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Food insecurity is associated with maternal depression and child pervasive developmental symptoms in low-income Latino households

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Abstract

The objective of this study was to investigate associations between household food insecurity, maternal clinical depression, and child behavior problems in low-income Latino households. Data were collected from a cohort of 168 children and their Latina mothers recruited prenatally at two San Francisco hospitals from 2006 to 2007. Food insecurity at year four was associated with increased odds of maternal clinical depression at years four to five (adjusted OR 1.22, 95% confidence interval 1.03 to 1.43). Food insecurity at year four was associated with child pervasive developmental problems at year five ($B=0.21$, $p=0.041$) in adjusted models. The association between food insecurity at year four and oppositional defiant problems at year five was partially mediated (28.7% mediation, $p=0.046$) by maternal clinical depression in years four and five. Our results suggest that household food insecurity is associated with greater maternal depression, and both food insecurity and maternal depression uniquely predict certain types of child behavior problems. Assessing for and addressing household food insecurity may be beneficial additions to psychosocial interventions targeting maternal and child mental health.

Keywords

Nutrition policy; mental health; anxiety; medically underserved; Hispanic; Mexican Americans

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Introduction

Food insecurity, maternal depression, and child behavior problems are common household stressors, particularly among low-income families. Household food insecurity, defined as lacking “sufficient, safe, and nutritious food that meets individuals’ dietary needs and preferences for an active and healthy life”,¹ affects an estimated 12.7% of households in the US; very low food security, characterized by multiple indications of disrupted eating patterns and reduced food intake, affects 5%.² Households with children under age six (16.9%) and low-income households (32.8%) have higher rates of food insecurity than these national averages.² Latinos are a growing minority population in the US with high rates of food insecurity, particularly among low-income families with children.^{3,4} In 2014, 22.4% of Latino households were food insecure, and 6.9% of Latino households had very low food security.⁴

Maternal depression affects an estimated 17% of mothers with toddler-aged children.⁵ Household food insecurity has been linked to maternal depression in the US⁶⁻⁹ and internationally.¹⁰ However, few studies have examined the relationship between food insecurity and maternal depression among Latino populations. One cross-sectional study of pregnant Latina women found that women who were food insecure were more likely to experience elevated levels of prenatal depression, although this was not examined postnatally.¹¹

Food insecurity has also been associated with child health outcomes such as increased developmental risk⁷ and psychosocial dysfunction,¹² including aggression, anxiety, depression, hyperactivity, and difficulties with peers.¹³ Whitaker et al¹³ reported a positive association between food insecurity and child behavior problems when controlling for maternal depression; however, the study did not report the effect of maternal depression on child behavior problems. One study suggested that the relationship between food insecurity and child developmental outcomes might be partially mediated by maternal depression.¹⁴ We are unaware of previous studies that have examined the relationships among food insecurity, maternal depression, and child behavior problems in low-income Latino populations.

We investigated the relationships between 1) food insecurity score (number of affirmative food insecurity responses) and maternal clinical depression, 2) food insecurity score and child behavior problem scores, and 3) the potential for maternal clinical depression score to mediate the relationship between food insecurity score and child behavior problem scores in a low-income Latino population. We hypothesized that 1) food insecurity score would be associated with maternal clinical depression 2) that food insecurity score would be associated with child behavior problem scores, and 3) that maternal clinical depression would mediate the relationship between food insecurity and child behavior problem scores.

Methods

Latina women recruited during the 2nd and 3rd trimesters of pregnancy at prenatal clinics at the [blinded] and [blinded] from May 2006 to May 2007 and their children were followed

longitudinally for five years. This study was part of a larger Latino mother-child cohort examining the relationship among maternal depression and child feeding practices and weight status. Full details of recruitment and enrollment are described in previous studies using the cohort.¹⁵⁻¹⁸ Maternal exclusion criteria included drug or alcohol abuse, pre-existing diabetes mellitus or gestational diabetes mellitus treated with insulin, polycystic ovary syndrome, an eating disorder such as bulimia or anorexia nervosa, or any health problems that would influence breast-feeding. Diabetics who were taking insulin or had any contraindications for breastfeeding were excluded. Infants at delivery were excluded if they had special care needs, chronic disease, or Apgar scores less than seven at five minutes.¹⁹ Close to 100% of Latina women presenting to the prenatal clinics were approached in both hospitals; approximately 90% of those who met the inclusion criteria agreed to participate.

This study was conducted according to the guidelines developed in the Declaration of Helsinki, and all procedures involving human subjects were approved by the [IRB blinded]. Written informed consent was obtained from all subjects. Demographic, socio-economic and health data of the participants were collected at the time of enrollment: maternal ethnicity (1. Mexican; 0. Other including nationalities from Central America, South America, and the Caribbean); maternal education (0. High school or less; 1. Some college or more); and child sex (0. Female; 1. Male). At four years, we collected maternal marital status (0. Not married including single, divorced, or separated; 1. Married); maternal employment (0. Not employed; 1. Employed); and maternal age (continuous). Medical history was collected from chart review and by questionnaire to determine mental health history, including previous diagnosis and/or treatment for depression or anxiety. All interviews were conducted face-to-face in the participant's choice of English or Spanish, generally lasting about 60 minutes. Maternal mental health and child behavior problems were assessed using measures that have been validated in Spanish speaking populations.^{16,18} We provided nutrition information, small gifts for the baby on delivery, and transportation vouchers to meet follow-up interviews.

Food insecurity was assessed using the 18-item US Household Food Security Scale Module (US HFSSM).²⁰ Participants completed the US HFSSM, which captures food security status over the previous 12 months, at the four-year postnatal visit. Food insecurity score was defined as the number of affirmative food insecurity responses in the US HFSSM. We used the continuous food insecurity score variable to perform the linear regression analyses in order to capture the full range of the food security scale. In addition, for descriptive purposes, respondents were categorized into food security status levels corresponding to number of affirmative questionnaire responses out of 18 according to the US Department of Agriculture (USDA) guidelines for households with children: high food security (0 affirmative responses), marginal food security (1-2 affirmative responses), low food security (3-7 affirmative responses), and very low food security (8-18 affirmative responses).²¹ Mothers were also asked if they participated in Food Stamps or the Supplemental Nutrition Assistance Program (SNAP), administered by the USDA, at year four.

Mothers were administered the Mini International Neuropsychiatric Interview (MINI, version 5.0)²² to evaluate for current major depressive episodes at three, four, and five years postpartum. Maternal clinical depression was defined as a diagnostic score for current major

depressive episode on the MINI (5 affirmative responses on the MINI including “feeling depressed or down, most of the day, nearly every day, for the past two weeks” and/or “much less interested in most things or much less able to enjoy the things you used to enjoy most of the time” in the past two weeks) at the four and five-year postpartum visits. If mothers were found to have positive depressive symptom scores, they were provided information on community mental health services.

Child behavior problems were assessed at age five using the Child Behavior Checklist (CBCL/1.5–5),²³ which has been validated in over 30 countries, including among Hispanic populations.²⁴ After administration of the questionnaire, responses were scored into Diagnostic and Statistical Manual of Mental Disorders (DSM)-Oriented Scales, which included affective problems, anxiety problems, pervasive developmental problems, attention deficit/hyperactivity problems, and oppositional defiant problems. Higher scores on these scales represent a greater number of behavioral problems. T scores that were greater than 65 for any given DSM-oriented scale were identified as in the “clinical” or “borderline clinical” range per scoring guidelines.²³

Statistical Analysis

Analyses were conducted with SPSS 12.0 for Windows (SPSS Inc., Chicago, IL). Given a sample size of $n=168$, approximate standard deviations of 3.0 for food insecurity score and 1.0 for CBCL 1.5–5 DSM-Oriented scales, the study was powered to detect a slope of the linear regression line of 0.64 (i.e. a 0.64 unit increase in CBCL 1.5–5 DSM-Oriented scale for every one unit increase in food insecurity score), with an alpha of 0.05 and power of 0.80.²⁵ Bivariate and multivariate linear regression was used to evaluate the relationship between food insecurity score and maternal clinical depression. Adjusted models controlled for socio-economic and demographic covariates that may impact food security and maternal or child mental health, including sex, ethnicity, maternal marital status, maternal employment, maternal education, maternal age, and participation in Food Stamps/SNAP.^{3,6,7,11}

Regression models were used to evaluate the relationship between food insecurity score and child behavior problems using the continuous CBCL 1.5–5 DSM-Oriented scales (linear regression) and dichotomous clinical/borderline clinical versus non-clinical outcomes (logistic regression). For the three child behavior scales (affective, pervasive developmental, and oppositional defiant problems) that were significantly associated with food insecurity score in simple linear regression models, additional linear regression models were conducted to test for potential mediation and adjust for covariates based on Baron and Kenny’s steps for mediation: 1) regress the dependent variable (child behavior score) on the independent variable (food security score) [Model 1 unadjusted, Model 3 adjusted]; 2) regress the proposed mediator (maternal clinical depression) on the independent variable (food security score) [Table 2]; 3) Regress the dependent variable (child behavior score) on both the proposed mediator (maternal clinical depression) and the independent variable (food security score) [Model 2 unadjusted, Model 4 adjusted].²⁶ We also used the Sobel-Goodman mediation test with food insecurity score as the independent variable, maternal clinical

depression as the mediator variable, and three child behavior problem scores as the dependent variables.²⁷ $P < 0.05$ was considered significant in all analyses.

Results

Our sample was comprised of 168 mothers and children, 84% of the original birth cohort of 201, followed through five years postpartum (Table 1). Children were approximately 51% male. More than half of households had high food security. The remaining households experienced marginal food security (8.6%), low food security (28.2%), or very low food security (4.9%). The prevalence of maternal clinical depression at four to five years postpartum was 13.1%. The prevalence of child behavioral symptoms at five years ranged from 3.6% for attention deficit/hyperactivity to 7.1% for pervasive developmental problems. Pervasive developmental symptoms included mothers reporting that their children avoided eye contact, did not answer, showed little affection, had a speech problem, exhibited strange behavior, or were upset by new situations.

Using linear regression, food insecurity score at year four was associated with increased odds of maternal clinical depression at years four or five in unadjusted models (OR 1.21, 95% confidence interval 1.06 to 1.38, Table 2) and adjusted (adjusted OR 1.22, 95% confidence interval 1.03 to 1.43) models. The adjusted model controlled for maternal education, employment, marital status, ethnicity, age, and participation in Food Stamps/SNAP.

In simple linear regression models examining the relationship between food insecurity score and various child behavior problem scores, food insecurity score was significantly associated with child affective score ($B=0.12$, $p=0.029$), child pervasive developmental problems score ($B=0.23$, $p=0.006$), and child oppositional defiant score ($B=0.14$, $p=0.027$) (Table 2). Although food insecurity was significantly associated with child affective problem scores in unadjusted (Table 3, Model 1) and adjusted (Table 3, Model 3) linear regression models, this was no longer significantly associated after adjusting for maternal clinical depression (Table 3, Models 2 and 4). Food insecurity remained significantly associated with child pervasive developmental score in unadjusted and adjusted linear regression models (Table 4, Models 1 to 4). Although food security was associated with child oppositional defiant score in unadjusted analyses (Table 5, Model 1), food insecurity was no longer significantly associated with child oppositional defiant score after adjusting for maternal depression and covariates (Table 5, Models 2–4).

Using the Sobel-Goodman mediation tests with food insecurity score as the independent variable, maternal clinical depression as the mediator variable, and three child behavior problem scores as the dependent variables, the percent of the total effect mediated were 22.2% ($p=0.070$) for affective score, 20.0% ($p=0.062$) for pervasive developmental score, and 28.7% ($p=0.046$) for oppositional score.

Discussion

In our study, one-third of low-income Latino families experienced household food insecurity at four years postpartum and 13% of mothers experienced maternal clinical depression

around four to five years postpartum. Food insecurity score was associated with maternal clinical depression in this low-income, Latino sample. In addition, food insecurity was associated with child pervasive developmental problem scores in adjusted models. The association between food insecurity score and child oppositional defiant score was partially mediated by maternal clinical depression. .

The 4.9% rate of very low food insecurity in our low-income sample was similar to national rates in the US of (5.0% in 2015)² and slightly lower than that reported among national Latino households (6.9% in 2014).⁴ In addition, our results showed a rate of maternal clinical depression (13.1%) four to five years postnatally, consistent with a nationally representative sample that found that 17% of mothers of three year olds had elevated depressive symptoms.⁵ Women may be at risk for depression during pregnancy due to hormonal changes and throughout motherhood due to the presence of additional stressors associated with parenting.⁵

In a low-income Latino sample, we found that food insecurity score was significantly associated with maternal clinical depression, consistent with our first hypothesis. These findings support the increasing evidence from North America⁶⁻⁹, including in Latino populations¹¹, and internationally¹⁰ of the relationship between food insecurity and maternal depression. However, this positive association does not necessarily indicate a direction of causation. On the one hand, food insecurity may lead to maternal depression. Food insecurity may contribute to maternal stress during pregnancy¹¹, which in turn may lead to dysfunction in the hypothalamic-pituitary-adrenocortical axis and the onset of recurrent depression.¹⁰ Food insecurity and resulting nutritional deficiencies have been linked to depressive symptoms and mood disturbances.^{9,10} In addition, depression may contribute to food insecurity. Depressed mothers may be unable to work or sustain employment,²⁸ may be unable to manage financial resources, and may lack the motivation or energy to shop or prepare food and meals for their families.⁷

We found that food insecurity was associated with child pervasive developmental problems, consistent with our second hypothesis. Previous studies have reported a relationship between food insecurity and increased developmental risk,⁷ aggression,¹² and psychosocial dysfunction¹² in children. Children in food insecure households may experience nutritional deficiencies that may hinder child development.²⁹ Our study did not find an association among food insecurity and child depression, anxiety, and hyperactivity reported by others.^{13,30} Though these other studies also used the CBCL 1.5-5 to measure child behavior problems,^{13,30} one applied a different food security measure, which may explain the difference in findings.³⁰

Furthermore, we found that maternal clinical depression may partially mediate the relationship between food insecurity score and child oppositional defiant score. This is consistent with one prior study suggesting that the relationship between food insecurity and child developmental outcomes might be partially mediated by maternal depression.¹⁴

Our study has several limitations. Although our data were from a longitudinal cohort, the data in this report are cross-sectional, so we are unable to prove causality, although the

independent variable (food insecurity) was measured one year prior to the dependent variable (child behavior problem score). Unmeasured potential confounders, such as genetic predispositions, certain personality traits, income, or parental immigration status, may affect relations between depression, child behavior, and food insecurity.⁶ Food insecurity, maternal clinical depression, and child behavior scale data were based on self-report, a method that is always subject to possible reporting bias. For example, responses to questionnaires could have been influenced by mothers' mental health symptoms. However, mothers scheduled study visits at times when they were well enough to complete the interview, and mothers were interviewed and responses recorded by trained researchers. Future studies should consider obtaining informant reports of food insecurity, depression, or child behavior from multiple family members including children. Future research with a larger sample size and greater power may be able to detect associations between food insecurity, maternal depression, and child behavior problems using categorical or dichotomous cutoffs to maximize impact on policy recommendations. The study population of low-income Latino mothers and children limits its generalizability to the broader US population; however, our results on the prevalence of food insecurity^{2,4} and maternal depression³¹ are similar to other studies reported in North America.

Our study has several strengths. We employed validated measures of household food insecurity (US HFSSM), maternal clinical depression (MINI), and child behavioral problems (CBCL 1.5–5). We also controlled for socio-economic factors, such as maternal employment, maternal education, maternal marital status, maternal age, maternal ethnicity, child sex, and participation in Food Stamps/SNAP. Our results indicated that food insecurity score was associated with maternal clinical depression, above and beyond these critical covariates.

Conclusions

Given the high prevalence of food insecurity, maternal clinical depression, and child behavior problems in Hispanic populations, health care providers should routinely screen for these at pediatric primary care visits and refer appropriately to local mental health or food security resources.^{6,32} Validated one to two question screens for household food insecurity have been developed for use in the primary care setting.^{33,34} It would be valuable for future research to evaluate how interventions targeting maternal depression and child mental health might be strengthened by addressing food insecurity. Recent research has demonstrated that social support may buffer the negative influence of food insecurity on depression risk.³⁵ Therefore, novel social support and social networking interventions may improve both food insecurity and maternal depression.³⁶

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Abbreviations:

DSM Diagnostic and Statistical Manual

CBCL	Child Behavior Checklist
MINI	Mini International Neuropsychiatric Interview
US HFSSM	US Household Food Security Scale Module

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Table 1.

Selected socio-demographic, anthropometric, and behavioral characteristics of children and mothers in sample

	n	%	Range
<i>Child demographics</i>			
Gender	168		
Male	82	50.8%	
Female	84	49.2%	
<i>Maternal socio-demographics</i>			
Age at four-year follow-up (years, mean \pm SD)	168	30.4 \pm 5.3	18–44
Ethnicity	168		
Mexican	100	59.5%	
Other ^a	68	40.5%	
Marital status	163		
Married	52	31.9%	
Not married (including single, divorced, separated)	111	68.1%	
Employed at four years	168		
Yes	90	53.6%	
No	78	46.4%	
Education	163		
High school or less	130	79.8%	
Some college or more	33	20.3%	
Participation in Food Stamps / SNAP at four years ^b	127		
Yes	53	41.7%	
No	74	58.3%	
<i>Maternal clinical depression (at four to five years)</i>	168		
Clinical depression		13.1%	
<i>Child behavioral characteristics (at five years)</i>	168		
Affective score (% in clinical or borderline clinical range)		2.0 \pm 2.1 (6.0%)	0–10
Anxiety score (% in clinical or borderline clinical range)		3.6 \pm 2.6 (5.4%)	0–13
Pervasive developmental score (% in clinical or borderline clinical range)		3.0 \pm 3.2 (7.1%)	0–15
Attention deficit/hyperactivity score (% in clinical or borderline clinical range)		4.8 \pm 2.9 (3.6%)	0–12
Oppositional defiant score (% in clinical or borderline clinical range)		3.2 \pm 2.6 (5.4%)	0–12
<i>Household Food Security</i>	163		
High food security	95	58.3%	
Marginal food security	14	8.6%	
Low food security	46	28.2%	
Very low food security	8	4.9%	
Food insecurity score	168	2.0 \pm 3.0	0–16

^aOther includes nationalities from Central America, South America, and the Caribbean including: El Salvador, Guatemala, Honduras, Nicaragua, Colombia, Dominican Republic, Peru, Puerto Rico, and other.

^bSNAP = Supplemental Nutrition Assistance Program

Table 2.

Regression with food insecurity score at year four as the independent variable in relation to maternal clinical depression at year four or five and child behavior problems at year five as dependent variables

Variable	B (SE) ^a	p value	Odds ratio (95% CI) ^b	p value
Maternal clinical depression (MINI), year four or five	--	--	1.21 (1.06 to 1.38)	0.004
Child behavior problems (CBCL 1.5–5), year five				
Affective	0.12 (0.05)	0.029	1.14 (0.97 to 1.35)	0.106
Anxiety	0.01 (0.20)	0.840	1.02 (0.81 to 1.28)	0.871
Pervasive developmental	0.23 (0.08)	0.006	1.21 (1.04 to 1.40)	0.015
Attention deficit/hyperactivity	0.12 (0.08)	0.109	0.91 (0.65 to 1.29)	0.606
Oppositional defiant	0.14 (0.06)	0.027	1.06 (0.90 to 1.24)	0.492

Bold indicates p<0.05

^aSimple linear regression for continuous outcomes

^bLogistic regression for dichotomous outcomes

Table 3.

Results from simple and multiple linear regressions with child affective score as the dependent variable and food insecurity score, maternal clinical depression, and other covariates as independent variables

	Model 1	p	Model 2	p	Model 3	p	Model 4	p
Food insecurity score	0.12 (0.05)	0.029	0.10(0.06)	0.072	0.14 (0.06)	0.032	0.13 (0.07)	0.053
Maternal clinical depression			1.17 (0.50)	0.022			0.88 (0.60)	0.144
Male sex (vs female)					-0.26 (0.40)	0.518	-0.36 (0.40)	0.370
Mexican ethnicity (vs other ethnicity)					-0.30 (0.43)	0.498	-0.17 (0.44)	0.690
Mother married (vs not married)					-0.03 (0.45)	0.945	0.06 (0.45)	0.900
Mother employed (vs not employed)					-0.11 (0.43)	0.790	-0.05 (0.43)	0.914
Mother with some college education or more (vs high school or less)					0.30 (0.53)	0.577	0.34 (0.53)	0.521
Maternal age					-0.04 (0.04)	0.577	-0.04 (0.04)	0.277
Food stamp/SNAP participation					0.22 (0.41)	0.598	0.23 (0.41)	0.578
R ²	0.029		0.065		0.066		0.090	
Adjusted R ²	0.023		0.053		0.000		0.014	

B (SE) presented for each model

Bold indicates $p < 0.05$

Table 4.

Results from simple and multiple linear regressions with child pervasive developmental score as the dependent variable and food insecurity score, maternal clinical depression, and other covariates as independent variables

	Model 1	p	Model 2	p	Model 3	p	Model 4	p
Food insecurity score	0.23 (0.08)	0.029	0.18 (0.08)	0.032	0.24 (0.10)	0.016	0.21 (0.10)	0.041
Maternal clinical depression			1.81 (0.74)	0.016			1.28 (0.10)	0.167
Male sex (vs female)					0.27 (0.62)	0.663	0.16 (0.62)	0.801
Mexican ethnicity (vs other ethnicity)					0.29 (0.66)	0.663	0.41 (0.67)	0.539
Mother married (vs not married)					-0.30 (0.68)	0.656	-0.11 (0.70)	0.873
Mother employed (vs not employed)					-0.46 (0.65)	0.477	-0.32 (0.66)	0.634
Mother with some college education or more (vs high school or less)					0.24 (0.81)	0.766	0.32 (0.82)	0.692
Maternal age					0.01 (0.06)	0.803	0.01 (0.06)	0.823
Food stamp/SNAP participation					-0.04 (0.63)	0.946	0.05 (0.63)	0.938
R ²	0.05		0.079		0.069		0.083	
Adjusted R ²	0.04		0.068		0.001		0.006	

B (SE) presented for each model

Bold indicates p<0.05

Table 5.

Results from simple and multiple linear regressions with child oppositional defiant score as the dependent variable and food insecurity score, maternal clinical depression, and other covariates as independent variables

	Model 1	p	Model 2	p	Model 3	p	Model 4	p
Food insecurity score	0.14 (0.06)	0.027	0.10 (0.07)	0.128	0.12 (0.08)	0.151	0.06 (0.08)	0.432
Maternal clinical depression			1.65 (0.60)	0.006			2.16 (0.73)	0.004
Male sex (vs female)					-0.28 (0.51)	0.577	-0.47 (0.73)	0.349
Mexican ethnicity (vs other ethnicity)					-0.03 (0.55)	0.956	0.17 (0.54)	0.751
Mother married (vs not married)					0.47 (0.56)	0.401	0.81 (0.56)	0.150
Mother employed (vs not employed)					-0.22 (0.54)	0.677	0.04 (0.53)	0.947
Mother with some college education or more (vs high school or less)					0.05 (0.67)	0.940	0.19 (0.65)	0.769
Maternal age					-0.01 (0.05)	0.797	0.19 (0.65)	0.745
Food stamp/SNAP participation					-0.04 (0.52)	0.933	0.12 (0.51)	0.809
R ²	0.030		0.073		0.038		0.108	
Adjusted R ²	0.024		0.061		-0.033		0.033	

B (SE) presented for each model

Bold indicates $p < 0.05$