



Original article

Food Insecurity and the Burden of Health-Related Social Problems in an Urban Youth Population



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A B S T R A C T

Purpose: Our study objectives were to (1) determine the prevalence of food insecurity; (2) examine the association between presence and level of food insecurity with other health-related social problems; and (3) assess the predictive values of a two-item food insecurity screen in an urban youth population.

Methods: Patients aged 15–25 years completed a Web-based screening tool. Validated questions were used to identify problems in seven health-related social domains (food insecurity, health care access, education, housing, income insecurity, substance use, and intimate partner violence). Chi-square and Kruskal-Wallis tests and logistic regression models controlled for age, sex, and race/ethnicity, assessed the association between food insecurity and health-related social problems. Predictive values of a two-item food insecurity screen compared with the United States Department of Agriculture Food Security Survey were calculated.

Results: Among 400 patients (mean age 18 years; 69.2% female; 54.6% black; 58.9% public insurance), 32.5% screened positive for food insecurity. Increasing food insecurity level was significantly associated with cumulative burden of social problems ($p < .001$). In adjusted analyses, food insecurity was associated with problems with health care access (aOR = 2.6, 95% confidence interval [CI] 1.7–4.1), education (aOR = 2.8, 95% CI 1.6–5.1), housing (aOR = 2.8, 95% CI 1.8–4.4), income insecurity (aOR = 2.3, 95% CI 1.2–4.5), and substance use (aOR = 2.5, 95% CI 1.5–4.3). The two-item screen demonstrated sensitivity of 88.5% and specificity of 84.1%.

Conclusions: One-third of youth in sample experienced food insecurity, which was strongly associated with presence of other health-related social problems. The two-item screen effectively detected food insecurity. Food insecurity screening may lead to identification of other health-related social problems that when addressed early may improve adolescent health.

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IMPLICATIONS AND
CONTRIBUTION

Food insecurity is a major public health problem that negatively impacts youth health. This study demonstrates that food insecure youth have significantly greater odds of additional social problems with health care access, education, housing, income insecurity, and substance use. A two-item food insecurity questionnaire can help providers effectively screen youth.

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Food insecurity, a serious public health problem, is defined by the US Department of Agriculture (USDA) as uncertainty of having, or inability to acquire, enough food to meet the requirements of all members of a household because of financial or resource constraint [1]. It affected 14.3% of all U.S. households

and 19.5% of households with children under the age of 18 years [2] in 2013. Food insecurity is associated with adverse health and developmental outcomes in youth including poor academic performance, school behavioral difficulties and suspensions [3], increased risk for overweight or obesity [4], less physical activity [5], increased odds of mood, anxiety, behavior and substance disorders [6], and decreased access to health care [7].

The USDA has published three validated food security surveys (USDA-FSS) [8], including one specifically for adolescents [9], to measure food security on a continuum: high, marginal, low, and very low [1]. Food insecurity is characterized by having low or very low food security. Because the length and complex scoring algorithms of USDA-FSS impedes their use as routine clinical tools, Hager et al. developed a two-item screen to identify low-income families at risk for food insecurity. They found that an affirmative response to either item had a sensitivity of 97.0% and specificity of 83.0% [10] when tested among adult caregivers of young children (≤ 36 months). To our knowledge, validity of this two-item screen has not been tested among adolescents and young adults.

Food insecurity is one of many social problems, including income insecurity, health care access barriers, and homelessness, which adversely affect health [11]. Poverty underlies many of these social problems and patients often have multiple needs [11,12]. The American Academy of Pediatrics has recommended that pediatricians become familiar with government and community-based services that assist families with these unmet social and economic needs [13]. Despite the high prevalence of social problems among adolescents and young adult patients (“youth” here forward) that negatively impact patients’ health, there is limited screening for these issues and lack of resource referrals to address them [11,12,14].

The objectives of this study were to evaluate food insecurity among youth, specifically (1) to determine the prevalence and severity of food insecurity; (2) to examine the association between level of food insecurity and other health-related social problems; and (3) to assess the predictive values of a two-item food insecurity screen as compared with the USDA-FSS in an urban youth primary care clinic population.

Patients and Methods

Participants and study design

The present work was a secondary data analysis of information collected as part of a larger study that used a Web-based system known as The Online Advocate to screen and provide referrals for a range of health-related social problems [14,15]. Four hundred one participants from an urban hospital-based Adolescent/Young Adult Medicine Program were selected by convenience sampling to participate in The Online Advocate study. Recruitment occurred between December 2008 and August 2010. Food security data were available for 400 of these 401 total participants; this study analyzes data from these 400 participants.

Inclusion criteria included ages 15–25 years, self-reported ability to read and speak English, living in urban Boston and ability to give consent or assent. Exclusion criteria included participants noted to have significant developmental delays or disabilities that would prevent comprehension of the survey or emotional and/or medical instability at time of visit. Recruitment followed the general research study recruitment protocol in the

Adolescent/Young Adult Medicine Program. Parental consent for youth under age 18 years was not required given the minimal risk nature of the survey and questions consistent with those encountered in routine clinical care. The Hospital Institutional Review Board approved this study.

Instruments and measures

The Online Advocate. The development of The Online Advocate has been previously published and is summarized in brief here [11,14,15]. It is a self-administered, Web-based system that screens for and identifies social problems in multiple domains. The questionnaire includes 130 questions, written at a fifth or sixth grade comprehension level on the Flesch-Kincaid readability test, and uses branched logic to determine question order; therefore, the actual number of questions answered varied depending on participant responses and ranged from 74–121. Participants could skip questions, and confidentiality was emphasized throughout. Participants took an average of 25 minutes to complete the survey, including selecting referrals to social services. A copy of this questionnaire is available on request.

Demographic data. Demographic data collected included age, gender, race/ethnicity, educational attainment, employment status, and type of health insurance.

Food insecurity. To measure food insecurity, participants were administered the appropriate validated USDA-FSS based on age and parental status. The 18-item US Household Food Security Survey Module was answered by patients aged 18–25 years who self-identified as being a parent. The 10-item Adult Food Security Survey Module [8] was completed by patients aged 18–25 years who did not self-identify as being a parent. Finally, the 9-item Self-Administered Food Security Survey Module for Youths Ages 12–17 years [9] was completed by participants aged 15–17 years. Affirmative answers to items were summed to produce a total score. USDA scoring algorithms were used for each USDA-FSS, and participant food security status was determined based on USDA 2006 definitions [16] (Table 1). Food secure youth were classified as having high (i.e., no reported food access problems or limitations) or marginal (i.e., anxiety over food sufficiency or shortage of food in the house but little or no indications of changes in diet or food intake) food security. Food insecure youth were classified as having low (i.e., reports of

Table 1
USDA-FSS scoring algorithms and food security classification

| Number of affirmative responses on USDA food security surveys (USDA-FSS) ^a | | | Food security classification |
|---|--|--|------------------------------|
| US Household out of 18 questions (≥18 years with children) | Adult out of 10 questions (≥18 years without children) | Youth out of 9 questions (12–17 years) | Category |
| 0 | 0 | 0 | High |
| 1–2 | 1–2 | 1 | Marginal |
| 3–7 | 3–5 | 2–5 | Low |
| 9–18 | 6–10 | 6–9 | Very low |
| Total score = number of affirmative responses | | | |

USDA = United States Department of Agriculture.

^a Participants answered the appropriate USDA-FSS based on age and parental status.

reduced quality, desirability or variety of diet, but little or no indication of changes in diet or food intake) and very low (i.e., reports of multiple indications of disrupted eating patterns and reduced food intake) food security.

The Hager et al. two-item food insecurity screen [10] was separately used to determine food security status. Because this screen is based on two items that exist in all three versions of the USDA-FSS, we abstracted these questions during data analysis. These two items are as follows: (1) “Within the past 12 months we worried that our food would run out before we got money to buy more”; (2) “Within the past 12 months the food we bought just did not last and we did not have money to get more.” Answers included, “often true,” “sometimes true,” or “never true.” Similar to the Hager study, patients were considered food insecure if they answered “often true” or “sometimes true” to either question, and considered food secure if they answered “never true” to both questions.

Health-related social problem domains. In addition to food insecurity, participants were screened for six additional health-related social domains: (1) health care access; (2) education; (3) housing; (4) income insecurity; (5) substance use; and (6) intimate partner violence. The domains comprised a series of one to four potential problems designated by a multidisciplinary team before the system launch. Within the health care access domain, problems included no health insurance, unable to receive prescriptions, unable to receive medical care, and unmet dental needs. Within the education domain, problems included unmet learning disability and dropped out of high school. Within the housing domain, problems included homeless, utilities shut off, and structural problems such as leaking roof, rodent infestation or nonfunctional plumbing. Income insecurity domain was characterized by being out of work and trying to find a job. Within the substance use domain, problems included a positive CRAFFT [17] screening tool for high-risk alcohol and drug use disorders and tobacco use. Finally, intimate partner violence domain was characterized by physical, verbal, or sexual abuse in the past 12 months. Previously validated questions and scales, including questions from national surveys, such as the Youth Risk Behavior Survey, the Growing Up Today Study, and the Adolescent Longitudinal Study of Health, were used to identify the specific problems within each domain [18–20]. For example, the CRAFFT screen identified problematic substance use [17], and questions from the American Housing Survey identified structural housing problems [21].

Data analysis

Descriptive statistics characterized the population with respect to demographics, food security, and social problems. Chi-square and Fisher’s exact test evaluated the association between food security classification and demographics, as well as the association with each health-related social problem domain. The Kruskal-Wallis test evaluated the association between food security classification and the total burden of health-related social problems. Logistic regression models, controlled for age, gender, and race/ethnicity, tested the association between level of food security and each social problem domain. Separate logistic models were run for the four-category USDA-FSS classification and the two-item food insecurity screen. We calculated sensitivity, specificity, negative predictive value (NPV) and positive

predictive value (PPV) to compare the two-item food insecurity screen to the USDA-FSS, using the USDA-FSS as the gold standard.

Results

Study population

A total of 400 participants consented to participate and completed the questionnaire. These participants did not statistically differ from the primary care clinic population overall with regard to age, gender, and race/ethnicity, or insurance status. The mean age was 18 years. The sample was predominantly female (69.2%) and black (54.6%) and the majority (58.9%) on public insurance (Table 2).

Prevalence and level of food insecurity

Overall, 211 participants (52.8%) had high food security, 59 (14.8%) had marginal food security, 70 (17.5%) had low food security, and 60 (15.0%) had very low food security. Using the USDA definition of food insecurity as those with low or very low food security, 32.5% were food insecure. Although no significant differences in level of food security occurred by gender or race/ethnicity, the distribution of food security classifications differed by age group ($p = .01$). Although the proportion of participants in the high and marginal food security categories were similar between 15–17 year olds and 18–25 year olds, younger participants were more likely to classify as low food security and older participants were more likely to classify as very low food security. Table 2 shows demographics by level of food security.

Food insecurity and health-related social problems

In unadjusted analyses, increasing level of food insecurity was significantly associated with the total number of health-related social problems ($p < .001$); high and marginal food secure participants screened positive for a median of one problem in comparison with two and three problems in participants with low and very low food security, respectively. Increasing level of food insecurity was associated with problems with health care access ($p < .001$), education ($p = .003$), housing ($p < .001$), income insecurity ($p = .03$), and substance use ($p < .001$) (Figure 1).

Similarly, in adjusted analyses, food insecurity was significantly associated with the presence of problems with health care access, education, housing, income insecurity, and substance use. Interpersonal violence was not significantly associated (Table 3).

Two-item food insecurity screen and predictive values

Overall, 158 (39.5%) participants were identified as food insecure by the two-item screen. Using the USDA-FSS as the gold standard, the two-item food insecurity screen demonstrated sensitivity of 88.5% and specificity 84.1%. Among those classified as food insecure on the two-item screener, 72.8% were identified as food insecure on the USDA-FSS (PPV). Among those who did not screen positive for food insecurity on the two-item screener, 93.8% also did not meet criteria for food insecurity on the USDA survey (NPV) (Table 4).

The total number of health-related social problems was significantly associated with a positive two-item food insecurity screen; food secure participants had a median of 1 problem while those who were food insecure had a median of three problems.

Table 2

Demographic characteristics by level of food security

| Characteristic | Total (N = 400), n (%) | High food security (N = 211), n (% of row) | Marginal food security (N = 59), n (% of row) | Low food security (N = 70), n (% of row) | Very low food security (N = 60), n (% of row) | p value |
|---|---------------------------|--|---|--|---|------------------|
| Age (mean years \pm SD): 18 years \pm 2 | | | | | | .01 |
| 15–17 years | 172 (43) | 92 (54) | 22 (13) | 40 (23) | 18 (10) | |
| 18–25 years | 228 (57) | 119 (53) | 37 (16) | 30 (13) | 42 (18) | |
| Gender | | | | | | .88 |
| Male | 123 (31) | 63 (51) | 17 (14) | 22 (18) | 21 (17) | |
| Female | 276 (69) | 148 (54) | 41 (15) | 48 (17) | 39 (14) | |
| Race/ethnicity | | | | | | .16 |
| White | 35 (9) | 22 (63) | 4 (11) | 6 (17) | 3 (9) | |
| Black | 216 (55) | 108 (50) | 32 (15) | 36 (17) | 40 (18) | |
| Hispanic | 117 (29) | 61 (52) | 21 (18) | 22 (19) | 13 (11) | |
| Asian/other | 27 (6) | 16 (59) | 2 (7) | 5 (19) | 4 (15) | |
| Educational attainment | | | | | | .05 |
| In high school | 193 (48) | 106 (55) | 29 (15) | 35 (18) | 23 (12) | |
| Did not complete high school | 40 (10) | 15 (38) | 4 (10) | 12 (30) | 9 (22) | |
| High school diploma/GED | 38 (10) | 16 (42) | 4 (10) | 9 (24) | 9 (24) | |
| Completed some college or vocational degree | 128 (32) | 73 (57) | 22 (17) | 14 (11) | 19 (15) | |
| Employment status | | | | | | .04 |
| Student only | 208 (57) | 102 (49) | 39 (19) | 35 (17) | 32 (15) | |
| Employed | 90 (25) | 55 (61) | 8 (9) | 16 (18) | 11 (12) | |
| Unemployed | 49 (14) | 17 (35) | 7 (14) | 13 (27) | 12 (24) | |
| Unable to work | 15 (4) | 5 (33) | 3 (20) | 2 (13) | 5 (33) | |
| Insurance type | | | | | | .04 ^a |
| Private | 107 (36) | 66 (62) | 13 (12) | 15 (14) | 13 (12) | |
| Public | 174 (59) | 74 (43) | 27 (15) | 36 (21) | 37 (21) | |
| Self-pay | 14 (5) | 5 (36) | 2 (14) | 5 (36) | 2 (14) | |

GED = General Education Development; SD = standard deviation.

^a Fisher's exact test used instead of Chi-square test because of low expected cell counts.

In adjusted analyses, similar to the USDA-FSS, food insecurity by the two-item screen was significantly associated with the presence of health-related social problems including health care access, education, housing, income insecurity, and substance use (Table 3).

Discussion

This study found that, in a clinic-based population of urban youth, one-third experienced food insecurity. Food insecure youth were more likely to experience other health-related social problems as compared with food secure youth. As severity of food insecurity increased, youth had a significantly higher associated risk of additional social problems. Screening for food insecurity not only identifies an important social determinant of health but also indicates which patients may simultaneously experience overlap of multiple health-related social problems.

There are limited data about the prevalence of food insecurity in youth. The USDA reports that in the United States in 2013, 9.0% of children under age 18 years experienced low food security and .9% experienced very low food security [22]. However, these are national data about children of all ages. Percentages in our study are likely higher because the study population was urban, predominantly minority, and represents an older population. Food insecurity rates among young adults are unknown as the USDA does not report food insecurity among individuals by age groups.

USDA national data, as well as other research studies of food insecurity among children and adolescents [23,24], are collected from report of adult parents/caregivers, and are not based on youth self-report. Parental perception may not reflect youth's experience with food insecurity as adolescents and young adults may sacrifice their own food for the benefit of other family members. Furthermore, adolescents may experience food

insecurity and hunger differently from younger siblings, given that adolescents have increased metabolic demands during a time of rapid physiological change and development. Although previous studies have not evaluated youth self-report of food insecurity, it has been demonstrated that children and adolescents are willing and able to report on their own experiences of food insecurity and may take responsibility for managing food resources in the home [25]. To our knowledge, this is the first study of food insecurity from youth self-report using USDA-FSS.

Young adults aged 18–25 years were more likely to experience very low food security than youth aged 15–17 years. As young adulthood brings more responsibilities in regards to education and jobs, young adults may have access to fewer nutrition resources as compared with youth <18 years. Young adults have unique health care issues: they have higher rates of morbidity and mortality as compared with adolescents including suicide, homicide, motor vehicle crashes, substance use, and sexually transmitted infections [26,27]. Despite this, young adults have the lowest health insurance coverage rate of any age group [28,29] and low preventive health care utilization [30]. Therefore, young adults may be at particularly high risk for food insecurity and other social problems given their increased responsibilities for providing for themselves and may lack access to social resource referrals if disconnected from preventive health care.

Food insecurity and burden of health-related social problems

Youth with food insecurity experienced a significantly higher cumulative burden of social problems than food secure youth. In our population, increasing severity of food insecurity was associated with significantly higher rates of problems with health care access, education, housing, income insecurity, and

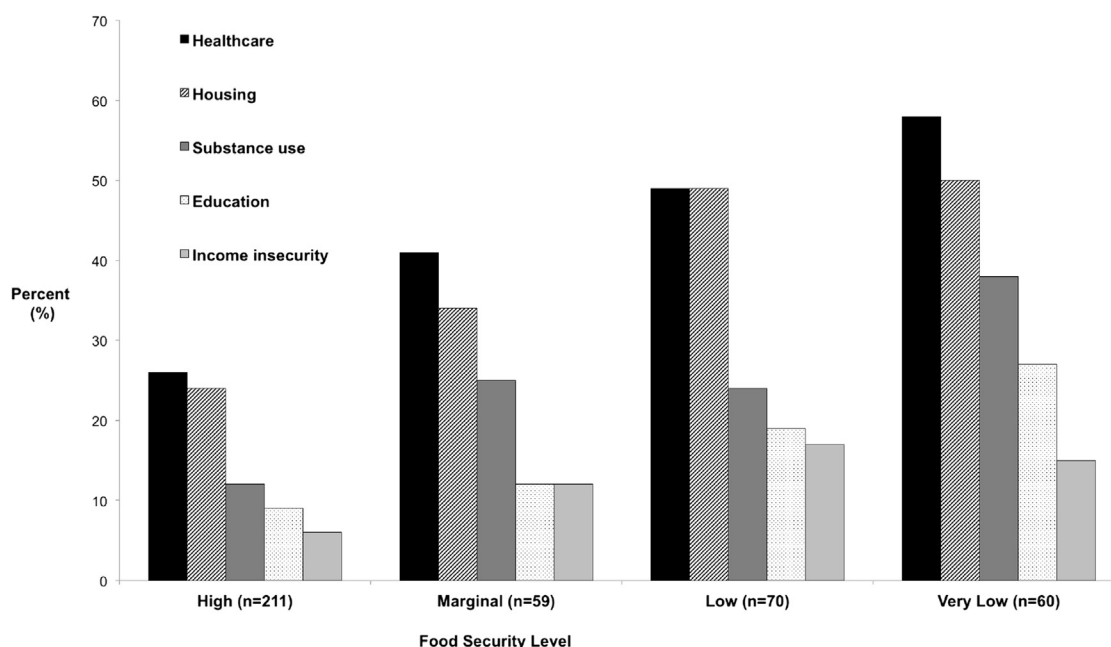


Figure 1. Burden of health-related social problems by level of food security. $p < .001$ for health care, housing, and substance use; $p = .003$ for education; $p = .03$ for income security; and interpersonal violence not found to be significant. Unadjusted analyses.

substance use. Although there is only modest research to date evaluating the association between food insecurity and other social problems, the link between food insecurity and poverty has been well established [31,32]. Poverty underlies many social problems, and resource needs typically do not occur in isolation, as a household budget is stretched to pay for housing, heat, food, clothing, and health care. In a national survey of 12,746 children and adolescents from low-income households, Ma et al. found that 43% of families with mild-to-moderate food insecurity, and 62% of families with severe food insecurity also had housing instability; additionally, food insecure youth in these families had poor health care access [7]. Several studies have demonstrated an association between food insecurity and adverse academic performance, social skills, and cognitive development in school-aged children [3,33]. Additionally, studies have demonstrated that subsidized housing decreases odds of household food insecurity [34] and poor nutrition among children of low-income families [35]. Finally, in a large sample of adolescents,

McLaughlin et al. demonstrated that food insecurity is associated with increased odds of substance use disorders in addition to other mood, anxiety, and behavior disorders [6]. To our knowledge, this is the first study to examine food insecurity and the intersection with multiple social needs simultaneously in a youth population.

Two-item food insecurity screen

This is the first study to evaluate the two-item food insecurity screen in an adolescent and young adult population, as it was originally validated to detect household food insecurity among families with children <3 years of age, based on caregiver report [10]. The sensitivity in our study was less than the Hager et al. study (88.5% vs. 97.0%) and specificity was comparable (84.1% vs. 83.0%). In our population, the two-item screen had a high NPV (93.8%) indicating that participants who screened negative by two-item screen were unlikely to have food insecurity, and a

Table 3

Logistic regression results testing the association of food security classification and presence of a problem in a social domain

| Domain | USDA-FSS | | | | | | Two-item food insecurity screen | | | |
|------------------------|--|--|----------|--|----------|--|---------------------------------|---|---|----------|
| | High food security (n = 211 [53%]), aOR (95% CI) | Marginal food security (n = 59 [15%]), aOR (95% CI) | <i>p</i> | Low food security (n = 70 [17%]), aOR (95% CI) | <i>p</i> | Very low food security (n = 60 [15%]), aOR (95% CI) | <i>p</i> | Food security (n = 270 [68%]), aOR (95% CI) | Food insecurity (n = 130 [32%]), aOR (95% CI) | <i>p</i> |
| Health care access | 1.0 | 2.0 (1.1–3.7) | .03 | 2.7 (1.5–4.8) | <.001 | 3.7 (2.0–6.9) | <.001 | 1.0 | 2.6 (1.7–4.1) | <.001 |
| Education | 1.0 | 1.4 (.6–3.6) | .48 | 2.4 (1.1–5.3) | .03 | 3.9 (1.8–8.4) | <.01 | 1.0 | 2.8 (1.6–5.1) | <.001 |
| Housing | 1.0 | 1.6 (.9–3.1) | .13 | 3.1 (1.8–5.5) | <.001 | 3.3 (1.8–6.0) | <.001 | 1.0 | 2.8 (1.8–4.4) | <.001 |
| Income insecurity | 1.0 | 1.8 (.6–4.9) | .28 | 3.2 (1.4–7.7) | .01 | 2.1 (.8–5.4) | .11 | 1.0 | 2.3 (1.2–4.5) | .02 |
| Substance use | 1.0 | 2.9 (1.4–6.1) | .01 | 2.6 (1.3–5.3) | .01 | 4.5 (2.3–9.2) | <.001 | 1.0 | 2.5 (1.5–4.3) | <.001 |
| Interpersonal violence | 1.0 | 1.0 (.4–2.3) | .98 | 1.7 (.9–3.4) | .13 | 1.4 (.6–3.0) | .42 | 1.0 | 1.6 (.9–2.7) | .12 |

Adjusted for age, gender, and race.

Models were run examining USDA-FSS food security classification (high, marginal, low, and very low) and the two-item food insecurity screen.

CI = confidence interval; USDA-FSS = United States Department of Agriculture Food Security Survey.

Table 4

Cross-tabulation of the USDA-FSS and two-item food insecurity screen in identifying food insecure participants

| | Identified by USDA-FSS, n (%) | Not identified by USD-FSS, n (%) | Total, n (%) |
|---|-------------------------------------|--|-----------------|
| Identified by the two-item FI screen | 115 (88.5) | 43 (15.9) | 158 (39.5) |
| Not identified by the Two-item FI screen | 15 (11.5) | 227 (84.1) | 242 (60.5) |
| Total | 130 (32.5) | 270 (67.5) | 400 (100) |

Sensitivity: 88.5%; specificity: 84.1%; positive predictive value: 72.8%; negative predictive value: 93.8%.

FI = food insecurity; USDA-FSS = United States Department of Agriculture Food Security Survey.

moderate PPV (72.8%), indicating that patients who screen positive for food insecurity on the two-item screen may benefit from a more extensive questionnaire to determine the presence and severity of food insecurity. Interestingly, because the two-item screening questions both relate to household money running out, it is possible that youth are not as aware as their parents of household finances, leading to a lower sensitivity rate in our study compared with the Hager et al. study. Similar to the USDA-FSS, the two-item food insecurity screen effectively detected patients with multiple social problems in addition to food insecurity.

There are several limitations to this study. The data were collected in one urban health care setting with a moderate proportion of minority youth on public insurance, and thus, may not be generalizable to other youth populations or health care settings. These data also reflect patients who presented for medical care and agreed to participate in the study. Youth who do not seek medical care may have even higher rates of food insecurity and other social problems. Youth from suburban settings with a higher socioeconomic status are likely to have lower prevalence of food insecurity; further, those from rural settings may have a unique food insecurity prevalence. Furthermore, the exclusion of non-English speaking youth in our study may have contributed to an underestimation of food insecurity among our primary care population, as immigrant youth may have higher rates of food insecurity than nonimmigrant youth. In addition, the youth needed to respond to questions about past experiences and thus recall bias may affect answers.

This study has several strengths. We used a Web-based interface, which previous studies have demonstrated are more honestly answered by youth than in-person interviews and paper testing [36,37]. Our questionnaire also used multiple validated screens and measures to identify food insecurity as well as multiple other social problems. Overall, youth populations have not been well studied, and to our knowledge, this is the first study to explore youth self-report and to evaluate the use of the two-item food insecurity screen in youth.

Food insecurity is prevalent among urban youth and is associated with significantly increased odds of other health-related social problems. Although extensive screening for social problems may be difficult to implement, a two-item food insecurity screen is effective in not only identifying food insecurity but may also indicate a higher likelihood of other social risks. Educating providers about food insecurity and providing appropriate and efficient screening tools can significantly increase the identification of patients with food insecurity during the clinical visit [38] and provide the opportunity to connect patients to appropriate social services, such as food pantries and food banks, and

Supplemental Nutrition Assistance Program. Early identification and intervention of food insecurity and other social problems is essential for improving the health of youth.

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