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## The Role of Food Insecurity in Developmental Psychopathology

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### Abstract

Food security is a condition achieved when all members of a household have access to adequate food at all times for a healthy, active lifestyle. As of 2014, 14% of households in the United States were food insecure. Previous research has suggested that household food insecurity is associated with numerous adverse medical and psychosocial outcomes across the lifespan. In this narrative review, we examine current research on food insecurity, specifically as it relates to child psychopathology and risk factors thereof: namely, parental mental illness and poor diet and metabolic health. Moreover, we begin to speculate about behavioral and physiological mechanisms by which these conditions may influence one another, and discuss possible interventions through enhanced screening and treatment, parent training, and provision of high quality foods to vulnerable households. Further research is needed to the effects of child and parental mental health on metabolic outcomes in families with food insecurity.

### Keywords

Food insecurity; Mental Illness; Depression; Developmental Psychopathology; Child Behavioral Problem; Supplemental Nutrition Assistance Program; Overweight; Obesity

### Food Security

Food security is a condition achieved when all members of a household gain access to enough food at all times for a healthy, active lifestyle. Further, a food secure household is able to readily acquire foods that are nutritionally adequate, socially acceptable, and safe to consume (Anderson 1990). Domestically, the U.S. Census Bureau annually assesses the prevalence of food insecurity using a federal survey which includes questions related to household experiences with adequate food during the past 12 months. Households endorsing reduced diet quality, variety and desirability are considered to have “low food security,” whereas households with “very low food security” also experience disrupted eating patterns

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### Conflict of Interest

Dr. Althoff is employed, in part, by the nonprofit Research Center for Children, Youth, and Families which produces the Child Behavior Checklist and related instruments. Ms. Ametti, and Dr. Bertmann have no conflicts of interest to report.

and reduced intake (Coleman-Jensen et al., 2015). Food insecure households typically have incomes around or below the Federal poverty line and contain adults with limited educational attainment and higher rates of unemployment. The risk of household food insecurity is generally higher among racial and ethnic minorities, large families with children, single parent households, and rural environments. Regionally within the U.S., food insecure households are more prominent in the South (Colman-Jensen et al., 2015). In 2011, following the Great Recession, domestic food insecurity reached its highest level since measurement began in 1995. It continues to remain above 14 percent with over 5 percent reporting very low food security (Coleman-Jensen, 2015). According to a recent examination by the U.S. Department of Agriculture, three key national-level economic drivers contribute to annual variations in food security; these include the unemployment rate, annual inflation, and relative price of food (Nord et al., 2014).

Generally, children in food insecure households are protected from reduced food availability and disrupted meal patterns. However, in very low food secure settings all family members are impacted. In 2014, 14 percent (17.4 million households) were reportedly food insecure with 9.4 percent (3.7 million households) reporting very low food security. These trends remain statistically unchanged since 2012 (Colman-Jensen et al., 2015). Furthermore, in 2014, 8.3 percent of households reported low food security specifically among children with 1.1 percent of these children suffering from very low food security (Colman-Jensen et al., 2015). A growing body of literature reports negative associations between food insecurity and health outcomes (Gitterman et al., 2015). Children living in food insecure households are significantly more likely to have fair or poor health compared to food secure children (Cook et al., 2013). Recent findings suggest that children living in food insecure households have elevated risk of iron deficiency anemia, tooth decay, frequent headaches, asthma, mental health, and metabolic health (Coleman-Jensen, 2015; Gitterman et al., 2015). These findings suggest that food insecurity is an important public health problem.

The purpose of this article is to review and synthesize existing literature related to the relationship between family food insecurity and two areas of preventive medicine associated with high morbidity – mental health and obesity risk. A combination search of PubMed with active hyperlinks and Google Scholar databases was conducted using a combination of keywords and MeSH terms, including: *body mass index, diabetes, diet, hypertension, hunger, insulin resistance, food security, food stamps, mental health, nutrition, obesity, overweight, parenting, and SNAP*, English language, peer-reviewed articles concerning children or adolescents were eligible for inclusion. Due to the nascent state of the field, all articles published prior to December 2015 were included in the search, but, with the exception of seminal papers, we concentrated on papers published between 2010 and 2015. The abstracts of identified articles were reviewed and selections were reviewed by two authors for suitability and selections were made based on relevance to food security, mental health, and obesity risk. Thirty-five articles were selected as suitable for this narrative review.

## Food Insecurity and Child Mental Health

Family food insecurity has consistently been related to impaired child mental health. In an early examination of this association, Molcho and colleagues (2007) studied 8424 school children, aged 10–17. After adjusting for age and social class, they demonstrated that self-reported food insecurity was associated with a decrease in consumption of healthy foods and an increased likelihood of missing a meal. Furthermore, they found that children reporting food insecurity had higher odds of experiencing a variety of emotional symptoms, including feeling low, irritable, or nervous on a weekly basis (as well as reporting life dissatisfaction) (Molcho et al., 2007). Chen and colleagues (2009) examined food insecurity in 764,526 Taiwanese elementary students by imputing across factors including low birth weight economic status, and time of year (in school or not in school) compared to ambulatory visits recorded in insurance datasets. Children living in poverty were much more likely to use ambulatory care for mental disorders (Odds Ratio (OR) = 2.29) as well as other, non-psychiatric medical conditions, such as upper and lower respiratory tract infections (Chen et al., 2009). Moreover, Cluver and Orkin (2009) examined the relationship between stigma associated with being orphaned due to AIDS, food insecurity, and bullying in South Africa. In combination with high scores on stigma, high food insecurity was associated with an 83.2% chance of having an internalizing disorder in children who have been orphaned (Cluver and Orkin, 2009).

These findings are supported by the work of Slopen et al. (2010) who assessed child behavioral problems using the Child Behavior Checklist (CBCL) in 2,810 children aged 4–14 in the Chicago area. After adjusting for gender, age, race, child behavioral problems at baseline, poverty, and maternal characteristics, children from persistently food insecure homes were 1.47 times more likely to have internalizing and 2.01 times more likely to have externalizing problems. Additionally, in this study, a transition in household food security status from food secure to food insecure increased the likelihood of developing externalizing problems, while movement into poverty alone did not.

Some of the effects of food insecurity may begin as early as infancy. In a sample of 8,944 children from the Early Childhood Longitudinal Study in the US, Zaslow et al. (2009) studied the association between household food insecurity in infancy and attachment in toddlerhood. Structural equation modeling was performed to test the direct and indirect effects of food insecurity on toddlers' attachment and cognitive development, while controlling for maternal symptoms. Food insecurity was related to insecure attachment and to impaired cognitive development of the toddler, but operated indirectly through maternal depression and parenting.

Melchior and colleagues (2012) demonstrated that these effects, which may begin early in life, continue in childhood. They assessed a representative cohort of over 2,100 children from Quebec for food insecurity at age 1 and 4, and identified differential mental health symptom trajectories for children who had experienced food insecurity. Specifically, children from families with food insecurity were more likely to demonstrate behavioral trajectories of persistent depression/anxiety (OR=1.79) and inattention/hyperactivity (OR=3.06). The inattention/hyperactivity symptoms persisted after controlling for a number

of demographic characteristics, including family income and parental education, suggesting that there are some relations between behavior and food insecurity that are relatively specific to food insecurity and not due to poverty alone.

These findings in children are consistent with those observed in studies of food insecurity and mental health in adolescents in the U.S. Using data from the National Comorbidity Survey Replication Adolescent Supplement (NCS-A), McLaughlin and colleagues (2012) examined food insecurity in 6,483 adolescents. Based on combined youth and parent reports of symptoms, food insecurity was related to increased odds of mood (OR = 1.1), anxiety (OR=1.1), behavior (OR=1.2), and substance disorders (OR=1.2) during the preceding year, after controlling for age, sex, ethnicity, and socioeconomic status (SES). It is worth noting that the effect sizes in this national sample appear to be lower than in the other samples, suggesting that there is less of an effect in adolescence. This may reflect differences in the way that adolescents acquire food, such that overall household food insecurity has less of an effect on adolescents. Alternatively, in the NCS-A, there were generally low levels of food insecurity overall, which may have led to a lower signal. In a large study (n>20,000) of Canadian late adolescents and early adults with a childhood hunger prevalence of more than 5%, a robust association (OR=2.9) was observed between childhood hunger and depression/suicidal ideation as measured by the Center for Epidemiologic Studies Depression Rating Scale (CES-D). This association persisted even after adjusting for potential confounding variables (McIntyre et al., 2013).

Recently, the impact of lack of food has been examined in studies of refugee populations, orphaned children and homeless families (Meyer et. al, 2013; Pappin et. al, 2015; Vandentorren et. al, 2013). Each of these investigations have demonstrated relationship between maternal and child mental health and lack of food. For example, Vandentorren et al. (2015) examined the prevalence of food insecurity among more than 10,000 families experiencing homelessness in the Paris region. Greater than 75% of the parents were food insecure, as were 69% of the children, and mental health disorders were common in the mothers and the children.

## Food Insecurity and Parental Mental Health

The high rates of maternal and child mental illness in families with food insecurity observed by Vandentorren and colleagues (2015) highlights a critical mechanism through which food insecurity relates to child mental health; that is, often parents bear more of the food security and mental health burden than children in vulnerable homes. Given the fact that parental mental health is a key predictor of child mental health, it is important to consider the evidence linking food insecurity and parental wellness. Melchior and colleagues (2009) related food insecurity to both maternal health and child behavioral outcomes. In this study of 1,116 British families, mothers' mental health was assessed with a DSM interview and children's behavior at age 10 was assessed by maternal report on the CBCL and teacher report on the Teacher Report Form (TRF). Controlling for income, food insecurity was shown to be related to the mothers' overall burden of mental health problems and domestic violence. Children from food-insecure families had higher rates of behavioral problems, even after adjusting for SES and maternal mental health (OR = 1.64). This finding was

consistent across both maternal and teacher report of child behavior problems. There was, however, a clear interactive effect, such that children from food-insecure households with maternal mental health problem had higher rates of behavioral problems (34%) than children from food-insecure households without maternal mental health problems (18%). Similarly, Melchior and colleagues (2009) demonstrated that the behavior problems in youth associated with family food insecurity were significant, even after controlling for maternal depression and anxiety, which was also higher in families with food insecurity.

Although most studies have been limited to mothers, associations between food insecurity and parental mental health suggest that food insecurity is related to higher levels of depression in either parent. Yet, it is also possible that higher levels of depressive symptoms lead to more food insecurity. For example, in a study of 413 women from the rural U.S., Huddlestone-Casas and colleagues (2009) demonstrated that the relation between food insecurity and depressive symptoms was bidirectional. There are many possible reasons for this bi-directionality, including the possibility that depressive symptoms may be associated with a mother being less able to secure employment or to utilize available resources. This is consistent with other research that has been done on this association (Lent et al., 2009). Further, maternal mental health has been directly linked to domestic violence exposure and other Adverse Childhood Experiences (Chilton et al., 2015; Chilton et al., 2014). In fact, Hernandez and colleagues (2014) showed that the association between exposure to interpersonal violence and household food insecurity at a 2-year follow-up was mediated by maternal depression. Thus, assessing and treating mothers from food insecure households for depressive symptoms may ameliorate some of the effects on child mental health.

## Food Insecurity and Obesity Risk

There are other connections between mental health and food, the most clearly being the association between metabolic outcomes such as diabetes and overweight/obesity and mental health. These medical conditions have, themselves, been associated with food insecurity. We review briefly here the associations between food insecurity and metabolic outcomes and how it may also relate to child mental health.

Support for an association between metabolic health and food security has been most consistent among adults, and, particularly, women. In a nationally representative, population-based study, Wilde and Peterman (2006) observed the highest prevalence rates of obesity among adult females reporting marginal or low food security during the past 12 months. In general, however, the relationship between food insecurity and weight status is complex, possibly non-monotonic, and the underlying mechanisms are poorly understood.

Some of the basic coping strategies used to manage food insecurity have been mechanistically implicated in the development of metabolic problems; namely, caloric substitution and adaptation to “feast-famine” cycle (Dinour et al., 2007). Caloric substitution is a coping mechanism commonly employed in response to circumstances of inadequate or uncertain food access, whereby energy requirements are met through the supplantation of healthy, nutritious foods with less expensive, energy-dense alternatives (i.e. sugar-sweetened drinks, salty snacks). This allows limited resources to be extended in order to avoid hunger;

but, consequently, limits the amount and types of nutrients consumed. Various studies have shown that individuals who are food insecure derive a higher percentage of their energy intake from fat and carbohydrates, consume less protein and fresh produce, and have micronutrient deficiencies (Kirkpatrick and Tarasuk, 2008; Leung et al., 2014; Widome et al., 2009). This strategy is consistent with research that has shown that groups with low levels of food insecurity tend to have higher body mass indices (BMIs) as compared with groups that are either fully food secure or severely food insecure (Metallinos-Katsaras, Must, and Gorman (2012). The second “feast-famine” coping strategy is a behavioral and physiological response to cyclical food restriction in which the individual learns to consume food when available and the body stores and gains fat more rapidly during periods of availability (Dinour et al., 2007). This strategy may be particularly relevant among individuals and families receiving inadequate food assistance or living with severe levels of food insecurity. Additional research suggests that a variety of other factors may further modify the effects of these coping strategies on metabolic outcomes. These include parental willingness/ability to sacrifice his/her own nutritional needs and/or satiety to protect children’s diet, participation in food assistance programs, amount and duration of benefits, parenting styles, maternal stressors, home food environment, budget management and nutrition education (Bronte-Tinkew et al., 2007; Dinour et al, 2007).

In pediatric populations, food insecurity has been equivocally linked to metabolic risk factors. Several studies have suggested that female children in food insecure households are at the greatest risk for adverse metabolic outcomes. Metallinos-Kataras and colleagues (2009) found that among low-income children girls aged 2–5 years in food insecure households were 47% more likely to be overweight. Furthermore, Alaimo and colleagues (2001) observed that household food insecurity was associated with overweight only among white, non-Hispanic girls ages 8–16; whereas food insufficiency was associated with a lower likelihood of overweight among girls ages 2–7 and was unrelated to BMI in boys of all ages. Similarly, in a longitudinal study of participation in the Supplemental Nutrition Assistance Program (SNAP, formerly the Food Stamp Program) five consecutive years of household participation was associated with a 43% increase in the probability of overweight among girls ages 5–11, but a 29% decrease among boys of the same age. Participation in SNAP however, was not significantly related overall to overweight in children ages 12–18 (Gibson, 2004).

It has been suggested that these gender differences may be related to different physiological compositions and fat storage and metabolic processes; yet, other studies have not corroborated these differences (Power and Shulkin, 2008). Widome and colleagues (2009) showed that, across genders, adolescents who reported experiencing hunger “some months but not every month” were at the highest risk for overweight, while Parker and colleagues (2010) demonstrated that adolescents from very low-food secure households were more likely to have abnormal glucose levels. Conversely, some studies have reported no significant differences in children’s BMI based on household food security status, and others have even found food insecurity to predict a decreased probability of overweight (Gundersen et al., 2008; Martin and Ferris, 2007; Rose and Bodor, 2006). Despite robust support for the relationship between food insecurity and obesity risk, the role of food insecurity in the pathogenesis of other metabolic morbidities remains understudied.

## Conclusions and Opportunities for Intervention

This narrative review of the literature has identified that food insecurity in families is independently related to parental and child mental health problems (mostly maternal depression and child behavioral problems) along with parental and child metabolic problems. Unfortunately, very little research has examined the relationships between child and parental mental health and metabolic outcomes specifically in families with food insecurity. Given the high rates of co-occurrence of mental health problems and metabolic problems in families with high levels of food insecurity, this is an important area for further investigation. What mechanisms may be associated with both metabolic problems and mental health problems? Food insecurity reduces the resources necessary to parent effectively. In a model of “scarcity” whereby poverty reduces the ability to flexibly utilize cognition (Mani et. al, 2013) parents living in scarcity may have reduced capacity for practicing positive parenting. This reduction in positive parenting capacity is made worse by, parental depressive symptoms and poor parental health, among other factors. Emerging evidence exists, however, that parental health and parenting practices may play a direct role in the pathogenic relation between poverty and child mental health outcomes. Luby and colleagues (2013) demonstrated that living in poverty (presumably with higher levels of food insecurity, although this was not specifically examined) leads to fundamental changes in the hippocampus of children. Similar to findings in adults (e.g. Sheline et al, 2012) changes in children’s hippocampus are associated with depressive symptoms. Critically, these brain changes that are associated with poverty are mediated by the parenting of the caregiver, such that higher levels of hostility increase the levels of the brain changes, while supportive parenting reduces the brain changes associated with poverty in children.

While not definitive, these emerging findings suggest the tantalizing possibility of being able to break the cycle of food insecurity leading to mental health problems in children. There are at least three avenues of potential intervention: 1) assessment and treatment of parent mental health; 2) enhanced positive parenting in food insecure households; and 3) direct delivery of quality food to food insecure households (thus eliminating the scarcity in which these families find themselves). Each of these levels of intervention requires that clinicians and researchers attend to the complex interaction between food insecurity, family mental health problems, and family metabolic problems. However, with appropriate attention to these relations, it is likely possible to enhance both the mental health and the metabolic health of the next generation.

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## Abbreviations

<b>SES</b>	socioeconomic status
<b>SNAP</b>	Supplemental Nutrition Assistance Program
<b>NCS-A</b>	National Comorbidity Survey Replication Adolescent Supplement

<b>CBCL</b>	Child Behavior Checklist
<b>OR</b>	odds ratio
<b>BMI</b>	body mass index

## References

- Alaimo K, Olson CM, Frongillo EA Jr. Low family income and food insufficiency in relation to overweight in US children: is there a paradox? *Archives of pediatrics & adolescent medicine*. 2001; 155:1161–1167. [PubMed: 11576013]
- Anderson SA. Core indicators of nutritional state for difficult-to-sample populations. *The Journal of nutrition*. 1990; 120:1557–1599.
- Bronte-Tinkew J, Zaslow M, Capps R, Horowitz A, McNamara M. Food insecurity works through depression, parenting, and infant feeding to influence overweight and health in toddlers. *The Journal of nutrition*. 2007; 137:2160–2165. [PubMed: 17709458]
- Chen L, Wahlqvist ML, Teng NC, Lu HM. Imputed food insecurity as a predictor of disease and mental health in Taiwanese elementary school children. *Asia Pacific journal of clinical nutrition*. 2009; 18:605–619. [PubMed: 19965355]
- Chilton M, Knowles M, Rabinowich J, Arnold KT. The relationship between childhood adversity and food insecurity: 'It's like a bird nesting in your head'. *Public health nutrition*. 2015; 18:2643–2653. [PubMed: 25611561]
- Chilton MM, Rabinowich JR, Woolf NH. Very low food security in the USA is linked with exposure to violence. *Public health nutrition*. 2014; 17:73–82. [PubMed: 23432921]
- Cluver L, Orkin M. Cumulative risk and AIDS-orphanhood: Interactions of stigma, bullying and poverty on child mental health in South Africa. *Social Science & Medicine*. 2009; 69:1186–1193. [PubMed: 19713022]
- Coleman-Jensen A. USDA Economic Research Service-Commemorating 20 Years of US Food Security Measurement. 2015
- Coleman-Jensen A, Gregory C, Rabbitt M. Food Security in the U.S. US Department of Agriculture Economic Research Service. 2015
- Coleman-Jensen A, Rabbitt M, Gregory C, Singh A. Household Food Security in the United States in 2014. US Department of Agriculture Economic Research Service. 2015
- Cook JT, Black M, Chilton M, Cutts D, Ettinger de Cuba S, Heeren TC, Rose-Jacobs R, Sandel M, Casey PH, et al. Are food insecurity's health impacts underestimated in the U.S. population? Marginal food security also predicts adverse health outcomes in young U.S. children and mothers. *Advances in nutrition (Bethesda, Md.)*. 2013; 4:51–61.
- Dinour LM, Bergen D, Yeh MC. The food insecurity-obesity paradox: a review of the literature and the role food stamps may play. *J Am Diet Assoc*. 2007; 107:1952–1961. [PubMed: 17964316]
- Gibson D. Long-term food stamp program participation is differentially related to overweight in young girls and boys. *J Nutr*. 2004; 134:372–379. [PubMed: 14747674]
- Gitterman BA, Chilton LA, Cotton WH, Duffee JH, Flanagan P, Keane VA, Krugman SD, Kuo AA, Linton JM, et al. Promoting Food Security for All Children. *Pediatrics*. 2015; 136:e1431–e1438. [PubMed: 26498462]
- Gundersen C, Lohman BJ, Eisenmann JC, Garasky S, Stewart SD. Child-specific food insecurity and overweight are not associated in a sample of 10- to 15-year-old low-income youth. 2008a
- Hernandez DC, Marshall A, Mineo C. Maternal depression mediates the association between intimate partner violence and food insecurity. *Journal of women's health (2002)*. 2014; 23:29–37.
- Huddleston-Casas C, Charnigo R, Simmons LA. Food insecurity and maternal depression in rural, low-income families: a longitudinal investigation. *Public health nutrition*. 2009; 12:1133–1140. [PubMed: 18789167]
- Kirkpatrick SI, Tarasuk V. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. *The Journal of nutrition*. 2008; 138:604–612. [PubMed: 18287374]



- Lent MD, Petrovic LE, Swanson JA, Olson CM. Maternal mental health and the persistence of food insecurity in poor rural families. *Journal of health care for the poor and underserved*. 2009; 20:645–661. [PubMed: 19648695]
- Leung CW, Epel ES, Ritchie LD, Crawford PB, Laraia BA. Food insecurity is inversely associated with diet quality of lower-income adults. *Journal of the Academy of Nutrition and Dietetics*. 2014; 114:1943–1953. e2. [PubMed: 25091796]
- Luby J, Belden A, Botteron K, Marrus N, Harms MP, Babb C, Nishino T, Barch D. The effects of poverty on childhood brain development: the mediating effect of caregiving and stressful life events. *JAMA Pediatr*. 2013; 167:1135–1142. [PubMed: 24165922]
- Mani A, Mullainathan S, Shafir E, Zhao J. Poverty impedes cognitive function. *Science (New York, N.Y.)*. 2013; 341:976–980.
- Martin KS, Ferris AM. Food Insecurity and Gender are Risk Factors for Obesity. *Journal of Nutrition Education and Behavior*. 2007; 39:31–36. [PubMed: 17276325]
- McIntyre L, Williams JV, Lavorato DH, Patten S. Depression and suicide ideation in late adolescence and early adulthood are an outcome of child hunger. *Journal of affective disorders*. 2013; 150:123–129. [PubMed: 23276702]
- McLaughlin KA, Green JG, Alegria M, Jane Costello E, Gruber MJ, Sampson NA, Kessler RC. Food insecurity and mental disorders in a national sample of U.S. adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2012; 51:1293–1303. [PubMed: 23200286]
- Melchior M, Caspi A, Howard LM, Ambler AP, Bolton H, Mountain N, Moffitt TE. Mental health context of food insecurity: a representative cohort of families with young children. *Pediatrics*. 2009; 124:e564–e572. [PubMed: 19786424]
- Melchior M, Chastang JF, Falissard B, Galera C, Tremblay RE, Cote SM, Boivin M. Food insecurity and children's mental health: a prospective birth cohort study. *PloS one*. 2012; 7:e52615. [PubMed: 23300723]
- Metallinos-Katsaras E, Must A, Gorman K. A longitudinal study of food insecurity on obesity in preschool children. *Journal of the Academy of Nutrition and Dietetics*. 2012; 112:1949–1958. [PubMed: 23174682]
- Metallinos-Katsaras E, Sherry B, Kallio J. Food insecurity is associated with overweight in children younger than 5 years of age. *J Am Diet Assoc*. 2009; 109:1790–1794. [PubMed: 19782181]
- Meyer S, Murray LK, Puffer ES, Larsen J, Bolton P. The nature and impact of chronic stressors on refugee children in Ban Mai Nai Soi camp, Thailand. *Global public health*. 2013; 8:1027–1047. [PubMed: 23886374]
- Molcho M, Gabhainn SN, Kelly C, Friel S, Kelleher C. Food poverty and health among schoolchildren in Ireland: findings from the Health Behaviour in School-aged Children (HBSC) study. *Public health nutrition*. 2007; 10:364–370. [PubMed: 17362532]
- Nord M, Coleman-Jensen A, Gregory C. Prevalence of US Food insecurity is related to changes in unemployment, inflation, and the price of food. US Department of Agriculture, Economic Research Service. 2014
- Pappin M, Marais L, Sharp C, Lenka M, Cloete J, Skinner D, Serekoane M. Socio-economic status and socio-emotional health of orphans in South Africa. *Journal of community health*. 2015; 40:92–102. [PubMed: 24968757]
- Parker ED, Widome R, Nettleton JA, Pereira MA. Food security and metabolic syndrome in U.S. adults and adolescents: findings from the National Health and Nutrition Examination Survey, 1999–2006. *Annals of epidemiology*. 2010; 20:364–370. [PubMed: 20382337]
- Power ML, Schulkin J. Sex differences in fat storage, fat metabolism, and the health risks from obesity: possible evolutionary origins. *The British journal of nutrition*. 2008; 99:931–940. [PubMed: 17977473]
- Rose D, Bodor JN. Household food insecurity and overweight status in young school children: results from the Early Childhood Longitudinal Study. *Pediatrics*. 2006; 117:464–473. [PubMed: 16452367]
- Sheline YI, Disabato BM, Hranilovich J, Morris C, D'Angelo G, Pieper C, Toffanin T, Taylor WD, MacFall JR, Wilkins C, Barch DM, Welsh-Bohmer KA, Steffens DC, Krishnan RR, Doraiswamy

- PM. Treatment course with antidepressant therapy in late-life depression. *American Journal of Psychiatry*. 2012; 169:1185–1193. [PubMed: 23534057]
- Slopen N, Fitzmaurice G, Williams DR, Gilman SE. Poverty, food insecurity, and the behavior for childhood internalizing and externalizing disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2010; 49:444–452. [PubMed: 20431464]
- Vandentorren S, Le Mener E, Oppenchain N, Arnaud A, Jangal C, Caum C, Vuillermoz C, Martin-Fernandez J, Lioret S, et al. Characteristics and health of homeless families: the ENFAMS survey in the Paris region, France 2013. *European journal of public health*. 2015
- Whitaker RC, Phillips SM, Orzol SM. Food insecurity and the risks of depression and anxiety in mothers and behavior problems in their preschool-aged children. *Pediatrics*. 2006; 118:e859–e868. [PubMed: 16950971]
- Widome R, Neumark-Sztainer D, Hannan PJ, Haines J, Story M. Eating When There is Not Enough to Eat: Eating Behaviors and Perceptions of Food Among Food-Insecure Youths. *American Journal of Public Health*. 2009; 99:822–828. [PubMed: 19299675]
- Wilde PE, Peterman JN. Individual weight change is associated with household food security status. *The Journal of nutrition*. 2006; 136:1395–1400. [PubMed: 16614436]
- Zaslow M, Bronte-Tinkew J, Capps R, Horowitz A, Moore KA, Weinstein D. Food security during infancy: implications for attachment and mental proficiency in toddlerhood. *Maternal and child health journal*. 2009; 13:66–80. [PubMed: 18317892]

**Highlights**

- Food insecurity is associated with maternal and child mental illness
- Food insecurity is associated with high BMI and poor diet quality
- Preventive medicine and nutrition interventions may help reduce disease

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