



Prevalence of Food Insufficiency Across Subgroups of Children with Special Health-Care Needs

Claire E. Branley, BS¹, Anne E. Fuller, MD, MS^{2,3}, Jessica Caouette, BS¹, Alon Peltz, MD, MBA, MHS⁴, Arvin Garg, MD, MPH⁵, and Stephenie C. Lemon, PhD¹

Objective To determine the association between subgroups of children with special health care needs (SHCN) and food insufficiency, and assess whether this association varies by income level, and to evaluate how food insufficiency trends have changed over the time.

Study design This was a cross-sectional survey study using the 2016-2023 National Surveys of Children's Health. SHCN subgroups were defined as follows: no special health care needs, prescription medication use only, elevated use of services, and functional limitations. The association between SHCN subgroup and food insufficiency was measured using weighted multivariable logistic regression models. Effect modification by income was evaluated. In addition, linear models described significant changes in food insufficiency rates by SHCN subgroup from 2016 to 2023.

Results Compared with children without SHCN, children with SHCN who used medications only (aOR = 1.31; 95% CI 1.21-1.41), had elevated use of services (aOR = 1.54; 95% CI 1.45-1.63), or had functional limitations (aOR 1.97; 95% CI 1.82-2.13) had higher odds of food insufficiency. Effect modification by income was significant for children with functional limitations. From 2016 to 2023, the associations between SHCN and food insufficiency were similar.

Conclusion Children with functional limitations are an especially high-risk group who require attention in public health efforts to reduce food insufficiency. (*J Pediatr* 2026;290:114950).

Food insufficiency is a major risk factor for poor health, particularly for children.¹ Food insufficiency is closely related to food insecurity but describes specifically the state of not having enough nutritious food available in the household, whereas food insecurity includes feelings of uncertainty or worry regarding food availability.¹ Children living in food insufficient households may have increased risk of impaired academic performance, higher emergency department use, and poor physical and mental health outcomes.²⁻⁵ While food insufficiency and child poverty reached a historic low in 2021, this is felt to be in-part due to temporary policies enacted during the COVID-19 pandemic which have since expired.⁶ Recent data show increasing levels of food insufficiency since 2021, with 14 million children living in households experiencing food insufficiency in 2023.⁷

Food insufficiency varies significantly across certain populations in the US and some children are at lower risk than others based on socioeconomic and health characteristics. Children with special health care needs (CSHCN), representing 1 in 5 US children, face higher risks of food insufficiency.^{8,9} CSHCN are those with a physical, mental, emotional or other type of health condition requiring health and related services beyond that required by children generally.¹⁰ However, this broad definition includes a wide diversity of underlying functional, health, and medical characteristics, each associated with unique socioeconomic impacts. For example, children who have functional limitations, such as mobility impairments, may experience significantly higher out of pocket medical expenses than CSHCN without functional limitations.¹⁰ In particular, low-income families caring for CSHCN may face greater socioeconomic hardship and may have more difficulty balancing paying for and coordinating care while affording food and other basic necessities.

The objectives of this study were to (1) examine the association between CSHCN subgroups and food insufficiency, (1a) describe how this relationship changes by income level, and (2) describe recent trends among this vulnerable population from 2016 to 2023 using the National Survey of Children's Health (NSCH).

From the ¹Division of Preventive and Behavioral Medicine, Department of Population and Quantitative Health Sciences, UMass Chan Medical School, Worcester, MA; ²Department of Pediatrics, McMaster University, Hamilton, Ontario, Canada; ³Offord Centre for Child Studies, Hamilton, Ontario, Canada; ⁴Department of Population Medicine, Harvard Pilgrim Health Care Institute, Harvard Medical School, Boston, MA; ⁵Child Health Equity Center, UMass Memorial Children's Medical Center, Worcester, MA

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CSHCN	Children with special health care needs
FPL	Federal poverty level
NSCH	National Survey of Children's Health
RERI	Relative excess risk due to interaction
SHCN	Special health care needs

Methods

Study Design and Participants

This study utilizes NSCH data, a national cross-sectional survey conducted annually. Households in all 50 states and Washington DC are randomly sampled to identify those with children aged 17 and under. One child is randomly chosen from eligible households, and a parent, guardian, or caregiver completes a survey on their behalf. The design and administration of the survey has been described previously.⁶ All data and questionnaires are publicly available. The UMass Chan Medical School Institutional Review Board considered this study exempt as it used publicly available de-identified data.

The final dataset is weighted to represent the total population of noninstitutionalized children in the US. The pooled sample from 2016 to 2023 includes 334 708 respondents, which represents a weighted population of 73 030 329 children. Our study included a complete case analysis such that respondents who were missing data on food insufficiency, health care need, or necessary covariates were excluded ($n = 12 704$) for a final analytic sample of $n = 322 004$. **Supplemental Figure 1** (available at www.jpeds.com) includes a study sample flow chart and sample sizes of subgroups of CSHCN.

Independent Variable: CSHCN Group

To meet the criteria of having a special health care need (SHCN), the respondent needed to indicate that the child had experienced at least 1 of 5 health consequences due to an ongoing health condition ie expected to last longer than 12 months. These health consequences were categorized into CSHCN subgroups as defined by the NSCH.^{10,11} Those that responded affirmatively to using medicine prescribed by a doctor but met no other criteria were categorized as “CSHCN - Rx alone.” Those that had elevated use of medical care, mental health, educational services, special therapy, or specialized counseling, with or without prescription medication use, were categorized as “CSHCN - Elevated use of services, \pm Rx use.” Children of parents that responded “yes” to “is your child limited or prevented in any way in his or her ability to do the things most children of the same age can do?” were categorized as “CSHCN - Functional limitations”. Children who met none of these above criteria were categorized as “No criteria met” and defined as the reference group. The final independent variable was a 4-category variable (see **Supplemental Figure 1**; available at www.jpeds.com).

Outcome: Food Insufficiency

Households were defined as food insufficient based on responses to a single-item validated questionnaire: “Which of these statements best describes your household’s ability to afford the food you need during the past 12 months?”¹² Parents had the following answer choices: (1) “We could always afford to eat good nutritious meals,” (2) “We could always

afford enough to eat but not always the kinds of food we should eat,” (3) “Sometimes we could not afford enough to eat,” and (4) “Often we could not afford enough to eat.” Children of parents who responded with answer choice 1 were categorized as “food sufficient.” Those who responded with answer choices 2 are often categorized as “marginally food sufficient” and those who chose answers 3 or 4 are “moderately” to “severely” food insufficient, respectively. However, marginal food sufficiency has independent associations with negative health outcomes among children and prior studies have defined responses 2, 3, or 4 as a household with marginal to severe food insufficiency.¹³⁻¹⁵ This definition is also included in the official NSCH data briefs.¹⁶ Therefore, food insufficiency was defined in 2 categories, with the outcome encompassing marginal to severe food insufficiency. Sensitivity analyses evaluating the more severe form of food insufficiency (only responses 3 or 4) were also done.

Covariates

Potentially confounding variables that may influence the association between children’s SHCN and food insufficiency were selected *a priori*.^{10,17} Child characteristics evaluated included age, sex, race or ethnicity, and insurance status. Race and ethnicity were evaluated as previous research has shown higher levels of food insufficiency among non-Hispanic Black, Hispanic, and Native American children in the US, which reflects a history of systemic racism that has led to a disproportionate burden of poverty, material hardship, and limited access to nutritious or culturally meaningful foods among these populations.¹⁸ Characteristics of the child’s parent or caregiver were also evaluated, including educational attainment (college or above/some college/high school/less than high school), family structure (2 parents, single parent, and other), caregiver employment (At least one parent employed full time), language spoken at home (English/not English), and nativity. Characteristics regarding the child’s household, including total number of children and household income (defined categorically using self-reported income as a percentage of the federal poverty level [FPL]) were also included.

Statistical Analysis

Descriptive characteristics of the full 2016-2023 sample were summarized as percentages and calculated across subgroups of health care needs. These sociodemographic characteristics were compared across CSHCN subgroups using chi square tests.

A cross-sectional study to describe the association between SHCN subgroup and food insufficiency was done. A nonautomated forward stepwise model building process was employed to evaluate covariates, including those that changed the association between CSHCN type and food insufficiency by greater than 10%. A multivariable logistic regression model was used, and results were expressed as odds ratios with accompanying 95% CIs. Additionally, predicted probabilities of food insufficiency for each subgroup of CSHCN were estimated from the logistic regression model. To

measure how poverty acts as an effect modifier on the association between SHCN subgroups and food insufficiency, each CSHCN subgroup was stratified by household income (above and below 200% FPL, chosen at this is the cut off for many federal aid programs). The relative excess risk due to interaction (RERI) was calculated using the ORs from the multivariable logistic regression as follows:

$$\text{RERI} = \text{OR}_{11} - \text{OR}_{10} - \text{OR}_{01} + 1$$

Where OR_{11} is the odds of food insufficiency among CSHCN with an income $\leq 200\%$ FPL, OR_{10} is the odds among CSHCN with an income $>200\%$ FPL, and OR_{01} is the odds among children without SHCN living at an income $\leq 200\%$ FPL. If the $\text{RERI} = 0$, this indicates some interaction, while an $\text{RERI} > 0$ indicates that the joint effects of health care needs and poverty are super-additive, meaning the combined association between each SHCN type and poverty are greater than the sum of their individual associations.¹⁹

To analyze trends in food insufficiency among these groups, we estimated the unadjusted prevalence of food insufficiency by year (from 2016 to 2023) for each subgroup of SHCN. To determine whether the changes in food insufficiency differed by health care need, we built several linear regression models, stratified by the 4 SHCN types and by time period. The years 2016-2021 and 2021-2023 were examined separately, as according to USDA data, food insufficiency was steadily decreasing from 2016 to 2021 and then rose from 2021 to 2023.²⁰ Sociodemographic characteristics that changed significantly among the population during these years (household FPL, insurance status, and child age) were adjusted for.²¹ Results are reported as an absolute and relative % change from 2016 to 2021, and then from 2021 to 2023.

All analyses incorporated appropriate sampling weights and stratum indicators to account for the complex survey design. Statistical significance was assessed using a two-sided P -value of 0.05. All analyses were carried out using STATA 18.0 software (StataCorp LLC).

Results

Approximately 20% of the sample were children with at least one SHCN; 5.2% met only the prescription medication criteria, 9.2% had elevated use of special services, and 5.1% had functional limitations (Table I). Approximately 1 of 3 (31.5%) of the total sample lived in households that reported food insufficiency. Overall, the study sample was on average 8.7 years old, 39% lived in households at or below 200% FPL, and over half utilized commercial insurance (59%) (Table I).

The association between SHCN and food insufficiency differed significantly based on the type of need reported (Table II). The final multivariable logistic regression model included household income, child's health insurance status, and parent's educational attainment. We found that

CSHCN who only met the criteria for medication use had 1.31 times higher odds of food insufficiency (95% CI 1.21-1.41) compared with children who met no criteria. These odds increased among CSHCN who reported elevated use of services (aOR 1.54, 95% CI 1.45-1.63). CSHCN who reported functional limitations to daily activities were associated with the highest odds (aOR 1.97, 95% CI 1.82-2.13). The predicted probability of food insufficiency was 29.6% (95% CI 29.2-30.1) among children without special healthcare needs and increased to 42.4% (95% CI 42.4-43.8) among children with functional limitations (Table II). Sensitivity analyses evaluating the more restrictive definition of food insufficiency yielded statistically similar results (analyses not shown).

Results of the analyses stratified by household income indicate that poverty was an effect modifier between SHCN and food insufficiency depending on SHCN type (Table III). The RERI was significantly greater than zero for children with functional limitations and elevated use of services, meaning the combined effect of having a SHCN and having a household income $\leq 200\%$ FPL had a greater impact on the odds of food insufficiency than either risk factor alone.¹⁹ This effect modification was only significant for children living with functional limitations.

Between 2016 and 2021, food insufficiency declined among all groups significantly. Between 2021 and 2023, it then increased significantly for children without SHCN and those that met medication or elevated use of services criteria but not for children with functional limitations (Figure 1). Across all years, significant differences in the prevalence of food insufficiency by criteria persisted (Table IV).

Although absolutely high, children without SHCN had the lowest rates of food insufficiency across all study years, with a prevalence of 31.4% (95% CI 30.3-32.5) in 2016. Linear regression results show that food insufficiency significantly decreased by 4.8% between 2016 and 2021 but increased 5.8% from 2021 to 2023.

Children who met prescription medication criteria only had the next lowest prevalence in 2016 (37.1%, 95% CI 33.4-40.8). Similar to children without SHCN, food insufficiency significantly decreased by 4.8% from 2016 to 2021 and increased by 6.6% from 2021 to 2023.

Children who had elevated use of therapies also had elevated prevalences across all years relative to children without CSHCN; 44% in 2016 (95% CI 41.5-47.6) which decreased by 5.5% from 2016 to 2021 and increased by 3.8% from 2021 to 2023.

Children with functional limitations consistently lived in homes with the highest rates of food insufficiency. In 2016, 52.1% of CSHCN that met the functional limitations criteria lived in food insufficient households (95% 47.5-56.6). Like other groups, the prevalence decreased significantly by 5.5% from 2016 to 2021. However, there was no significant difference in the prevalence of food insufficiency in this sample between 2021 and 2023.

Table I. Descriptive statistics of children by special health care need type

Characteristic	Children with special health care need subgroups			
	No criteria met	CSHCN -prescription medication only	CSHCN-elevated use of services or therapy, with or without prescription medication	CSHCN - functional limitations
Unweighted N	256 246	20 875	35 994	18 216
Child age in y (median, IQR)	8 (4,13)	12 (7, 15)	11 (8, 15)	11 (6, 14)
Child sex (%)				
Male	49.7	53.7	55.0	63.6
Female	50.3	46.3	44.0	36.4
Child race and ethnicity (%)				
Hispanic	26.2	19.7	21.6	25.2
Non-Hispanic Asian	5.1	2.9	2.1	2.7
Non-Hispanic Black	12.0	17.0	14.6	17.5
Non-Hispanic Native American/Alaska Native/Native Hawaiian/Pacific Islander	0.01	0.01	0.01	0.01
Non-Hispanic, other, multiracial	0.06	0.07	0.07	0.06
Non-Hispanic White	50.2	53.2	54.3	47.4
At least one parent employed (%)				
Yes	94.1	93.6	91.4	87.3
Parent relationship (%)				
Two parents	75.6	70.6	63.7	63.6
Single parent	19.5	23.5	27.3	28.0
Other family type	4.9	5.9	9.0	8.4
Number of children in household (%)				
1	24.6	31.2	28.0	28.8
2	39.6	39.8	38.4	37.3
3	23.2	20.4	21.9	21.6
4+	12.6	8.6	11.7	12.2
Insurance status (%)				
Private only	60.7	60.5	52.0	38.4
Public only	28.3	30.7	37.3	43.9
Private and public	3.9	5.0	6.6	13.6
Uninsured	7.1	3.9	4.1	4.1
Household income as a % FPL				
≥400%	32.6	33.3	31.1	23.6
300-399	12.3	11.8	11.3	10.4
200-299	16.4	16.1	16.0	15.9
100-199	20.7	20.0	20.9	24.8
0-99	18.1	18.7	20.8	25.3
Parent educational attainment (%)				
College or above	52.1	52.2	51.6	44.6
Some college or technical school	20.3	22.9	21.0	25.3
High school degree or GED	18.6	18.4	18.8	22.0
Some high school or less	9.0	6.6	7.1	8.1
Household language – not English (%)	15.8	7.9	8.0	9.6
Parental nativity – outside of US (%)	29.8	18.8	19.3	21.8
Food insufficient (%)	29.1	34.3	39.1	48.6

GED, General Education Development.

Data collected via self-report in the National Survey of Children’s Health, 2016-2023 (unweighted n = 322 004, weighted n = 69 479 016).

Table II. Association between children with special health care need subgroup and food insufficiency*

Food insufficiency	aOR (95% CI)	Predicted probability, % (95% CI)
No criteria met	Ref.	29.6 (29.2-30.1)
CSHCN – Prescription medication only	1.31 (1.21-1.41)	34.5 (33.1-35.8)
CSHCN – Elevated use of services or therapy, with or without prescription medication	1.54 (1.45-1.63)	37.6 (36.6-38.6)
CSHCN – Functional limitations	1.97 (1.82-2.13)	42.4 (40.9-43.8)

aOR, adjusted odds ratio.

Data from the National Survey of Children’s Health, 2016-2023 (unweighted n = 322 004, weighted n = 69 479 016).

*Model is adjusted for household income, parent’s educational attainment, and child’s health insurance status. Additional adjustments for child sex, race or ethnicity, or age, parent employment, nativity, relationship status, household language, number of children in the household, and household region did not change the reported aORs by more than 10%.

Discussion

In this nationally representative sample of U.S. children, we found significant variation in food insufficiency among subgroups of CSHCN. While food insufficiency prevalence was high among all CSHCN, those with functional limitations had the highest probability of food insufficiency, and this disparity persisted across all 8 years examined in this study. This gap was further accentuated among low-income families, as the combined effect of having a functional limitation and living in households at or below 200% of the FPL greatly increased the odds of food insufficiency more so for children with functional limitations than any other group. These results indicate that although there has been a renewed focus on addressing the systemic barriers families with children

Table III. Evaluation of the effect modification of income on the association between special health care need type and food insufficiency using the relative excess risk due to interaction (RERI), National Survey of Children’s Health, 2016–2023 (unweighted n = 322 004, weighted n = 69 479 016)*

CSHCN subgroup	aOR among children at or above 200% FPL	aOR among children below 200% FPL	RERI (95% CI)*
No criteria met	Ref.	2.03	N/A
CSHCN – Prescription medication only	1.26	2.58	0.29 (–0.07, 0.64)
CSHCN – Elevated use of services or therapy, with or without prescription medication	1.32	3.30	0.95 (0.63, 1.31)
CSHCN – Functional limitations	1.64	4.37	1.72 (1.13, 2.29)

*RERI is calculated by the following equation: $RERI = OR_{11} - OR_{10} - OR_{01} + 1$. For example, the RERI for children with functional limitations is $4.37 - 1.64 - 2.03 + 1 = 1.72$. A value > 0 indicates a super-additive effect of the 2 exposures. A higher RERI indicates a stronger interaction between poverty and SHCN on the odds of food insufficiency. These results are produced using the “RERI” command in STATA which also provides 95% CI, incorporating appropriate survey weights. See Reference #19 for more information. Model is adjusted for child’s insurance status and parent’s educational attainment, marital status, and nativity.

who have SHCN face, particularly within the medical setting, significant gaps remain in equitable access to food among children who have SHCN.

A previous study used 2016 NSCH data and defined the child’s SHCN by complexity and found that children with more complex SHCN were more than twice as likely to live in households reporting food insufficiency.⁹ Our study expands on this by highlighting the particularly high prevalence among children who have functional limitations, as well as significantly higher odds of food insufficiency for children who have elevated use of services and those who only take prescription medication. This may be because children with functional limitations have higher out-of-pocket medical expenditures, more medical visits or referrals, and may use a variety of services outside the health care system, all of which could contribute to difficulty affording food.^{10,22} The higher prevalence of food insufficiency could potentially lead to disparities in diet quality and obesity; one previous study found that CSHCN who lived in food insufficient households were more likely to also have obesity, although it is not known if

this varies by SHCN type.^{5,23,24} More research is needed to understand whether food insufficiency among children with functional limitations translates to a higher risk of diet-related chronic conditions.

Our study extends previous research that adjusts for the effect of income. We found that reporting the joint effect of poverty and SHCN increased the odds of food insufficiency greater than either risk factor alone, but that this varied by SHCN type. The joint effect of poverty and SHCN was more pronounced for children with functional limitations and was nonsignificant for those who only meet medication criteria. This finding is concerning, highlighting the need to focus food insecurity prevention strategies on this group to reduce further poor health outcomes. Affordable health care for CSHCN could reduce the food insufficiency burden by addressing difficulties in paying for medical bills or lowering the odds of emergency room utilization, a financial shock that can destabilize the family’s budget and increase the odds of food insufficiency.^{9,25} Additionally, as health care systems seek greater partnership with

Food Insufficiency by Type of Special Healthcare Need

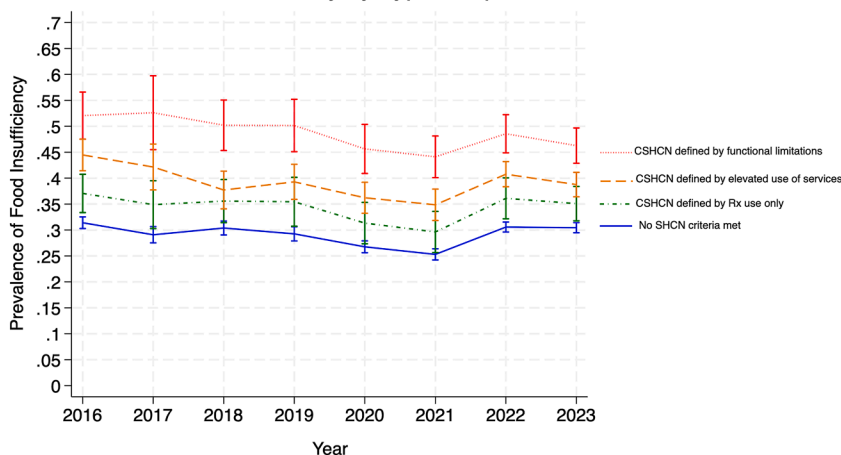


Figure 1. Food insufficiency trends by subgroup of special health care need among US children aged 0–17, National Survey of Children’s Health, 2016–2023, n = 322 004.

Table IV. Prevalence and adjusted trends of food insufficiency by subgroup of special health care needs among children in the US, National Survey of Children's Health, 2016-2023 (unweighted n = 322 004, weighted n = 69 479 016)

CSHCN subgroup	Weighted prevalence (95% CI)			Trends 2016-2021*			Trends 2021-2023*		
	2016	2021	2023	Absolute difference	Relative difference	P value	Absolute difference	Relative difference	P value
No criteria met	31.4 (30.3-32.5)	25.3 (29.6, 31.5)	30.4 (29.5, 31.4)	-4.8	-15.2	.000	+5.8	+23.1	.004
CSHCN – Prescription medication only	37.1 (33.4, 40.8)	29.6 (25.8, 33.7)	35.1 (31.8, 38.5)	-4.8	-12.9	.005	+6.6	+22.3	.03
CSHCN – Elevated use of services or therapy, with or without prescription medication	44.5 (41.4, 47.5)	34.9 (31.9, 38.0)	38.8 (36.4)	-5.5	-12.4	.002	+3.8	+10.9	.03
CSHCN – Functional limitations	52.1 (47.5, 56.6)	44.1 (40.1, 48.2)	46.3 (42.9, 49.7)	-5.5	-10.6	.04	+3.0	+6.8	.242

*Adjusted trends include household income to federal poverty level ratio, insurance status, and child age.

community-based organizations,²⁶ special attention should be paid to children with functional limitations to ensure that they are being sufficiently connected to these partners. Multiple resources have been created to train health care providers and allied health professionals on the important of social drivers of health, particularly food insecurity.²⁷ Incorporating disability advocacy or community organizations that already focus on children with special health care needs and those with functional limitations into these initiatives may further improve the effectiveness of their outreach and impact.

Our trend analyses further emphasize the disparities of food insufficiency by SHCN type. Food insecurity among households with children reached a historically low rate in 2021.²⁸ Many have attributed this to the expansion of federal nutrition assistance programs through provisions such as the Pandemic Electronic Benefits Transfer, SNAP emergency allotments, expanded Child Tax Credits, and pauses on eligibility checks for Medicaid. Many of these programs ended in early 2023, and this in combination with rising food prices likely contributed to a rapid rise in poverty and food insecurity among children, which is reflected in our trend analyses.^{20,28,29} Children with functional limitations specifically had the smallest relative decrease from 2016 to 2021 and the smallest relative increase in food insufficiency from 2021 to 2023. This could be due to 2 reasons. First, the baseline higher prevalence of food insufficiency among children with functional limitations means that making relative improvements is more difficult. However, it may also be because nationwide interventions were broad and did not target children with functional limitations specifically; therefore, the withdrawal of pandemic-related food assistance perhaps was not as significant for this group. Notably, one of the biggest changes that could affect children with functional limitations is the unwinding of pauses in Medicaid/CHIP disenrollment which began in April 2023 and may not be reflected in these data. As changes to eligibility for Medicaid and CHIP continue to evolve, future research is needed to uncover whether children with functional limitations are accessing these federal programs at the same prevalence, and what additional supports are needed to narrow this disparity.

Strengths of this study include the use of a nationally representative dataset that provides a comprehensive picture of the health and wellbeing of children with SHCN. However, the cross-sectional nature of this study limits the ability to draw causal inferences. Food insufficiency may also lead to children developing SHCN. For example, experiencing food insufficiency during pregnancy or infancy may increase the likelihood of preterm birth or adverse birth outcomes, which could lead to SHCN in the child's future.^{30,31} Future studies using longitudinal data are needed to explore this bidirectional relationship. It is also important to consider that the established labels for CSHCN groupings may not adequately capture the severity of challenges faced by families with children who have functional limitations in particular. In addition, NSCH data are collected via self-report and are limited to families who speak English or Spanish; therefore, results may not apply to other populations. Lastly, it is possible that the relationship between SHCN and food insufficiency is affected by unmeasured confounding, though multiple known confounders were evaluated based on the literature.

The disparity in prevalence of food insufficiency between children who do and do not have special health care needs has persisted since 2016. Nearly half of children who experience functional limitations in their daily activities live in food insufficient households, which represent a major risk to their quality of life and future health. Renewed focus on connecting these children to programs and prevention strategies that are proven to reduce food insufficiency is needed. ■

CRedit authorship contribution statement

Claire E. Branley: Writing – review & editing, Writing – original draft, Validation, Project administration, Formal analysis, Conceptualization. **Anne E. Fuller:** Writing – review & editing, Validation, Conceptualization. **Jessica Caouette:** Writing – review & editing, Validation, Methodology. **Alon Peltz:** Writing – review & editing, Validation, Supervision, Methodology. **Arvin Garg:** Writing – review & editing, Validation, Supervision, Methodology. **Stephanie C. Lemon:** Writing – review & editing, Validation, Resources, Project administration, Methodology, Funding acquisition, Conceptualization.

Declaration of Competing Interest

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Reprint requests: Claire E. Branley, BS, Division of Preventive and Behavioral Medicine, Department of Population and Quantitative Health Sciences, University of Massachusetts Chan Medical School, 55 Lake Ave North, Worcester, MA 01655. E-mail: claire.branley1@umassmed.edu

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