition to HFI resulted in a statistically significant

[c] Dr. Cook is one of the Principal Investigators in the Children's HealthWatch study group.

[d] Sites in Los Angeles and Washington, DC are currently inactive.

[e] This age group was chosen for sampling because its special vulnerability makes it a sentinel population for adverse health outcomes in pediatric populations related to constrained household resources and changes in social policies and economic conditions. Because of their locations in inner-cities the Children's HealthWatch sites serve populations with high prevalence of low income families, those most affected by social policy changes.

increase in the odds of fair/poor health above the odds when only HFI was present (from 1.51 to 2.00). Though the presence of CFI in addition to HFI resulted in an increase in odds of hospitalization from 1.19 to 1.24, this increment was not statistically significant.[94]

Participation in the SNAP (formerly the Food Stamp Program) modified the effects of food insecurity on child health status (odds of fair/poor health), reducing, but not eliminating them. Children in FSP-participating households that were HFI only had adjusted odds of fair/poor health 24% lower than those in similar non-FSP households, while children in FSP-participating households that were H&CFI had adjusted odds of fair/poor health 42% lower than those in non-FSP households.[95]

These results, like previous ones, indicate that the relationship between food insecurity and the health status of very young children is such that the adverse effects of food insecurity worsen as its severityincreases. They also suggest that SNAP benefits, like a therapeutic drug prescribed in inadequate doses, appear to attenuate but not fully reverse this association.

Child Food Insecurity and Iron Deficiency

Iron deficiency, and iron deficiency anemia (IDA), are the most prevalent nutritional deficiencies in the U.S. and worldwide.[96, 97] Iron deficiency in early life has been linked to concurrent and persistent deficits in cognition, attention, and behavior even after treatment. Several recent studies have reported a prevalence of IDA in children up to 18% in some high-risk subpopulations in the U.S.[98, 99, 100, 101] One study found that joint or separate participation in the WIC and SNAP reduced the risk of iron deficiency. The link between these child nutrition programs and iron deficiency confirms a recent Children's HealthWatch study that examined associations between child food insecurity (CFI) and IDA in children ages 6-36 months.[103] Infants ages <6 months old and children with established diagnoses known to increase risk of anemia (e.g., low birth-weight, HIV/AIDS, sickle cell disease, or lead level >10 mcg/dl) were excluded from this study. In logistic regressions adjusted for a range of possible confounders, food insecure children had adjusted odds of having IDA 140% greater than food secure children. Only household food insecurity, and not child food insecurity, was examined in this study.[104]

IDA is a troublesomely common problem among at-risk pediatric populations. The Pediatric Nutrition Surveillance System (PedsNSS), a national program run by the Centers for Disease Control and Prevention, found a 14% prevalence of anemia in 2001 among children under 5 years old in its sample comprised mostly of low-income, nutritionally at-risk children.[105] In severe cases, hospitalization is required; in 2003, over 100 children under the age of 5 were hospitalized for dietary iron-deficiency anemia, at an average cost of $5,573 per child. [106]

LINKAGES BETWEEN FOOD INSECURITY AND OBESITY

Research on food insecurity and overweight has, in the past, mostly focused on adults and school-aged children.[107] However, a growing body of research about young children demonstrates a strong correlation between early food insecurity and later overweight and obesity. The pathways through which this correlation acts are not yet fully defined, but thus far appear to involve quality and quantity of food consumed; health and feeding practices; and caretaker depression.

Connecting Food Insecurity and Obesity

Families with children, especially those with young children, are the group most likely to be food insecure.[108] In turn, children whose families are food insecure are more likely to be at risk of overweight (>85% weight-for-age) or obesity as compared to children whose families are food secure.[109] Children experiencing child food insecurity, the most severe level of food insecurity, are at even greater risk of being overweight, and this trend has definitively begun by the preschool years (ages 3-5).

Research using the measure of 'food insufficiency', which captures the equivalent of severe food insecurity, found that if a family with young children had experienced food insufficiency at any point during the child's

toddler years, the child was 3.4 times more likely to be obese at 4.5 years old.[110] This increase in risk was greater than the 2.5-fold risk increase associated with having an overweight or obese parent. Low birthweight (LBW) (<2500g) was also a significant risk factor, with LBW babies having odds more than 3 times greater of being obese at the end of the preschool years than their non-LBW peers. Because LBW is associated with nutritional deficiency in utero, it appears that food insecurity even prenatally increases a child's risk of overweight. Most strikingly, children exposed to the early-life double damage of low birthweight and family food insufficiency had odds 27.8 times higher than their peers of being overweight or obese at age 4.5; normal birthweight babies who experienced family food insufficiency had odds 1.8 times higher, and large babies (>4000g) who experienced family food insufficiency had odds 5.7 times higher.[111]

Health Effects and Costs of Obesity

Obesity is highly correlated with many health problems, among them cardiovascular disease, hypertension, diabetes, and joint degeneration.[112, 113, 114] Disturbingly, these problems of middle-age and older adults are being found at younger and younger ages. A recent study in Georgia found that even adolescents with mid-range body mass displayed increases in blood pressure, arterial stiffness, and other signs of cardiovascular trouble.[115] In another study, overweight adolescents had more Medicaid claims for diabetes, asthma and respiratory problems than normal weight adolescents.[116] The total estimated medical cost in the United States for obesity-related disease management among 6-17 year old children reached $127 million in 2003, and continues to rise along with the prevalence of overweight and obesity within this age group.[117] Beyond immediate healthcare costs, the early onset of health problems associated with obesity shortens the lifespan of affected individuals, contributes to increased rates of morbidity, and influences their lifetime earning potential. Unfortunately, though overweight and obesity are documented in toddlers through school-age, little research has been conducted on the consequences and costs of obesity for children younger than six.

FOOD INSECURITY, WHICH IS RELATED TO BOTH UNDER-NUTRITION AND OVER-NUTRITION, IMPACTS NEARLY ONE IN EVERY FIVE U.S. CHILDREN.

- IN 2007, THE MOST RECENT YEAR FOR WHICH DATA IS AVAILABLE , 12.4 MILLION U.S. CHILDREN WERE FOOD INSECURE. THIS IS 16.9% OF ALL U.S. CHILDREAN
- YOUNGER CHILDREN ARE AT EVEN GREATER RISK OF FOOD INSECURITY, WITH 18.9% OF ALL CHILDREN IN HOUSE-HOLDS WITH CHILDREN UNDER 6 YEARS OF AGE FOOD-INSECURE IN 2007.

Obesity and its Effects on Emotional and Cognitive Development

In addition to physical consequences, obesity has a substantial negative impact on the emotional and cognitive well-being of young children. Overweight and obese children are often stigmatized by their peers, and stigmatization can profoundly influence their psychological and social development.[118] Young children who are overweight or obese typically become overweight adolescents, and body image is often a major focus at this time of life, leading to poor self-esteem, emotional health problems and issues with social adjustment among this group.[119] One study using the National Longitudinal Study of Adolescent Health found that among children 12 to 14 years-old, overweight and obese children were significantly more likely to be depressed, report low self-esteem, and have poor school/social functioning compared to normal weight children.[120]

Among obese adolescents, lower levels of self-esteem have been associated with increased rates of sadness, loneliness, nervousness, smoking, and alcohol consumption.[121] One study of adolescents found that obese children were more likely to isolate themselves socially and report serious emotional problems. These problems in turn led to direct loss of human capital through:

- Suicide: Obese girls were nearly twice as likely to have attempted suicide as their non-obese peers.[122]
- Academic underachievement: Obese adolescents were more likely to perceive themselves as below average students, and boys were twice as likely to expect to quit school.[123]

Long-Range Consequences of Obesity

If overweight and obese children are unable to reduce their Body Mass Index (BMI) as they grow older, they face an adulthood where the costs of obesity can include diminished employment opportunities and reduced incomes.

- A study of former welfare recipients found that morbidly obese White women trying to transition from welfare to work were less likely to find employment, spent more time receiving cash welfare, and had lower monthly earnings than similar non-obese women.[124]
- Another study by the same author found that among White females, a difference in weight of about 65 pounds was associated with a 9-percent difference in wages.[125] This effect of weight on earnings is similar in magnitude to the effect of 1.5 years of education, or 3 years of work experience, on wages earned.
- A third study found that among adults, a one-point increase in BMI over time was associated with a $1,000 decrease in net worth on average, holding other factors such as income constant.[126] One major reason for this association was that overweight and obese adults tended to leave school earlier than their peers.

Obesity is thus an offshoot of food insecurity that has lasting consequences for the long-term economic productivity and security of individuals.

Food Insecurity, Maternal Depression, and Child Health

Maternal depression is strongly related to child development in a variety of ways, including reduced ability to provide needed care, impaired mother-child interaction and attachment, and child neglect and abuse.[127, 128, 129, 130, 131, 132] Several recent studies have found associations between food insecurity and maternal depression.[133, 134]

A recent Children's HealthWatch study examined associations among mothers' positive depressive symptoms (PDS), food insecurity and changes in benefits from federal assistance programs.[135] Using a subsample of 5,306 mother-child dyads seen at three of the Children's HealthWatch sites, we found that mothers with PDS had odds of reporting household food insecurity 169% greater, fair/poor child health 58% greater, and child hospitalizations 20% greater than mothers without PDS, after adjusting for possible confounders. In addition, controlling for the same covariates, mothers with PDS had odds of reporting decreased welfare support 52% greater, and odds of reporting loss of SNAP benefits 56% greater than mothers without PDS.[136]

These results suggest that maternal depression may be an indirect pathway by which household food insecurity exerts negative influence on child health and development. It is not possible to determine the direction of causality from these results, nor to rule out the possibility of some amount of dual causality. Additional longitudinal research is needed to determine whether and under what circumstances maternal depression temporally precedes food insecurity, and vice versa.

The Impacts of Program Participation on Food Insecurity

In a study examining associations between participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and indicators of underweight, overweight, length, child's health status, and food security in children ages ≤12 months, Children's HealthWatch researchers found that infants that did not receive WIC benefits because of access problems were more likely to be underweight, short, and perceived as having fair/poor health, compared with WIC recipients, after adjusting for possible confounders.[137] Though these two groups did not differ significantly on food security status after adjusting for covariates, children in both were more likely to be food insecure than children whose caregivers did not perceive a need for WIC. These results supported findings from other research indicating that low-income infants ≤12 months of age benefit from participation in the WIC program. [138, 139, 140]

Another Children's HealthWatch study examining the relationships between receiving housing subsidies and nutritional and health status among low-income food-insecure children ages < 3 years living in rented housing found that children in food-insecure renting families not receiving housing subsidies had significantly lower weight-for-age compared to those in families receiving subsidies. In addition, compared to food-insecure children

in subsidized housing, those in non-subsidized housing had odds of having weight-for-age z-scores more than two standard deviation units below the mean 111% greater. [141] These findings help inform another dimension in the understanding of how household food security interacts with other survival needs to influence children's health, in concert with recent studies showing strong associations between housing conditions and health among low-income children.[142, 143, 144]

Association Between Food Insecurity and Early Childhood Developmental Risk

A recent Children's HealthWatch study evaluated the relationship between household food security status and developmental risk among 2010 children ages 4-36 months based on responses to the Parent's Evaluations of Developmental Status (PEDS).[145] After controlling for established correlates of child development, including mothers' depressive symptoms and education, food insecure children in this age group were found significantly more likely to be identified by their caretakers as being at developmental risk than similar children in food-secure households.[146]

Hospitalization

All the negative health effects of food insecurity act in concert to increase young children's risk of hospitalization. Between the ages of 0 and 3, children living in food insecure households are one-third more likely to have a history of hospitalization than their food secure peers.[147] In the United States in 2003, nearly 400 children under the age of 5 were hospitalized with primary diagnoses of nutritional deficiencies, at an average cost of approximately $16,000 per child.[148] Just one of those diagnoses alone—protein-calorie malnutrition—cost Medicaid approximately $1.25 million among 0-to-4-year-olds in 2003. Cases in which nutritional deficiency was the primary diagnosis capture only a small sample of the children whose hospitalizations were precipitated by food insecurity. Because food insecurity weakens the immune system, food insecure children are more vulnerable to infections, and end up hospitalized with illnesses that their food secure peers fight off successfully either on their own or with basic primary care.

Hospitalization is but one of a large complement of costs incurred by children, their families, the community/workforce, and the broader economy due to the physical effects of food insecurity. More frequent doctor's visits, and increases in other medical expenses, present a heavy cost burden to families already strapped for financial resources. Many food insecure families cannot afford health insurance, meaning that the burden of their medical costs shifts largely onto state and federal taxpayers. The time cost associated with caring for an ill child means missed days of work for parents, presenting a cost to employers and employees alike. In the worst circumstances, chronic illness in children from lower-income families may cause a parent to lose a job if the job does not allow for any or enough sick days.

School-age and Adolescence

Over the past decade a modest but steadily accumulating body of research has examined the influence of food insecurity on physical and mental health and academic, behavioral, and psychosocial functioning of preschool and school age children. These studies have used several different measures of food insecurity including a single screening question developed by the USDA and referred to as "the USDA food sufficiency question," a scale developed by the Community Childhood Hunger Identification Project prior to release of the U.S. FSS, and the FSS itself. These measures differ in the questions they include, in the wording of some questions and in psychometric properties.[149] While each research report addresses a somewhat different set of correlates of food insecurity and related constructs, there is consistency in the basic findings that emerge from applications of these measures regarding adverse effects on physical and mental health, academic performance and behavioral and psychosocial problems in pre-school and school-age children.

Several studies using data on responses to the USDA food sufficiency question in the Third National Health and Nutrition Examination Survey (NHANES III) examined associations between household food sufficiency and children's health, school performance and psychosocial functioning. One study, consistent with the CSNAP food insecurity work summarized above, found food insufficiency associated with higher prevalence of fair/poor health, and iron deficiency, and with greater likelihood of experiencing stomachaches, headaches and colds in 1-5 year olds.[150] Another found that 6-11 year old children in food insufficient families had lower arithmetic scores, were more likely to have repeated a grade, to have seen a psychologist and to have had more difficulty

getting along with other children, than similar children whose families were food sufficient. This study also found teenagers from food insufficient families more likely than food-sufficient peers to have seen a psychologist, been suspended from school, and to have had difficulty getting along with other children.[151] A third study showed 15-16 year olds from food insufficient households significantly more likely to have had dysthymia, thoughts of death, a desire to die, and to have attempted suicide. [152]

Another set of studies used a food security measurement tool developed by the Community Childhood Hunger Identification Project—CCHIP[153] (a validated scale to assess hunger in children developed prior to, and partly incorporated into the FSS) to examine associations between hunger and physical and mental health in school-age children. One of these studies, using data from implementation of the CCHIP scale in nine states, found that children under age 12 years categorized as hungry or at-risk of hunger were twice as likely as not-hungry children to be reported as having impaired functioning by either a parent or the child themselves. Teachers reported significantly higher levels of hyperactivity, absenteeism, and tardiness among hungry/at-risk children.[154]

A second CCHIP study used a sample of 328 parents and children from families with at least one child under the age of 12 years. Parents with a child between ages 6 and 12 years completed a Pediatric Symptom Checklist (PSC). This study found children categorized as hungry by the CCHIP scale were more likely to have clinical levels of psychosocial dysfunction on the PSC than either at-risk or non-hungry children. Analysis of individual items from the PSC found that most all behavioral, emotional, and academic problems were more prevalent in hungry children, and that aggression and anxiety had the strongest degree of association with hunger.[155]

A third CCHIP study used data on externalizing and internalizing behaviors and anxiety/depression from the Child Behavior Checklist, and chronic health indicators adapted from the National Health Interview Survey, Child Health Supplement in a sample of 180 preschool and 228 school age children in Worcester, MA. This research found that, after adjusting for confounders, severe hunger was a significant predictor of chronic illness among both preschool age and school-age children, and significantly associated with internalizing behavior problems, while moderate hunger was a significant predictor of health conditions in preschool children. Severe hunger was also associated with higher reported anxiety/depression among school-age children, after adjusting for confounders.[156]

Finally, a small set of fairly recent studies use data from administration of the FSS in national and local surveys to examine associations of food insecurity with health, growth and development after the first three years of life. A recent study used data from the new Early Childhood Longitudinal Survey Kindergarten cohort (ECLS-K) to test the hypothesis that food insecurity is associated with overweight among kindergarten-age children. The authors found no significant association of food insecurity with overweight in this cross-sectional study, in any of several configurations of regression models. The authors conclude that though there are many very sound reasons to be concerned about food insecurity in kindergarten-age children, their results indicate that concern about overweight should not be one.[157]

A second study from the ECLS, included data from the kindergarten and third grade administrations in a longitudinal assessment of how food insecurity over time is related to changes in reading and mathematics test performance, weight and BMI, and social skills in children.[158] This much more elaborate and extensive longitudinal study found food insecurity in kindergarten associated with lower mathematics scores, increased BMI and weight gain, and lower social skills in girls at third grade, but not for boys, after controlling for time-varying and time-invariant covariates in a lagged model. Using difference score and dynamic models based on changes in predictors and outcomes from kindergarten to third grade, the authors found that children from persistently food-insecure households (food insecure at both kindergarten and third grade years) had greater gains in BMI and weight than children in persistently food-secure households, after controlling for covariates, though these effects were only significant for girls in stratified analysis. Also among girls, but not boys, persistent food insecurity was associated with smaller increases in reading scores over the period than for persistently food-secure girls.

In dynamic models, for households that transitioned from food security to food insecurity over kindergarten to third grade (became food insecure), the transition was associated with significantly smaller increases in reading

scores for both boys and girls compared to children from households remaining food secure. For children transitioning from food insecurity to food security (becoming food secure) the transition was associated with larger increases in social skills scores for girls, but not for boys. Similarly, in difference models when children from households that became food insecure were compared with children who became food secure, food insecurity was associated with smaller increases in reading scores for both boys and girls, though they were only significant for girls.

In gender-stratified difference models examining BMI, weight and social skills, becoming food insecure was associated with significantly greater weight and BMI gains for boys but not for girls. Becoming food insecure was associated with greater declines in social skills scores for girls but not boys.

The authors of this rather complicated study conclude that it provides the strongest empirical evidence to date that food insecurity is linked to developmental consequences for girls and boys, though these consequences are not identical across gender. Particularly strong associations are found between food insecurity and impaired social skills development, reading performance, and increased BMI and weight gain for girls, though the effects on BMI and weight gain appear to differ depending on whether the girls are persistently food insecure or their status changes over time. The longitudinal and dynamic nature of the models used and the extensive controls for confounders at the household and individual levels lead the authors to conclude that the most plausible interpretation of their findings is that food insecurity in the early elementary years has developmental consequences that may be both nutritional and nonnutritional.[159]

A third study used data from a cross-sectional telephone survey of households including 399 children ages 3-17 years from 36 counties of the Delta region of Arkansas, Louisiana and Mississippi to examine associations between household food insecurity and proxy- or self-reported child health-related quality of life (CHRQOL). Researchers used the 23-item Pediatric Quality of Life Initiative (PEDS QL) survey which yields a total score and two subscale scores – physical and psychosocial functioning. This study found food insecurity significantly associated with total child CHRQOL and physical function after adjusting for confounders.

Children ages 3-8 years in food-insecure households were reported by parents to have lower physical function, while children ages 12-17 years reported lower psychosocial function. Black males in food-insecure households reported lower physical function and lower total CHRQOL than those in food-secure households.[160]

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A fourth study used data from the 1997 Panel Study of Income Dynamics Child Development Supplement to compare the risk of a child 5-12 years of age being at or above the 85th percentile on age-gender specific BMI in food-secure and food-insecure households when controlling for participation in SNAP, the National School Lunch Program and the School Breakfast Program. The authors found that food-insecure girls who participated in all three of these food assistance programs had odds of being at risk of overweight (85th percentile ≤ BMI < 95th percentile) 68% lower than food-insecure girls in nonparticipating households, after

controlling for confounders. No significant differences were found for girls in food-secure households, nor for boys in either food-secure or food-insecure households. [161]

CHILD HUNGER IS AN EDUCATIONAL PROBLEM

Cognitive Development

Food insecurity in early childhood can have a long-term negative impact on the cognitive and socio-emotional development of a child, ultimately impairing his or her productivity and economic potential. Children who enter school without proper nourishment and support are at an early disadvantage and struggle to keep up with their more advantaged peers. One study found that kindergartners from food insecure homes not only entered school with lower math scores, but also learned less over the course of the school year.[162] Even children considered marginally food secure meaning that they had enough food but their families struggled to meet their needs—lagged behind their peers. [163] Food insecurity thus depresses both the starting point and the upward trajectory of a child's education from the moment he or she enters the kindergarten classroom.

Learning deficits in the earliest years of education have a cumulative effect as children continue through elementary school and beyond. Data from the Early Childhood Longitudinal Study—Kindergarten (ECLS-K) Cohort, which followed more than 21,000 children from kindergarten through third grade, showed that by the third grade, children who had been food insecure in kindergarten had lower reading and mathematics scores than their peers who had not been food insecure in kindergarten. For example, children in families that had not been food insecure in kindergarten had an average gain of 84 points in reading, compared with a 73-point gain among children who had experienced food insecurity. The data also demonstrated the corrective effect of federal nutrition programs, which can work to decrease or eliminate food insecurity in recipient households. Gains in reading and mathematics scores were higher for girls who entered SNAP between kindergarten and third grade than for girls who left SNAP during that time.[166] This demonstration of the inverse relationship between food supplementation and cognitive delay shows once again the dynamic effect of nutrition upon cognitive development in young children.

Food insecurity has a continuing negative impact on the cognitive and academic development of children as they grow older. Educational achievement through the middle and secondary school years depends on students mastering basic skills and building on their knowledge over time. Food insecure children learn at a slower rate than their peers, and that fact coupled with their initial delay leaves them further and further behind as they progress through the educational system. Studies have found that elementary school students from food insecure homes have significantly lower mathematics scores and are more likely to have repeated a grade than their peers from food secure homes.[167]

Case Study: Special Education

Food insecurity increases the likelihood that a child will be judged to need special educational services; at the worst end of the spectrum, children who are not only food insecure but are classified as hungry are twice as likely as those who are not hungry to be receiving special education services, and twice as likely to have repeated a grade.[168] According to the U.S. Department of Education, special education services cost an extra $5,918 per pupil in school-year 1999-2000. As the national average per pupil cost of public education is around $6,800 (fiscal year 2001), the additional cost of special education services brings the total cost of educating a special needs child to nearly double the annual expenditure for a child without special needs.[169] Once they begin to receive special education, children typically stay within the special needs system for the remainder of their school career, so the nearly $6,000 additional cost accrues annually until they leave the school system. For a special-needs kindergartener, then, progress through the eighth grade alone represents approximately $54,000 in additional expenditures on the part of the school system, and indirectly, on the part of the taxpayer.

Socio-emotional and Behavioral Consequences

When their ability to provide a nutritious diet and regular meals for their children is uncertain, parents feel anxiety

and frustration, leading to high levels of stress. Stress within the household in turn takes a toll on young children, and can cause serious behavioral and emotional issues that can impair mental health and social adjustment. Using the ECLS-K, researchers have found that even after controlling for other variables, food insecure kindergarteners were rated by their parents as having a poorer emotional state (less self-control, higher levels of sadness, loneliness, impulsiveness, and overactivity), and by both their parents and teachers as having lower social ability scores, in comparison to their food secure peers.[170] Another study, the CCHIP, found that school-age children who are hungry and at-risk for hunger are more likely to have problems with hyperactivity, absenteeism, and generally poor behavioral and academic functioning than their not-hungry peers.[171]

Older children continue to show the negative effects of food insecurity. Elementary school-aged children who are food insecure not only have an increased prevalence of negative behavioral and health outcomes[172], but are more than twice as likely to have seen a psychologist.[173] By the time they are teenagers, food insecure children are twice as likely as their peers to have seen a psychologist, twice as likely to have been suspended from school, and have greater difficulty getting along with other children.[174]

The damaging effects of the lack of a stable food source are even greater in children classified as hungry, the most severe level of food insecurity. For both preschoolers and school-aged children, child hunger is associated with higher rates of internalizing problems and child anxiety.[175] By elementary school, researchers have found that children who are hungry are four times more likely than non-hungry children to have a history of needing mental health counseling; seven times more likely to be classified as clinically dysfunctional; seven times more likely to get into fights frequently; and twelve times more likely to steal.[176] Behavioral problems like aggression and stealing often lead to contact with the criminal justice system. Besides the economic and emotional toll crime takes on its victims and society, the public also bears the substantial costs of incarceration. For 2006, the U.S. Justice Department estimates that it cost an average of $63 per day to imprison an inmate, or nearly $23,000 each year.[177] As many criminals cycle in and out of the justice system over their lifetimes, the costs can multiply dramatically. Though food insecurity is only one factor in the complex mix of influences that predispose individuals to criminal behavior, its very real influence on brain architecture and chemistry at an early age, and its impact on social and emotional health during critical years of socialization make it responsible for at least a fraction of the enormous costs that crime imposes on the broader society.

Children who struggle in school with lower grades, difficult social interactions, and repeating grades are also at a much greater risk of dropping out in high school, an outcome with dramatic economic consequences. In 2006, the median annual income for a high school dropout was only $18,868; that was $8,516 less than a high school graduate and $27,567 less than a college graduate.[178] A study of dropouts in Massachusetts estimates that over the course of their working career, a dropout will earn $500,000 less than a high school graduate and almost $2 million less than a college graduate.[179] As low-income workers are less likely to hold jobs with benefits like health insurance, pensions or retirement plans, they fall even further physically and financially behind those who graduate. Society, in turn, bears the costs of increased health problems, lost worker productivity, and lost tax revenue as individuals achieve and earn less.

Lifetime Earnings

A person's earning capacity is determined largely by educational attainment in the U.S. and elsewhere. When human capital deficits (e.g., health problems, including those correlated with food insecurity) interfere with cognitive development, achievement of school readiness, learning or academic achievement, they can impact educational attainment and reduce one's earning capacity. Reduced earning capacity, in turn, reduces that person's lifetime earnings, and their economic contribution to the social and economic systems.

Such impairments of one person's earning capacity do not only impact that person and her/his contribution to society, they also can impact their children's human capital accumulation and earning capacity. This is the pattern suggested by the term "cycle of poverty," in which the impacts of one generation's poverty present barriers to the next generation's achievement of its potential (Karp, 1993).[180]

Table 2 shows median annual income levels for people ages 25 years and above with different levels of educational attainment in the U.S. in 2007, along with the net present value of simplified hypothetical earnings streams at these levels over 40 years (out to retirement at age 65 years). The median and lifetime earnings for earners with professional degrees (medical, legal, etc.) are nearly five times as great as those for earners without a high school degree.

These lifetime earning-stream estimates are very conservative since they do not include pay raises or investment earnings over the 40-year period. Yet they illustrate the magnitude of differences in lifetime earnings arising from different levels of human capital accumulation. They also illustrate the magnitude of forgone income that can result from failure to attain one's academic potential. Food insecurity problems have been shown to adversely impact school performance and academic achievement. To the degree that food insecurity is a factor inhibiting educational attainment, it also limits lifetime earnings and the contribution such forgone earnings would make as they multiplied and rippled through the economy.

TYPES OF COSTS ASSOCIATED WITH FOOD INSECURITY

Food insecurity imposes several kinds of costs on individuals, families, and the socio-economic system. As described above, food insecurity in the U.S. is predominantly a consequence of poverty, though research over the past decade has shown clearly that food insecurity and poverty are not congruent conditions.

Given food insecurity's strong associations with poverty, and with other factors correlated with poverty, it is extremely difficult to isolate the portion of particular economic costs that is attributable solely to food insecurity. As a result, we take care to avoid specifying cost magnitudes in cases where costs are influenced by food insecurity, but not known to have arisen solely and specifically from food insecurity.

Table 2: Median Income Levels of People 25 Years and Over by Level of Educational Attainment, 2006 and Net Present Value of Lifetime Earnings at Each Median Income Level [181]

Education Attainment	Median Annual Income (Standard Error)	Net Present Value of Lifetime Earnings Over 40 Working Years At Median Earning Level (Discount Rate = 3.3%)
Total	$33,907 ($200)	
Less than 9th Grade	$18,868 ($290)	$415,731
9th to 12th Non-graduate	$20,506 ($149)	$451,822
High School Graduate	$27,384 ($102)	$603,369
Some College, No Degree	$31,789 ($125)	$700,626
Associate Degree	$35,274 ($218)	$777,215
Bachelor's Degree	$46,435 ($201)	$1,023,1321
Masters Degree	$55,445 ($346)	$1,221,655
Doctorate Degree	$78,212 ($1,972)	$1,723,295
Professional Degree	$85,857 ($4,263)	$1,891,743

Source: U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplement, 2007.

Direct Costs of Food Insecurity

Direct costs come from expenditures, directly related to either the causes or consequences of food insecurity, which would not be made in the absence of food insecurity. The costs of the public and private food assistance systems may be direct costs, as are the costs of medical care for illnesses or conditions resulting from orexacerbated by food insecurity. In FY 2006 the cost of the U.S. public food assistance system was approximately $53 billion.[182] The cost of the private emergency food assistance system has been estimated at about 10% of the public food assistance system, or about $5.2 billion per year.[183] The total costs of medical care directly related to food insecurity are unknown. This report focuses on costs due to consequences, rather than costs of already-implemented measures. Such costs include the costs of professional care for health and development problems resulting from, or exacerbated by, food insecurity.

Indirect Costs of Food Insecurity

Food insecurity imposes indirect costs in a variety of ways. One previously mentioned example is the cost of special education expenditures that arise at least in part due to impacts of food insecurity on children's physical or mental development, school readiness, academic performance and educational attainment. In 2006, federal on budget funds for Special Education were $11.46 billion, and some part of that was attributable to food insecurity and hunger. The ultimate indirect cost incurred by society from food insecurity is the loss or reduction of human capital in the overall workforce.

Cost-Benefit Evaluations

Costs are not inherently "bad." In fact, compelling arguments can be made that anything of value to humans has costs associated with it. The important question is always whether the benefits derived are greater than the costs. While we recognize that there are several kinds of values, in this paper we focus mainly on economic value. Moreover, we do not attempt to complete overall cost-benefit analyses, only to point out important categories of costs associated with food insecurity.

THE DOCTOR'S VIEWPOINT

Doctors strongly support this approach to "vaccinating" our children against childhood hunger, and treating them effectively if and when this health problem does occur. For physicians and medical researchers, SNAP "is one of America's best medicines to prevent and treat childhood food insecurity." 184 Children's HealthWatch research has shown that very young children who live in food insecure house holds, even those meeting the level of only mild food insecurity, are two-thirds more likely to be at risk for cognitive, motor or socio-emotional problems on screening tests when compared to those living in food secure households.185 Dr. Diana Cutts, Children's HealthWatch lead researcher for the Minneapolis site, said in testimony before the Committee on Agriculture, Subcommittee on Department Operations, Oversight, Nutrition, and Forestry that "Nutrition assistance programs, such as the Food Stamp Program and WIC, are the medicines needed to treat food insecurity and these accompanying illnesses, but the programs need to be dosed at levels that cure rather than just diminish the problem. The programs are also critical and economically sound investments on the health end of the equation, as they provide the physiological building blocks necessary for proper growth, health, development, and learning...preventive efforts are the best way to avoid the tangible and long-lasting costs of food insecurity in childhood." Doctors believe that no child deserves to be burdened with the consequences of food insecurity, a condition that is preventable with society's positive efforts.

CONCLUSION

Taken together, the studies summarized in this report offer solid evidence that food insecurity (or analogous earlier measures) is associated with a range of adverse health, growth and development outcomes in children across the age range 0-18 years, although the relationships are complex, with some variability from study to study. Age, ethnicity, and gender, as well as multiple other factors, including program participation, contribute to this variability.

Food insecurity, even at the least severe household levels, has emerged as a highly prevalent risk to the growth, health, cognitive, and behavioral potential of America's poor and near poor children. The threshold levels of severity for adverse effects of food insecurity on health and development in young children occur before the appearance of readily identifiable clinical markers such as underweight. The research reviewed here provides evidence that the effects of food insecurity worsen as its severity worsens, and that child food insecurity and hunger are associated with worse consequences than household food insecurity alone. However even at the lowest levels of severity Children's HealthWatch data suggest that, at least for babies and toddlers, household food insecurity is an established risk factor for health and development. This leads to the very troubling conclusion that for infants and toddlers food insecurity is an "invisible epidemic" of a widely prevalent and serious condition known to exist and to pose serious risks to child health and development, and whose remedy is well-understood and cost-effective, but is being withheld from those at greatest risk.

Food insecurity can occur and inflict harm at any or all parts of the life-cycle. However, the particular vulnerability of infants and toddlers ages 0-36 months undergoing especially rapid physical growth and neurocognitive development, provides a special opportunity for protecting and positively influencing the remainder of the life-cycle. Moreover, the apparent heightened susceptibility of older girls to the negative impacts of food insecurity in multiple domains suggests that it is particularly urgent to decrease this risk among those who will become mothers of the next generation of children.

Of the many interlocking forms of deprivation experienced by poor and near-poor children in the United States, food insecurity is one of the most readily measured as well as one of the most rapidly remediable through policy changes. Our country, unlike many others in the world, is clearly capable of producing and distributing sufficient healthful food to all its inhabitants, constrained only by political will.

We clearly know how to fix the problem of food insecurity and the harm it does to children, and we have an opportunity now to do that. Food insecurity and hunger damage the architecture of children's brains, and that makes it extremely difficult for them to ever reach their full potential as effective workers and members of society. As a result of that we all lose. But American business leaders have the means and ingenuity to prevent this from happening. By doing that, and ending child food insecurity and hunger, they can ensure a prosperous future for us all.

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