

# Journal of Applied Research on Children: Informing Policy for Children at Risk

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Volume 3  
Issue 1 *Food Insecurity*

Article 9

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2012

## Food Insecurity and the Behavioral and Intellectual Development of Children: A Review of the Evidence

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### Recommended Citation

Perez-Escamilla, Rafael and Pinheiro de Toledo Vianna, Rodrigo (2012) "Food Insecurity and the Behavioral and Intellectual Development of Children: A Review of the Evidence," *Journal of Applied Research on Children: Informing Policy for Children at Risk*: Vol. 3 : Iss. 1 , Article 9.

Available at: <https://digitalcommons.library.tmc.edu/childrenatrisk/vol3/iss1/9>

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# Food Insecurity and the Behavioral and Intellectual Development of Children: A Review of the Evidence

## Acknowledgements

Partially supported by the National Center on Minority Health and Health Disparities, National Institutes of Health EXPORT Grant P20 MD001765. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Center on Minority Health and Health Disparities or the National Institutes of Health.

## **Introduction**

Household food insecurity (HFI) is defined in the USA as “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways.”<sup>1</sup> HFI is currently conceptualized as a progression of events that may start with household members being worried about not being able to access their needed food in the future due to socioeconomic uncertainties, followed by first sacrificing the quality of the diet and when food insecurity reaches its more severe form reducing the amount of calories consumed.<sup>1</sup> The current HFI paradigm posits that adults tend to buffer children with adults experiencing the more severe forms of food insecurity before children do.<sup>1</sup> The instruments most commonly used for examining risk factors and consequences of HFI are based on the US Household Food Security Survey Module (HFSSM) and/or scales derived from it. The complete HFSSM is an 18-item experience-based scale in which an individual who has knowledge of the food situation in the household responds to questions about worries related to food deprivation, as well as to questions about dietary quality and food insufficiency experienced by adults and/or children living in the household. Based on the number of affirmative responses, an additive score is computed for each household, thus allowing each household to be classified as experiencing food security, low food security, or very low food security.<sup>1</sup> The HFSSM and related (sub)scales allow for assessing the food (in)security situation in the whole household but do not provide information regarding the food (in)security experience among specific members of the household.<sup>1</sup>

Data collected with the HFSSM indicate that, in 2010, 14.5% (17.2 million) of US households were food insecure at some point during the year. Risk factors for HFI include: household income near or below the federal poverty line; single-headed households with children; and black and Hispanic households. Given that an alarming 1 in 5 children are at risk of hunger (1 in 3 among black and Latino children) and that 3.9 million households with children were food insecure in 2010,<sup>2</sup> it is crucial to understand how HFI affects the present and future development and well-being of our children.

## **Household Food insecurity and Child Development: Conceptual Framework**

HFI is likely to be the result of material poverty, poor health of household member(s), as well as suboptimal livelihood and household management strategies.<sup>1</sup> HFI can affect the child’s physical, mental, social, and psycho-emotional development through different pathways (see Figure 1). A

“biological” pathway involves the direct link between HFI, poorer dietary intakes, nutritional status, and overall well-being. A “psycho-emotional” pathway involves the worry/anxiety, feeling of deprivation and alienation, distress, and adverse family and social interactions that result when households are exposed to HFI. It is plausible that both pathways can lead to serious behavioral and psycho-emotional problems in caregivers and their children and, as a result, to suboptimal child social and intellectual development.<sup>3</sup> It is also likely that many, if not all, of these relationships are bidirectional (e.g., HFI may lead to maternal depression and vice versa).

Understanding the impact of HFI on child development requires an in-depth analysis of how this condition affects children through direct pathways and indirectly through caregiver-mediated pathways.<sup>3</sup> HFI is a powerful stressor that can increase the levels of anxiety, stress, and depression among the children’s caregivers. This situation may in turn have a negative impact on the development of the child as caregivers with mental health issues may not be able to have optimal interactions with their offspring. In addition, potentially powerful material hardship stressors, such as HFI, may negatively affect all household members, contributing to a physical and psycho-emotional dysfunctional environment that poses a risk for the optimal development of the child.

### **Objectives**

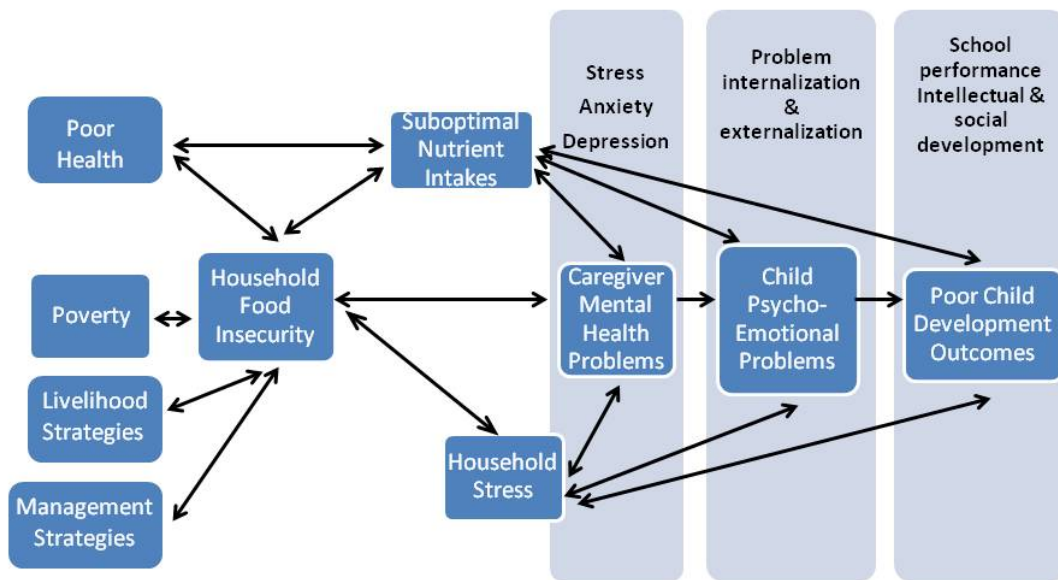
Because poverty is a strong determinant of both HFI and child development, it is important to examine whether HFI per se is a risk factor for suboptimal child development. The first objective of this review article is to examine the association between HFI and child intellectual, behavioral, and psycho-emotional development, controlling for socioeconomic indicators. The second objective is to examine the relationship between HFI and maternal mental health, which is known to have a powerful impact on the development of children. The third objective is to examine if the relationship between poverty and poor child development outcomes is mediated by HFI and if the relationship between HFI and child development is mediated by caregiver’s characteristics.

### **Methods**

We conducted a Pubmed search using the key words “food insecurity children” and identified 358 articles. To be included, articles had to: 1) be based on studies measuring HFI using an experience-based scale,<sup>4</sup> 2) be peer reviewed, and 3) include child intellectual, social, and/or psycho-emotional behavioral outcomes. Studies were also selected based on

backward and forward Pubmed citation searches and from the authors' files. After review of the abstracts, a total of 26 studies were selected based on our inclusion criteria. Unless otherwise indicated, all studies included adjusted for potential socioeconomic and demographic confounders. Previous reviews<sup>3</sup> were included as supporting evidence.

**Figure 1.** Household Food Insecurity as a Mediator of the Influence of Poverty and Other Factors on Child Development Outcomes: Conceptual Framework



### Results

All studies included were observational, with the great majority being cross-sectional and conducted in the US. The presentation of results that follows is broken down into three sections. The first section examines the influence of HFI on child psycho-emotional and social development as well as on academic outcomes controlling for key socioeconomic confounders. The second section examines the influence of HFI on maternal depression. The third section tests the hypothesis that the relationship

between HFI and child development is not confounded by poverty but rather that HFI and parental characteristics mediate the relationship between poverty and suboptimal child development outcomes.

### **Household Food Insecurity and Child Psycho-Emotional, Social, and Academic Development**

Qualitative research has shown that HFI in US households are likely to have a strong psycho-emotional impact on children and that these impacts are long lasting.<sup>5,-10</sup> As shown in this section, these findings have been corroborated with epidemiological studies.

#### *Cross-sectional Studies*

Cross-sectional US-based studies have consistently shown independent associations between HFI and a series of child psycho-emotional and academic indicators. These findings are present, despite the fact that studies have used different HFI scales, including the HFSSM,<sup>12-17</sup> the HFSSM food sufficiency item,<sup>11,18</sup> and the Community Childhood Hunger Identification Project (CCHIP) scale.<sup>19,20</sup> Findings from the Children's Sentinel Nutrition Assistance Program (C-SNAP, now called Children's HealthWatch) study showed that 4- to 36-month-old children living in food insecure households were more likely than their food secure counterparts to be identified by their caretakers as being at increased developmental risk based on the Parent's Evaluation of Developmental Status (PEDS) scale, even after controlling for maternal depression and other confounders.<sup>14</sup>

A cross-sectional study conducted in Arkansas, Louisiana, and Mississippi found, after adjusting for confounders, that 3- to 8-year-old children had lower physical function and 12- to 17-year-olds had lower psychosocial function if they lived in food insecure households.<sup>13</sup> Black, but not white, youth living in food insecure households scored lower in both physical and psychosocial function compared with their counterparts living in food secure households.<sup>13</sup> A US multistate study found that, based on teachers' reports, food insecure children were more likely to be hyperactive and to be either late or absent from school.<sup>20</sup> A study conducted in Pittsburgh found that aggression and anxiety, as reported by a parent based on the Pediatric Symptom Checklist, were strongly associated with HFI among 6- to 12-year-old children, although this association was not controlled for potential confounders.<sup>19</sup> A survey conducted in Massachusetts found that severe HFI was associated with problem internalization among preschool- and school-aged children, and among the latter it was also associated with more anxiety/depression.<sup>21</sup>

Whitaker et al<sup>22</sup> analyzed factors associated with HFI using cross-sectional data collected from low-income households located in 18 cities in the US. About half of the women respondents were black (51%), 23% were Hispanic, and the rest belonged to other ethnic/racial groups. Respondents' children were 3 years old on average. Based on the HFSSM (adult items), 71% of the households were food secure, 17% were marginally food insecure, and 12% were food insecure. Multivariate analyses showed that the percentage of women with clinical depression and anxiety symptoms was 17% among food secure, 21% among the marginally food insecure, and 30% among the food insecure ( $p < 0.05$ ). Among children there was also a dose-response relationship between HFI and child behavioral/mental health problems, 23% vs. 31% vs. 37%, respectively ( $p < 0.05$ ). In this study behavioral/mental health problems were defined as aggressiveness, anxiety, depression, lack of concentration, and/or hyperactivity.

Results from the third US National Health and Nutrition Examination Survey (NHANES) results show that 6- to 11-year-old children from food insufficient (vs. food sufficient) households had lower arithmetic scores and were more likely to have repeated a grade, to have seen a psychologist, and to have more difficulty getting along with their peers. In this study, a child was classified as living in a "food insufficient" household if the respondent to the family questionnaire reported that the family either "sometimes" or "often" did not get enough food to eat. In addition to the latter two outcomes, food insufficient adolescents were also more likely to have been suspended from school.<sup>11</sup> NHANES-III analyses also revealed that 15- to 16-year-old youth from food insufficient households were more likely to have experienced dysthymia, thoughts of death, a desire to die, and suicide attempts.<sup>18</sup>

### *Longitudinal Studies*

Longitudinal structural equation models (SEM) applied to the US Early Childhood Longitudinal Study birth cohort (ECLS-B) data showed that HFI at 9 months of age predicts lower maternal attachment and lower mental development at 2 years of age. In this study, HFI was assessed with the 10 adult items from the HFSSM. For both outcomes, this association was mediated by maternal depression and poorer parenting practices at 9 months.<sup>15</sup> Another analysis of the ECLS-B examined whether persistent and/or intermittent adult food insecurity vis-à-vis persistent food security had a negative influence on toddler's mental and motor development at 2 years.<sup>23</sup> Persistent HFI was defined as living in a food insecure household at both 9 months and 2 years. Intermittent food insecurity referred to

households in which children were either food insecure only at 9 months or only at 2 years. Researchers found that intermittent HFI (i.e., HFI at 2 years but not at 9 months) predicted lower mental development scores at 2 years (assessed with a modified version of the Bayley mental scale) compared with persistently food secure households, especially among girls. Unexpectedly persistent HFI was not associated with mental development scores. The authors speculate that it is possible that mothers living in persistently food insecure households developed useful coping strategies to deal with this situation. Thus, toddlers may be buffered against the negative influence of persistent HFI through adults' favorable coping mechanisms. When HFI becomes an intermittent condition, it is possible that it becomes more difficult for caregivers to understand how to have consistent access to needed social and health benefits and services. In this study, HFI (persistent or intermittent) was not associated with toddlers' motor development.

A longitudinal analysis of the US Early Childhood Longitudinal Study kindergarten cohort (ECLS-K) data documented that HFI is likely to impair child academic and social development, although several effects may be gender-specific.<sup>12</sup> HFI in kindergarten predicted lower math scores and social skills in third grade among girls but not boys. Likewise, girls (but not boys) from persistently food insecure households (i.e., those that were food insecure both at kindergarten and third grade) had lower increases in reading scores compared with their persistently food secure counterparts. Children (both girls and boys) living in households that were food secure in kindergarten and then became food insecure by third grade had lower increases in reading scores compared with children whose households were persistently food secure. Transitioning from food insecurity to food security during the same period of time was associated with improved social skills among girls only.<sup>12</sup> However, a subsequent longitudinal analysis of the ECLS-K data that extended the period under study until fifth grade did not corroborate this finding.<sup>16</sup> This study, however, did find that girls who did not experience HFI throughout elementary school had a significantly higher social skills composite score. Consistent with Jyoti et al<sup>12</sup> this association was not found among boys. An intriguing finding from the Howard study<sup>16</sup> is that transitioning from living in a food insecure household in first grade to living in a food secure household in third grade was associated with significantly lower (instead of higher) social skills scores. This association was not significant when this transition happened after third grade. It is possible that the initial period of transition from being food insecure to being food secure is accompanied by a period of social skills "instability" as a result of changes in the status



quo and perhaps the loss of access to social and health services that the family was eligible for when the household was food insecure. This study also suggests that this transition between first and third grades was specifically associated with poorer child self-control behaviors (e.g., respecting the property of others and controlling temper) and approaches to learning (e.g., attentiveness, task persistence, eagerness to learn) scores but was not related to externalizing behaviors (e.g., arguing, fighting, getting angry). Thus, future studies need to examine specific sub-domains of the social skill construct and not simply base conclusions on composite scores.

A recent US 2-year follow-up study found that persistent HFI, between 4 and 14 years old and 5 and 16 years old, increased 1.47 times the risk of internalizing problems and 2.01 times the risk of externalizing problems.<sup>24</sup> In contrast with the study by Howard,<sup>16</sup> children living in households that transitioned from food security at baseline to food insecurity at follow-up were 1.78 times more likely to internalize problems. The lack of agreement on HFI “transition” findings between the work of Slopen et al<sup>24</sup> and that of Howard<sup>16</sup> may be related to differences in sample characteristics, age of children, and/or analytical approaches.

In sum, the studies reviewed in this section strongly suggest that HFI, independently of socioeconomic status, represents not only a biological but also a psycho-emotional and developmental challenge to children exposed to it. This, in turn, is likely to translate into poor academic performance and intellectual achievement later on in life. All of these studies were conducted in the US, and the great majority included racial/ethnic minority children.

### **Household Food Insecurity and Maternal Depression**

Maternal depression has been identified as a risk factor for suboptimal child development. It is possible that women who are depressed are less likely to stimulate and engage with the development of their children.

Epidemiological studies have consistently found an independent association between HFI and maternal depression.<sup>25,26</sup> Pregnant women from North Carolina who lived in food insecure households (vs. food secure households) were more likely to have higher levels of perceived stress, trait anxiety, and depressive symptoms.<sup>25</sup> These relationships were dose-response as a function of HFI severity. Pregnant Latinas living in Connecticut were also more likely to have elevated levels of depression symptoms if they lived in food insecure (vs. food secure) households.<sup>26</sup> As previously indicated, data from the ECLS showed that HFI at 9 months of age was associated with maternal depression, which in turn mediated the association between HFI and poorer health and mental development and

obesity outcomes at 2 years of age.<sup>15,27</sup> The C-SNAP (Children's HealthWatch) study found that maternal depressive symptoms were associated not only with HFI but also with worse child health indicators and less likelihood to remain enrolled in a food assistance program.<sup>28</sup> The study conducted by Whitaker et al<sup>22</sup> also found that HFI was independently and positively associated, in a dose-response fashion, with maternal clinical depression and anxiety symptoms. As previously reported, this study showed a dose-response relationship between HFI severity and child behavioral/mental health problems (e.g., aggressiveness, anxiety, depression, lack of concentration, and/or hyperactivity) among children who were 3 years old on average.

Findings from the US longitudinal study "Rural Families Speak," which was based on structural equation models, identified a recursive (bidirectional) relationship between HFI and maternal depression measured with the HFSSM and Center for Epidemiologic Studies Depression Scale (CES-D) scale, respectively.<sup>29</sup> This study includes women from 16 states in the US with at least one child under 13 years of age. Findings from this study are consistent with those from the mixed-methods study by Lent et al.<sup>30</sup>

The studies previously reviewed clearly indicate that the material hardship of food insecurity has been consistently associated with suboptimal cognitive, behavioral, and psycho-emotional outcomes of children. The evidence also consistently demonstrates an association between HFI and poor maternal mental health outcomes. Because poor maternal mental health is likely to lead to poor parenting skills and suboptimal child development, then the questions become: Does HFI lead to poor mental health outcomes of caregivers? Does the opposite happen (i.e., Do poor maternal mental health outcomes lead to HFI)? Or is this a bidirectional relationship as suggested by Huddlestone-Casas et al?<sup>29</sup> These questions are important to answer because, as indicated in the discussion section, how we go about intervening to improve child development may be quite different depending on the answers to these questions.

From the child development perspective, these findings are of concern as maternal depression has been associated with lower quality care, lower quality of maternal-child interactions, decreased attachment with the child, and even child neglect and abuse.<sup>31</sup> Thus, maternal depression may be one of the factors mediating the relationship of HFI with worse child psychosocial development. Other parental characteristics may also play a role as discussed below.

### **Household Food Insecurity as a Mediator of the Influence of Poverty on Child Development: The Role of Caregivers**

If HFI is not simply a proxy for socioeconomic status, as the evidence clearly indicates, then it becomes paramount to find out if and how HFI mediates the relationship between poverty and suboptimal child development. Belsky et al<sup>17</sup> attempted to partially address these questions based on the E-Risk UK study. E-Risk is a nationally representative retrospective birth cohort study that began in 1999 with 1,116 families with same-sex twins aged 5 years. Follow-ups were conducted when children were 7, 10, and 12 years old. The study by Belsky et al<sup>17</sup> examines the role of HFI, parental characteristics, and household environment on child development indicators assessed at 5 and/or 12 years. *Children's IQ* was measured with the Wechsler Intelligence Scale. *Children's behavioral problems* were rated based on measures of problem externalization and a conduct problem scale. *Children's emotional problems* were assessed based on an internalizing scale, an anxiety scale, and a depression inventory. The *household environments* were assessed through material (income) and non-material (maternal personality and household sensitivity to children's needs) indicators. Five maternal personality dimensions were captured, when children were aged 5 to 7 years, with the scale used: 1) openness to experience, 2) conscientiousness, 3) extra-version, 4) agreeableness, and 5) neuroticism. Household sensitivity to children's needs was assessed when children were 7 to 10 years old by observers' ratings of the parents' attention to children's needs and the physical (dis)organization of the home environment. *Food insecurity* was measured when the children were 7 to 10 years old with a 7-item scale derived from the HFSSM. Households were classified as food secure or food insecure based on the 5- and 12-year assessments.

The main finding from this study was that HFI was associated with poorer child cognitive, behavioral, and psycho-emotional outcomes. However, the relationship between HFI and child IQ was no longer significant after adjusting for household income. Furthermore, the relationship between HFI and child behavior problems was no longer significant after adjusting for income, maternal personality, and household sensitivity to children's needs. By contrast, the relationship between HFI and child emotional problems remained significant, albeit attenuated, even after adjusting for income, maternal personality, and household sensitivity to children's needs. The authors concluded that, even though HFI is likely to be a long-term emotional stressor for children, the previously reported association between HFI and poorer child cognitive and behavioral problem indicators is likely to be (at least partially) confounded by

household material (income) and non-material (maternal personality, household organization) indicators. An alternative interpretation of these findings, however, is that caregivers' personalities and household management skills are likely to mediate the relationship between HFI and poor child development. Indeed, the study conducted by Huang et al,<sup>32</sup> and discussed below, suggests that maternal mental health characteristics may mediate the relationship between HFI and child development outcomes.

Huang et al<sup>32</sup> analyzed two waves of data (1997 and 2002) from the US Child Development Supplement in the nationally representative Panel Study of Income Dynamics. The study sample included children who were at least 3 years old in 1997 and who were living in households with an income < 200% of the poverty line; this selection was made to try to control for income-related confounders. Children were 7.5 years old and 11.6 years old on average in waves 1 and 2, respectively. The key outcome variables examined were children internalizing and externalizing behavior problems. The findings from three fixed effects regression models showed that: 1) HFI (measured with the 18-item HFSSM) was positively associated with both internalizing and externalizing problems after adjusting for survey wave, child and household head socioeconomic and/or demographic characteristics, and child disability status; 2) HFI was no longer associated with child behavioral problems after adding parental characteristics (stress, warmth, distress, and self-esteem) into the model, suggesting a mediation effect by parental characteristics; 3) HFI was significantly associated with externalizing problems once parental stress, the parental characteristic more strongly associated with child behavior problems, was removed from the model, suggesting a parental stress mediation effect. These findings suggest that parental characteristics and stress may mediate the impact of HFI on child behavior problems. However, this finding could not be confirmed by two alternative statistical models: 1) a lagged model including HFI in wave 1 as a predictor of child behavior problems in wave 2, and 2) a propensity score analysis testing the association between HFI and behavioral problems among children having the same probability of experiencing HFI in wave 2.

An important limitation of our review is that no studies were identified to examine poor dietary intake as a possible mediator of the relationship between HFI and poor child development outcomes (see Figure 1). This represents a major gap in knowledge.

To sum up, 2 prospective studies offer some degree of evidence that HFI is likely to mediate the relationship between poverty and suboptimal child development. Interestingly, 1 of the studies suggests that

parental stress (a strong risk factor for depression) may be an important mediator of the relationship between HFI and child behavioral problems<sup>32</sup> although this finding needs to be replicated.

### Discussion

An integration of the evidence reviewed in this article strongly suggests that HFI is indeed a powerful stressor that is likely to have a direct and indirect impact on the psycho-emotional, social, behavioral, and intellectual development of children. Our review strongly supports the likelihood that the HFI experience affects child development above and beyond the independent effects of poverty. Moreover, our study indicates that the impact of HFI on child development is likely to be strongly influenced not only by nutritional factors but also by psycho-emotional issues affecting the family unit as a whole. The epidemiological findings are indeed confirmed by qualitative research studies on how children experience food insecurity.<sup>10</sup>

Further advances in our understanding of how HFI affects the development of children will depend heavily on stronger conceptual frameworks, research designs, and statistical modeling approaches. Because poverty is a powerful determinant of both HFI and poor child development, it is crucial that researchers specify *a priori* the conceptual framework that will guide their study design and analysis. Studies are needed to rule out the possibility that the relationship between HFI and child development is totally confounded by poverty. These studies need to have adequate designs to find out if HFI mediates or modifies the relationship between poverty and poor child development. They also need to be adequately powered for suitable analyses, such as structural equation modeling, for testing mediation<sup>33</sup> and effect modification. A critical mass of cross-sectional studies is already in place. Thus, it is strongly recommended to emphasize longitudinal cohort studies in this type of research. The current prospective studies available have indeed allowed us to make progress in our understanding in this area, but many questions remain. Longitudinal structural equation models (SEM) can provide sound conceptual-based analytical frameworks for better understanding the complex pathways that may explain a link between HFI and suboptimal child development. An example of this is the study by Huddlestone-Casas et al<sup>29</sup> that was able to identify a bidirectional relationship between HFI and maternal depression.

Parental characteristics, including caregivers' stress levels, are emerging as likely mediators of the association between HFI and child development. Future studies need to build upon the few studies that have

attempted to assess this potential and highly relevant mediation effect. Likewise, studies have identified child sex as a likely effect modifier of the relationship between HFI and child development. Parents may protect boys from hunger before girls. Alternatively, girls may be more subject to parental anxiety than boys. However, the reasons for sex effect modification are not fully understood, and it is likely that they are context-specific. Thus, mixed methods approaches will be needed to gain a better understanding of this area of inquiry.

Experience-based HFI scales, such as the HFSSM, provide an aggregate measure of the level of food insecurity experienced by the household. However they don't provide information about how HFI differentially affects different household members. In other words, the measure doesn't describe the food insecurity experience for a specific child in the household. Some researchers have handled this by assessing HFI just including the child items or the adult items of the scale. Still, this approach does not provide specific information for the index child, especially if there is more than 1 child living in the household. Inclusion of additional indicators will be needed to provide more specific information about the food insecurity experience of the index child. This information is crucial for understanding direct vs. nutrition-mediated effects of HFI on child development and overall well-being.

US national data show that many households move in and out of food insecurity across time. Longitudinal studies suggest that this is a very dynamic process that requires frequent follow-ups to be better characterized. A thought-provoking finding is that moving from a food insecure to a food secure situation may not be immediately beneficial to the development of children. This is perhaps a result of a reduction in access to food assistance programs, as well as health and social services that households may have been eligible for if they had remained food insecure. This implies that households that have been food insecure previously may require continued assistance and support until they transition to a "stable" food secure situation.

Finally, attention needs to be paid to the social and physical environments where food insecure households tend to be concentrated<sup>34-</sup><sup>36</sup> that are amenable to change (e.g., more access to affordable healthy foods, more safe areas to perform leisure time activities). Simply focusing on individual households or members living within those households is unlikely to be sustainable long term. Thus, the US needs to embrace social policies capable of improving the living conditions in the communities where our most vulnerable children live.

### **Policy Implications**

The first policy implication that becomes evident from our review is that household members who have already been exposed to food insecurity are likely to be in need of family support services to learn to cope constructively with this stressor and its mental health sequelae. Children in particular need to be provided with access to additional psychosocial stimulation to allow them to catch up to the development level of their better-off counterparts. In this instance, programs such as Head Start and WIC may be ideally poised to help address the negative consequence of HFI on the development of children. The WIC program has recently been shown to be associated with a reduction in severe HFI<sup>37</sup> and may provide an ideal setting for offering mental health services or referrals to their clients—pregnant and lactating women and their children under 5 years of age. The recommendation to offer mental health services to families exposed to HFI is strongly supported by qualitative data.<sup>30</sup> Our findings also suggest that, to prevent further developmental problems in children, food insecure families should have improved access to food and nutrition assistance programs. In 2010, only 59% of households that were food insecure participated in at least one federal food and nutrition assistance program.<sup>2</sup> In other words, improved access to mental health and child development programs as well as to food assistance programs is likely to improve the development and well-being of children at risk of living or living in food insecure households.

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