Food Insecurity and Mental Disorders in a National Sample of U.S. Adolescents

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Objective: To examine whether food insecurity is associated with past-year *DSM-IV* mental disorders after controlling for standard indicators of family socioeconomic status (SES) in a U.S. national sample of adolescents. **Method:** Data were drawn from 6,483 adolescent–parent pairs who participated in the National Comorbidity Survey Replication Adolescent Supplement, a national survey of adolescents 13 to 17 years old. Frequency and severity of food insecurity were assessed with questions based on the U.S. Department of Agriculture's Food Security Scale (standardized to a mean of 0, variance of 1). *DSM-IV* mental disorders were assessed with the World Health Organization Composite International Diagnostic Interview. Associations of food insecurity with *DSM-IV*/Composite International Diagnostic Interview diagnoses were estimated with logistic regression models controlling for family SES (parental education, household income, relative deprivation, community-level inequality, and subjective social status). **Results:** Food insecurity was highest in adolescents with the lowest SES. Controlling simultaneously for other aspects of SES, standardized food insecurity was associated with an increased odds of past-year mood, anxiety, behavior, and substance disorders. A 1 standard deviation increase in food insecurity was associated with a 14% increase in the odds of past-year mental disorder, even after controlling for extreme poverty. The association between food insecurity and mood disorders was strongest in adolescents living in families with a low household income and high relative deprivation. **Conclusions:** Food insecurity is associated with a wide range of adolescent mental disorders independently of other aspects of SES. Expansion of social programs aimed at decreasing family economic strain might be one useful policy approach for improving youth mental health. J. Am. Acad. Child Adolesc. Psychiatry; 2012; 51(12):1293-1303. **Key Words:** food insecurity, poverty, hunger, adolescence, mental health.

More than one in five U.S. youth younger than 18 years lived in a family with an income below the federal poverty line in 2010.[1] Poverty is defined by the federal government as inadequate income relative to estimated need based on family size[1] and is consistently associated with increases in internalizing and externalizing problems in children and adolescents.[2–5] However, little research has examined whether poverty specifically increases risk for youth psychopathology or whether other dimensions of socioeconomic status (SES) explain this relation. On the one hand, poverty might influence mental health as a result of deprivation in resources needed to sustain health, including food and shelter. This sort of material deprivation typically occurs in the context of extreme poverty[6] and may be associated with psychopathology risk. On the other hand, prior research has found a linear association between family income and youth psychopathology, with lower levels of income related to a higher risk of anxiety, depression, and behavior disorders across the entire income distribution.[7,8] This pattern suggests a social gradient in youth mental health, with poverty simply representing the tail of the distribution. Alternatively, other dimensions of SES are related to child and adolescent internalizing and externalizing psychopathology, including parental education and occupation,[7–9] and might explain the relation between poverty and youth mental health.

Different measures of SES assess distinct aspects of social class and status that influence health

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through unique pathways.[10] The relative importance of various aspects of SES in predicting youth psychopathology is poorly understood, because few studies have examined the differential associations of multiple SES measures with mental health outcomes. To determine which aspects of SES are most strongly associated with youth psychopathology, the authors recently examined the associations of numerous SES measures with adolescent mental disorders using data from a U.S. national sample of adolescents. Subjective social status, the perception of one's status in relation to others,[11] was associated with adolescent mental disorders more strongly and consistently than other measures of SES, including parental education, family income, relative family income (compared with other families in one's community), and community-level income inequality in models that examined SES predictors one at a time and controlled for all indicators simultaneously.[12] Family income adjusted for family size was unrelated to mental disorders, even before adjustment for other SES measurements. These findings suggested that the relation between SES and adolescent mental disorders is largely driven by individual-level perceptions of status rather than by objective deprivation, although it is unknown whether low perceptions of status increase the risk of mental disorders or whether the presence of a mental disorder drives lower perceptions of status.

However, the SES measures examined in this previous study may have failed to identify families experiencing the most extreme forms of poverty involving material deprivation. Even indicators of low income may be insufficient for detecting families that are consistently unable to pay for basic necessities, because access to these resources can vary markedly for families with the same level of income owing to differences in family size, extended family networks, lifestyle, area of residence, and expenses.[13] Adjusting income for family size provides only a cursory metric of income relative to need. Food insecurity, the inability to purchase adequate amounts of food to meet basic needs,[14] is one marker that may better capture severe material deprivation. In the United States, food insecurity is most commonly experienced by families living in poverty and those that have experienced recent economic stressors such as unemployment or loss of food stamps.[6,15] Food insecurity is associated with adverse health outcomes in children and adolescents, including vitamin and nutrient deficiency, developmental delay, hospitalization, and overweight status, even after adjustment for family income.[16–18] Food insecurity is also associated with symptoms of anxiety and depression and externalizing problems in children,[19–21] although the authors are unaware of previous research examining the relation between food insecurity and youth mental disorders.

The authors examined the association between food insecurity and adolescent mental disorders in the National Comorbidity Survey Replication Adolescent Supplement (NCS-A), a national population-based sample of U.S. adolescents. They first examined the distribution of exposure to food insecurity across other markers of SES to determine whether food insecurity is indeed a marker of extreme material deprivation in this sample. Next, they examined the associations of food insecurity with past-year *DSM-IV* disorders after controlling for other measurements of SES.

METHOD

Sample

As previously reported in more detail,[22] the NCS-A was carried out from February 2001 through January 2004. Adolescents 13 to 17 years old were interviewed face to face in dual-frame household and school samples.[22,23] The household sample included adolescents who were recruited from households that participated in the National Comorbidity Survey Replication (NCS-R).[22] A total of 879 school-attending adolescents participated in the household survey, with a response rate of 86.8% (conditional on adult participation in the NCS-R). The remainder of the sample included 9,244 adolescents recruited from a representative sample of schools in NCS-R sample areas. The adolescent response rate in the school sample was 82.6% (conditional on school participation). The total NCS-A sample, combining household and school samples, included 10,123 adolescents. Although the proportion of initially selected schools that participated in the NCS-A was low (28.0%), replacement schools were carefully matched to the original schools. A comparison of household sample respondents from nonparticipating schools with school sample respondents from replacement schools found no evidence of bias in estimates of prevalence or correlates of mental disorders.[22]

One parent or guardian was asked to complete a self-administered questionnaire (SAQ) about the participating adolescent's developmental history and mental health. The SAQ response rates, conditional on adolescent participation, were 82.5% in the household sample and 83.7% in the school sample. An SAQ was completed for 8,470 adolescents; 1,987 of parents completed a

short-form SAQ and 6,483 completed a long-form SAQ. This report focuses on the 6,483 adolescent–parent pairs for whom data were available from the adolescent interviews and long-form SAQs. Written informed consent was obtained from parents or guardians before approaching the adolescents. Written adolescent assent was then obtained from the adolescents before surveying adolescents or parents. Each respondent was given $50 for participation. These recruitment and consent procedures were approved by the human subjects committees of Harvard Medical School and the University of Michigan.

Once the survey was completed, cases were weighted for variation in the within-household probability of selection in the household sample and residual discrepancies between sample and population sociodemographic and geographic distributions. The household and school samples were then merged with the sums of weights proportional to relative sample sizes adjusted for design effects in estimating disorder prevalence. These weighting procedures are detailed elsewhere.[22] The weighted sociodemographic distributions of the composite sample closely approximate those of the U.S. Census population.[23]

Measurements

Diagnostic Assessment. Adolescents were administered a modified version of the Composite International Diagnostic Interview (CIDI), a fully structured interview administered by trained lay interviewers.[24] For these analyses, *DSM-IV* disorders were grouped into four classes: mood disorders (major depressive disorder or dysthymia and bipolar I or II disorder), anxiety disorders (panic disorder with or without agoraphobia, agoraphobia without a history of panic disorder, social phobia, specific phobia, generalized anxiety disorder, posttraumatic stress disorder, and separation anxiety disorder), behavior disorders (attention-deficit/hyperactivity disorder, oppositional-defiant disorder, conduct disorder, and intermittent explosive disorder), and substance disorders (alcohol and drug abuse, alcohol and drug dependence with abuse).[12] The present report focuses on disorders that were present in the 12 months before the interview.

Parents provided information about adolescent symptoms of major depressive disorder/dysthymia, attention-deficit/hyperactivity disorder, oppositional-defiant disorder, and conduct disorder, disorders for which parent reports have previously been shown to play a large role in diagnosis.[25,26] Parent and adolescent reports were combined at the symptom level using an ''or'' rule, such that a symptom was considered present if it was endorsed by either respondent. All diagnoses were made using *DSM-IV* organic exclusion rules. All but two diagnoses were made using *DSM-IV* diagnostic hierarchy rules. The exceptions were oppositional-defiant disorder, which was defined with or without conduct disorder, and substance abuse, which was defined with or without dependence.

A clinical reappraisal study blindly reinterviewed a subsample of NCS-A respondents with the Schedule for Affective Disorders and Schizophrenia for School-Age Children Lifetime Version.[27] As reported in more detail elsewhere,[28] concordance between the lifetime CIDI/SAQ and the Schedule for Affective Disorders and Schizophrenia for School-Age Children Lifetime Version diagnoses was good, with an area under the receiver operating characteristic curves of 0.87 for any disorder and 0.56 to 0.90 for individual disorders.

Food Insecurity. Food insecurity was assessed in the CIDI and parent SAQs using a set of items drawn from the short form of the U.S. Department of Agriculture's Food Security Scale, a validated measurement of food insecurity.[29] Adolescents and their parents completed two dichotomous items indicating whether in the past 12 months they had ever been hungry but did not eat because they could not afford enough food and whether they had ever eaten less than they thought they should because there was not enough money to buy food (in the CIDI, adolescents completed only the second hunger question if they endorsed the first question). Two additional items assessed how often adolescents and parents did not have enough money to buy food and could not afford to buy balanced meals in the past 12 months. These items were assessed using a 4-point Likert scale ranging from never (1) to often (4).

SES Covariates. The authors controlled for several individual-level indicators of SES and a community-level measurement of income distribution to determine whether food insecurity was associated with adolescent mental disorders above and beyond other aspects of SES. The SES variables included highest parental educational attainment (coded into four categories: college graduate or advanced degree, some college, high school graduation, and less than high school graduation), family household income, relative deprivation, and subjective social status. Household income was coded in relation to the poverty line adjusted for family size, with low income defined as less than 1.5 times the official federal poverty line, low-average as 1.5 to 3 times the poverty line, high-average as 3 to 6 times the poverty line, and high as at least 6 times the poverty level. Information on parental education and family income was assessed in the parent SAQ. Relative deprivation was defined as the difference between each adolescent's total household income and the mean income of all households in their census tract, divided by the standard deviation of tract-level income of those households,[30] with higher values indicating greater income deprivation. Subjective social status was

assessed using a measurement that determines where adolescents believe they rank in the social hierarchy.[31] Higher scores reflect higher perceptions of status in relation to other adolescents. Community-level income inequality was estimated using the Gini coefficient in each adolescent's census tract. The Gini coefficient is a widely used measurement of income inequality[32] and ranges from 0 in situations of complete equality (i.e., everyone has the same income) to 1 in situations of complete inequality (i.e., one person has all the income). Relative deprivation, subjective social status, and community-level inequality were standardized to a mean of 0 and a variance of 1.

Analysis Methods

The authors first used a two-parameter Item Response Theory (IRT) analysis[33] to assign each adolescent a weighted food insecurity score, based on adolescent and parent responses. This IRT approach allowed the authors to capture information about the contribution of each item to the sensitivity of the total scale and weight items based on their relative contribution. A small proportion of data was missing on items used to create the food insecurity score (0.7% of adolescent and 5.0% of parent/guardian responses). Missing values were imputed before conducting the IRT analysis. Analyses included the two dichotomous items assessing hunger and limited food in the past year (because of the CIDI skip procedure, these items were combined for adolescents) and six nested dichotomies embedded in the two 0 to 4 responses to questions about inadequate finances for food. Specifically, the 0 to 4 responses to each item were converted into three dichotomies (1 versus 2–4, 1–2 versus 3–4, 1–3 versus 4); responses indicating no hunger and adequate finances for food (scores of 0) were used as the reference group. Slopes for food insecurity items had a considerable range (0.35–5.88), indicating that some items were stronger indicators of the underlying dimension than others, with the highest slopes for parent reports of inadequate finances for food. Weighted scores were created based on these results by multiplying each dichotomous item response by the slope parameter and summing these values over all food insecurity variables (adolescent and parent responses) for each adolescent. The food insecurity score was then standardized to a mean of 0 and a variance of 1.

The authors examined the association of food insecurity with 12-month adolescent mental disorders using logistic regression. They first estimated a series of logistic regression models examining the bivariate associations of food insecurity and each of the other SES indicators with disorder outcomes. A more complex multivariate model was then estimated that included food insecurity and all other SES indicators simultaneously. Models were estimated first in an overall data array, which was a consolidated data file that stacked the 20 separate disorder-specific files and included 19 dummy variables to distinguish among these files, thereby forcing the estimated slopes of disorders on food insecurity and other SES indicators to be constant across disorders. This model was then estimated again in subsamples defined by class of mental disorder (mood, anxiety, behavior, and substance disorders) to investigate the possibility of variation in associations of food insecurity with different types of adolescent mental disorders. The authors added interactions between food insecurity and other SES indicators to this multivariate model to determine whether the associations between food insecurity and adolescent mental disorders varied according to other aspects of SES. All models controlled for respondent age (coded into four dummy variables corresponding to 13 or 14, 15, 16, and 17 years of age), sex, and race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and other). Relative deprivation, subjective social status, and community-level inequality were treated as linear variables in the analyses. Logistic regression coefficients and standard errors were exponentiated to create odds ratios (ORs) with 95% confidence intervals. All significance tests were evaluated using .05-level two-sided tests. To account for sample weights and clustering, the design-based Taylor series method implemented in SAS 9.1 (SAS Institute, Cary, NC) was used to estimate standard errors.

RESULTS

Food Insecurity and SES

Food insecurity was rare in the NCS-A. Although IRT-derived food insecurity scores ranged from −0.54 to 4.63 (mean = 0, variance = 1), the median value in the total sample was −0.54, indicating that most respondents reported no food insecurity. The authors examined the severity of food insecurity at different levels of this standardized scale by determining the proportion of respondents who indicated they had been hungry in the past year but did not eat because there was not enough money for food. A total of 2.3% of respondents in the 61st to 80th percentiles of the food insecurity scale, 6.0% in the 81st to 95th percentiles, and 48.7% above the 95th percentile responded affirmatively to this item.

The authors next examined the mean level and distribution of food insecurity according to race/ethnicity and other SES indicators. Mean food insecurity score increased monotonically with decreasing parental educational attainment (ranging from −0.18 for adolescents with at least one parent with a college degree to 0.36 for adolescents from families where the highest parental education was less than a high school degree)

TABLE 1 Distribution of Food Insecurity Scores by Socioeconomic Status in the National Comorbidity Survey Replication Adolescent Supplement (NCS-A)[a] (n = 6,483)

	n	Min	Max	Mean	25%	50%	75%
Total sample	6,483	−0.54	4.63	0.00	−0.54	−0.54	0.19
Parental education							
Less than high school	377	−0.54	4.19	0.36	−0.54	−0.47	0.65
High school	1,981	−0.54	4.63	0.10	−0.54	−0.54	0.46
Some college	1,464	−0.54	4.39	0.07	−0.54	−0.54	0.27
College plus	2,661	−0.54	4.39	−0.18	−0.54	−0.54	−0.49
Household income							
≤1.5× poverty line	925	−0.54	4.63	0.55	−0.54	−0.13	1.39
>1.5–≤3× poverty line	1,218	−0.54	4.39	0.19	−0.54	−0.51	0.59
>3–≤6× poverty line	2,139	−0.54	4.63	−0.07	−0.54	−0.54	−0.17
>6× poverty line	2,201	−0.54	4.04	−0.29	−0.54	−0.54	−0.51
Relative deprivation[b]							
Quartile 1 (≤−0.50)	1,523	−0.54	4.63	0.36	−0.54	−0.47	0.82
Quartile 2 (−0.50, −0.24)	1,593	−0.54	4.24	0.02	−0.54	−0.54	0.21
Quartile 3 (−0.24, 0.19)	1,686	−0.54	4.63	−0.13	−0.54	−0.54	−0.20
Quartile 4 (>0.19)	1,681	−0.54	3.91	−0.25	−0.54	−0.54	−0.50
Community-level inequality[b]							
Quartile 1 (≤−0.65)	1,704	−0.54	4.39	−0.11	−0.54	−0.54	−0.18
Quartile 2 (−0.65, −0.07)	1,676	−0.54	4.39	−0.01	−0.54	−0.54	−0.02
Quartile 3 (−0.07, 0.59)	1,583	−0.54	4.63	−0.01	−0.54	−0.54	0.23
Quartile 4 (>0.59)	1,520	−0.54	4.63	0.13	−0.54	−0.54	0.46
Subjective social status							
Quartile 1 (≤5)	1,207	−0.54	4.63	0.16	−0.54	−0.53	0.46
Quartile 2 (6, 7)	2,322	−0.54	4.63	0.02	−0.54	−0.54	0.21
Quartile 3 (8)	1,597	−0.54	3.71	−0.07	−0.54	−0.54	−0.18
Quartile 4 (9, 10)	1,357	−0.54	4.19	−0.10	−0.54	−0.54	−0.18

Note: Max = maximum; Min = minimum.
[a]*Food insecurity scores are standardized to a mean of 0 and a variance of 1.*
[b]*Variables were standardized to a mean of 0 and a variance of 1.*

and with decreasing family income (ranging from −0.29 for adolescents in the lowest income quartile to 0.55 for adolescents in the highest income quartile; Table 1). A similar pattern was observed for subjective social status. Adolescents with a higher subjective social status had lower food insecurity scores (ranging from −0.10 for adolescents with the highest subjective social status to 0.16 for adolescents with the lowest subjective social status). Food insecurity was also greater in adolescents living in areas with higher degrees of community-level inequality (ranging from −0.11 for adolescents in the lowest quartile of inequality to 0.13 for adolescents in the highest quartile). However, the opposite pattern was found for relative deprivation. Higher levels of relative deprivation (i.e., lower family income in relation to others in one's community) were associated with *lower* food insecurity scores (ranging from −0.25 for adolescents in the highest quartile of relative deprivation to 0.36 for adolescents in the lowest quartile).

Pearson correlations between the food insecurity score and other SES indicators showed a significant negative association between food insecurity and parental education, income, relative deprivation, and subjective social status and a significant positive association between food insecurity and community-level inequality.

Associations Between Food Insecurity and Adolescent Mental Disorders

In bivariate models, a higher food insecurity score was associated with a greater odds of any past-year mental disorder (OR 1.2) and a greater odds

TABLE 2 Bivariate Associations (Odds-Ratios [OR]) of Food Insecurity and Socioeconomic Factors With Past-Year *DSM-IV* Mental Disorders in the National Comorbidity Survey Replication Adolescent Supplement (NCS-A)[a] (n = 6,483)

	Any Disorder OR (95% CI)	Mood Disorder OR (95% CI)	Anxiety Disorder OR (95% CI)	Behavior Disorder OR (95% CI)	Substance Disorder OR (95% CI)
Parental education					
Less than HS	1.5* (1.1–2.0)	1.0 (0.7–1.6)	1.7* (1.3–2.2)	1.5 (0.9–2.4)	1.5 (0.8–2.8)
HS	1.2* (1.0–1.5)	1.2 (1.0–1.6)	1.2 (1.0–1.5)	1.3* (1.0–1.6)	1.0 (0.7–1.6)
Some college	1.4* (1.2–1.7)	1.4* (1.1–1.8)	1.4* (1.1–1.7)	1.5* (1.1–1.9)	1.7* (1.1–2.6)
χ^2_3 (*p*)	17.3 (<.001)*	9.4 (.025)*	18.9 (<.001)*	10.0 (.019)	7.7 (.052)
Household income					
<1.5 × poverty line	1.1 (0.8–1.6)	1.0 (0.6–1.6)	1.3 (1.0–1.8)	1.2 (0.8–1.7)	0.8 (0.4–1.4)
>1.5–< 3 × poverty line	1.2 (1.0–1.5)	1.1 (0.8–1.4)	1.3 (1.0–1.7)	1.4* (1.0–1.9)	0.8 (0.4–1.4)
>3–<6 × poverty line	1.1 (0.9–1.3)	1.0 (0.8–1.2)	1.1 (0.8–1.5)	1.2 (0.9–1.5)	0.9 (0.6–1.4)
χ^2_3 (*p*)	2.8 (.420)	0.6 (.910)	4.8 (.190)	5.5 (.140)	1.3 (.740)
Relative deprivation[b]	1.0 (0.9–1.0)	1.0 (0.9–1.0)	1.0 (0.9–1.0)	1.0 (0.9–1.0)	1.0 (0.9–1.0)
Community-level inequality[b]	1.0 (0.9–1.0)	1.0 (0.9–1.1)	1.0 (0.9–1.1)	1.0 (0.9–1.1)	0.9* (0.8–1.0)
Subjective social status[b]	0.8* (0.7–0.8)	0.8* (0.7–0.8)	0.8* (0.8–0.9)	0.7* (0.7–0.8)	0.7* (0.6–0.8)
Food insecurity[c]	1.2* (1.1–1.2)	1.2* (1.0–1.3)	1.2* (1.1–1.2)	1.2* (1.2–1.3)	1.2* (1.0–1.3)

Note: HS = high school.
[a]*Models control for age, sex, and race/ethnicity.*
[b]*Variables are standardized to have a mean of 0 and a standard deviation of 1.*
[c]*Higher scores indicate greater food insecurity.*
*$p < .05$.

of past-year mood, anxiety, behavior, and substance disorders (OR 1.2 for all disorder classes; Table 2). The odds of any past-year mental disorder were also increased for adolescents whose parents had less than a college degree (OR 1.2–1.5) and for adolescents who had lower subjective social status (OR 0.8). Specifically, low parental education was significantly associated with past-year mood, anxiety, and behavior disorders, and low subjective social status was associated with increased odds of all four disorder classes. Greater community-level inequality was associated with lower odds of substance disorders (OR 0.9).

In the fully adjusted multivariate model controlling for all SES indicators simultaneously, higher food insecurity remained significantly associated with increased odds of any past-year mental disorder (OR 1.1) and with increased odds of mood, anxiety, behavior, and substance disorders (OR 1.1–1.2; Table 3). Subjective social status was also associated with past-year mental disorders in this model, such that adolescents with a lower perceived status had higher odds of any mental disorder and each of the four disorder classes (OR 0.7–0.8). Parental education was associated with any past-year mental disorder and with anxiety disorders.

To evaluate whether the associations of food insecurity with adolescent disorders simply reflected a relation between extreme poverty and mental disorders, a dummy variable was added to the model indicating whether the respondent's family had income in the bottom 5% of the distribution relative to the poverty line based on family size. The authors also examined a model that included a continuous variable for family income relative to the poverty line based on family size and a separate model that also included a squared term for this variable to capture any nonlinear associations between family income and adolescent disorders. The authors added controls for a wide range of childhood adversities that have been previously found to be significantly associated with disorder onset in this sample: parent psychopathology, child maltreatment, and family violence.[34] The magnitude of the associations between food insecurity and mental

TABLE 3 Multivariate Associations (Odds-Ratios [OR]) of Food Insecurity and Socioeconomic Factors With Past-Year *DSM-IV* Mental Disorders in the National Comorbidity Survey Replication Adolescent Supplement (NCS-A)[a] (n = 6,483)

	Any Disorder OR (95% CI)	Mood Disorder OR (95% CI)	Anxiety Disorder OR (95% CI)	Behavior Disorder OR (95% CI)	Substance Disorder OR (95% CI)
Parental education					
Less than HS	1.3 (0.9–1.8)	0.9 (0.6–1.4)	1.5* (1.1–2.0)	1.3 (0.8–2.1)	1.5 (0.8–2.7)
HS	1.1 (0.9–1.4)	1.2 (0.9–1.5)	1.1 (0.9–1.4)	1.2 (0.9–1.5)	1.1 (0.7–1.7)
Some college	1.3* (1.1–1.6)	1.3* (1.1–1.7)	1.3* (1.0–1.6)	1.3* (1.0–1.7)	1.6* (1.0–2.6)
χ^2_3 (*p*)	8.1 (.044)	6.9 (0.07)	8.1 (.045)	4.0 (.26)	6.5 (.09)
Household income					
<1.5× poverty line	0.8 (0.6–1.1)	0.7 (0.4–1.1)	1.1 (0.8–1.5)	0.8 (0.5–1.2)	0.5 (0.3–0.9)
>1.5–<3× poverty line	1.0 (0.8–1.2)	0.8 (0.6–1.1)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	0.5 (0.3–1.1)
>3–<6× poverty line	1.0 (0.8–1.1)	0.8 (0.6–1.0)	1.0 (0.8–1.4)	1.0 (0.8–1.3)	0.8 (0.5–1.2)
χ^2_3 (*p*)	1.7 (.65)	4.3 (.23)	0.6 (.90)	4.1 (.25)	6.0 (.11)
Relative deprivation[b]	1.0 (1.0–1.0)	0.9* (0.9–1.0)	1.0 (1.0–1.0)	1.0 (0.9–1.0)	0.9 (0.9–1.0)
Community-level inequality[b]	1.0 (0.9–1.0)	1.0 (0.9–1.1)	1.0 (0.9–1.1)	1.0 (0.9–1.1)	0.9 (0.8–1.0)
Subjective social status[b]	0.8* (0.7–0.9)	0.8* (0.7–0.9)	0.9* (0.8–0.9)	0.8* (0.7–0.8)	0.7* (0.6–0.8)
Food insecurity[c]	1.1* (1.1–1.2)	1.1* (1.0–1.2)	1.1* (1.0–1.2)	1.2* (1.1–1.3)	1.2* (1.0–1.3)

Note: HS = high school.
[a]*Models control for age, sex, and race/ethnicity.*
[b]*Variables are standardized to have a mean of 0 and a standard deviation of 1.*
[c]*Higher scores indicate greater food insecurity.*
*$p < .05$.

disorders was unchanged in models controlling for extreme poverty and continuous family income and minimally attenuated (5.4%–10.3%) when controlling for childhood adversities (detailed results not shown but available on request).

Interactions Between Food Insecurity and SES

The authors examined the interactions between food insecurity and other SES indicators in predicting past-year mental disorder (detailed results not shown but available on request). The only significant interactions were between food insecurity and family income ($\chi^2_3 = 11.8$, $p = .008$) and relative deprivation ($\chi^2_1 = 7.8$, $p = .005$) in predicting past-year mood disorders. The association between food insecurity and mood disorders was stronger for adolescents with a low family income (OR 1.2–1.6 for adolescents in the lowest three quartiles compared with adolescents in the highest quartile) and was stronger for adolescents with higher levels of relative deprivation (OR 1.1).

DISCUSSION

Children and adolescents are at greater risk of experiencing poverty than any other segment of the U.S. population, and the dramatic increase in youth poverty over the past decade[35] raises concerns about the implications of this trend for child health and development. Deprivation in resources needed to sustain health, including food, shelter, clothing, and access to health care, is one of the primary pathways through which poverty may have an adverse impact on health.[10,13,36] The present findings suggest that, indeed, the lack of access to reliable and sufficient amounts of food is associated with increases in adolescent mental disorders. These findings are concerning because recent estimates have suggested that more than 20% of U.S. families with children experience at least some degree of food insecurity.[37]

Food insecurity is socially patterned in the NCS-A such that adolescents in families with lower parental education and income are more likely to have high levels of food insecurity than adolescents from families with higher education and income. This finding suggests that food insecurity is a marker of material deprivation. Previous studies also have found that food insecurity is inversely related to income and occurs more commonly in families experiencing poverty.[6,15] Further, food insecurity is higher in

adolescents who live in communities characterized by a greater inequality in income distribution. A potential explanation for this finding is that high levels of income inequality result in lower investment in social programs and human capital,[38] which may decrease local funding for programs aimed at alleviating food insecurity, such as food banks. An alternative interpretation is that families living in unequal neighborhoods spend a larger proportion of household income on housing and consumer goods to maintain the material standard of living that is typical for their community,[39] leaving less disposable income for food. If this is true, one would expect to see high levels of food insecurity in families experiencing greater relative deprivation (lower income compared with others in their community). However, the opposite relation was found between food insecurity and relative deprivation, such that higher relative deprivation was associated with lower food insecurity. This suggests that disinvestment in social programs may be a more likely explanation for the high levels of food insecurity observed in unequal communities.

Food insecurity was associated with adolescent mood, anxiety, behavior, and substance disorders after controlling for numerous other indicators of SES, such that a one standard deviation increase in food insecurity was associated with 14% greater odds of past-year mental disorder in adolescents. Importantly, food insecurity was more strongly related to adolescent mental disorders than traditional SES measurements, including parental education and income. The associations between food insecurity and adolescent mental disorders were not attenuated even when extreme poverty was controlled, suggesting that this aspect of material deprivation reflects a form of economic strain that has more pernicious consequences for adolescent mental health than simply living in a family with a very low income. Prior research has indicated that difficulty paying for the necessities of living is associated with poor physical health over and above the effects of income.[13] Food insecurity was associated with mood disorders more strongly in adolescents living in families with low household income and high relative deprivation, consistent with prior research reporting the strongest associations between food insecurity and adverse physical health in low-income families.[16] Together these findings suggest that extreme material deprivation not only is associated with behavioral problems in children,[19–21] but also may be a determinant of mental disorders. The authors cannot determine in this study whether inadequate access to food specifically is related to mental disorders or whether these findings simply reflect an association of deprivation in access to basic necessities more broadly with adolescent psychopathology. This issue warrants further investigation in future research.

The authors' previous study in this sample showed that adolescents' perceptions of their social status were associated strongly with mental disorders.[12] In the final model of the present analysis, food insecurity and subjective social status were associated with past-year mood, anxiety, behavior, and substance disorders. Together these findings suggest two very different pathways through which SES might influence adolescent mental health: one that operates through material deprivation and another that operates through individual-level perceptions of status.

These findings highlight the importance of identifying the mechanisms linking food insecurity to adolescent mental health. Food insecurity likely represents a source of chronic stress for parents trying to provide basic necessities for their children and has been associated with parental mental health problems, including depression.[20,40] Food insecurity therefore may influence child mental health through pathways related to parenting quality. Indeed, evidence has suggested that food insecurity is associated with less sensitive and responsive parenting.[40] Food insecurity may also increase the risk for youth mental disorders through more direct pathways. The hypothalamic–pituitary–adrenal (HPA) axis plays a central role in regulating appetite and energy balance,[16] and hypothalamic–pituitary–adrenal (HPA) axis dysregulation has been implicated in the pathophysiology of numerous youth mental disorders. Experimental evidence has suggested that a low caloric intake is associated with heightened emotional and hypothalamic-pituitary-adrenal (HPA) axis reactivity to stress,[41] and observational studies have reported associations of caloric restriction with increased cortisol secretion and perceived stress.[42] Heightened emotional and physiologic reactivity in turn has been associated prospectively with the onset of mental disorders.[43]

The study findings should be interpreted in light of several noteworthy limitations. First, the NCS-A was conducted from 2001 through 2004. In the intervening decade, child poverty has increased dramatically and the number of youths

experiencing food insecurity has likely increased. Although the authors have little reason to believe that the relation between food insecurity and mental health has changed over this period, the present findings warrant replication in samples collected more recently. Second, the sampling design may have resulted in an under-representation of adolescents who were homeless, did not speak English, and did not attend school. The prevalence of food insecurity[6,15] and mental disorders[44] is likely higher in these segments of the population, which may have attenuated the associations between food insecurity and mental disorders in the present analysis. Third, the NCS-A is a cross-sectional study, which raises concerns about reverse causality. Reverse causality is a particular concern when interpreting the associations of mental disorders with subjective social status. Parents also may be less likely to have stable employment in families where an adolescent has a severe mental disorder or having a child with a mental disorder may result in expenses that strain resources that would otherwise be available to purchase food, increasing the risk of food insecurity. Perhaps the most noteworthy limitation is the authors' inability to determine whether food insecurity is a risk factor for adolescent mental disorders or a risk marker. Food insecurity may simply be a marker of other types of material deprivation, such as a lack of warm clothing in the winter or inadequate access to health care. These possibilities remain to be evaluated in future studies.

The inability to reliably access adequate amounts of food to meet basic needs is associated with a wide range of adolescent mental disorders. Given the dramatic increases in child poverty in the past decade, these findings argue for expanding programs aimed at alleviating hunger in children and economic strain in families. Consistent evidence has suggested that the Food Stamp Program, the Special Supplemental Food Program for Women, Infants, and Children, and school nutrition programs are successful at improving access to food and nutritional outcomes for children,[45] although numerous barriers impede the use of these benefits by eligible families. The present study suggests that if a lack of access to food is specifically associated with adolescent mental disorders, then these programs may also have a meaningful impact on youth mental health, underscoring the importance of increasing their reach and uptake to assist families struggling to provide adequate food for their children. &

CG Clinical Guidance

- Food insecurity is associated with mood, anxiety, behavior, and substance disorders above and beyond the effects of other measures of SES in adolescents, suggesting that it may be clinically useful to routinely inquire about hunger in child and adolescent patients.
- Identifying children and adolescents in clinical care who experience recurrent hunger can be accomplished with a brief verbal assessment at each session.
- Routinely assessing whether children and adolescents in care are experiencing food insecurity provides the opportunity to link families to social services aimed at alleviating hunger and facilitating consistent access to food.

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