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ABSTRACT

The prevalence of overweight and obesity has increased for all children, even among low-income children, many of whom are food insecure and face several stressors. In this article, we investigate whether economic stressors and food insecurity influence childhood overweight using data from the Panel Study of Income Dynamics and its second Child Development Supplement. The results indicate no significant relationship between food insecurity and childhood overweight, but two types of economic stressors have a positive association with children's risk of overweight, namely financial and community stress. A clear policy implication is that reducing childhood overweight is another potential benefit from helping families avoid stress due to economic difficulties.

Food Insecurity, Economic Stressors, and Childhood Overweight

Recent estimates indicate that 17.1% of U.S. children between the ages of 2 and 19 years are considered overweight and another 16.5% are considered at risk of overweight (Ogden et al., 2006). The prevalence of overweight has increased for all children over the last three decades, even among low-income children (Anderson and Butcher, 2006; Kumanyika and Grier, 2006; Wang and Zhang, 2006). Childhood overweight and obesity have negative physical, psychological, and social consequences on children that extend into adulthood (Gunnell et al., 1998; Mahoney et al., 1996; Nieto et al., 1992; Power et al., 1997; Schwimmer et al., 2003; Serdula et al., 1993; Smoak et al., 1987; Williams et al., 1992) and include reduced life expectancy (Fontaine et al., 2003). Beyond these negative outcomes for children, the economic costs of obesity among all Americans were estimated at approximately \$92 billion in 2004 (Fiebelkorn, 2006), which accounted for over 9% of national health care expenditures (Finkelstein et al., 2003). In 2004, the national cost of obesity was approximately \$11 billion for children with private insurance and \$3 billion for those with Medicaid (Marder and Chang, 2006). Children treated for being overweight are roughly three times more expensive for the health care system than the average insured child (Marder and Chang, 2006). Another problem that has driven up the costs of the child overweight epidemic is the dramatic increase in hospital stays associated with diseases related to child obesity (e.g., hypertension, diabetes, asthma, etc.) in the past 20 years (Wang and Dietz, 2002). Children diagnosed with obesity are over twice as likely to be hospitalized compared to non-obese children (Marder and Chang, 2006). Thus, understanding factors related to childhood overweight and obesity

not only has implications for the quality of life for America's children, but it also has important implications for the increasing health care costs the United States is experiencing.

Alongside this serious public health concern, one in five children in the U.S. lives in a food insecure household (Nord et al., 2006). Food insecurity disproportionately affects low-income children as 42.5% of children living under the poverty line are food insecure (Nord et al., 2006). In other words, they live in a household that does not have the means to access enough food to sustain active, healthy living for all members. Somewhat paradoxically, studies have found a co-existence of food insecurity and obesity among low-income children. Yet, studies which specifically test for statistical relationships between the two have produced mixed results, with some studies finding either no relationship between food insecurity and childhood overweight or obesity (Alaimo et al., 2001; Gundersen et al., forthcoming; Kaiser et al., 2002; Martin and Ferris, 2007), an inverse relationship (Jimenez-Cruz et al., 2003; Matheson et al., 2002; Rose and Bodor, 2006), or a positive relationship (Casey et al., 2001; Casey et al. 2006; Dubois et al., 2006; Jyoti et al., 2005).

In addition to experiencing high levels of overweight and food insecurity, children in low-income families experience high levels of stress (Finkelstein et al., 2006). These children face a number of important economic stressors that are associated with worse health and lower socioemotional well-being (e.g., Friedemann, 1986; Gutman, McLoyd and Tokoyawa, 2005; Jaffee et al., 2005; Parke et al., 2004; Sleskova et al., 2006; Wadsworth and Compas, 2002). In this article, we investigate how economic stress, along

with food insecurity, is associated with childhood overweight using data from a sample of low-income children from the Panel Study of Income Dynamics (PSID). While previous work examining the relationship between food insecurity and childhood overweight has reached mixed results, they have not considered the potential role of economic stress in explaining this relationship.

From a policy perspective, this study builds on a growing body of evidence that identifies overlapping effects of public programs (e.g., Garasky and Stewart, 2007; Keng, Garasky and Jensen, 2002). If the direct gains to recipients of benefits from the Temporary Assistance to Needy Families (TANF) program or the Food Stamp Program include providing individuals and families with a greater ability to meet their needs, then an indirect gain may be decreasing the number of economic stressors that families experience. If a reduction in economic stressors translates into better health (i.e., lower likelihood of overweight for the children in the family), then an added benefit from these programs is a potential reduction in health care (e.g., Medicaid and SCHIP) expenditures.

Background

Food Insecurity and Overweight among Low-Income Children

Food insecurity in the United States has become a well-publicized concern to policymakers and program administrators. Food insecure households are defined as those households that were uncertain of having, or unable to acquire, enough food for all their members because they had insufficient money or other resources. The more serious consequence, food insecurity with hunger, occurs when the food intake of some household members was reduced and their normal eating patterns were disrupted because

of the lack of resources. Rates of food insecurity are much higher among low-income populations, the populations under consideration in this article.¹ Rates of overweight and obesity have increased for all children since the 1970s (Anderson and Butcher, 2006; Kumanyika and Grier, 2006; Wang and Zhang, 2006). Not only is a larger share of all children overweight, but those who are overweight are also heavier than in the past (Anderson and Butcher, 2006). To illustrate the changes in the BMI distribution of all children over time, Anderson and Butcher (2006) report that over the approximately 30 years between 1971 and 1974 and 1999 and 2002, a 4'6" child with the median BMI gained 4.6 pounds for a 6.3 percent increase (73.4 to 78.0 pounds). But a child at the 95th percentile gained about 19 pounds for a 17.5 percent weight gain (108.3 to 127.3 pounds).

While the rates of childhood overweight have increased, research has found either no relationship between this growing epidemic and food insecurity (Alaimo et al., 2001; Gundersen et al., 2007; Kaiser et al., 2002; Martin and Ferris, 2007), an inverse relationship (Jimenez-Cruz et al., 2003; Matheson et al., 2002; Rose and Bodor, 2006), or a positive relationship (Casey et al., 2001; Casey et al. 2006; Dubois et al., 2006; Jones et al., 2003; Jyoti et al., 2005). The inverse relationship is somewhat intuitive and early studies of poverty and child growth clearly show compromised growth and underweight among impoverished children (see Tanner (1962) for a discussion). The perhaps counterintuitive positive relationship has been ascribed to overconsumption of cheaper, energy-dense foods (Dietz, 1995; Drewnowski and Specter, 2004), overeating in times when food is more plentiful (Scheier, 2005), metabolic changes to ensure a more efficient

use of energy (Alaimo et al., 2001), different standards between the food insecure and food insecure of what constitutes an adequate diet (Gundersen and Ribar, 2005), parents overprotecting their children by giving them more food than needed when food is available (McIntyre et al., 2003) and mothers being food insecure during pregnancy (Laraia et al., 2006).

Economic Stressors and Overweight among Low-Income Children

The concept of “stress” is complex and multifaceted. Its definition varies by discipline (Chrousos and Gold, 1992; Monat and Lazarus, 1991) and even within disciplines (Monat and Lazarus, 1991). Consistent with theoretical work on the “stress process” (Chrousos and Gold, 1992; Pearlin et al., 1981), we define *stress* as a negative physiological response and *stressors* as the external factors that may cause this negative response (Aneshensel, 1992; Chrousos and Gold, 1992; Pearlin et al., 2005). There is a growing body of biological evidence describing how and why stress can lead to overweight (e.g., Bjorntorp, 2001; Raikkonen et al., 1996; Rosmond and Bjorntorp, 1999). One mechanism is that increased levels of cortisol (the chief hormone released during the stress response) during stressful conditions (Bjorntorp, 2001) and the chronic hypersecretion of cortisol leads to metabolic abnormalities and overweight. The limited research in children suggests that higher levels of cortisol are associated with higher measures of body fat (Dimitriou et al., 2003). An additional is that stress may also contribute to poor eating habits (Jenkins, Rew and Sternglanz, 2005) and lower physical activity levels in children (Roemmich, Gurgol and Epstein, 2003), which are both associated with overweight and obesity (Ness et al., 2007). However, while we are not able to directly test either the

clinical or behavioral stress-overweight/obesity relationship in this article, we are able to assess how derivatives of stress experienced by low-income families influence childhood overweight.

We use a family stress framework to understand the relationship between food insecurity, economic stress, and overweight in children. Family stress is defined as “pressure or tension in the family system” (Boss, 1988, p. 12) and stressors and “stressor events” are conditions and occurrences that provoke change in the family system (p. 36). Family stress and stressors can also arise from individuals, households, and contextual factors external to the family such as neighborhoods and communities (Robert, 1999). In this article, we limit our indicators of family stress to four types of economic stressors: housing, health, financial, and community stressors.

Housing. Housing stressors disproportionately affect low-income children (e.g., Graham-Bermann et al., 1996) and have been associated with lower levels of child well-being. For example, poor housing, neighborhood, and living conditions are associated with behavioral and emotional problems in children (Jaffee et al., 2005). Housing stressors such as the inability to keep up on mortgage payments, multi-family housing, and crowding are associated with lower mental well-being among adults (Edwards, Booth and Edwards, 1982; Regoeczi, 2003; Taylor, Pevalin and Todd, 2007) which could indirectly affect children’s health and well-being.

Health. Low-income families spend a greater proportion of their income on health care than do higher income families (Galbraith et al., 2005) and have more trouble accessing health services despite their greater health needs (Stevens et al., 2006). Lack of

health insurance has been associated with increased prevalence of overweight in children and adolescents (Haas et al., 2003). In one study of obese children, parent's recall of negative health events of the child was associated with obesity onset (Franzese et al., 1998). Children's physical and mental health problems and disabilities also may increase stress and worry in parents (Brannan, Heflinger and Foster, 2003, Floyd and Gallagher, 1997; Wallander and Noojin, 1995) which may indirectly affect the health and well-being of the child including increasing the risk of overweight.

Financial. It is well-documented that children from low socio-economic status (SES) families exhibit higher levels of stress (Finkelstein et al., 2006). These stressors include high expense levels relative to income, limited assets, and an inability to pay bills or make needed purchases (e.g., Drentea and Lavrakas, 2000; Gutman et al., 2005; Haas et al., 2003; Lorenz et al., 1991; Parke et al., 2004; Wadsworth and Compas, 2002; Xiao et al., 2006).

Community. In general, poor neighborhood and community living conditions (e.g., noise, crowding, housing and neighborhood quality) disproportionately experienced by low-income children have negative effects on their physical and psychosocial development (Evans, 2006). Adolescents who live in a poor community have higher likelihoods of being overweight (Wickrama, Wickrama and Bryant, 2006).

It is important to point out that beyond the impact of these economic stressors, families may experience "stress pile-up" as a result of dealing with multiple stressors at once (White and Klein, 2002) with effects on overweight being cumulative. For example, the number of risk factors was positively associated with internalizing problems in a

sample of African American children from single mother households (Jones et al., 2002). Thus, in addition to examining the independent effects of specific types of the aforementioned stressors, we also create a cumulative risk index which totals the number of stressors experienced in each of the four stressor categories.

In summary, in addition to food insecurity, lower income children face greater economic stressors that may directly and indirectly affect risks of overweight. In this article, we investigate both the independent and cumulative effects of these economic stressors on a child's propensity to be at-risk for overweight or overweight as well as overweight. Previous studies have not systematically examined the potential effects of these factors. The present analysis addresses this gap in knowledge.

Methods

Our central interests in this article are the associations of food insecurity and economic stressors with childhood overweight. To this end, we consider categorical measures of overweight and estimate the following probit models:

$$CWC_{ij} = 1 \text{ if } CWC_{ij}^* > 0; CWC_{ij} = 0 \text{ otherwise}$$

$$CWC_{ij}^* = \alpha + \beta_{FI}FI_i + \beta_{ES}ES_i + \lambda X_i + \varepsilon_i \quad (1)$$

where i denotes a child; j denotes the child weight category breakdowns we are considering (child at-risk of overweight or overweight versus child normal weight, and child overweight versus child not overweight); FI is equal to 1 if the children in the household are food insecure, 0 otherwise; ES is a vector of economic stressor indices: housing stressors, health stressors, financial stressors and community stressors; X is a vector of standard covariates and characteristics of the household and child; and ε is an

error term. Estimations of (1) allow us to assess (via β_{FI} and β_{ES}) the independent relationships between food insecurity and economic stressors on child overweight.

We also estimate a model with a total stressors index with the probit estimation as follows:

$$CWC_{ij} = 1 \text{ if } CWC_{ij}^* > 0; CWC_{ij} = 0 \text{ otherwise}$$

$$CWC_{ij}^* = \alpha + \beta_{FI}FI_i + \beta_{ES}ES_i + \lambda X_i + \varepsilon_i \quad (2)$$

Data

Our analyses are conducted with data from the Panel Study of Income Dynamics (PSID) and its Child Development Supplement (CDS). The PSID, begun in 1968, is a longitudinal study of a representative sample of individuals and the family units which reside in the United States. While emphasizing the dynamic aspects of economic and demographic behavior, the content of the PSID is broad and includes a range of measures relevant to this research. In 1997, a refresher sample of post-1968 immigrant families and their adult children was introduced to keep the study representative of the U.S. population. A major content expansion was introduced in 1997. The CDS focuses on the human capital development of children age 0-12 in PSID families (PSID, 2005). A second round of the CDS (CDS-II) was conducted in 2002. Information from interviews from the CDS-II constitutes the basis of our study. We supplement these CDS-II data with contemporaneous data from the 2003 PSID interview wave. Our analytic sample consists of 778 children and adolescents ages 5 through 19 interviewed for the CDS-II who reside in low-income (income \leq 200% poverty) households, are not classified as

underweight as defined below, and have complete information for the regression analyses.

The CDS-II and 2003 PSID are well-suited for this research as both have a large sample of low-income households and detailed information on child weight, food insecurity, economic stressors and relevant covariates. These data sets have other strengths as well. First, CDS-II observational measures of children's height and weight (the information necessary to calculate body mass index and determine overweight status) were obtained by trained personnel (e.g., nurses or field interviewers). The use of directly measured height and weight strengthens this study as other large, national studies (e.g., Youth Risk Behavior Survey) tend to rely on less reliable self-report or parental-report methods. Second, the 2003 PSID administered the full 18-question Core Food Security Module (Bickel et al., 2000). Consequently, we can employ the exact same methodology used in the USDA's annual report of the official food insecurity and hunger rates when assessing household food insecurity (Nord et al., 2006).

Variables

Childhood weight status. The measures used to delineate childhood overweight begin with the calculation of a child's body mass index (BMI, kg/m^2). The BMI for each child is then mapped into a percentile based on his or her age (in months) and gender using the Centers for Disease Control and Prevention (CDC) growth charts for the United States (Ogden et al., 2002). Under this measure, a child is classified as follows: Normal weight, $\text{BMI} \geq 5^{\text{th}}$ percentile and $< 85^{\text{th}}$ percentile; at-risk of overweight, $\text{BMI} \geq 85^{\text{th}}$ percentile and $< 95^{\text{th}}$ percentile; and overweight, $\text{BMI} \geq 95^{\text{th}}$ percentile. Underweight children (BMI

< 5th percentile) (n=22) are not included in this study since underweight children should not be included in the referent group (e.g., normal weight) and we are not interested in examining the association between underweight and stressors given the focus of this article.

Food insecurity. We employ the same methodology used to calculate the official food insecurity rates in the U.S. for families with children (Nord et al., 2006). Defined over a 12-month period, a series of 18 questions is posed to respondents. (For families without children and for one-person households, a subset of ten questions is posed.) Each question is designed to capture some aspect of food insecurity and, for some questions, the frequency with which it manifests itself. Examples include “I worried whether our food would run out before we got money to buy more,” “Did you or the other adults in your household ever cut the size of your meals or skip meals because there wasn’t enough money for food?” and “Did a child in the household ever not eat for a full day because you couldn’t afford enough food?” A household with children is categorized as (a) food secure if the respondent replies affirmatively to two or fewer of these questions, (b) food insecure without hunger if the respondent replies affirmatively to three to seven questions, and (c) food insecure with hunger if the respondent replies affirmatively to eight or more questions.¹

Economic stressors. We examine four categories of economic stressors (housing, health, financial, and community). Each element in each category is operationalized as a dichotomous variable and each is combined into an index (see below).

Economic stressors related to housing are measured via four variables. CDS-II respondents when asked about economic problems in the last 12 months were asked three questions about housing experiences. Did they move to cheaper living quarters? Did they move in with other people? Did they send one or more of the children to live with someone else? A 'yes' response to any of these items is considered an indicator of economic stress. The last housing related measure of economic stress regards mortgage and rent expenditures. Respondents were queried about monthly first mortgage, second mortgage and rent payments. An indicator of economic stress is calculated by summing these payments and multiplying by 12 to arrive at an annual housing expenditure. The annual housing expenditure is divided by annual family income to determine the share of annual income spent on housing. If the share of income spent on housing is greater than 30 percent, an amount commonly considered to represent a household that is housing cost burdened (HUD, 2007), we consider this to be an indicator of economic stress.

Economic stressors related to health are measured via two variables. The first measure relates to health insurance coverage. Respondents were asked "In 2001 or 2002, was anyone in the family covered by health insurance or some other kind of health care plan?" Respondents who answered that no one in their family was covered by health insurance over the two-year period are considered to be experiencing this aspect of economic stress. Regarding health care expenditures, respondents were asked a series of questions about health care expenditures. Specifically, they were queried about how much their family spent in the last 12 months on the focal child for dental care and on medical insurance. They also were asked how much they spent in 2001 and 2002 on

nursing home and hospital bills combined, and how much they paid out-of-pocket for doctor, outpatient surgery and dental bills combined. We divide these amounts by two to arrive at average annual expenditures. Our indicator of economic stress is calculated by dividing the sum of these annual expenditure amounts by the annual income of the family to determine the share of annual income spent on health care. If the share of income spent on health care is greater than 7.5 percent, an amount that must be exceeded before medical and dental expenditures can be deducted by someone itemizing deductions for federal income taxes (IRS, 2006), we consider this to be an indicator of economic stress.

Economic stressors related to finances are measured via ten variables. CDS-II respondents were asked a series of questions regarding possible financial problems they may have experienced in the past 12 months. Responses to ten of these questions comprise our indicators of financial stress. Specifically, respondents were asked: Have you done any of the following or have any of the following happened as a result of economic problems in the last 12 months?: (1) Sold possessions or cashed in life insurance; (2) Postponed major purchases; (3) Postponed medical care; (4) Borrowed money from friends or relatives; (5) Filed for or taken bankruptcy; (6) Fallen behind in paying bills; (7) Had a creditor call or come to see you to demand payment; (8) Had your wages attached or garnished by a creditor; (9) Had a lien filed against your property because you could not pay a bill; and (10) Had your home, car or other property repossessed. For each question, a 'yes' response is considered an indicator of economic stress.

Economic stressors related to the community stress are measured via two variables. CDS-II interviewers were asked to assess the neighborhood of the families they interviewed on a range of characteristics. We examine two of these indicators. First, interviewers were asked to rate the general condition of most of the housing units or other buildings in the face-block on a scale of in good repair to badly deteriorated. Families residing in neighborhoods assessed as being in poor condition or badly deteriorated are considered to be experiencing community-related economic stress. Second, interviewers were to rate the condition of the street in the face-block on a scale from very good to poor. Families residing in neighborhoods with streets assessed as being in fair or poor condition are considered to be experiencing community-related economic stress.

We create indices for each stressor category by summing the dichotomous response values for each variable in a given category. Specifically, the housing stressors index is the sum of responses to the four items in this category, the health stressors index is the sum of the two health stress measures, the financial stressors index is based on the ten financial stress variables, and the community stressors index is based on two measures. The total stressors index is then the sum of these four indices. The total stressors index has possible values that range from zero to eighteen.

Other covariates. A number of other covariates are included in these analyses. The number of persons in the family unit and age of the household head are continuous variables. Total family income is measured in 2002. The current marital status of the household head is classified with three dichotomous measures: married, not married but cohabitating, or single (not married or cohabitating). The race of the household head is

represented by a single, dichotomous variable set to ‘1’ if she or he is white. The educational attainment of the household head is operationalized via a dichotomous variable: less than high school or high school / GED only versus greater than high school. Whether or not the respondent owns the dwelling unit is measured dichotomously.

Results

We begin with a discussion of differences in child weight categories (normal, at-risk of overweight, and overweight) by food insecurity status. In Table 1, we display (weighted) results by child weight status categories - normal weight (column (1)), at-risk of overweight or overweight (column (2)), at-risk of overweight (column (3)), and overweight (column (4)). Over 40 percent of children are either at-risk of overweight (18%) or overweight (22%). With respect to food insecurity, approximately 26 percent of children are food insecure - 21.2 percent are in households experiencing food insecure without hunger while 5.2 percent are in households experiencing food insecurity with hunger (not reported in table). In general, there are no statistically significant differences in weight classification by household food security status. The only exception is that children who are in food insecure without hunger households are less likely to be at-risk of overweight in comparison to children in food secure households.

--- Table 1 about here ---

In Table 2 we consider differences in child weight categories by our four indices of economic stress and the total economic stressors index.¹ We report the means and standard errors for each of the indices. To further generate a sense of the distribution of responses, we also report the modal response. The average values for each of the stressor

indices (housing, health, financial, and community) are 0.44, 0.26, 1.54, and 0.68, respectively. The differences in means between the weight categories are small and, in all but one comparison, statistically insignificant. The modal response for each of the indices is 0. The total economic stressor index does not have a clear pattern. The modal value for normal weight children is 3; for at-risk of overweight children, 2; and for overweight children, 4.

--- Table 2 about here ---

Multivariate Results

We now turn to our multivariate results. In Table 3, we begin by displaying results for a model specification that controls for only food security status. Being food insecure without hunger and food insecure with hunger are included relative to the benchmark category of being food secure. In column (1), the results are for being at-risk of overweight or overweight (versus normal weight). In column (2), the results are for overweight (versus normal or at-risk of overweight). As seen there, consistent with the results in Table 1, the association between food insecurity and weight status is statistically insignificant in both models. This is the same finding found by some others (e.g., Alaimo et al., 2001; Gundersen et al., forthcoming; Kaiser et al., 2002; Martin and Ferris, 2007). In columns (3) and (4), we introduce a standard set of control variables, minus the food insecurity measures. Household size is negatively associated with both at-risk of overweight or overweight and overweight while homeownership is positively associated with both of these outcomes. The household head being single (relative to being married) also is negatively related to being at-risk of overweight or overweight.

The household head being white (relative to not being white) is negatively related to being overweight. The other variables are statistically insignificant. In columns (5) and (6), the food insecurity and control variables are all entered into the model. The results are similar to columns (1) through (4).

--- Table 3 about here ---

In Table 4 we incorporate our stressor indices. In columns (1) and (2), we use the four category indices - housing, health, financial and community.¹ Two indices are statistically significant: the financial stressor index and the community stressor index. In terms of associations with being at-risk of overweight or overweight (column (1)), a one unit increase around the mean in the financial stressor index (from 1 to 2) is associated with a 6.3 percent increase in a child's probability of being at-risk of overweight or overweight (probabilities not reported in table for brevity). A one unit increase around the mean in the community stressor index (from 0 to 1) is associated with a 11.2 percent probability increase. For overweight (column (2)), unit increases are related to 10.0 percent and 16.4 percent increases, respectively. The relationships of the other variables are akin to those in Table 3.

--- Table 4 about here ---

In columns (3) and (4), the total stressor index is used. This variable is positive and statistically significant in both regressions. Again, we calculated the probability of a child being at-risk of overweight or overweight based on their stress score. In terms of its relationship with at-risk of overweight or overweight (column (3)), a one unit increase around the mean in the total stress index (from 3 to 4) is associated with a 4.5 percent

increase in a child's probability of being at-risk of overweight or overweight. For overweight, the increase is 7.4 percent.

Conclusions

One in every six children in the United States is obese, making it one of the most prevalent medical problems among youth today. Alongside this serious public health concern, one in five children in the U.S. lives in a food insecure household. Previous research indicates that these two issues co-occur in low-income children. Our analysis adds to ambiguous findings of previous research regarding the relationship between food insecurity and overweight in children. We considered the potential role of stress within the household emanating from economic sources. Low-income children are more likely to suffer from economic stress, and in small-scale studies, stress has been associated with childhood overweight. In this article, we investigated whether economic stress (as measured by housing, health, financial, and community stressors) and food insecurity were associated with childhood overweight using data from a sample of low-income (family income \leq 200% of poverty) children from the Panel Study of Income Dynamics (PSID) and its second Child Development Supplement (CDS-II).

Consistent with some previous research (e.g., Alaimo et al., 2001; Gundersen et al., forthcoming; Kaiser et al., 2002; Martin and Ferris, 2007), we did not find a significant relationship between food insecurity and overweight in this sample of low-income children. Economic stress, however, was found to have a significant relationship with childhood overweight. Our results are consistent with a cumulative stress perspective. Children's well-being, in this case child weight status, is related to not only

different *types* of economic stressors, but also to the number of economic stressors faced as measured by our stress indices. Namely, we found that an increased number of economic stressors experienced by these children was associated with an increased risk of their being overweight or at-risk for overweight. We found that experiencing one additional indicator of economic stress was associated with a 4.5 percent increase in a child's probability of being at-risk of overweight or overweight, and a 7.4 percent increase in a child's probability of being overweight. These results indicate that although low-income children face a myriad of economic stressors, the strongest relationships between economic stressors and increased likelihood of overweight are exhibited by financial stressors (e.g., parents falling behind in paying bills, having to borrow money from friends or relatives) and community stressors such as poor quality housing.

A clear policy implication from this research is the identification of another potential benefit from helping low-income families to meet their basic needs. The additional benefit – potentially reducing the likelihood that a child in a low-income household will be at-risk of overweight or overweight -- is derived from the reduction in economic stress within the household. In other words, programs that help families establish economic security through finding well-paying jobs, providing in-kind supports and/or helping families in other ways meet their financial obligations also may be contributing to the enhancement of the health of the children in these households as they reduce their likelihood of being overweight. The gains to the Medicaid program and State Child Health Insurance Programs (SCHIP) from reduced health care expenditures may be substantial.

We conclude with four suggestions for future research. First, a wide set of other indicators of stress could be analyzed. Two examples may be child care and maternal employment issues that often cause stress among household members. This would allow for a more complete picture of the relationships between stress and overweight/obesity among low-income households. Second, although examining the mechanisms underlying the relationship between economic stress and overweight and obesity is outside the scope of this study, several potential pathways could be examined. One possibility is parenting stress. Several studies suggest that economic pressure is associated with lower marital quality, parenting, and higher levels of depression in children's caretakers which is associated with worse child outcomes (e.g., Kalil and Dunifon, 2007; Robila and Krishnakumar, 2006; Whitbeck et al., 1997).

Third, future research may wish to investigate the effects of longer-term economic shifts within families on childhood weight status using a longitudinal study design. For example, the effects of income volatility, changes in family structure, and job loss could be considered. Fourth, while this article has not examined the effect of the social safety net on childhood overweight, future research may wish to consider how the numerous programs within the social safety net in the U.S. interact to help families mitigate the challenges they face due to economic stress. Previous work has demonstrated that the program most closely connected to food intake, the Food Stamp Program, can help smooth food consumption over time (Gundersen and Ziliak, 2003); something similar may be the case in terms of its effect on overweight.

Footnotes

¹ For recent work on the determinants of food insecurity see, for example, Dunifon and Kowaleski-Jones (2003); Gundersen et al. (2003); Ribar and Hamrick (2003); Bhattacharya, Currie, and Haider (2004); Borjas (2004); Furness et al. (2004); Bitler, Gundersen, and Marquis (2005); Laraia et al. (2006); Van Hook and Balistreri (2006); and Gundersen (forthcoming).

² In 2006, the label “food insecurity with hunger” was changed to “very low food security status.” Despite this change in nomenclature, the methods used to define households are identical under the two names.

³ These results and those in Table 1 are weighted.

⁴ As seen in Appendix Table 1, these measures average, respectively, 0.47 (scale: 0-4), 0.26 (scale: 0-2), 1.63 (scale: 0-10), and 0.71 (scale: 0-2).

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Table 1. Child weight classifications and household food security status for families with incomes less than or equal to 200% of poverty.

	Normal weight	At-risk of overweight or overweight	At-risk of overweight	Overweight	Unweighted sample (N)
	(1)	(2)	(3)	(4)	
All children (%)	59.82	40.18	17.69	22.49	778
Food secure (%)	58.11	41.89	19.41	22.48	599
Food insecure without or with hunger (%)	64.60	35.40	12.90	22.49	179
Food insecure without hunger (%)	67.50	32.51	11.11*	21.40	130
Food insecure with hunger (%)	52.77	47.22	20.25	26.97	49
Unweighted sample (N)	481	297	125	172	

Notes: Unweighted sample (N) = 778. Normal weight (BMI $\geq 5^{\text{th}}$ and $< 85^{\text{th}}$ percentiles); at risk of overweight (BMI $\geq 85^{\text{th}}$ and $< 95^{\text{th}}$ percentiles); overweight (BMI $\geq 95^{\text{th}}$ percentile). Results are weighted using child-level weights. Superscripts of *, **, and *** are used if the p-value of the difference in means between row 3 (food insecure without or with hunger), 4 (food insecure without hunger) or 5 (food insecure with hunger) when compared to row 2 (food secure) is less than .10, .05, or .01, respectively.

Table 2. Child weight classifications by economic stressor indices.

	All	Normal weight	At-risk of overweight or overweight	At-risk of overweight	Overweight
	(1)	(2)	(3)	(4)	(5)
Housing stressor index (0-3) ^a					
Mean number of 'yes' responses	0.443	0.468	0.405	0.505	0.326**
(Standard error)	(0.032)	(0.042)	(0.049)	(0.082)	(0.054)
Modal number of 'yes' responses	0	0	0	0	0
Health stressor index (0-2) ^a					
Mean number of 'yes' responses	0.264	0.273	0.252	0.300	0.214
(Standard error)	(0.024)	(0.033)	(0.036)	(0.058)	(0.043)
Modal number of 'yes' responses	0	0	0	0	0
Financial stressor index (0-8) ^a					
Mean number of 'yes' responses	1.539	1.463	1.653	1.610	1.686
(Standard error)	(0.088)	(0.108)	(0.149)	(0.220)	(0.202)
Modal number of 'yes' responses	0	0	0	0	0
Community stressor index (0-2) ^a					
Mean number of 'yes' responses	0.679	0.702	0.644	0.630	0.655
(Standard error)	(0.044)	(0.057)	(0.070)	(0.109)	(0.092)
Modal number of 'yes' responses	0	0	0	0	0
Total stressor index (0-11) ^a					
Mean number of 'yes' responses	2.925	2.906	2.953	3.044	2.881
(Standard error)	(0.109)	(0.133)	(0.186)	(0.278)	(0.247)
Modal number of 'yes' responses	1	3	2	2	4
Unweighted sample (N)	778	481	297	125	172

Notes: Normal weight (BMI $\geq 5^{\text{th}}$ and $< 85^{\text{th}}$ percentiles); at risk of overweight (BMI $\geq 85^{\text{th}}$ and $< 95^{\text{th}}$ percentiles); overweight (BMI $\geq 95^{\text{th}}$ percentile). Results are weighted using child-level weights. Superscripts of *, **, and *** are used if the p-value of the difference in means when compared to normal weight children (column 2) is less than .10, .05, or .01 respectively.

^a Minimum and maximum values.

Table 3. The Effect of Various Factors on the Probability of At-Risk of Overweight (ARO) or Overweight (OW) and Overweight

	ARO or OW	OW	ARO or OW	OW	ARO or OW	OW
	(1)	(2)	(3)	(4)	(5)	(6)
Food insecure without hunger	0.017 (0.123)	0.090 (0.133)	-	-	0.065 (0.127)	0.164 (0.138)
Food insecure with hunger	-0.216 (0.195)	-0.125 (0.216)	-	-	-0.143 (0.200)	-0.014 (0.222)
Number in household	-	-	-0.074** (0.036)	-0.096** (0.041)	-0.074** (0.036)	-0.098** (0.041)
Age of household head	-	-	-0.007 (0.005)	-0.004 (0.006)	-0.007 (0.005)	-0.004 (0.006)
Income	-	-	0.006 (0.004)	0.006 (0.005)	0.006 (0.004)	0.006 (0.005)
Head is cohabitating	-	-	0.040 (0.267)	-0.042 (0.293)	0.021 (0.270)	-0.094 (0.297)
Head is single	-	-	-0.209* (0.120)	-0.136 (0.132)	-0.209* (0.120)	-0.146 (0.133)
Head is white	-	-	-0.186 (0.114)	-0.231* (0.126)	-0.186 (0.114)	-0.238* (0.126)
Head has high school degree or less	-	-	0.157 (0.101)	0.053 (0.111)	0.162 (0.101)	0.048 (0.111)
Homeowner	-	-	0.225** (0.104)	0.274** (0.113)	0.223** (0.105)	0.283** (0.115)
Constant	-0.291*** (0.052)	-0.777*** (0.057)	0.216 (0.317)	-0.317 (0.352)	0.212 (0.318)	-0.331 (0.353)

Notes: Standard errors in parentheses.

* significant at 10% level; ** significant at 5% level; *** significant at 1% level.

Number of observations is 778.

Table 4. The Effect of Various Factors on the Probability of At-Risk of Overweight (ARO) or Overweight (OW) and Overweight, Including Indices of Stressors

	ARO or OW	OW	ARO or OW	OW
	(1)	(2)	(3)	(4)
Housing stressor index	-0.105 (0.074)	-0.071 (0.081)	-	-
Health stressor index	0.017 (0.101)	-0.043 (0.112)	-	-
Financial stressor index	0.060** (0.028)	0.070** (0.031)	-	-
Community stressor index	0.104* (0.060)	0.110* (0.066)	-	-
Total stressor index	-	-	0.045** (0.022)	0.053** (0.024)
Food insecure without hunger	0.040 (0.129)	0.132 (0.140)	0.032 (0.128)	0.126 (0.139)
Food insecure with hunger	-0.248 (0.205)	-0.139 (0.229)	-0.197 (0.202)	-0.083 (0.225)
Number in household	-0.085** (0.037)	-0.110*** (0.042)	-0.074** (0.036)	-0.098** (0.041)
Age of household head	-0.008 (0.006)	-0.004 (0.006)	-0.007 (0.005)	-0.004 (0.006)
Income	0.005 (0.005)	0.006 (0.005)	0.006 (0.004)	0.007 (0.005)
Head is cohabitating	0.046 (0.269)	-0.071 (0.300)	0.035 (0.271)	-0.087 (0.299)
Head is single	-0.266** (0.123)	-0.206 (0.136)	-0.219* (0.120)	-0.158 (0.133)
Head is white	-0.218* (0.116)	-0.277** (0.129)	-0.212* (0.115)	-0.269** (0.128)
Head has high school degree or less	0.161 (0.102)	0.049 (0.112)	0.161 (0.101)	0.048 (0.112)
Homeowner	0.224** (0.108)	0.301** (0.117)	0.249** (0.106)	0.316*** (0.116)
Constant	0.225 (0.334)	-0.370 (0.371)	0.070 (0.326)	-0.501 (0.363)

Notes: Standard errors in parentheses.

* significant at 10% level; ** significant at 5% level; *** significant at 1% level.

Number of observations is 778.

Appendix Table 1. Summary Statistics for Variables in Multivariate Regressions.

Variable	Mean	Standard Deviation	Minimum	Maximum
Food insecure without hunger	0.167	0.373	0	1
Food insecure with hunger	0.063	0.243	0	1
Housing stress index	0.467	0.665	0	3
Health stress index	0.256	0.473	0	2
Financial stress index	1.632	1.710	0	8
Community stress index	0.706	0.807	0	2
Total stress index	3.060	2.180	0	11
Number in household	4.298	1.478	1	11
Age of household head	39.522	9.176	16	79
Income (\$1000)	20.621	12.045	-99.265	58.754
Head is cohabitating	0.033	0.180	0	1
Head is single	0.635	0.482	0	1
Head is white	0.239	0.427	0	1
Head has high school degree or less	0.351	0.478	0	1
Homeowner	0.405	0.491	0	1

Notes: Results are unweighted. Number of observations is 778.