Screening Pediatric Patients for Food Insecurity: A Retrospective Cross-Sectional Study of Comorbidities and Demographic Characteristics

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ABSTRACT

Background: Food insecurity is a household-level economic and social condition of limited or uncertain access to adequate and nutritional food that is associated with diabetes, obesity, anxiety, depression, and behavioral disorders. The presence of these comorbidities motivated the UW Health Pediatrics Department to start screening for food insecurity.

Methods: Our study describes demographic characteristics of screened patients, comparing risk factors and health status between food insecure patients and food secure patients. We extracted variables on all screened patients: sex, age, race, ethnicity, insurance type, height, weight (to calculate body mass index [BMI] and BMI percentile), and any diagnosis of diabetes, hypertension, sleeping problems, restless leg syndrome, anemia, elevated blood lead levels, depression, anxiety, or attention deficit disorder/attention deficit hyperactivity disorder (ADD/ADHD).

Results: Over the 8-month screening period, 1,330 patients were screened for food insecurity, and 30 screened positive. Insurance type was a significant predictor for food insecurity; patients on public or with no insurance had 6.39 times greater odds of being food insecure than those on private insurance (CI 3.81, 13.29). Also, diagnoses of anemia and ADD/ADHD were both significantly higher in the food insecure group. The odds of having anemia was 8.47 times greater for food insecure patients (CI 3.03, 23.63), and the odds for having ADD/ADHD was 5.89 times greater for food insecure patients than food secure patients (CI 1.48, 23.55).

Discussion: These results provide useful information to clinicians as the screening process moves toward widespread adoption. These results also provide a baseline for expanded research once screening is implemented throughout all pediatric clinics within our health care organization.

BACKGROUND

Food insecurity is a household-level economic and social condition of limited or uncertain access to adequate and nutritional food.[1] Since the United States' 2008 recession, food insecurity has increased and currently affects 14.1% of the US population—approximately 45 million people.[1] Certain populations are especially susceptible to food insecurity such as low income groups, minority races, rural populations, and children.[1] In Wisconsin, the prevalence of food insecurity is similarly high in all urbanicity levels and across all state public health regions,[2] and the food insecure rate of 11.5% is lower than the national average of 14.1%.[1] However, when broken down by race and ethnicity, marked disparities are apparent. Among both Hispanic and black families in Wisconsin, the food insecurity rate is 35%, which is significantly higher than the national rates of 24% and 26% for each group, respectively.[3]

Recent studies have linked food insecurity with chronic diseases such as diabetes, obesity, metabolic syndrome, anxiety, depression, and behavioral disorders[4,5] including persistent hyperactivity/inattention.[6] Further, families of low income children with food insecurity report more behavioral, emotional, and academic problems than do low-income children without food insecurity, which suggests a possible dependent relationship with food insecurity and these other health issues.[7] Thus, there is considerable evidence of the social determinants and health outcomes of food insecurity nationally.

Little has been studied in Madison, Wisconsin, the state's 2nd largest city, which is located in Dane County and served in part by our health care organization. However, a 2014 study found a 33.9% food insecurity rate in La Crosse, Wisconsin, which was much higher than expected and prompted clinicians to consider patients' access to food as part of the health history.[8]

We sought to describe demographic characteristics and health

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conditions of those patients screening positive for food insecurity compared to those who did not screen positive within our health care organization. Doing so can improve understanding of the social and health issues surrounding food insecurity and can inform the screening process and better tailor subsequent interventions.

METHODS

We conducted a retrospective cross-sectional study comparing characteristics of food insecure patients to food secure patients. Variables for all screened patients were retrieved from the electronic health record (EHR).

A previously validated 2-question paper screen developed by the US Department of Agriculture was used to identify food insecure patients.[9] A family was identified as food insecure if they answered "often true" or "sometimes true" to either of the following questions: "We worried whether our food would run out before we got money to buy more," and "The food we bought just didn't last and we didn't have money to get more."

In November 2015, local health care organizations partnered with The HungerCare Coalition, a local nonprofit program that helps educate health care professionals on issues related to food insecurity, to pilot screening for food insecurity in primary care pediatric clinics. Screens were given to all patients seen for a well-child visit from November 2015 through June 2016 by 4 physicians participating in the pilot program at a downtown Madison general pediatric clinic. The parent/caregiver answered the screen rather than the child. All screens were accompanied by a brief explanation to the parent/caregiver on the importance of checking for food insecurity.

Due to the nature of the study, there was no field in the EHR to collect screen results, so positive screens were identified manually on paper. It was assumed that any patient seen for a well-child visit who was not identified as a positive screen during the screening period was a negative screen.

UW Health Information Technology Services provided information on the following variables for each screened patient: age at time of encounter, race, ethnicity, insurance type at time of encounter (public/no insurance or private), height, weight, and any diagnosis of or medication for diabetes, hypertension, sleeping problems, restless leg syndrome, anemia, elevated blood lead levels, depression, anxiety, or attention deficit disorders. BMI percentile was calculated using the height, weight, age (months), and sex of each patient. Weight percentile was calculated for patients under the age of 2 years.

We determined if the patient characteristics were significantly associated with a positive food insecurity screen. In addition to descriptive statistics (counts), an odds ratio, 95% confidence interval about that odds ratio, and *P*-value using binomial logistic regression were calculated. Because the prevalence of depression/anxiety and attention deficit disorder/attention deficit hyperactivity disorder (ADD/ADHD) varies by age and sex, age- and sex-adjusted models were used for those comorbidities. Likelihood ratio tests were used to compare models with and without insurance for depression/anxiety and ADD/ADHD to determine if insurance should be included as a covariate.

Table 1. Summary of Population Demographics by Food Insecurity Status

	Food Secure	Food Insecure
Total	1,300	30
Sex (male) (%)	643 (49.5)	18 (60.0)
Age in years (mean (SD))	7.8 (4.74)	5.46 (3.97)
Age Group (%)		
0-1	64 (4.9)	6 (20.0)
2-5	464 (35.7)	10 (33.3)
6-10	419 (32.3)	12 (40.0)
11-15	260 (20.0)	1 (3.3)
16-20	93 (7.2)	1 (3.3)
Race/Ethnicity (%)		
White, non-Hispanic or Latino	1,018 (78.3)	12 (40.0)
White, Hispanic or Latino	72 (5.5)	7 (23.3)
Black or African American	59 (4.5)	3 (10.0)
Non-white, Hispanic or Latino	32 (2.5)	1 (3.3)
Asian	57 (4.4)	0 (0.0)
Multiracial and other	62 (4.8)	7 (23.3)
Insurance (%)		
Private	1,124 (86.4)	15 (50.0)
Public/None	176 (13.6)	15 (50.0)

Table 2. Food Insecurity by Insurance Type

	Food Secure Total	Private, Food Insecure Total, Odds Ratio (95% CI)
Private	1,124	15, 1
Public/None	176	15, 6.39 (3.07, 13.29)*

* *P*-value < 0.05

Table 3. Health Outcomes by Food Insecurity Status

	Food Secure	Food Insecure
BMI mean (SD)	17.49 (4.26)	16.51 (5.31)
BMI percentile (mean [SD])	57 (29)	58 (33)
Overweight BMI n (%)	272 (21.0)	9 (30.0)
Underweight BMI n (%)	42 (3.2)	2 (6.7)
Depression/anxiety n (%)	63 (4.8)	2 (6.7)
ADD or ADHD n (%)	33 (2.5)	3 (10.0)
Hypertension n (%)	2 (0.2)	0 (0.0)
Elevated blood lead levels n (%)	1 (0.1)	0 (0.0)
Restless leg syndrome n (%)	13 (1.0)	0 (0.0)
Sleep problems n (%)	8 (0.6)	0 (0.0)
Anemia n (%)	30 (2.3%)	5 (16.7%)

Abbreviations: BMI, body mass index; ADD, attention deficit disorder; ADHD, attention deficit hyperactivity disorder.

Table 4. Comorbidities by Food Insecurity Status

	BMI >85% OR (95% CI)	BMI <5% OR (95% CI)	Anemia OR (95% CI)	Depression/ Anxiety* OR (95% CI)	ADD or ADHD** OR (95% CI)
Non-Food Insecure	Ref	Ref	Ref	Ref	Ref
Food Insecure	1.62 (0.73, 3.57)	2.13 (0.49, 9.26)	8.47*** (3.03, 23.63)	4.11 (0.79, 21.31)	5.89*** (1.48, 23.55)

*Model controls for age and sex.
** Model controls for age, sex, and insurance.
****P*-value <0.05.
Abbreviations: BMI, body mass index; ADD, attention deficit disorder; ADHD, attention deficit hyperactivity disorder.

According to the guidance of the University of Wisconsin-Madison Health Sciences Institutional Review Board, this quality improvement work does not constitute research per the definition of the Common Rule (45 CFR 46).

RESULTS

During the 8-month screening period, 1,330 patients were screened for food insecurity, and 30 (2%) screened positive. Demographic differences were identified between the food secure and food insecure groups (Table 1), most notably by race/ethnicity ($P<0.001$). Of the food secure patients, 78.3% identified as white, non-Hispanic/Latino, compared to 40.0% of the patients in the food insecure group. Of the food secure patients, 10% identified as either Hispanic/Latino or black, compared to 33.3% of patients in the food insecure group.

When considering insurance status, patients with public/no insurance had 6.39 times greater odds of being food insecure compared to privately insured patients (CI 3.07, 13.29) (Table 2).

Several health outcomes associated with food insecurity were never or rarely (<1%) identified in food insecure patients, including hypertension, elevated blood lead levels, restless leg syndrome and sleep problems (Table 3).

We found significant relationships in our sample between food insecurity and diagnoses for both anemia and ADD/ADHD. Food insecure patients have 8.47 times greater odds for being diagnosed with anemia (CI 3.03, 23.63). Further, after adjusting for age, sex, and insurance, these patients had 5.89 times greater odds for being diagnosed with ADD/ADHD (CI 1.48, 23.55) (Table 4).

DISCUSSION

Food insecurity is caused by a lack of resources for obtaining enough nutritional food including money, transportation, and local availability. We found that a key correlation with food insecurity is insurance type and that being food insecure increases a patient's risk of being diagnosed with either anemia or ADD/ADHD. Since we did not have access to patient financial information, we used insurance type as a proxy for income. We were not surprised to find that patients with public/no insurance had higher odds of being food insecure, as national data suggests that income is the number one predictor of food insecurity.[10] Further, because rates of poverty are higher among Hispanic/Latino and black families in Dane County, this income disparity contributes to those groups' higher rates of food insecurity.

We also hypothesized that we would find a relationship between anemia and food insecurity since childhood anemia is often related to nutritional issues, including inadequate iron intake. The relationship between food insecurity and ADD/ADHD also is grounded in the literature.[8,9] Indeed, a prospective study of children found that food insecurity was predictive of hyperactivity/inattention.[6]

Our analysis supported a correlation between food insecurity and both BMI and anxiety/depression, as would be predicted by the results of other studies,[4] but the overall low numbers of food insecure patients did not allow for statistical significance. The paradox of being food insecure, and thus not having enough food, and having an elevated BMI is explained by the fact that food insecure families typically resort to calorically dense yet nutritionally sparse food, such as processed or fast food. However, as the obesity epidemic becomes more widespread, even food secure families have increased prevalence of elevated BMIs, which also could account for why our 2 groups showed no statistical difference in BMI.

The main limitations to our study include its descriptive cross-sectional design and a small patient sample. Associations, but not causality, can be determined by the observational data and cross-sectional design. Nonetheless, the BMI, anemia, and ADD/ADHD findings are consistent with the literature. Since only 30 patients screened positive for food insecurity, the differences between the 2 groups must be evaluated carefully. Because of variation in the physician documentation process and problem list utilization rates, patient health status was synthesized from diagnoses, medications, and problem lists. Patients could have been misclassified or health status was underreported, but the utilization of electronic health records reflects the information available to clinicians. Finally, this paper-based screening was a

preliminary test of a subsequent EHR implementation, so there could be a concern that variation occurred in the application of the screening rules. However, we are confident that the 3 selected providers consistently tested the screening process and applied it to each patient encounter. Thus, we believe that all patients were screened, no patient refusals were documented, and the lack of a positive food insecurity screen was indicative of food security for the patient. Given the small scale of the implementation with just 3 providers at 1 clinic site, the processes were considered to be used reliably. There is some margin of error in this assumption.

We hope that these data are useful for clinicians as the screening process moves past the implementation pilot program into more widespread screening. This study is a framework to guide screening in the future, perhaps to include it as standard screening for specific medical conditions, not only at preventive care visits. It is important to know which patient populations are at risk for food insecurity and to also understand the health implications that accompany being food insecure to most appropriately assist patients who screen positive. We plan to conduct a similar study once the screening process is in place at all primary care clinics in our health system to see if other clinics yield similar results. A longitudinal study would be useful to determine if food insecure patients becoming food secure would alleviate some comorbidities, which would indicate successful social interventions.

In summary, we found that patients with a lower income, as represented by having public/no insurance, had significantly increased odds of being food insecure, and that food insecure patients were subsequently at increased odds of having anemia or a diagnosis of ADD/ADHD.

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