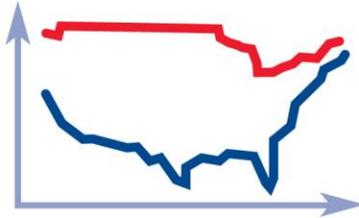




Issue Paper # 8



PARTNERSHIP  
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ECONOMIC  
SUCCESS

## READING, WRITING AND HUNGRY

### The consequences of food insecurity on children, and on our nation's economic success

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# INTRODUCTION

Food is at the foundation of what the psychologist Abraham Maslow called the “hierarchy of human needs.” Along with oxygen, water, and regulated body temperature, it is a basic necessity for human survival. Food security—defined 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.<sup>1</sup> 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.<sup>2</sup>

For young children, food insecurity can threaten survival, impair growth and development, lead to illness, poor health, and psychosocial problems, and impair the full development of human potential. These consequences carry significant costs for individuals, families, society and the national economy.

## Objectives

This report addresses the range of economic consequences associated with persistently high rates of household food insecurity in the United States. We focus specifically on the growing body of research demonstrating the harmful effects of food insecurity for very young children. We identify short- and long-term economic costs of those effects, with emphasis on the costs arising from food insecurity’s impacts on children. Our specific objectives are to address the following questions:

- What are the effects of food insecurity on a young child’s health, growth and development?
- What are the short-term economic costs of food insecurity, and its correlated health consequences?
- What is the long-term economic burden of food insecurity on children and the national economy?
- How does food insecurity impact areas of life often overlooked in the discourse on hunger and poverty?
- What are the relative magnitudes of preventive versus remedial costs to mitigate the negative impact of food insecurity?

The available literature addressing these questions is limited in many areas, and is derived from multiple fields of research. However, despite a scarcity of isolable and definite costs, we are able to conclude that food insecurity imposes a heavy burden on the economy which far outweighs the economic cost of preventive measures. We recognize and note significant limitations in the existing literature around food insecurity in early childhood, and recommend that further research focus on the pre-kindergarten period, including longitudinal follow-up, in order to fully trace the economic impact of food insecurity on the life trajectory of young children.

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<sup>1</sup> Nord 2007.

<sup>2</sup> Bickel 2000.

# AN ECONOMIC FRAMEWORK FOR CONSIDERING CONSEQUENCES OF FOOD INSECURITY

## Human capital theory

Human capital theory, developed and articulated by Gary Becker in the early 1960s, is one very useful framework for considering the economic consequences of childhood food insecurity.<sup>3</sup> 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.

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<sup>3</sup> Becker 1962; Becker 1975; Becker 1994.

## WHAT ARE FOOD SECURITY, FOOD INSECURITY, AND HUNGER, AND HOW ARE THEY RELATED?<sup>4</sup>

**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 sensations that accompany hunger, are not available or accessible due to lack of resources.

## 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.

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<sup>4</sup> Nord 2005.

## 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.<sup>5</sup>

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.

A simple example of a household production process is baking a cake. A family purchases flour, eggs, butter and sugar and combines these with family labor, human capital, time and energy to produce a cake. The family does not want the flour, eggs, butter and sugar *per se*, but they do want the cake. So they use the ingredients as inputs into their household production process, along with their human capital, to produce the cake, which gives them a great amount of satisfaction or utility.

## 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

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<sup>5</sup> Grossman 1999; Danziger 2000; Mirowsky 1998.

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.<sup>6</sup>

### **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.

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<sup>6</sup> Shultz 1995.

## 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.

***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 or exacerbated by food insecurity. In FY 2006 the cost of the U.S. public food assistance system was approximately \$53 billion.<sup>7</sup> 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.<sup>8</sup> The total costs of medical care directly related to food insecurity are unknown. This report will focus 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 familiar 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. The ultimate indirect cost incurred by society from food insecurity is the loss or reduction of human capital in the overall workforce.

Another view of indirect costs arises from the role of human capital (educational attainment) on lifetime earnings. Table 1 shows median annual income levels for people ages 25 years and above with different levels of educational attainment in the U.S. in 2006, 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.

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<sup>7</sup> Economic Research Service 2007.

<sup>8</sup> Ohls 2002.

They also illustrate the magnitude of forgone income that can result from failure to attain one's academic potential. Food insecurity has 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.

**Table 1: 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<sup>9</sup>**

Educational 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 9 <sup>th</sup> Grade	\$18,868 (\$290)	\$415,731
9 <sup>th</sup> to 12 <sup>th</sup> 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)	\$1,023,132
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.

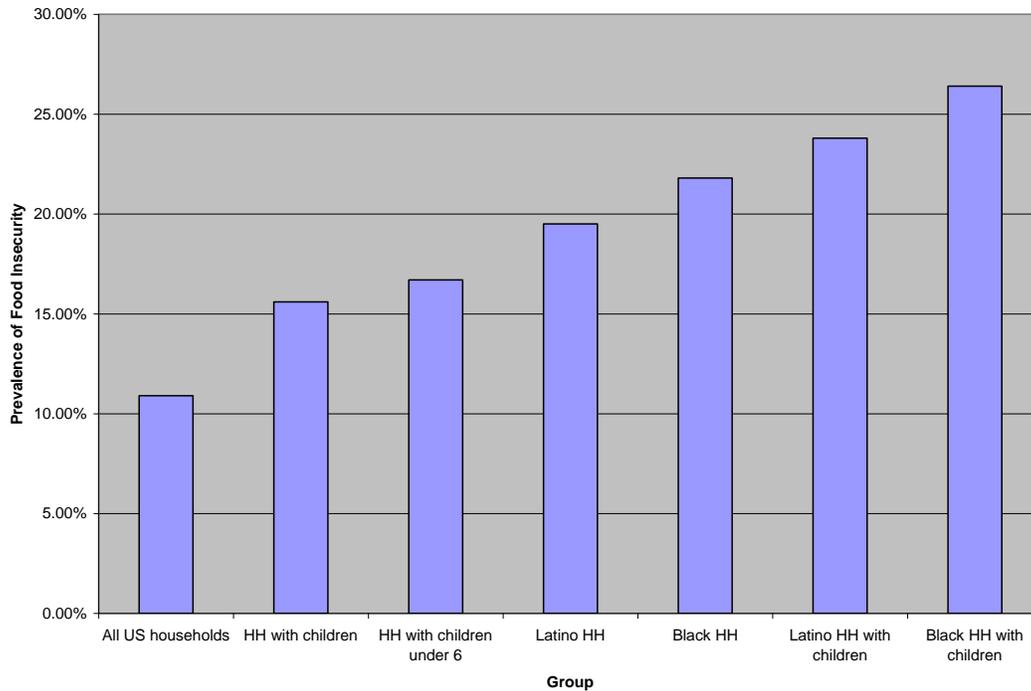
### Cost-benefit evaluations

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.

<sup>9</sup> Current Population Survey 2007.

# FOOD INSECURITY IN CONTEXT

Food Insecurity Prevalence Rates<sup>10</sup>



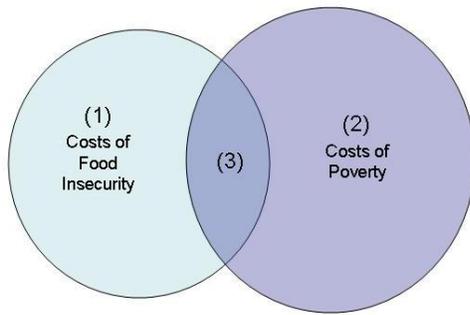
In 2006, 12.6 million children in the United States lived in food insecure households; this represented over 17 percent of the nation's children.<sup>11</sup> Thus, the consequences explored in this paper are not only severe, they are also widely prevalent among America's next generation. Food insecurity prevalence varies widely among demographic groups, and is strongly correlated with the prevalence of poverty. This makes sense: as less money is available to households, they are more likely to have to make tradeoffs between expenditures for basic needs. The food budget is the most flexible basic need, and is thus most likely to be constricted when other payments, such as rent or home energy bills, are pressing. Black and Latino households are significantly more likely to be food insecure than the average household in the US, and children greatly increase the odds of a household experiencing food insecurity. Among households below 100% of poverty, the prevalence of food insecurity is nearly 7% higher for those with children than for those without children.<sup>12</sup>

<sup>10</sup> Data from Nord 2007.

<sup>11</sup> Cook 2007.

<sup>12</sup> Ibid.

## COST INTERSECTION: FOOD INSECURITY AND POVERTY



Most studies on the cost of poverty consider both the *isolated* costs of poverty—section (2) of the diagram—and those costs which arise from poverty-induced food insecurity and its related consequences—section (3) of the diagram—without attempting to disaggregate the two. In other words, they do not control for food insecurity when calculating the magnitude of poverty’s impact. By contrast, this paper considers the impact of food insecurity, above and beyond the impact of poverty—section (1) of the diagram—isolating food insecurity from

poverty as fully as possible by considering studies that control for poverty and poverty-related factors.

Most of the studies reviewed here look at the impact of food insecurity while *controlling* for the impact of poverty. In other words, in this paper we are considering harm and costs that are separate from—and in some areas, over and above—the costs of child poverty that others have elucidated.<sup>13</sup> Conversely, studies looking at the costs of child poverty rarely control for food insecurity in their analyses. A 1996 Children’s Defense Fund analysis demonstrated that each year of child poverty at 1996 levels would reduce future economic output by \$130 billion due to ‘total labor market effects’ alone.<sup>14</sup> The analysis did not control for food insecurity during childhood; thus, the \$130 billion figure includes some consequences of food insecurity as a portion of the overall consequences of poverty. Moreover, since studies that control for poverty have demonstrated an *independent* correlation between childhood food insecurity and lower educational attainment, the portion of poverty’s costs attributable to food insecurity is, in turn, only one portion of the *total* economic cost of food insecurity. The costs outlined in this report thus represent a portion of the costs of poverty as they are generally calculated (since food insecurity-related costs tend to be aggregated with poverty-related costs), plus additional costs of food insecurity that are generally excluded from poverty analyses.

Food insecurity is among a constellation of stresses that regularly impinge on low-to-moderate-income families in the U.S. Though it is a correlate of poverty, food insecurity is neither congruent with poverty nor completely separate from it. Moreover, food insecurity often interacts with other correlates of poverty, such as housing instability and energy insecurity, to modify and amplify their adverse impacts on the health of children and their families. Just as it is extremely important to examine the causes and consequences of the various correlates of poverty separately, it is also important not to subsume all correlates of food insecurity in attribution of costs to food insecurity.<sup>15</sup>

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<sup>13</sup> See Holzer 2007; Sherman 1997.

<sup>14</sup> Total labor market effects represent the impact of lower worker productivity, resulting from lower educational attainment, on the economy. This impact is only one of many consequences of child poverty; others not included in the study include increased costs associated with medical care, hospitalization, obesity, remedial education, and extra psychosocial supports for poor children.

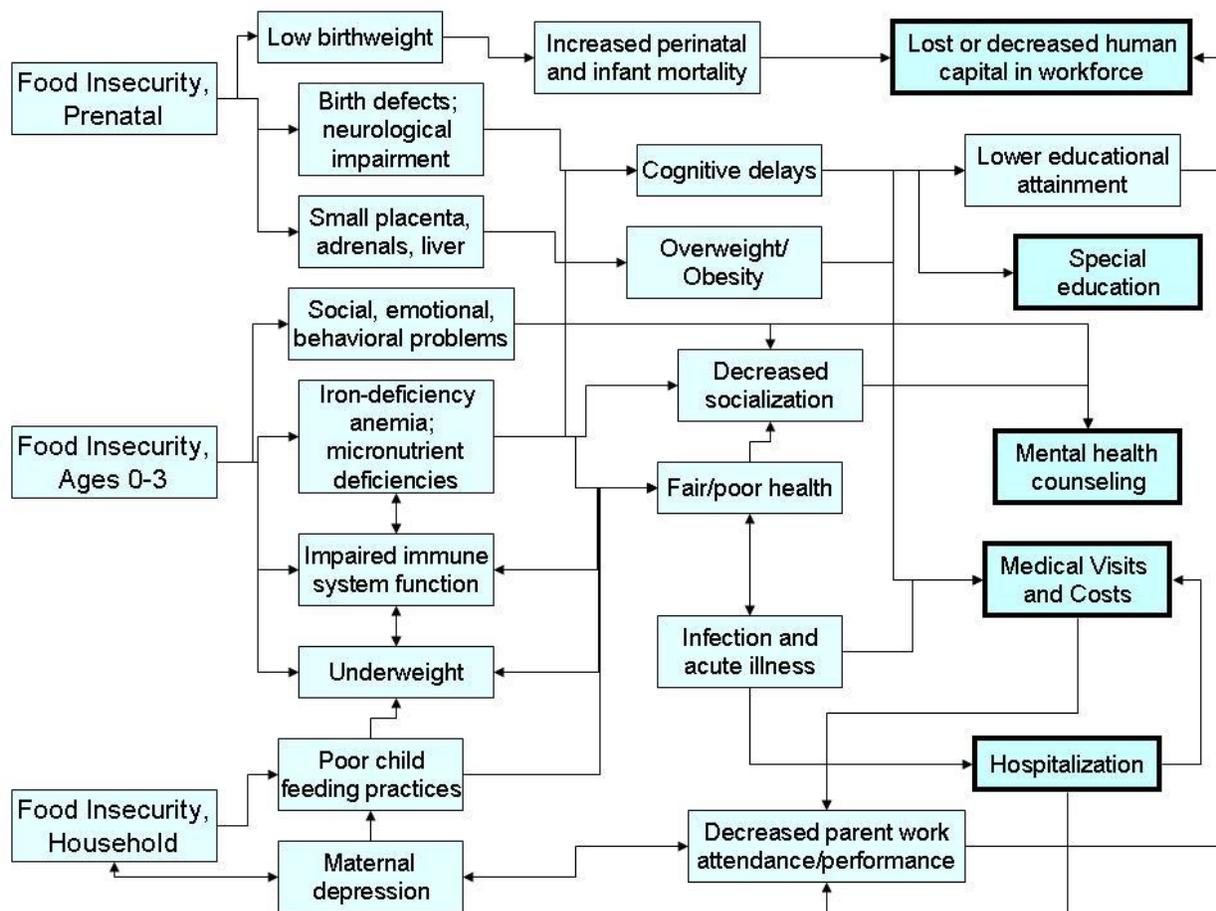
<sup>15</sup> Duncan and Brooks-Gunn, 2000; Brown, et al., 2007.

It is also essential to understand that the impact of food insecurity which we set forth is far lower than it would be in the absence of the nation's existing, albeit inadequate, safety net. To state the obvious, the studies considered here examine our society as it stands today, with the extent and particularly the depth of hunger and food insecurity among young children already reduced by a range of interventions such as public income supports (e.g., TANF, the Earned Income Tax Credit, the Child Tax Credit) and nutrition programs (e.g., WIC, food stamps, Child and Adult Care Food Program). If these supplemental supports did not exist, levels of hunger and food insecurity in America would be significantly higher, as would the consequent harm, particularly to vulnerable young children.

By analogy, a study of the cost of health care uninsuredness would show considerable negative outcomes due to lack of health coverage, but would not be able to quantify how much harm was already prevented by Medicaid, Medicare and other public interventions. The impacts and costs set out in this report therefore have two attributes:

- They are unacceptably high given the wealth of our society and the compelling moral and economic reasons for making wise investments in children's well-being;
- They are far lower than they would be, had the nation not already made substantial investments through supplemental programs.

### COSTS OF FOOD INSECURITY IN YOUNG CHILDREN\*



\*Developed by C-SNAP based on research reviewed and summarized in this paper.

Boxes in bold represent economic cost centers; lower human capital is the ultimate cost endpoint for pathways tracing the consequences of food insecurity. Double arrows represent relationships in which causality runs both ways, commonly referred to as ‘vicious cycles.’ For instance, the double arrow between food insecurity and maternal depression denotes that household food insecurity can contribute to mothers’ depression when they have an inadequate diet and/or feel unable to provide for their children; likewise, maternal depression can contribute to food insecurity by causing deterioration in the mother’s feeding and caretaking practices. A second example is the double arrow between underweight and impaired immune function. This arrow refers to the ‘infection-malnutrition cycle,’ in which undernutrition limits the immune system’s ability to fend off illness, causing increased prevalence of poor health in young children, which causes poor eating, further undernutrition, and often more severe underweight.<sup>16</sup>

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<sup>16</sup> For more on the infection-malnutrition cycle, see Ward 2002.

# IN THE BEGINNING: PRENATAL NUTRITION AND INFANT HEALTH

What mothers consume during pregnancy has a very significant bearing on the well-being of their newborn infants. A number of recent studies demonstrate that undernutrition in utero has substantial negative effects on both the short- and long-term growth and health of infants. At the same time, the studies of the positive impacts of nutrition interventions for pregnant women similarly demonstrate how remediating nutritional deficiencies in pregnancy has substantial cost benefits.

## Food insecurity and 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.<sup>17</sup>

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.<sup>18</sup> 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.<sup>19</sup>
- **IQ at 18 years of age:** Low birthweight is associated with lower age 18 IQ.<sup>20</sup>
- **Educational attainment:** A 10% increase in birthweight increases a child's odds of graduating from high school.<sup>21</sup>
- **Adult earnings:** Increased educational attainment increases an individual's expected earnings as an adult.<sup>22</sup>

Low birthweight disproportionately affects Blacks: 11.8% of Black children come into the world as low birthweight babies, compared to 7.5% of White children and 6.9% of Latino children.<sup>23</sup> This trend is at least partially attributable to higher rates of poverty and food insecurity among Black women in America, and contributes to the intergenerational transmission of racial inequalities.

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<sup>17</sup> Bergner 1970.

<sup>18</sup> Hediger 1998.

<sup>19</sup> S. Black 2005.

<sup>20</sup> Ibid.

<sup>21</sup> Ibid.

<sup>22</sup> Ibid.

<sup>23</sup> Pediatric and Pregnancy Nutrition Surveillance System 2007.

The existence of programs such as the federal Special Supplemental Nutrition Program for Women, Infants and Children (widely known as “WIC”) is predicated in significant part on these connections between nutritional status of pregnant women and the health and developmental outcomes of their newborn infants. For example, Maternal WIC participation during pregnancy results, on average, in a 7.5 percent increase in infant birthweight.<sup>24</sup>

## WIC and Infant Mortality:

Calculations for a group of 1,000 births

28 fewer deaths per thousand	X	7.5% birthweight increase (due to WIC)	=	21 fewer deaths per thousand
10% birthweight increase				
\$39 cost	X	9 months pregnancy	=	\$350 cost per pregnancy
1 month WIC participation				
\$350 cost per pregnancy	X	1,000 pregnancies	=	\$350,000 cost per thousand

\$350,000 cost → 21 fewer infant mortalities

Black et. al. show that a 10 percent increase in birthweight reduces 1-year mortality by approximately 28 deaths per 1,000 births.<sup>25</sup> Given a 7.5 percent birthweight increase associated with WIC participation, a conservative estimate shows WIC participation among eligible pregnant women reducing 1-year mortality, relative to control rates with no WIC participation, by 21 deaths per 1,000 births.

The average monthly benefit per person for WIC was \$39 in 2007; the expense over a nine-month pregnancy thus equals around \$350

per woman, and the total cost of enrollment for 1,000 eligible women would be around \$350,000.<sup>26</sup>

The total cost of WIC provision during pregnancy for 1,000 eligible women would be approximately \$350,000 at 2007 cost levels.<sup>27</sup> Calculations based on the latest research estimate that this investment would save approximately 21 infants within this group from death before the age of one.<sup>28</sup> Even in the most basic sense, considering that even an individual with less than a ninth grade education will have a lifetime earnings value over \$415,000 to contribute to the nation’s economy, the WIC investment is over 21 times more cost-effective than non-investment (\$350,000 cost to invest, versus 21 x \$415,000 cost to accept the higher rate of infant mortality).

## Food insecurity and fetal development

Beyond general growth retardation, maternal undernutrition has significant effects on specific physical systems in the developing fetus. Food insufficiency<sup>29</sup> late in the gestational period

<sup>24</sup> Kowaleski-Jones 2002.

<sup>25</sup> S. Black 2005..

<sup>26</sup> Food and Nutrition Service 2008.

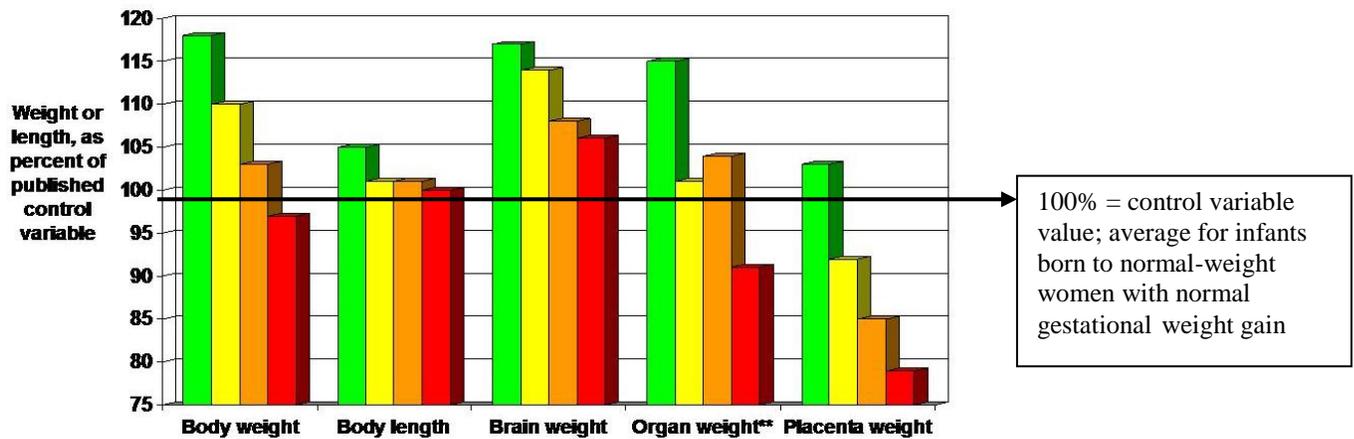
<sup>27</sup> The average monthly benefit per person for WIC was \$39 in 2007<sup>27</sup>; the expense over a nine-month pregnancy thus equals around \$350 per woman, and the total cost of enrollment for 1,000 eligible women would be around \$350,000. Food and Nutrition Service 2008.

<sup>28</sup> S. Black 2005.

<sup>29</sup> Food insufficiency is a metric that captures the equivalent of severe food insecurity.

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.<sup>30</sup> This physiology is also descriptive of the ‘thrifty phenotype,’ which is thought to lead to child obesity, as described further in the obesity section of this paper.

### Poor Maternal Nutrition Leads to Poor Fetal Growth<sup>31</sup>



**Nutritional Categories:**

- Overweight women with high gestational weight gain
- Underweight women with high gestational weight gain
- Overweight women with low gestational weight gain
- Underweight women with low gestational weight gain

\*\*Organ weight represents average of thymus, heart, lungs, spleen, liver, adrenals, and kidney weights.

Data from Naeye, "Effects of maternal nutrition on the human fetus"

Intrauterine malnutrition also has detrimental effects on the developing fetal nervous system, and can lead to disorders of neurological development that cause sensory and cognitive impairments.<sup>32</sup> One rigorously controlled 2007 study finds that food insecurity around the time of pregnancy increases the risk of certain birth defects, including cleft palate, spina bifida, and anencephaly.<sup>33</sup> Treatment of just one case of cleft palate commonly requires a medical team of a maxillofacial surgeon, audiologist, speech pathologist, prosthodontist, otolaryngologist, periodontist, and geneticist, as well as speech and orthodontic services, over an extended period during childhood, all at a cost of over \$100,000 per child (1994 dollars) over the course of a lifetime.<sup>34</sup>

<sup>30</sup> Naeye 1973.

<sup>31</sup> Chart adapted from Naeye 1973.

<sup>32</sup> Schulte 1971. Such disorders include defective myelinization and neurocellular growth retardation.

<sup>33</sup> Carmichael 2007. Anencephalic infants are born without a forebrain, and are generally blind, deaf, unconscious, and unable to feel pain. Spina bifida is a neural tube defect that causes varying degrees of paralysis and is often accompanied by cognitive difficulties. Cleft palate is a disorder in which the skull plates that form the roof of the mouth fail to fuse, resulting in a soft spot or hole between the mouth and the nasal cavity.

<sup>34</sup> Waitzman 1994.

# ZERO TO FIVE: FOOD INSECURITY AND PHYSICAL HEALTH

At birth, infants transfer their dependence from the mother's body to the broader household environment. Nutrient intake, once directly regulated by maternal food consumption, begins to be governed by household food availability and quality, parenting practices, and many other factors. As the complexity of the child's environment increases, so does the number of pathways through which food insecurity, interacting with that environment, can impact health, growth, and development. The same phenomenon seen in the prenatal period, namely that nutrient intake impacts physiological systems, plays out in increasingly complex ways.

## Nutrient Deficiencies

Food insecurity dramatically increases the likelihood of dietary deficiencies among infants and toddlers, which carry economic costs and impede normal trajectories of growth and development. One of the most common is iron-deficiency anemia (IDA). Children living in food insecure households are 140 percent more likely to develop IDA than their food secure peers.<sup>35</sup> IDA delays the cognitive development of young brains by altering the efficiency of central nervous system functions, compromising attention and recognition memory in particular.<sup>36</sup> In infants, the condition slows information processing, and causes a wide range of negative changes including less positive affect, decreased social interaction, decreased attention to caregiver reactions, difficulty being soothed, delayed crawling, increased likelihood of tremulousness, and lower overall positive response to the physical and social environment.<sup>37</sup>

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.<sup>38</sup> 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.<sup>39</sup> Since most severe cases of food insecurity occur in very poor households, children hospitalized due to food insecurity are very likely to have public, if any, health insurance, and the cost of their treatment is born by the taxpayer. By contrast, a full year of the maximum food stamp allotment would cost less than \$2,000 per child each year; the preventive cost in these cases is well under half of the remedial treatment.<sup>40</sup>

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<sup>35</sup> Skalicky 2006.

<sup>36</sup> Burden 2007.

<sup>37</sup> Lozoff 2003.

<sup>38</sup> Polhamus 2007.

<sup>39</sup> Agency for Healthcare Research and Quality 2003.

<sup>40</sup> It is also worth noting that, from a state and local perspective, because food stamp benefits are 100 percent federally-funded, the cost to the taxpayers in the jurisdiction is very small. (Administrative costs are shared by the state and federal government at 50% each.) At the same time, there are substantial positive economic, as well as health, outcomes: economists generally believe that food stamps are among the most, if not the most, stimulative forms of spending for the economy. See, e.g., statements collected at [http://frac.org/news/real\\_stimulus.htm](http://frac.org/news/real_stimulus.htm) and [www.realstimulus.org](http://www.realstimulus.org)

Remedial measures, beyond being more costly, are also unable to fully make up for the damage done by IDA and other nutrient deficiencies. The negative effects of IDA are enduring, lasting well beyond the period of deficiency. One study using corrective iron therapy found that, before treatment, infants with IDA had lower mental and psychomotor developmental index scores, specifically lower language capabilities and body balance and coordination skills than their peers. Once the infants began iron therapy, they continued to lag behind their peers in these indices for at least three months. Other studies have demonstrated correlations between IDA in infancy and impaired IQ, motor skills, balance, and coordination at 5 to 7 years of age.<sup>41</sup> Thus some children already lag behind their peers on the first day of kindergarten due to IDA, and the deficiency has a measurable impact upon children's overall development and school readiness during the critical beginning stages of elementary school. IDA is but one of many nutrient deficiencies that can arise from food insecurity<sup>42</sup>, all of which negatively impact growth and development. Remedial therapies cannot undo the full extent of the negative impacts; only preventive measures—such as Food Stamp Program participation—can lower the prevalence of food insecurity among at-risk children and buffer them from negative health consequences.<sup>43</sup>

## Poor Health

Insufficient nutrient and/or calorie intake impairs physical growth and the development of young children's immune systems, leading to high prevalence of underweight and fair/poor health among food insecure children.<sup>44</sup> One study found that food insecurity nearly doubles the risk for fair or poor health among children 0 to 3, and that a dose-response relationship exists between the degree of food insecurity and the severity of health concerns, meaning as a child's food insecurity grows worse, that child's health concerns are likely to become incrementally more severe.<sup>45</sup> A child's overall health is responsive over time to changes in diet, with short-term transitions in food insecurity status prompting measurable short-term changes in health status.<sup>46</sup> This dynamic quality means that food insecure children can reap substantial, rapid benefits from nutritional interventions.

Immune system function, as reflected in susceptibility to infection by viruses and bacteria, is an important component of the overall health assessment in infants and toddlers. Children whose immune systems are compromised fall ill far more often than their peers, and spend significant time and bodily energy fighting off infection, leaving fewer resources free for physical, cognitive, and social development. Food insecurity is a major cause of immunodeficiency, as it limits the resources available to fuel the immune system, worsening the defenses of children and making them more susceptible to infection. Poor children who are food insecure fare much worse than poor children with adequate nutrition in part because of nutrition's large role in supporting

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<sup>41</sup> Walter 1989.

<sup>42</sup> Other food insecurity-related nutrient deficiencies include Vitamins A, E, and C; calcium; and protein deficiencies. The correlation between food insecurity and these conditions in the United States has been more definitively shown in adults. See Rose 1997.

<sup>43</sup> A. Perry 2007.

<sup>44</sup> M. Black 2004.

<sup>45</sup> Cook 2004.

<sup>46</sup> McLeod 2006.

immune function. The ‘infection-malnutrition cycle’ exacerbates the direct negative health effects of food insecurity, compounding them with a range of opportunistic illnesses.<sup>47</sup>

Poor children who live in food insecure households fall victim to infection and acute illness on a much more frequent basis than their peers who have adequate nutrition in their diets.<sup>48</sup> One study found that food-insufficient low-income preschool children are 50% more likely to be reported in poor health than food-sufficient children of the same age and family income category.<sup>49</sup> They are also 200% more likely to suffer stomachaches and 57% more likely to catch cold than their food-sufficient peers of equal family income.<sup>50</sup> Another study found that poor, *hungry* children were more likely than poor but *not hungry* children to suffer from health problems such as frequent colds, ear infections, anemia, asthma, and headaches.<sup>51</sup> Risks in these areas continue to be elevated by food insecurity as children reach school age.

## Oral Health

Most research on children’s oral health to date focuses on the school years, but pinpoints many concerns with roots in early childhood. From 1999-2002, 28% of children ages 2 through 5 in the United States had dental caries—the infectious dental disease that leads to cavities—in their primary teeth.<sup>52</sup> The connections between food insecurity, Early Childhood Caries (ECC), and children’s overall health will be fully explored for the first time in a forthcoming study by Braunstein and colleagues; however, even without that data, we can already identify many strong links between food insecurity and poor oral health in young children.

Periodontal (gum) disease, like food insecurity, increases a woman’s risk of having a low birthweight and/or premature baby.<sup>53</sup> Such babies, in turn, are at increased risk for tooth enamel defects, which effectively compromise the protective covering of the teeth and increase the risk of developing caries. Food insecurity during the first three years of life adds another layer of increased risk for poor dental health, since tight food budgets limit choices and force parents to buy products with the lowest per-calorie cost.<sup>54</sup> In the American food market, the cheapest calories come in the form of highly processed, high-calorie, low-nutrient products. These foods provide a feeling of satiety without providing the nourishment needed to sustain healthy growth and development. Dental research shows that these same foods are the ones most likely to rot children’s teeth (most cariogenic), raising the prevalence of ECC among food insecure children.<sup>55</sup>

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<sup>47</sup> Ward 2002.

<sup>48</sup> Casey 2005; Weinreb 2002; Dunifon 2003.

<sup>49</sup> Alaimo *Am J Public Health* 2001.

<sup>50</sup> Ibid.

<sup>51</sup> Wehler 1995.

<sup>52</sup> Beltran-Aguilar 2005.

<sup>53</sup> Treating a pregnant mother’s dental disease is safe, but it is not effective in preventing low birthweight and its subsequent consequences. (Boyd 1998; Tianoff 2005; Ferguson 2007) Therefore, caring for young women’s teeth before and between pregnancies is the only way to avoid the portion of the high short- and long-term costs of low birthweight that is attributable to poor maternal oral health. Women’s oral health and nutrition status should be viewed as part and parcel of their overall physical health status, known to have a strong impact on the health of their unborn and future children.

<sup>54</sup> Drewnowski 2004.

<sup>55</sup> Garcia-Closas 1997; Ruottinen 2004, Lussi 2004.

Caries can cause pain, infection in the mouth often spreading to other parts of the body, poor sleep, trouble eating, and irritability, all of which contribute to poorer nutrient intake and impaired development. Dental health problems thus generate a vicious cycle: food insecure children, seeking to fend off the feeling of hunger, consume nutrient-poor foods, which cause oral health problems, which impair their ability to eat properly, worsening their already poor nutritional status. This cycle helps to explain why children with ECC are diagnosed with failure to thrive (FTT) in disproportionately high numbers. An FTT diagnosis signifies that a child has failed to grow as expected for his/her age and gender because of malnutrition. Among inner city children, those with ECC are more likely to meet the criteria for FTT, especially at older ages (e.g. preschoolers), than their peers without caries.<sup>56</sup> Because food insecurity heightens the risk of both ECC and FTT, it is not surprising that the same groups of children are at highest risk for food insecurity, dental disease, and FTT: those from low-income families; those with public or no health insurance; racial/ethnic minorities; immigrants and citizen children of immigrants; and former low birthweight children.

The costs of letting young children's teeth deteriorate to the point of ECC are extremely high. Through the age of five, treatment for the condition usually requires sedation and/or general anesthesia along with hospitalization, at an average cost of between \$1500 and \$6000 per treatment.<sup>57</sup> In total the US spends nearly \$38 million per year on oral health-related hospital costs for children ages 0-17.<sup>58</sup> A subset of those costs, approximately \$8 million per year, is due to dental abscess. This serious infection can be fatal if left untreated; the tragic death in 2007 of 12-year-old Deamonte Driver in Maryland was a painfully clear illustration of the consequences that can arise from lack of timely treatment, often due to lack of insurance coverage.

One study of preschool-aged children with Medicaid dental coverage found that those who had their first preventive visit by age one had lower dentally-related costs and lower need for restorative and emergency dental visits, cumulative through age five, compared to their peers whose first preventive visits came at a later age.<sup>59</sup> Cumulative costs rose incrementally as the age of first visit increased, demonstrating a substantial cost savings associated with early investment in oral health among this low-income group of children. A second study looked at Medicaid reimbursements over a three-year period and found that inpatient emergency department treatment for dental problems was approximately ten times more costly than the anticipated cost of preventive dental care.<sup>60</sup> Because food insecure children tend to be a subset of those covered by public health insurance, and because they have higher-than-average rates of dental problems, it stands to reason that preventive care among this population would be especially cost-saving.

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<sup>56</sup> Acs 1992, 1999.

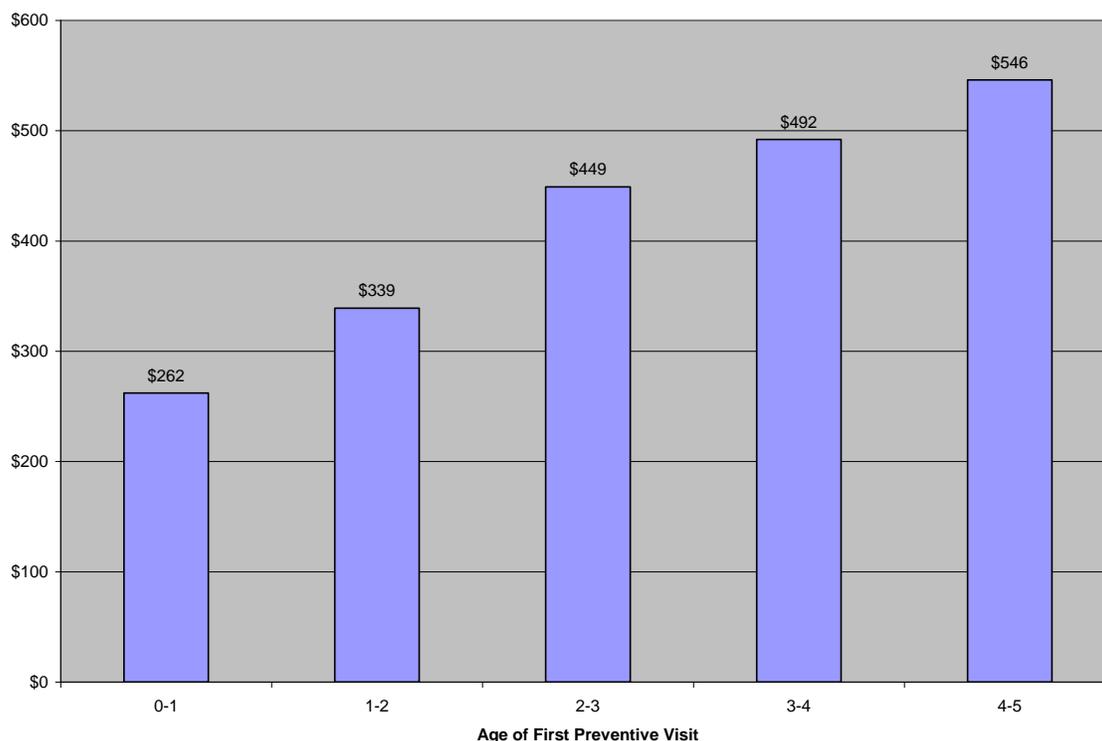
<sup>57</sup> Vargas 2006.

<sup>58</sup> Kids' Inpatient Database (KID) 2003.

<sup>59</sup> Savage 2004.

<sup>60</sup> Pettinato 2000.

**Average cumulative per-child dentally-related costs over the first 5 years, according to age at first preventive visit<sup>61</sup>**



Early preventive dental care is highly effective in lowering the cumulative costs of children’s dental care over the first five years of life. Preventive care for children covered under public health insurance would produce substantial savings in acute care costs.

**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.<sup>62</sup> 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.<sup>63</sup> 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

<sup>61</sup> Graph adapted from Savage 2004.

<sup>62</sup> Cook 2004.

<sup>63</sup> Agency for Healthcare Research and Quality 2003. Diagnoses included nutritional marasmus; protein-calorie malnutrition; and active rickets.

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.

### **Other Economic Costs of Negative Physical Outcomes**

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.

## 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 kindergarteners from food insecure homes not only entered school with lower math scores, but also learned less over the course of the school year.<sup>64</sup> Even children considered marginally food insecure—meaning that they had enough food but their families struggled to meet their needs—lagged behind their peers.<sup>65</sup> 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.<sup>66</sup> 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.<sup>67</sup> 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 the Food Stamp Program between kindergarten and third grade than for girls who left the Food Stamp Program during that time.<sup>68</sup> 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.<sup>69</sup>

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<sup>64</sup> Wincki 2003.

<sup>65</sup> Ibid.

<sup>66</sup> Jyoti 2005.

<sup>67</sup> The Condition of Education 2004

<sup>68</sup> Frongillo 2006.

<sup>69</sup> Alaimo *Pediatrics* 2001.

## 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.<sup>70</sup> 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.<sup>71</sup> 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.

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<sup>70</sup> Kleinman 1998.

<sup>71</sup> Skelly 2001.

## 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.<sup>72</sup> Another study, the Community Childhood Hunger Identification Project, 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.<sup>73</sup>

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<sup>74</sup>, but are more than twice as likely to have seen a psychologist.<sup>75</sup> 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.<sup>76</sup>

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.<sup>77</sup> 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.<sup>78</sup> 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.<sup>79</sup> As many criminals cycle in and out of the justice system over their lifetime, the costs can multiply dramatically. Though food insecurity is only one minor factor in the complex mix of influences that predispose individuals to criminal behavior, its very real influence on brain 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 small fraction of the enormous costs that crime imposes on the broader society.

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<sup>72</sup> Stormer 2003.

<sup>73</sup> Murphy 1998.

<sup>74</sup> Dunifon 2003.

<sup>75</sup> Alaimo *Pediatrics* 2001.

<sup>76</sup> Ibid

<sup>77</sup> Weinreb 2002.

<sup>78</sup> Kleinman 1998.

<sup>79</sup> Office of the Federal Detention Trustee 2004.

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.<sup>80</sup> 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.<sup>81</sup> 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 cost of increased health problems, lost worker productivity, and lost tax revenue as individuals achieve and earn less.

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<sup>80</sup> Current Population Survey 2007.

<sup>81</sup> Boston Youth Transitions Task Force 2006.

# MATERNAL DEPRESSION, CHILD HEALTH, AND FOOD INSECURITY

Most of the existing literature on food insecurity and mental health focuses on school-aged and adolescent children's mental health and food security status.<sup>82</sup> However, two relatively recent studies have shown that maternal mental health, particularly depression, is highly associated with food insecurity and influences child health and well-being. Though it is difficult to identify whether maternal depression or food insecurity comes first, the research is clear that mothers who report depressive symptoms are more likely to live in food insecure households, have an overweight toddler, report that their young children are in fair/poor health and have had previous hospitalizations.<sup>83</sup>

In a study of children ages 0-3 who were patients in an emergency room or acute care clinic in 5 urban medical centers, mothers who reported depressive symptoms had odds 2.69 times higher of living in a food insecure household.<sup>84</sup> Children of mothers who screened positively for depression had 58% higher odds of being in fair/poor health and 21% higher odds of having had a previous hospitalization. Many of these families had borne the brunt of welfare reform and their public assistance benefits had been reduced or sanctioned. Of those whose federal support had been reduced or eliminated, mothers were 52% more likely to report depressive symptoms. Of those whose food stamp benefit had been eliminated, mothers were 56% more likely to report depressive symptoms.<sup>85</sup>

Whether mental health problems were present before or after food insecurity, it is clear that a mother's mental health has an impact on her child's health. Mothers struggling with depressive symptoms tend to have difficulty maintaining employment and developing optimal parenting skills, which in turn affect the child's ability to stay healthy.<sup>86</sup> Children's psychological well-being is heavily impacted by maternal depression; children of depressed mothers are at increased risk for psychiatric disorders, excessive aggression or shyness, behavioral problems, and academic underperformance, among other difficulties.<sup>87</sup> A recent study using nationally representative data from the Early Childhood Longitudinal Study – Birth Cohort (ECLS-B) found that food insecurity, by influencing parental depression, parenting practices, and the presence of cognitively stimulating activities, negatively impacts security of attachment and mental proficiency in toddlerhood.<sup>88</sup>

Another study based on the same dataset (ECLS-B) focused on the pathways between mental health, food insecurity and negative health outcomes for toddlers.<sup>89</sup> The authors found that in food insecure households parents were more likely to be depressed, and toddlers in the family were more likely, in turn, to be in fair/poor health. Additionally, they found that in food insecure

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<sup>82</sup> See Alaimo 2002; Kleinman 1998.

<sup>83</sup> Casey 2004, Bronte-Tinkew 2007.

<sup>84</sup> Casey 2004.

<sup>85</sup> Ibid.

<sup>86</sup> Lennon 2001.

<sup>87</sup> Ibid.

<sup>88</sup> Zaslow 2008.

<sup>89</sup> Bronte-Tinkew 2007.

households, parents were less likely to have good parenting skills, which led them to make problematic infant feeding choices, which consequently led to overweight toddlers. Food insecurity inhibits positive parent-child relationships, whether through increased anxiety or reduced ability to perceive problems, and that subsequently affects the health and weight gain of 2 year olds.<sup>90</sup>

The economic implications of maternal depression and household food insecurity for young children's health and potential are great. Maternal depression itself is a cost of food insecurity, as it is often precipitated or exacerbated by food insecurity and must be addressed through costly medical and support services. Because stable mothers are better able to care for their children and tend to have better feeding practices, treating food insecurity-related maternal depression can be considered a remedial measure for children in food insecure households.

Alongside the documented costs of poor child health and developmental difficulties discussed previously, maternal depression often has a synergistic effect, meaning that as problems mount, it may be harder for the mother to control or heal her depression, which then may, in and of itself, cause missed work days and reduced productivity. Conversely, treating maternal depression has the potential for substantial child health cost savings. In a study on childhood asthma and maternal depression, treating the mother's depression resulted in cost savings of \$798 per child due to improved asthma management and parenting practices.<sup>91</sup> Though no such specific data exists on costs related to food insecurity, it can be reasonably assumed that similar results would be found, since the medical costs of food insecurity include hospitalizations and doctor visits similar to those incurred in asthmatic episodes, and these costs can be reduced through improved parenting and feeding practices. Thus maternal depression is a cost of food insecurity, but proactive management of maternal depression can serve as a cost-saving measure that helps to buffer children from food insecurity's harmful effects.

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<sup>90</sup> Ibid.

<sup>91</sup> Perry 2008.

# LINKAGES BETWEEN FOOD INSECURITY AND OBESITY

Research on food insecurity and being overweight has, in the past, mostly focused on adults and school-aged children.<sup>92</sup> However, a growing body of research about young children demonstrates a strong correlation between early food insecurity and being overweight and obese later. 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.<sup>93</sup> In turn, children whose families are food insecure are more likely to be at risk of being overweight ( $\geq 85\%$  weight-for-age) or obesity as compared to children whose families are food secure.<sup>94</sup> 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.<sup>95</sup> 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 weight 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.<sup>96</sup>

## Pathways

Why does this seemingly ironic connection exist between not enough food and too much body weight? The simplest answer is that in industrialized Western nations, the cheapest foods tend to be high in sodium and calories, and extremely low in needed nutrients. These foods comprise the diet of necessity for food insecure families trying to make ends meet, given tight budgets and limited access to stores with greater variety.<sup>97</sup> Just as this nutrient-calorie imbalance negatively

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<sup>92</sup> See Olson 1999; Townsend 2001; Frongillo 2006.

<sup>93</sup> Nord 2007.

<sup>94</sup> Casey 2006.

<sup>95</sup> Dubois 2006.

<sup>96</sup> Ibid.

<sup>97</sup> Drenowski 2004; Mendoza 2006; Neault 2005.

impacts young children’s oral health, it becomes a problem for physical health as well, and often leads to consumption of surplus levels of calories in the form of obesogenic (obesity-promoting) foods. Beverages fit the same pattern; for example, at the time of this publication, a two liter bottle of generic soda with 880 calories cost \$0.75 at a local supermarket, whereas a half gallon of milk with 880 calories cost \$2.59, more than triple the cost per calorie.<sup>98</sup>

Reduced physical activity is a major contributor to rising rates of obesity in children.<sup>99</sup> Physical activity is steadily declining among young children overall, but the trend is stronger among food insecure children. Because they are more likely to come from low-income families, food insecure children tend to live in the often low-income neighborhoods where outside play may not be safe, and other options for recreation may be limited.

Stress is also a major factor in homes experiencing food insecurity. Stress negatively affects parenting practices, and poor parenting practices in turn lead to improper infant and toddler feeding. Recent findings show that parents in food insecure families are more likely to have negative parenting practices in areas including how and what to feed their infants. These families are also more likely to have overweight toddlers.<sup>100</sup> A caretaker’s lack of either awareness or ability to make informed decisions around how long to breastfeed, when to introduce solid foods and what kinds of foods to use, as well as the kinds of foods appropriate for older infants and toddlers, can lead to excess weight gain and obesity in very young children.

A more complex mechanism, the “thrifty phenotype hypothesis,” pinpoints the prenatal period as a pivotal time for setting later metabolic patterns.<sup>101</sup> The theory holds that when children experience food deprivation in utero or during early infancy, their bodies adapt to that environment by becoming “nutritionally thrifty,” decreasing growth and orienting systems towards conserving and storing energy. This “thrifty” state is akin to the systems of a bear in hibernation; the body anticipates a period of hunger, and programs itself to survive that period by building up energy stores and damping down processes that use energy, including growth.<sup>102</sup> Subsequently, these children are introduced to the Western nutritional environment, in which high-calorie, low-micronutrient foods are most affordable and accessible to low-income families. The transition marks a disjunction between early-life conditions, which have primed the child physiologically to hoard calories, and later-infancy and toddlerhood conditions, when the child’s diet is likely to be flooded with nutritionally empty calories. Because the so-called “window of plasticity” for setting endocrine and metabolic patterns has closed by that point, the children respond to excess calories as if they were still in a situation of caloric deprivation, storing them as energy for future use. The result is large amounts of fat stores, leading to overweight and obesity as well as increased risk of developing type 2 diabetes.<sup>103</sup>

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<sup>98</sup> Giant Foods pricing, early 2008. Due to rapidly rising food costs, and steeper increases for healthy staple items, the price gap between healthy and unhealthy food continues to widen. For current cost data, see Bureau of Labor Statistics, Consumer Price Indexes.

<sup>99</sup> Datar 2004.

<sup>100</sup> Bronte-Tinkew 2007.

<sup>101</sup> Wells 2007.

<sup>102</sup> The physiological markers included in the ‘thrifty hypothesis’ include decreased growth; decreased islet function; impaired growth of the  $\beta$  cells of the pancreas; and other hormonal and metabolic adaptations designed to conserve and store energy.

<sup>103</sup> Hales 2001.

## Health Effects and Costs of Obesity

Obesity is highly correlated with many health problems, among them cardiovascular disease, hypertension, diabetes, and joint degeneration.<sup>104</sup> Disturbingly, these problems of middle-age and older adults are being found in younger and younger children. 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.<sup>105</sup> In another study, overweight adolescents had more Medicaid claims for diabetes, asthma and respiratory problems than normal weight adolescents.<sup>106</sup> 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.<sup>107</sup> 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.

## Obesity and Its Effects on Emotional and Cognitive Development

Beyond 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.<sup>108</sup> Young children who are overweight or obese typically become overweight adolescents, and body image at this time of life often becomes a major focus, leading to poor self-esteem, emotional health and social adjustment among this group.<sup>109</sup> 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.<sup>110</sup>

Among obese adolescents, lower levels of self-esteem have been associated with increased rates of sadness, loneliness, nervousness, smoking, and alcohol consumption.<sup>111</sup> 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.<sup>112</sup>
- 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.<sup>113</sup>

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<sup>104</sup> Goran 2003; Dong 2007; Reijman 2007.

<sup>105</sup> Dong 2007.

<sup>106</sup> Buescher 2008.

<sup>107</sup> Goran 2003.

<sup>108</sup> Friedlander 2003.

<sup>109</sup> Strauss 2000.

<sup>110</sup> Swallen 2005.

<sup>111</sup> Ibid.

<sup>112</sup> Falkner 2001.

<sup>113</sup> Ibid.

## Long-Range Consequences of Obesity

If overweight and obese children are unable to lose weight 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 non-obese women<sup>114</sup>.
- Another study by the same author found that among White females, a difference in weight of about 65 pounds was associated in a 9-percent difference in wages.<sup>115</sup> 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 body mass index (BMI) over time was associated with a \$1,000 decrease in net worth on average, holding other factors such as income constant.<sup>116</sup> 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.

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<sup>114</sup> Cawley 2005.

<sup>115</sup> Cawley 2004.

<sup>116</sup> Zagorsky 2004.

## LONG-TERM HEALTH

Emerging research continues to flesh out the connections between childhood health status and adult outcomes in areas including health, socio-economic status (SES), job attainment, and education. As we have discussed, in every area of development, child health is a critical determinant of the general adult health trajectory. Conditions in early life also have an impact on a child's chances of developing particular diseases like cardiovascular disease, among others, as an adult.<sup>117</sup>

Taking a broad view of childhood circumstances, correlations between factors such as childhood health, education, and socioeconomic status and later adult outcomes are highly relevant to the food insecurity discussion because all of those childhood conditions are worsened by food insecurity.<sup>118</sup> Childhood health and SES are interwoven, and family income over time is key to predicting a child's health status.<sup>119</sup> This connection has to do not only with the general environment children grow up in but also with parents' ability to deal with illness when it happens – to afford the best treatment, coordinate different kinds of care, follow a special diet, etc. Lower-income families are more likely to have children in poor health, who in turn miss more school, achieve lower levels of education, and enter the job market with fewer skills, poorer health, and diminished work opportunities. The net result is loss of human capital in the overall employment market, and intergenerational transmission of poverty caused in part by the influence of food insecurity, and in turn, health, upon children's growth and development trajectories.

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<sup>117</sup> Elo 1992.

<sup>118</sup> Case 2005.

<sup>119</sup> Case 2002.

## PREVENTIVE MEASURES

Children who experience food insecurity early in life can experience improvements in their health, growth, and development trajectories when their nutritional status improves. Short-term transitions in food security status correlate with changes in long-term health status. One analysis of the Canadian National Population Health Survey found that over a two-year period, a decrease in food security was associated with a decrease in overall health, while an increase in food security was associated with an increase in overall health.<sup>120</sup> Because the 0 to 3 years are the period of the most rapid brain and body growth, the earlier the improvement in nutritional status, the greater the chance of avoiding serious health and developmental consequences.

Of course, prevention is always better than the cure. In the case of food insecurity, several time-tested preventive measures exist, and consistently prove effective in lowering the prevalence of food insecurity, and its negative consequences, among at-risk infants and toddlers. The WIC Program provides an iron-sufficient diet to children in income-eligible families up to age five. In addition to improving pregnancy outcomes as discussed earlier, studies show that WIC enrollment from birth improves iron status among preschoolers and lowers the prevalence of iron-deficiency anemia among young children. The program thus averts for many children the physical, cognitive, and social costs of this deficiency which have been described previously.<sup>121</sup> Inversely, income-eligible children who do not receive WIC assistance are significantly more likely to be underweight and in fair/poor health than their peers who do receive the benefit.<sup>122</sup>

The Food Stamp Program, which provides supplemental resources for food purchases to income-eligible families, increases a household's chances of achieving food security, and is associated with better micronutrient intake among preschoolers. In one study, even though the group that did not receive food stamps had a higher average socioeconomic status, the group that did receive food stamps had a lower prevalence of food insecurity and better overall micronutrient intake.<sup>123</sup> Another study demonstrated that receipt of food stamp benefits reduces negative child health consequences among food insecure families, decreases rates of hospitalization, and results in a 25% decrease in the likelihood of food insecurity at the family level.<sup>124</sup>

Socioeconomic status and health have a reciprocal relationship; in order to change the trajectory of a child's life for the better, investments must be made in both increasing his/her SES *and* improving his/her health.<sup>125</sup> Nutrition assistance programs, such as the Food Stamp Program and WIC, are critical investments on the health end of the equation, and provide the physiological building blocks necessary for proper growth, health, development, and learning. Better still would be a society in which an adequate, nutritious diet is achievable for every child without targeted intervention programs. Until that day comes, preventive efforts are the best way to avoid the tangible and long-lasting costs of food insecurity in childhood.

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<sup>120</sup> McLeod 2006.

<sup>121</sup> Miller 1985.

<sup>122</sup> Black 2004.

<sup>123</sup> Perez-Escamilla 2000.

<sup>124</sup> Cook 2006.

<sup>125</sup> Luo 2005.

## IS PREVENTION COST-EFFECTIVE? THE FOOD STAMP EXAMPLE

We have demonstrated that prevention around food insecurity is better for children than attempting to address negative consequences after the fact. But is it economically sound policy? Food stamps are a good example of the positive answer to this. They are economically sound both as broad economic policy and as an investment in early childhood.

As to economic policy, numerous economists have characterized increased spending on food stamps as the single most effective or one of the handful of most effective ways to stimulate the economy. They include the director of the Congressional Budget Office, former high-level government officials from both parties, and private sector economists.<sup>126</sup>

As an early childhood investment, food stamps shows that prevention is not only best for children's futures, it is cost-effective as well. If every food insecure child received the maximum monthly allotment of \$162 per person in food stamps<sup>127</sup>, the annual cost to the taxpayer would be less than \$2,000 per child. The returns on this investment, according to one study, would be a 25% reduction in the rate of food insecurity among this group; this is, if anything, a conservative estimate of reduction of food insecurity.<sup>128</sup> Even using this less-than-perfect yield with respect to elimination of food insecurity, it is easy to demonstrate that this type of preventive spending is much less expensive than the cost of dealing with increased levels of negative outcomes that result if prevention is not in place. In effect, a 100% preventive investment is smaller in magnitude than the 25% of remedial costs that it helps to avoid.

**Exhibit A:** Food insecurity more than doubles the likelihood of a child needing special education services<sup>129</sup>; conversely, eliminating food insecurity halves the likelihood of needing special education. A 100% investment in food stamps within the pool of food insecure children will halve the later costs of special education services among one-fourth of that population pool (since 100% receipt of food stamps will reduce food insecurity by 25%). Because special education costs an average of \$6000 extra per child per year, a 50% reduction in need among 25% of the population means a total savings magnitude of one-eighth across the population, or about \$1250 per child annually.

**Exhibit B:** A similar calculation can be done for hospitalization costs. We know that food insecurity makes a child one-third more likely to experience hospitalization during the first three years of life, and we also know that the average cost of a pediatric hospitalization is around \$11,300. So, among the food insecure population, food insecurity itself is responsible for an increased cost of about \$3,500 per child during the first three years, or about \$1,170 per child per year.<sup>130</sup> Universal food stamp receipt for food insecure children would decrease the rate of food

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<sup>126</sup> Sources collected at [http://frac.org/news/real\\_stimulus.htm](http://frac.org/news/real_stimulus.htm), and [www.realstimulus.org](http://www.realstimulus.org).

<sup>127</sup> Food and Nutrition Service, Food Stamp Program 2008.

<sup>128</sup> Cook 2006.

<sup>129</sup> Kleinman 1998.

<sup>130</sup> Calculation: Odds ratio is 1.31; increased cost per child per year = .31 x 11,300 / 3 years; divide that number by 4 to find cost savings, since only 1/4 of food insecurity will be eliminated through assistance.

insecurity among this group by one-fourth, thereby saving one-fourth of the per-child hospitalization cost increase, or about \$300 per child per year.

**Exhibit C:** Consider the myriad other direct, indirect, short-term, and long-term costs resulting from food insecurity. If over 75% of the costs of prevention (\$1550 of a \$2000 expenditure) are recouped in savings from two cost centers alone, it is easy to see that savings in all of the other areas discussed previously—from healthcare costs to educational attainment to worker productivity—will far and away exceed the initial investment in this preventive effort.

## DIRECTIONS FOR FUTURE RESEARCH

The majority of the current scientific literature on food insecurity focuses on children at or beyond the kindergarten age, as these children are part of educational and other tracking systems and thus more easily studied. However, because the first five years of life encompass the most critical period of brain and body growth, and because they create the foundation upon which all further development must build, it is important to gain a better understanding of the prevalence and impact of food insecurity among children during these years. Longitudinal studies are needed which identify children *before* they enter kindergarten, and track them throughout their educational career to better understand what factors influence eventual outcomes. In addition, specific data on young children is needed in the following areas:

- **Oral health:** Most of the oral health literature to date focuses on children at or beyond the kindergarten age. More research is needed on the oral health of young children, its effects on general health and development, and the costs of leaving problems untreated.
- **Obesity:** More research is needed on the reasons for and timing of overweight/obesity onset in the early years, especially in relation to food insecurity, as well as its consequences for young children's health, growth, and development.
- **Young children's mental health:** Few studies exist that look at the relationship between maternal depression, food insecurity and young children's physical and mental health. A longitudinal study would not only help to determine more about the relationship between food insecurity and whether maternal depression is a cause and/or effect but also would illuminate the long-range consequences for young children.
- **Family trade-offs:** Especially in the current climate of rising prices and additional squeeze on family budgets, data to understand the trade-offs that families of young children make would be important. In particular, research is needed on the decisions families make around basic needs expenses (including food, housing, energy, and transportation) and the costs to them when a child falls ill.
- **Long-range consequences of early shortage:** Currently conclusions about the costs and health consequences of early deprivation have to be extrapolated from a series of studies in overlapping areas. A study with qualitative and quantitative components to definitively understand the long-term human and societal cost of allowing young children to suffer food insecurity would be essential.

## POLICY IMPLICATIONS

In order to reach the Partnership for America’s Economic Success’ goal of supporting children in becoming successful adults who are “literate, numerate, job-ready and team-capable,” investments in young children need to be made a top priority in legislative policy at both the state and national levels. Children are the engines of our future economic productivity and stability as a nation. In this paper, we have tried to elucidate the importance of fulfilling one of our most basic obligations to children – providing a nutritious and consistently available diet. The consequences of failing at this task are enormous, as we have pointed to throughout our discussion of food insecurity and its physical, mental, and cognitive health effects in both the short- and long-term and on the individual and societal levels. There are many ways to prevent the problem, the most fundamental of which is increasing families’ incomes and economic security and therefore their ability to purchase food, especially in the face of rising prices for health care and energy as well as food. However, essential solutions also include programs like (but not limited to) the Food Stamp Program and the WIC Program, which are largely federally funded. These investments have proven to be successful and cost-effective means of reducing food insecurity and nutritional deficiencies and boosting health and development and human capital in general. They need, however, to be strengthened in their reach and impact.

## CONCLUSION

The current body of research on food insecurity in young children supports the following general conclusions:

- **Effects of food insecurity on health, growth and development:** Food insecurity impairs proper growth and development in very young children and establishes a poor developmental trajectory, leading to cognitive delays through the early school years. Developmental impacts are compounded by increased prevalence of poor health and physical impairments, which cause children to lag further behind their peers.
- **Short-term economic costs of food insecurity and correlated health consequences:** The short-term costs of food insecurity include increased infant mortality; increased medical costs due to hospitalization, iron-deficiency treatment, infections, and other illnesses; and increased need for supplemental education to address cognitive delays and other school readiness issues. These costs are acute and substantial.
- **Long-term economic burden of food insecurity on children and the national economy:** Food insecurity contributes to academic underachievement and long-term health problems, steering children towards a trajectory of lower lifetime earnings and poorer health. For each child whose potential is not fully realized, the economy loses significant value in talent and productivity.
- **Food insecurity's impact on seemingly unrelated areas of life:** Because food insecurity affects all physiological systems, its effects can be surprising and even counterintuitive. Food insecurity increases prevalence of poor outcomes ranging from obesity to social/emotional instability as it skews the entire balance of young children's physiology.
- **Relative magnitudes of preventive versus remedial costs to address food insecurity:** Preventive programs such as WIC and the Food Stamp Program are substantially less expensive than acute treatment of food insecurity's negative consequences, even accounting for the fact that those negative consequences will only manifest in a portion of food insecure children. Food assistance programs reduce, but cannot eliminate food insecurity; thus, other measures to improve access and affordability of food in low-income communities are needed.

Consequences of food insecurity are particularly hard to isolate and quantify for two reasons. First, they mutually reinforce one another; the child who spends his or her days sick and out of school due to poor nourishment falls behind in cognitive development, spends less time socializing with peers, and becomes more likely to incur costs on the cognitive/socio-emotional/behavioral side of the equation as well as on the physical side. Because of the interconnectedness of all facets of growth and development during this particularly sensitive period, a negative event due to food insecurity in even one area can have a domino effect, producing a cascade of increasingly poor outcomes for a child.

Second, as discussed at the outset, food insecurity is intimately connected to other deficits in basic needs, including housing, energy, caregiver time and resources, and environmental safety. While it is important to recognize the potentially significant benefits for a child of eliminating his or her food insecurity, it is equally critical to take a broader view and understand that

significant gaps in lifetime achievement will persist between low-income children and their peers so long as the term “low-income” equates with “low opportunity” due to insufficiencies in basic needs areas.

Nonetheless, food insecurity in early childhood changes the trajectory of young lives in a real and significant way. When children grow up undernourished and unhealthy, the associated impairments of physical, cognitive, and social/emotional development persist long after the early childhood period, and cause food insecure children to become adults who perform, achieve, and thrive less successfully than their peers. No child deserves to be burdened with the consequences of this fully preventable condition for the duration of his/her life, and no responsible, far-sighted society should permit the widespread prevalence of a condition that is guaranteed to produce a less healthy, capable, and well-performing population.

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