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ORIGINAL PAPER

Frequency of Food Insecurity and Associated Health Outcomes in Pediatric Patients at a Federally Qualified Health Center

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Abstract
Food insecurity (FI) has been recognized as a public challenge not only for developing countries but also for the U.S. population. The present study was designed to identify the prevalence of FI and the association of household FI with the health status of pediatric patients seen at a Federally Qualified Health Center in New Jersey which provides health care mainly for Latino patients. Patients were included if they were screened for FI at their well visits during a 4-month period following implementation of the 2-item screening tool recommended by American Academy of Pediatrics. We compared demographic and morbidity data of children with FI to those living in food-secure households. The results are presented as the distribution of frequency (%) and odds ratios (OR) with 95% confidence interval (95% CI). FI was detected in 15.8% (95% CI 14.2–17.5%) of 486 studied children. We recorded higher rates of anemia (10.4 vs. 3.2%, $p < 0.005$), hypercholesterolemia (10.4 vs. 3.4%, $p < 0.01$), and any morbidity (24.7 vs. 9.3%, $p < 0.02$) in children living in FI households. Multivariate logistic regression analysis revealed an association of household FI with at least one recorded morbidity independent of the patient's age, gender, and body mass index (OR 1.79, 95% CI 1.31–2.43). No one was diagnosed with diabetes, and only a few with asthma and hypertension. We have concluded that living in households with FI increased the risk for unfavorable health outcomes in a predominantly economically disadvantage community of children within the U.S. population.

Keywords Food insecurity · Health outcome · Children · Underserved · Community

Introduction

The growing evidence identifies food insecurity (FI) as a public challenge not only for developing countries but also for the U.S. population [1–3]. Children are found to be more vulnerable than adults when it comes to inadequate nutritional quantity and quality due to their special needs for growth and development [4]. According to the U.S. Department of Agriculture (USDA), more than 13 million American children in 2015 lived in a FI household [2], however there is a wide variability in the rate of households with FI across the race–ethnical and social-economic disadvantaged subgroups [1, 5–7]. The National Health and Nutrition Examination Survey (NHANES) identified FI in 36.6% of children aged 8–17 years in households with annual incomes < 200% of the poverty line [8]. Moreover, immigrants' families are more likely to be at risk for FI than those who are born in the United States [7]. The 2016 NHANES recorded FI households in more than one-third of low-income, uninsured, or Hispanic hospitalized children [9]. It has been shown that younger, low-income children in inner-city settings in households exposed to FI are more likely to report negative health outcomes than similar children in food-secure families [10]. Due to the increased risk for physiological and health-related problems in children living in food-insecure household, the American Academy of Pediatrics (AAP) recognized the need for the assessment of FI in pediatric patients [4]. Although FI affects children in any community [4], it is particularly important to identify the relationship between FI and the health of children in an underserved community, as these children are at greater risk for adverse childhood experiences [11, 12].

This study is the first attempt to detect the rate of household FI for pediatric patients after EMR implementation of a FI assessment tool at a Federally Qualified Health Center (FQHC) in New Brunswick, NJ, where up to 60%

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are patients of Latino origin. Additionally, we analyzed the health status of these studied children with respect to living in a FI household. We believe that any additional evidence regarding the connection of household FI with the health of children could be important for developing special strategies to help both families and health care practitioners navigate ways to reduce the risk of negative outcomes associated with FI.

Methods

This study is a retrospective analysis of FI and health related conditions in pediatric patients seen at the Eric B. Chandler Health Center (EBCHC), a FQHC in New Brunswick, New Jersey. A FI screening tool was integrated into the electronic medical record (EMR) in February 2016 as a part of standard of care as recommended from the AAP. We used the AAP recommended highly sensitive and validated 2-item screening tool, which is a derivative of the 18-item US Household Food Security Scale (HFSS) [13]. The parent or guardian who accompanied the child to the well child visit was asked to answer the following questions: (1) "within the past 12 months, we worried whether our food would run out before we got money to buy more", and (2) "within the past 12 months, the food we bought just didn't last and we didn't have money to get more." According to the AAP, FI was classified as positive if the parent or guardian answered "yes" to either of these questions [4]. In addition to the FI data, demographic and clinical characteristics, including child gender, age, and morbidity(s) as registered and documented in the EMR were collected. Patient's age was categorized as follows: infants/toddlers (< 24 month), children (2–11 years), and adolescents (12–18 years). The Body Mass Index (BMI) was calculated for all patients and classified for those older than 2 years old as underweight, normal weight, overweight, and obese as recommended by the Center of Disease Control and Prevention (CDC) [14].

Data Presentation and Statistical Analysis

The consecutive sample of pediatric patients whose household FI status was documented in the EMR during the study period from February 2016 to June 2016 was stratified into 2 groups: FI (+) and FI (−). We compared demographic and clinical data, including EMR recorded health characteristics using Chi square statistics and analysis of variance (ANOVA) for categorical and continuous variables, respectively. In addition, patients without any morbidity were compared to those with at least one in the multivariate controlled regression models to identify an independent role of living in a household with FI. The results are presented as the distribution of frequency (n, %), mean, and odds ratios (OR) with 95% confidence interval (95% CI). We used Statistica 12 for Windows (StatSoft Inc, Tulsa, OK) to analyze the data. A p value of less than 0.05 was considered statistically significant. Institutional Review Board (IRB) at Rutgers Robert Wood Johnson Medical School approved the study. Given the retrospective collection of the existing clinical data, the IRB waived the need for written informed consent.

Results

Among 486 children whose FI status was assessed during the study period, 77 [15.8% (95% CI 14.2–17.5%)] were classified into FI (+) group. FI (+) and FI (−) groups were comparable for age, BMI, and weight categories (Table 1). As shown in Table 1, adolescent patients represented approximately 10% of the total number of patients, and there were equal numbers of participants in each group in the infant/toddlers and children categories. Males were more frequently recorded in the FI (+) than in the FI (−) group. Extensive review of the EMR for each of the studied children identified cases with asthma, anemia, hypercholesterolemia, and hypertension. No one was diagnosed with diabetes, and only a few with hypertension. Overall, higher rates of anemia and hypercholesterolemia have been recorded in children living in FI households than those in FI (−) group (Table 1). The distribution of the diagnosed morbidities was associated with patients' age (Fig. 1). As shown in Fig. 1, the main variability between FI (+) and FI (−) groups in the distribution of the EMR recorded pathology was found in infants/toddlers and adolescents. Multivariate logistic regression analysis revealed an independent association of household FI with at least one morbidity listed on the child's EMR independent of the patient's age, gender, and BMI (Table 2). In addition to living in the FI household, patients' age and BMI were independently associated with EMR recorded negative outcomes.

Discussion

Our study showed up to 16% prevalence of FI in the households of our studied pediatric patients, which is higher than those reported in the county where the FQHC is located [15]. We found an almost twofold higher risk of unfavorable health outcomes in children with FI as compared to their food-secure counterparts. Similar to other investigations [16–18], our study showed the relationship of FI with the diagnosis of anemia in children. In addition, we found an increased rate of hypercholesterolemia recorded in the studied adolescent patients living in households with FI. It has been shown that childhood

Table 1 Children characteristics with respect to the FI status

Characteristics	FI (+) N = 77	FI (−) N = 409	*p* value
Gender (male), n (%)	34 (44.2)	234 (57.2)	< 0.04
Age categories, n (%)			
Infants/toddlers	38 (49.4)	234 (57.2)	0.28
Children	32 (41.6)	132 (32.3)	
Adolescents	7 (9.0)	43 (10.5)	
BMI, mean (95% CI)	18.2 (17.3, 19.0)	18.1 (17.7, 18.5)	0.86
	N = 39	N = 175	
Weight status, n (%)			
Underweight	1 (2.6)	7 (4.0)	0.89
Normal weight	19 (48.7)	89 (51.2)	
Overweight	7 (18.0)	34 (19.5)	
Obese	12 (38.8)	44 (25.3)	
Anemia, n (%)	8 (10.4)	13 (3.2)	< 0.005
Hypercholesterolemia, n (%)	8 (10.4)	14 (3.4)	< 0.01
Asthma, n (%)	5 (6.5)	14 (3.4)	0.20
Hypertension, n (%)	0 (0)	2 (0.49)	0.53
Any morbidity, n (%)	19 (24.7)	38 (9.3)	< 0.001

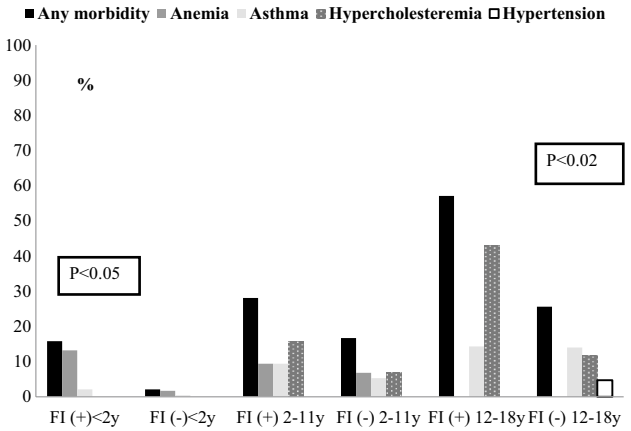

Fig. 1 Distribution of diagnosed morbidities by age group

Table 2 Multivariate regression model to identify association of different characteristics with any morbidity recorded on the EMR

Variables	OR (95% CI)	*p* value
Age (months)	1.01 (1.0–1.02)	< 0.0001
Male gender (%)	1.1 (0.84–1.45)	0.49
BMI (%)	1.19 (1.11–1.26)	< 0.0001
FI (+) vs. FI (−)	1.79 (1.31–2.43)	< 0.0001

malnutrition could contribute to adulthood co-morbidities, including diabetes, hyperlipidemia, and coronary artery disease [9]. Comparable to other reports [3, 19], we found no association of BMI with FI. However, it should be noted that there is literature that reports a 20% increased risk for obesity in children living within an FI household [20]. Several studies explored the inference of household FI on health outcomes, including increased prevalence of anemia [18, 21], asthma [22], hospitalization with diabetes [23], physical inactivity [24], and overuse of medications [23]. There are no reports, however, on the frequency of cardiovascular risk factors, including hypertension, diabetes, and hyperlipidemia in the pediatric population with respect to FI in the household.

Several limitations of our study should be noted. First, utilization of existing clinical data is a subject for misclassification bias. Nevertheless, uniform use of the AAP recommendations for preventive care of pediatric patients [25] may perhaps reduce the risk for the misdiagnosis of anemia and dyslipidemia. Moreover, medical records is a more precise source of pediatric health information as compared to the parental responses obtained from the survey research [26]. Secondly, the AAP recommended FI assessment tool used throughout our study characterized FI for the family members as a group [9, 27, 28] that could also be termed as "marginal food security" [29]. Although the determined FI has not been otherwise specified for a child in household, nutritional adequacy defined by the 2-items tools could predict adverse health outcomes in children [13]. Lastly, it is possible that the FI data recorded was less than the actual frequency because adult caregivers are more likely to underreport FI for their children [30, 31].

Conclusions

Our observational study showed an association of FI with an increased risk for unfavorable health outcomes in predominantly Latino children who constitute an economically disadvantage community within the U.S. population. The result of our study advocates timely measurements of households' FI status in an underserved pediatric community given the role of nutritional inadequacy of household food resources in families who are at risk for many social determinants of health [32]. Pediatricians' awareness on this matter is important for instruction of parents on nutritional resources and follow up of patients at risk in order to prevent the consequence of FI related long-term sequelae. Further investigation will be needed to improve our knowledge regarding health outcomes in children living in FI households.

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Compliance with Ethical Standards

Conflict of interest The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper. The corresponding author wrote the first draft of the manuscript and it has been edited and approved by all authors.

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