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## Food Insecurity and Health Care Utilization Among Older Adults in the United States

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### ABSTRACT

This study examined the relationships between food insecurity and utilization of four health services among older Americans: office visits, inpatient hospital nights, emergency department visits, and home health care. Nationally representative data from the 2011 and 2012 National Health Interview Survey were used (N = 13,589). Nearly 83.0% of the sample had two or more office visits, 17.0% reported at least one hospital night, 23.0% had at least one emergency room visit, and 8.1% used home health care during the past 12 months. Adjusting for confounders, food-insecure older adults had higher odds of using more office visits, inpatient hospital nights, and emergency department visits than food-secure older adults, but similar odds of home health care utilization. The findings of this study suggest that programs and policies aimed at reducing food insecurity among older adults may have a potential to reduce utilization of health care services.

### KEYWORDS

Food insecurity; health care utilization; National Health Interview Survey; older adults

## Introduction

Food insecurity is a prevalent public health issue facing older adults in the United States (1, 2). Food insecurity is defined as “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways” (3). Between the beginning of the economic crisis in 2007 and 2011, the number of older adults experiencing food insecurity increased by 50% (4). Approximately three million (8.9%) households with older adults experienced food insecurity in 2014 (5). Food insecurity among older adults is particularly concerning given the rapid increase in the proportion of the US population comprised of individuals aged 65 years and older; in 2012, they represented 13% of the US population and are expected to grow to about 20% by 2030 (6).

Food insecurity is associated with adverse health consequences such as poor self-reported health status (7–9), obesity (10, 11), physical and mental health problems (7–9, 12, 13), higher cardiovascular risk (14), poor diabetes self-management (14–18), hypertension (14), and medication nonadherence (15, 19–22). Among older adults, food insecurity is also associated with

functional limitations and depression (1, 7, 23). Due to age-related decline in health characterized by increase in incidence and prevalence of multiple chronic conditions with age (24), health effects of food insecurity among older adults are likely to be more severe (25) and further increase the need for health care services. However, food insecurity may also affect one's ability to purchase needed health care services if food insecure persons chose to allocate their limited resources toward food. Therefore, food insecurity is a clinically relevant problem and has significant implications for health care utilization and costs of older adults and the nation.

However, our understanding of the extent to which food insecurity is associated with health care services utilization among older adults is limited, mainly due to lack of available data (26). Our previous studies have established a state-level dataset of older Georgians enrolled in Medicare and meals services by merging the Georgia Advanced Performance Outcomes Measures Project 6 (GA Advanced POMP6) and the Medicare claims (CMS) data and examined the relationship between food insecurity and health care utilization (26, 27). We have found that food-insecure older Georgians have lower home health and out-of-pocket expenditures than food-secure older Georgians (26), but comparable levels of health care services utilization as food-secure older Georgians (27). Given the very limited research on this issue especially at the national level, it is not easy to compare these findings with other subgroups of older adults in the United States. The association between food insecurity and health care utilization among low-income older adults who were receiving food assistance may differ from the general population of older adults. This study extends our previous work looking at potential relationships between food insecurity and utilization of health care services in a nationally representative sample of older adults by using nationally representative data from the National Health Interview Survey 2011 and 2012 (NHIS). We are particularly interested in examining the relationship between food insecurity and the utilization of four types of health care services: outpatient office visits, inpatient hospital nights, emergency department visits, and home health care utilization. More attention is being given to disease prevention and containment of the rising health care costs of the nation, yet services aimed at enhancing the food security of elderly face severe cutbacks. The findings of this study will shed light on the relationships between indicators of health care utilization and potentially modifiable factors such as food insecurity, which is critical to better meet the diverse needs of the rapidly growing older population.

## Methods

### Data

Data from the NHIS 2011 and 2012 were used in this study. The NHIS is a national, cross-sectional, multistage cluster household survey of health and

health care utilization of US resident civilian noninstitutionalized population. The NHIS data are comprised of four core modules: Household, Family, Sample Child, and Sample Adult. Supplemental modules are added on a yearly basis. In 2011, for the first time since the initiation of NHIS in 1957, the Family core module of NHIS included a Family Food Security (FFS) supplement sponsored by the United States Department of Agriculture (USDA). The FFS supplement was repeated in the NHIS 2012. Data used in this study were drawn from the Sample Adult core and the FFS supplement. A sample adult is chosen from each family to answer detailed questions regarding health status and health care utilization. The Sample Adult core has self-reported measures of health status and health care utilization. A detailed description of the survey design, methodology, and response rates can be found elsewhere (28).

### ***Measurement of variables***

#### ***Dependent variables: Health care utilization***

Utilization of four types of health care services was examined in this study. The NHIS respondents were asked questions about the frequency of office visits and emergency department visits in the past 12 months and the following 9 response categories were provided: none, 1, 2–3, 4–5, 6–7, 8–9, 10–12, 13–15, and 16 or more. The type of office visits reported included visits to not only medical doctors but also other health professionals including chiropractors. In this study, the frequency of office visits was categorized into five categories (i.e., 0–1, 2–3, 4–5, 6–9, and 10 or more), and the frequency of emergency department visits was measured with three categories (i.e., 0, 1, and 2 or more). Inpatient hospital nights during the past 12 months were measured as a categorical variable with three categories (i.e., 0, 1–3, and 4 or more). A dichotomous variable measured whether the respondent received any home care from a health professional in the past 12 months.

#### ***Key independent variable: Food insecurity***

The FFS supplement of NHIS included the 10-item Household Food Security Survey Module to assess food insecurity status. A detailed description of this measure of food insecurity is published elsewhere (29). Based on the sum of affirmative responses to the Household Food Security Survey Module, respondents were classified into four groups: high food security (Raw score 0), marginal food security (Raw score 1–2), low food security (Raw score 3–5), and very low food security (6–10). In this study, older adults in low and very low food security groups were combined and classified as food insecure (Raw score 3–10).

#### ***Other Variables***

Models to assess the relationship between food insecurity and health care utilization were adjusted for demographic, socioeconomic, health status, and

health behavior factors known to be associated with health care services utilization in prior research and theory (24, 26, 30–33). Demographic factors included age (65 to 74 years, 75 to 84 years, 85 years and older), gender (male, female), race/ethnicity (Hispanics, non-Hispanic white, non-Hispanic black and others), marital status (married, divorced or separated, widowed, single), living arrangement (living alone, living with someone), and region of residence (Northeast, Midwest, South, West).

Socioeconomic factors included income level, education, and type of health insurance coverage. Level of income as percentage of the federal poverty level (FPL) was classified in following categories: <100%, 100%–199%, 200%–299%, 300%–399%, and 400%. Education was categorized as less than high school diploma, high school diploma, some college or associate degree, and at least college degree. Based on self-reported information on type of health insurance coverage, respondents were categorized into four mutually exclusive groups: Medicare only, Medicare and private insurance, Medicare and Medicaid, and other insurance coverage.

Measures of health status in NHIS include self-reported health on a five-point scale and the self-reported clinical diagnosis of chronic conditions. Self-reported health was categorized as excellent or very good, good, and fair or poor. Four dichotomous variables were created to measure whether the respondent had hypertension, diabetes, at least one cardiovascular condition (coronary heart disease, angina pectoris, heart attack, heart condition/disease), or severe mental health disorder. In NHIS, mental health of the respondents was assessed using the Kessler-6 measure of psychological distress (34). Based on affirmative responses to questions on presence of eight chronic conditions including hypertension, coronary heart disease, stroke, diabetes, cancer, emphysema, asthma, and arthritis, a score for total number of conditions was calculated and then grouped into three categories: 0, 1–2, and 3 or more.

### **Analytic sample**

The pooled NHIS 2011 and 2012 analytic sample included individuals aged 65 years and older. Out of 14,284 adults aged 65 years and older, 13,698 older adults had complete information on key study variables. Since virtually all adults aged 65 years and older are eligible for Medicare coverage, less than 1% of the sample reported lack of insurance coverage ( $n = 109$ ; 23.4% food-insecure and 76.6% food-secure older adults). It is noteworthy that prevalence rate of food insecurity among uninsured older adults is nearly four times higher than the national prevalence rate. This subpopulation of food-insecure, uninsured older adults is likely to face severe challenges in meeting their food and health care needs and should be examined separately. However, in our data, cell frequencies for each category of office visits and inpatient hospital nights by food insecurity status were very small for these uninsured

older adults, which affected the stability of the regression models. Therefore, for statistical reasons, these individuals were excluded from multivariate analysis. The final analytical sample comprised of 13,589 older adults (95% of all respondents aged 65 years and older, mean age  $74.4 \pm 6.7$  years, 56% female, 80% white).

### **Statistical methods**

Bivariate and multivariate analyses were used to examine the relationships between food insecurity and indicators of health care services utilization. Measures of outpatient office visits, inpatient hospital nights, and emergency department visits in NHIS data were ordered categorical variables and measure of home health care utilization was a binary variable. Chi-square tests were used to assess the bivariate association between food insecurity and measures of health care utilization. Binary logistic regression model was used for estimating the likelihood of home health care utilization. Ordered logistic regression models, also known as proportional odds models, appropriate for analyzing categorical ordered variables, were used for analyzing office visits, inpatient hospital nights, and emergency department visits. Ordered logistic regression is based on the assumption of proportional odds. In this study, the global test of null hypothesis for proportional odds was rejected for office visits, inpatient hospital nights, and emergency department visits models suggesting that at least one variable in the model violated proportional odds assumption. However, a test of the assumption for each variable separately showed that food insecurity, key variable of interest in this study, satisfied the proportional odds assumption. We estimated generalized ordered logistic regression models, specifically partial proportional odds models using the GOLOGIT2 routine in STATA 11 to further examine any differences in the effects of other variables across different levels of dependent variables (35). The GOLOGIT2 routine produces a series of  $k-1$  logistic regression models for a dependent variable with  $k$  levels. In these models, some parameter estimates are the same for all levels of the dependent variable, while others are allowed to vary. Although the magnitude of the effect of variables that were allowed to vary differed across different levels of the dependent variable, our inferences did not change. Therefore, noting the caveat that the models did not pass the global test for proportional odds, we report the results for ordered logistic model for ease of interpretation. Ordered logistic regression coefficients are interpreted as log odds of one category to the adjacent category with a lower value. For example, for the office visits variable, the coefficients were the log odds of “10 or more visits” to “6–9,” “6–9” to “4–5,” “4–5” to “2–3,” and “2–3” to “0–1.” If an estimated parameter, for example, for food insecurity, was positive, it would mean that food insecure were more likely to have “10 or more visits” than “6–9” or “6–9” visits than “4–5” and so on. To

determine whether association of food insecurity with utilization of health care services differed by poverty level, health, and health insurance coverage, statistical interaction of food insecurity with these variables was tested in all models.

The NHIS is a complex design survey. All analyses and estimates were weighted and adjusted for complex sample design using the NHIS sample weights to account for this complexity. The sample weights were also adjusted for pooling of two years of data. All data analysis was conducted by using the STATA software (36).

**Results**

***Sample characteristics***

The sample used in this study comprised 13,589 persons aged 65 years and older representing nearly 39 million older Americans. Overall, 5.7% of respondents, representing approximately 2.2 million older Americans, reported food insecurity. The demographic, socioeconomic, and health characteristics of food-secure and food-insecure older adults are presented in Table 1. Nearly half of the sample was aged 65–74 years, 56% were female, and 80% were white. Nearly one-fifth of the sample reported fair or poor health (21.8%) and had diabetes (20.3%). About 30% had at least one heart condition.

**Table 1.** Characteristics of the study sample by food insecurity status: NHIS 2011 and 2012.

	Total sample (N = 13,589, 38.8 M Weighted)	Food insecure (n = 961, 5.57%, 2.2 M weighted)	Food secure (n = 12,628, 94.43%, 37 M Weighted)	
	%	%	%	p-Value*
Food insecurity	5.57			
Demographic characteristics				
Age				<.0001
65–74	52.12	62.45	51.51	
75–84	36.63	30.54	36.99	
85+	11.25	7.01	11.50	
Female	56.07	64.08	55.59	0.0001
Race				<.0001
Hispanic	7.12	17.66	6.49	
Non-Hispanic black/Other	80.25	28.46	11.70	
Non-Hispanic white	12.63	53.88	81.81	
Marital Status				<.0001
Married	58.50	36.19	59.81	
Divorced or separated	10.90	23.92	10.14	
Never married	3.98	6.01	3.86	
Widowed	26.62	33.88	26.20	
Live alone	31.18	38.33	30.76	<.0001
Region				<.0001
Northeast	18.87	16.91	18.99	

(Continued)

**Table 1.** Continued.

	Total sample (N = 13,589, 38.8 M Weighted)	Food insecure (n = 961, 5.57%, 2.2 M weighted)	Food secure (n = 12,628, 94.43%, 37 M Weighted)	p-Value*
	%	%	%	
Midwest	22.21	15.03	22.63	
West	21.88	21.75	21.89	
South	37.04	46.31	36.49	
<b>Socioeconomic characteristics</b>				
<b>Income as % of FPL</b>				<.0001
<100%	8.71	33.03	7.27	
100%–199%	23.30	44.43	22.05	
200%–299%	20.57	15.10	20.89	
300%–399%	14.62	4.85	15.20	
≥400%	32.81	2.59	34.59	
<b>Education</b>				<.0001
Less than high school	20.04	47.88	18.39	
High school	30.77	25.99	31.05	
Some college	49.20	26.12	50.56	
College				
<b>Health insurance</b>				<.0001
Medicare only	33.40	46.43	32.63	
Medicare and private	50.93	20.31	52.74	
Medicare and Medicaid	5.76	23.83	4.69	
Other insurance	9.91	9.42	9.94	
<b>Health</b>				
<b>Self-reported health</b>				<.0001
Excellent/very good	44.66	16.86	46.30	
Good	33.56	27.78	33.90	
Fair/poor	21.78	55.36	19.79	
<b>Number of chronic conditions</b>				<.0001
0	13.69	7.36	14.07	
1–2	52.76	40.26	53.49	
3 or more	33.55	52.38	32.44	
Hypertension	62.32	71.53	61.77	<.0001
Diabetes	20.34	32.98	19.60	<.0001
Heart condition	30.24	37.27	29.82	0.0001
<b>Body weight</b>				<.0001
Under weight	1.95	2.51	1.91	
Normal weight	32.96	29.93	33.14	
Overweight	37.68	32.07	38.01	
Obese	27.42	35.49	26.94	
<b>Severe mental disorder</b>	1.75	9.19	1.31	<.0001
Smoking	8.40	17.16	7.88	<.0001
Year				0.5381
2011	48.80	50.11	48.72	
2012	51.20	49.89	51.28	

\*Based on Pearson's Chi-square test.

Compared with food-secure older adults, food-insecure older adults had worse economic and health status. Poverty was more prevalent among food-insecure older adults. Compared to food-secure older adults, food-insecure older adults were less likely to have Medicare and Private insurance coverage but more likely to have both Medicare and Medicaid coverage. Food-insecure older adults were also more likely to report poorer



self-perceived health status and have three or more chronic conditions than food-secure older adults. Prevalence of hypertension, diabetes, heart condition, and severe mental disorder was also higher in food-insecure than food-secure older adults.

### ***Relationship between food insecurity and health care utilization***

The majority of the sample (83.2%) reported two or more office visits, and nearly 17% spent at least one night in the hospital during the past 12 months (Table 2). Nearly one-fifth (22.5%) of the respondents reported at least one emergency department visit, and 8.1% used home health care. Based on bivariate tests, there were differences in the health care utilization patterns of food-secure and food-insecure older adults. Food-insecure older adults were more likely to utilize the health care services examined in this study. Compared with those who were food-secure, food-insecure older adults were more likely to report 10 or more office visits (31.0% vs. 19.8%) and report four or more hospital nights (18.4% vs. 8.8%). Food-insecure older adults were also more likely to report two or more emergency department visits (18.4% vs. 7.0%) and use home health care in the past 12 months (15.0% vs. 7.8%). Table 3 shows the adjusted odds ratios and corresponding 95% confidence intervals from the multivariate ordered logistic regressions for office visits, inpatient hospital nights, emergency department visits, and multivariate binary logistic regression model for home health care use. After adjustment for demographic and socioeconomic characteristics, health, and health behavior, food insecurity remained strongly associated with office visits, inpatient

**Table 2.** Health care service utilization of the study sample by food insecurity status: NHIS 2011 and 2012.

Variables	Total sample (N = 13,589, 39 M Weighted) %	Food insecure (n = 961, 5.57%, 2.2 M Weighted) %	Food secure (n = 12,628, 94.43%, 37 M Weighted) %	p-value*
Office visits				<.0001
0–1	16.78	12.61	17.03	
2–3	25.74	17.82	26.20	
4–5	20.85	20.86	20.85	
6–9	16.21	17.75	16.12	
10 or more	20.42	30.96	19.80	
Inpatient hospital nights				<.0001
0	83.08	70.46	83.83	
1–3	7.60	11.18	7.38	
4 or more	9.32	18.37	8.79	
Emergency department visits				<.0001
0	77.39	61.15	78.35	
1	14.95	20.44	14.63	
2 or more	7.66	18.41	7.02	
Any home health use	8.17	15.24	7.75	<.0001

\*Based on Pearson's Chi-square test.

**Table 3.** Association between food insecurity and health care utilization: NHS, 2011 and 2012 (Weighted,  $N = 13,589$ , Approx. 39 M Weighted).

	Office visits		Hospital nights		Emergency department visits		Home health care	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>Food insecurity</b>	1.29***	(1.08, 1.55)	1.46***	(1.16, 1.82)	1.60***	(1.32, 1.96)	1.19	(0.89, 1.59)
<i>Demographic characteristics</i>								
<b>Age</b>								
75–84	1.08	(0.99, 1.17)	1.10	(0.97, 1.26)	1.08	(0.96, 1.22)	1.61***	(1.32, 1.97)
85+	1.17*	(1.02, 1.33)	1.16	(0.96, 1.40)	1.22*	(1.02, 1.47)	3.31***	(2.56, 4.29)
Ref: 65–74								
<b>Female</b>	1.26***	(1.16, 1.37)	1.05	(0.92, 1.20)	1.10	(0.98, 1.23)	1.19	(1.00, 1.42)
<i>Race</i>								
Hispanic	0.91	(0.79, 1.05)	0.79	(0.62, 1.02)	1.02	(0.85, 1.23)	0.80	(0.58, 1.11)
Non-Hispanic black/other	0.86**	(0.77, 0.96)	0.95	(0.81, 1.11)	0.86*	(0.75, 0.99)	0.95	(0.76, 1.18)
Ref: Non-Hispanic white								
<b>Marital status</b>								
Divorced or separated	1.00	(0.87, 1.16)	1.25	(0.99, 1.59)	1.34***	(1.09, 1.66)	1.37	(0.98, 1.90)
Never married	1.00	(0.81, 1.23)	0.98	(0.72, 1.33)	1.06	(0.82, 1.38)	1.69*	(1.11, 2.58)
Widowed	1.08	(0.94, 1.23)	1.22	(0.98, 1.52)	1.31***	(1.08, 1.58)	1.55**	(1.16, 2.09)
Ref: Married								
Live alone	0.99	(0.88, 1.12)	0.99	(0.82, 1.19)	0.85	(0.72, 1.00)	0.82	(0.65, 1.04)
<i>Region</i>								
Northeast	1.27***	(1.12, 1.45)	1.04	(0.87, 1.24)	1.19*	(1.03, 1.36)	1.18	(0.93, 1.50)
Midwest	0.88*	(0.78, 0.99)	1.18	(0.99, 1.41)	1.21**	(1.06, 1.39)	0.91	(0.71, 1.15)
West	0.93	(0.84, 1.03)	0.83*	(0.72, 0.96)	1.06	(0.92, 1.21)	0.64***	(0.49, 0.84)
Ref: South								
<i>Socioeconomic characteristics</i>								
Income as % of FPL								
<100%	0.76**	(0.64, 0.91)	0.72*	(0.56, 0.93)	0.93	(0.75, 1.15)	1.14	(0.79, 1.64)
100%–199%	0.81***	(0.72, 0.91)	0.78**	(0.65, 0.94)	1.01	(0.86, 1.19)	0.92	(0.70, 1.21)
200%–299%	0.87*	(0.77, 0.97)	0.78***	(0.65, 0.93)	0.94	(0.80, 1.10)	0.92	(0.69, 1.22)
300%–399%	0.91	(0.80, 1.03)	0.89	(0.73, 1.07)	1.07	(0.90, 1.28)	1.07	(0.79, 1.44)
Ref: ≥400%								

(Continued)

Table 3. Continued.

	Office visits		Hospital nights		Emergency department visits		Home health care	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>Education</b>								
Less than high school	0.66***	(0.58, 0.75)	0.98	(0.81, 1.20)	0.97	(0.82, 1.16)	0.84	(0.61, 1.16)
High school	0.81***	(0.73, 0.90)	0.98	(0.81, 1.18)	1.06	(0.90, 1.24)	0.96	(0.73, 1.26)
Some college	0.79***	(0.71, 0.88)	1.06	(0.90, 1.24)	1.07	(0.91, 1.25)	0.81	(0.61, 1.09)
Ref: College								
<b>Health insurance</b>								
Medicare only	0.86***	(0.78, 0.94)	1.11	(0.96, 1.29)	0.99	(0.88, 1.12)	1.04	(0.87, 1.24)
Medicare and Medicaid	1.13	(0.96, 1.33)	1.51**	(1.15, 1.98)	1.38**	(1.11, 1.72)	2.05***	(1.53, 2.76)
Other insurance	1.12	(0.98, 1.27)	1.14	(0.93, 1.39)	1.29**	(1.10, 1.52)	0.91	(0.68, 1.22)
Ref: Medicare and Private								
<b>Health</b>								
<b>Self-reported Health</b>								
Good	1.55***	(1.43, 1.70)	1.39***	(1.21, 1.61)	1.34***	(1.18, 1.52)	1.50***	(1.19, 1.89)
Fair/poor	2.54***	(2.25, 2.86)	2.97***	(2.50, 3.53)	2.48***	(2.17, 2.83)	3.79***	(3.02, 4.78)
Ref: Excellent/very good								
<b>Number of chronic conditions</b>								
1–2	2.39***	(2.05, 2.78)	1.88***	(1.43, 2.45)	1.61***	(1.30, 1.99)	2.59***	(1.66, 4.03)
3 or more	4.08***	(3.44, 4.83)	2.58***	(1.85, 3.61)	2.22***	(1.72, 2.86)	4.18***	(2.52, 6.93)
Ref: 0								
Hypertension	0.99	(0.91, 1.09)	1.03	(0.87, 1.22)	0.98	(0.87, 1.11)	0.87	(0.69, 1.09)
Diabetes	1.21***	(1.10, 1.34)	1.04	(0.89, 1.22)	1.01	(0.88, 1.15)	1.07	(0.87, 1.31)
Heart condition	1.63***	(1.50, 1.76)	2.01***	(1.78, 2.27)	1.86***	(1.66, 2.08)	1.56***	(1.31, 1.86)
<b>Body weight</b>								
Under weight	0.92	(0.72, 1.18)	0.98	(0.66, 1.45)	1.01	(0.72, 1.42)	0.93	(0.57, 1.53)
Overweight	1.06	(0.96, 1.16)	0.86*	(0.75, 0.98)	0.88*	(0.78, 1.00)	0.91	(0.74, 1.12)
Obese	1.16**	(1.04, 1.30)	0.85*	(0.73, 0.99)	0.83*	(0.71, 0.96)	0.94	(0.75, 1.17)
Ref: Normal weight								
<b>Severe mental disorder</b>	1.41	(0.98, 2.03)	1.04	(0.72, 1.50)	1.77**	(1.25, 2.51)	1.14	(0.76, 1.71)
<b>Smoking</b>	0.76***	(0.67, 0.87)	0.68***	(0.55, 0.84)	0.75***	(0.62, 0.91)	0.75	(0.57, 0.98)
year2011	1.00	(0.93, 1.09)	0.98	(0.87, 1.11)	0.99	(0.89, 1.11)	1.02	(0.87, 1.19)
Constant							0.01	

Note. OR, Odds Ratio; CI, Confidence Interval.

p 0.001; p 0.01; p 0.05.

hospital nights, and emergency department visits. Food-insecure older adults had higher odds of having more office visits (OR 1.29; 95% CI 1.08, 1.55), inpatient hospital nights (OR 1.60; 95% CI 1.32, 1.96), and emergency department visits (OR 1.19; 95% CI 0.89, 1.59). Food insecurity, however, was not significantly associated with home health care use. The interactions of food insecurity with poverty level, measures of health status, and health insurance coverage were not significant, suggesting that the association between food insecurity and health care use is not modified by these variables.

Several other factors were significantly associated with health care utilization. Individuals aged 85 years and older had significantly higher odds of more outpatient office visits, and emergency department visits and were more likely to use home health care than those aged 65 to 74 years. Females had significantly more office and emergency department visits; however, there was no gender difference in utilization of other health care services. Individuals with incomes above 400% of FPL had significantly more office visits and inpatient hospital nights than lower income groups. Poor to fair self-reported health was also positively associated with utilization of all types of health care services. Presence of a heart condition was also positively associated with utilization of all types of health care services examined in this study. Obesity was positively associated with office visits but negatively associated with hospital nights and emergency department visits. Compared to those who Medicare and supplemental private insurance, individuals who were dual enrolled in Medicare and Medicaid had more office visits and were more likely to use home health services.

## Discussion

This study examined the relationship between food insecurity and health care utilization in a nationally representative sample of older adults from NHIS 2011 and 2012. Controlling for demographic, socioeconomic, health, and health behavior factors, older adults living in food-insecure households had higher utilization of office visits, inpatient hospital nights, and emergency department visits than food-secure older adults. Although there was a positive association between food insecurity and home health care use, it was not statistically significant when controlling for other factors. Our findings suggest that food-insecure and food-secure older adults have distinct health care utilization patterns irrespective of the availability of Medicare, which ensures universal health care access among older Americans aged 65 years and older.

Although previous studies focused on other subpopulations, the results are generally consistent with the present findings. Food insecurity was associated with delaying needed medical care and medications and increased utilization of emergency departments and hospitalizations in low-income adults aged 18–64 years (20), higher physician utilization among low-income adults with

diabetes (37), higher utilization of hospitalization and emergency departments among homeless adult users of Health Care for the Homeless clinic sites (38), and more visits to emergency departments due to poor self-management of diabetes (18). However, the findings of this study are substantially different from our previous studies focusing on health care utilization based on state-wide data on food insecurity and Medicare claims among low-income older Georgians. In a statewide sample of older Georgians, food-insecure older Georgians used lower home health and had lower out-of-pocket expenditures (26) but comparable levels of health care utilization compared to their food-secure counterparts (27). Such findings may be due to differences in study sample, design, and health care use assessment between GA Advanced POMP6-CMS and NHIS. The GA Advanced POMP6-CMS study sample differed from the national sample of older adults on several dimensions. In particular, the GA Advanced POMP6-CMS study sample were comprised of older adults enrolled in meal services. They were more likely to report poorer socioeconomic and health status than NHIS sample, having substantially higher prevalence of food insecurity than that in NHIS (39) or any other nationally representative surveys (9). Thus, although NHIS data provide national perspective on the association between food insecurity and utilization of different health care services among older adults, this relationship may differ among subpopulations of older adults facing different economic and health challenges. Such differences underscore the need to take into account the heterogeneity in circumstances faced by subpopulations of older adults when studying these issues.

Although the data used in this study preclude any definitive conclusion regarding the mechanisms for the relationship between food insecurity and utilization of different types of health services, there are several potential explanations for these findings. First, consistent with Andersen's behavioral model of health care utilization (30), the findings of this study suggest that food-insecure individuals may be predisposed to higher health care utilization due to potentially dire health care needs. This pattern has been reported in previous studies in other vulnerable subpopulations such as homeless (38) and low-income adults (20). Existing research documenting direct and indirect negative impacts of food insecurity on health is also in support of this explanation. Second, this study may suggest that public health insurance programs such as Medicare absorb the brunt of health care costs faced by food insecure older adults, who are in worse health status and need it to ensure access to needed health care services. Comparable utilization of home health care by food secure and food-insecure older adults is also consistent with this explanation. Our data, however, do not allow us to identify the underlying reasons for the differences in the utilization of different types of services between food secure and food-insecure older adults.

There are several limitations of this study to mention. First, food insecurity status and health care utilization were measured through self-report, which may introduce bias. Future research should examine the comparability and agreement of health care services utilization data obtained from different sources including administrative claims data and self-reported data in older adults. Second, food insecurity is often a cyclic phenomenon, and cross-sectional data may not elucidate the dynamic relationship between health care utilization and food insecurity. It is also likely that health care utilization may affect food insecurity status. Older adults facing deteriorating health may preferentially allocate resources toward health care resulting in increased likelihood of food insecurity. Longitudinal measurements of food insecurity, health status, and health care utilization are needed to fully comprehend the association between food insecurity and health care utilization. Third, there are many unobserved factors related to food insecurity that we were not able to consider in our study due to lack of data. These factors include total household financial and nonfinancial resources, total household expenditures, availability of community resources including transportation services, and may influence the choice/decision and actual utilization of different types of health care services.

This study expands our previous work based on state level data and provides a national perspective on health care services utilization patterns of food insecure older adults, offering implications for research, practice, and policy. The findings of this study underscore the need to further research the effect of food insecurity on health care utilization patterns in subpopulations of older Americans using appropriate data and research methodology. Data on specific reasons for health care visits, types and intensity of services used during the visit, as well as the episodes of illness are needed to comprehensively understand these differences. Results of this study suggest that food insecurity among older adults has serious implication for health care utilization and costs for these individuals and their families as well as for the nation. Interventions are needed to address the clinical consequences of food insecurity and resulting impact on health care utilization. Food insecurity may also affect the response to the treatment regimen prescribed by the clinicians, particularly for diet-related conditions such as diabetes and hypertension. Health care providers must develop protocols for identifying food-insecure patients and be cognizant of unique challenges faced by food-insecure patients in managing their health conditions. Given the prevention focus of the Affordable Care Act (40), such interventions also have the potential to prevent onset and deterioration of disease resulting from poor health and disease management. Higher utilization of health care services by food-insecure older adults suggests that programs and policies aimed at reducing food insecurity among older Americans may have a potential to improve health and decrease utilization of health care services and thus reduce the total health care cost. The

growing population of older adults in the United States will likely challenge federal entitlement programs such as Medicare and increase demand for home and community-based services such as meal services targeted toward older adults. Coordinating provision of health care services with community and aging services may lead to more efficient and effective allocation of limited public and individual resources and increased viability of healthy aging among older adults.

### Take away points

- Food-insecure and food-secure older adults have different health care utilization patterns. Food-insecure older adults are significantly more likely to have higher level of health care utilization as measured by number of office visits, inpatient hospital nights, and emergency department visits than food-secure older adults.
- Programs and policies aimed at reducing food insecurity among older Americans may have a potential to improve their health and decrease utilization of health care services and thus reduce individual and national health care cost.
- Using appropriate data and methodology, more research is needed to further understand pathways through which food insecurity affects health care utilization among older adults, with special focus on most vulnerable subpopulations of older Americans such as food-insecure, uninsured older adults.

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