Short communication

Food insecurity is associated with multiple chronic conditions and physical health status among older US adults

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ARTICLE INFO

ABSTRACT

In the past two decades, food insecurity has increased by 45% among older adults but its relationship to health outcomes has not been extensively studied. The objective of this study was to examine the associations between food insecurity, multiple chronic conditions, and self-reported health status among a nationally representative sample of older U.S. adults. Data came from the National Poll on Healthy Aging, a national cross-sectional survey conducted in December 2019 among 2,048 individuals aged 50–80 years. Food insecurity was assessed using the six-item short form of the USDA Food Security Survey Module. The primary outcomes of interest were the number of self-reported chronic conditions and self-reported physical health status. Multinomial logistic regression models were used to examine the associations between food security status and the outcomes of interest, adjusting for sociodemographic characteristics. The overall prevalence of food insecurity among older adults was 14%. After adjustment for sociodemographic characteristics, food insecurity was positively associated with multiple chronic conditions (RRR 1.60, 95% CI 1.08, 2.36, for 2–3 conditions vs. 0–1; RRR 2.59, 95% CI 1.55, 4.33 for 4–10 chronic conditions vs. 0–1). Food insecurity was also associated with lower self-reported health status (RRR 1.84, 95% CI 1.16, 2.93 for good vs. excellent/ very good health; RRR 5.13, 95% CI 3.08, 8.52 for fair/poor vs. excellent/very good health). Food insecurity is an important social determinant of health among older adults. These findings can contribute to clinical and public health efforts to simultaneously alleviate food insecurity and promote health behaviors among older adults.

1. Introduction

Food insecurity, defined as limited access to nutritious foods due to a lack of financial resources, is an important social determinant of health for older adults. Since 2001, the prevalence of food insecurity among older adults has increased by 45%, and disproportionately affects individuals who live alone, are unemployed or disabled, live close to the poverty line, and who live with their grandchildren in the home (Coleman-Jensen et al., 2019; Ziliak and Gundersen, 2019a, 2019b). Over this same time period, the prevalence of older adults with multiple chronic conditions (i.e. two or more conditions) has also increased (Ward et al., 2014). Food insecurity may be associated with the risk of multiple chronic conditions through the pathways of inadequate nutrition and chronic stress (Laraia, 2013). Furthermore, food insecurity

may exacerbate existing health conditions for older adults with financial challenges due to the known trade-offs between purchasing food versus medication, leading to poorer disease management, greater subsequent health care needs, and worse overall health (Berkowitz et al., 2013). The objective of this study was to examine the associations between food insecurity, multiple chronic conditions, and self-reported physical health status using a national sample of U.S. adults aged 50–80.

2. Materials and methods

2.1. Study population

Data for this study came from the University of Michigan National

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Poll on Healthy Aging (NPHA), a nationally representative survey of community-dwelling US adults ages 50–80 (n = 2048, completion rate 77%). This survey was conducted in December 2019 and respondents were selected from the Ipsos web-enabled KnowledgePanel®. The KnowledgePanel® is designed to resemble the US population; adults are randomly recruited through address-based sampling, and households are provided with access to the Internet and hardware if needed to complete the survey. The University of Michigan Institutional Review Board formally reviewed this study; this study was declared exempt from human subjects review as a study of de-identified respondents.

2.2. Household food security

The primary exposure was the six-item short form of the U.S. Department of Agriculture (USDA) Food Security Survey Module, which assesses experiences or behaviors related to food insecurity over the past year. Affirmative responses were used to assign food security status according to USDA guidelines: high or marginal food security (0–1 affirmative responses), food insecurity (2–6 affirmative responses). This measure has been shown to be a reliable substitute for the 18-item US Household Food Security Survey Module and results in less respondent burden for food-insecure individuals (US Department of Agriculture, 2012).

2.3. Health outcomes

The two primary outcomes were the number of self-reported chronic conditions and self-reported physical health status. The presence of ten chronic conditions were assessed in NPHA: 1) asthma, chronic bronchitis or COPD; 2) cancer; 3) chronic pain; 4) diabetes; 5) heart disease; 6) high blood pressure; 7) high cholesterol; 8) kidney disease; 9) non-alcoholic fatty liver disease; and 10) sleep disorder. The number of conditions was collapsed into three categories for analysis: 0–1, 2–3, and 4 or more chronic conditions, consistent with prior studies of multiple chronic conditions (Ward et al., 2014). Self-reported physical health status was assessed using the single-item measure, "In general, how would you rate your physical health?" Response categories were collapsed into three categories for analysis: excellent/very good, good, fair/poor. This one-item question has been shown to be a robust predictor of future morbidity and mortality (McGee et al., 1999; Miilunpalo et al., 1997).

2.4. Participant characteristics

Sociodemographic characteristics of interest within NPHA included respondents' age, sex, race/ethnicity, educational attainment, marital status, household income, employment status, health insurance status, and participation in the Supplemental Nutrition Assistance Program (SNAP) in the past 12 months.

2.5. Statistical analysis

Post-stratification weights, based on age, race/ethnicity, education, Census region, household income, home ownership status, and metropolitan area, were created by Ipsos, and applied to all statistical analyses to generate nationally representative estimates. Sociodemographic characteristics by respondents' food security status were compared using chi-squared tests. Multinomial logistic regression models were then used to examine the associations between food security status and the health outcomes of interest. Models were first adjusted for age and sex, and subsequently for all other sociodemographic characteristics with the exception of SNAP participation. SNAP participation was not included in the adjusted models as it was conceived to be a mediator between food insecurity and subsequent health outcomes. Statistical tests were two-sided and significance was considered at *P < 0.05*. Statistical analyses were performed using

Table 1
Characteristics of study population by food security status.

	Food secure[1]	Food insecure[1]	P
Age			*< 0.001*
50–59	38.5	52.2	
60–69	36.9	35.5	
70–80	24.6	12.3	
Sex			*0.16*
Male	48.4	43.1	
Female	51.6	56.9	
Race/ethnicity			*< 0.001*
White, Non-Hispanic	72.9	59.4	
Black, Non-Hispanic	9.8	17.2	
Hispanic	10.5	17.8	
Other or multiple race, Non-Hispanic	6.8	5.5	
Educational attainment			*< 0.001*
High school degree or less	36.6	61.0	
Some college	26.9	25.4	
College graduate or higher	36.6	13.6	
Marital status			*< 0.001*
Married or living with partner	69.5	49.7	
Not married or partnered	30.5	50.3	
Annual Household income			*< 0.001*
Under $50,000	29.0	68.6	
$50,000–99,999	31.0	22.6	
$100,000 or higher	39.9	8.8	
Current employment status			*< 0.001*
Working full-time	38.3	31.3	
Working part-time	9.3	9.7	
Not working/unable to work	7.1	31.0	
Retired	45.3	27.9	
Health insurance			*0.001*
Employer-based coverage	47.9	35.9	
Medicare/Medicaid/VA	41.5	52.0	
Other source/marketplace	7.4	5.0	
No health insurance	3.3	7.1	
SNAP participation in last 12 months			*< 0.001*
Yes	6.3	31.8	
No	93.7	68.2	
Chronic medical conditions			
Asthma, chronic bronchitis, or COPD	9.9	21.6	*< 0.001*
Cancer	9.4	10.3	*0.67*
Chronic pain	12.5	30.3	*< 0.001*
Diabetes	19.5	31.7	*< 0.001*
Heart disease or related heart condition	9.0	11.3	*0.29*
High blood pressure	40.3	46.7	*0.10*
High cholesterol	31.7	37.9	*0.09*
Kidney disease	2.0	5.6	*0.005*
Non-alcoholic fatty liver disease	1.8	2.5	*0.48*
Sleep disorder	10.0	20.7	*< 0.001*
Number of chronic medical conditions[2]			
0–1	60.1	46.5	*< 0.001*
2–3	31.9	35.0	
4 or more	9.0	18.5	
Self-reported physical health status			*< 0.001*
Excellent or very good	46.7	18.2	
Good	39.7	36.7	
Fair or poor	13.6	44.8	

SNAP, Supplemental Nutrition Assistance Program; COPD, Chronic obstructive pulmonary disease.

[1] Proportions are weighted based on participant's age, race/ethnicity, education, Census region, household income, home ownership status, and metropolitan area to generate nationally representative estimates.

[2] Self-reported medical conditions include: 1) asthma, chronic bronchitis or COPD; 2) cancer; 3) chronic pain; 4) diabetes; 5) heart disease; 6) high blood pressure; 7) high cholesterol; 8) kidney disease; 9) non-alcoholic fatty liver disease; and 10) sleep disorder.

Stata version 15.1 (StataCorp, College Station, TX).

3. Results

Estimated characteristics of the study population are shown in Table 1. The overall prevalence of food insecurity among older adults aged 50–80 was 14%. Compared to food-secure individuals, food-insecure individuals were more likely to be of younger age, Non-Hispanic Black or Hispanic race/ethnicity, have lower educational attainment, not be married or partnered, have lower household incomes, not be working or unable to work, and have government-sponsored health insurance ($Ps < 0.001$). There was no difference in sex by food security status.

Approximately 54% of food-insecure individuals had multiple chronic conditions (i.e. two or more conditions), compared to 41% of food-secure individuals ($P < 0.001$). Of the specific conditions assessed, food-insecure individuals were more likely than food-secure individuals to report having asthma, chronic bronchitis or COPD; chronic pain, diabetes; kidney disease, or a sleep disorder than food-secure respondents ($Ps < 0.001$). There were no significant differences in cancer, heart disease, high blood pressure, high cholesterol, or non-alcoholic fatty liver disease by food security status. Food-insecure individuals were also more likely to report lower overall health status than food-secure individuals – approximately 45% of food-insecure individuals reported their physical health as fair or poor, compared to 14% of food-secure individuals.

Associations between food insecurity and self-reported health measures are shown in Table 2. After adjustment for sociodemographic characteristics, food insecurity was associated with significantly higher odds of 2–3 chronic health conditions (RRR 1.60, 95% CI 1.08, 2.36) and 4 or more chronic health conditions (RRR 2.59, 95% CI 1.55, 4.33) versus 0–1 chronic health conditions. Food insecurity was also associated with significantly higher odds of good physical health (RRR 1.84, 95% CI 1.16, 2.93) and fair/poor physical health (RRR 5.13, 95% CI 3.08, 8.52) versus excellent/very good physical health.

4. Discussion

In this national sample of older adults, adults experiencing food insecurity were more likely to have multiple chronic conditions than their food-secure counterparts, even after adjustment for educational attainment, household income, employment status, and other sociodemographic factors. The association between food insecurity and multiple chronic conditions has been previously observed. One study found that food insufficiency, an older measure of food insecurity, was associated with greater than a three-fold higher odds of multimorbidity in a sample of older women (n = 279) receiving home-delivered meals (Sharkey, 2003). Two other studies examined the reverse association and found that having multiple chronic conditions also predicted higher odds of food insecurity (Jih et al., 2018; Tarasuk et al., 2013). The

cross-sectional nature of the present study limits our understanding of the directionality of the association, though both directions are plausible. Past research has shown that food insecurity is associated with multiple health outcomes, such as cardiometabolic risk factors (Saiz et al., 2016), hypertension (Seligman et al., 2010), diabetes (Seligman et al., 2007), poorer sleep outcomes (Ding et al., 2015), and cost-related medication underuse (Afulani et al., 2015). Conversely, adults in low-income households with chronic conditions could face financial hardships in managing their health conditions that could increase their subsequent risk of food insecurity (Jeon et al., 2009). The results from the present study further contribute to this growing literature, demonstrating that food insecurity was associated with lower self-reported physical health, which may be due to a higher burden of chronic conditions experienced by food-insecure respondents. Our findings are mostly congruent with prior research; however, food insecurity was not significantly associated with hypertension in bivariate analyses. This difference could be attributed to the older study population, in which hypertension is relatively prevalent (i.e. 40.3% among food-secure adults vs. 46.7% among food-insecure adults). The association between food insecurity and lower self-reported health status has also been observed in various populations, including adults with disabilities (Brucker, 2017), adults from community health centers (Alvarez et al., 2015), and older adults using national datasets (Lee and Frongillo, 2001; Ziliak and Gundersen, 2017). The current study builds on this prior work by providing the most recent national data on food insecurity and its association with key health measures among older US adults.

Given that one in seven older adults in the sample experienced food insecurity in 2019, efforts to provide application assistance for the Supplemental Nutrition Assistance Program (SNAP), screen for food insecurity in clinical settings, and provide referrals to community food resources (e.g. food pantries, congregate meal programs) are increasingly necessary to alleviate food insecurity among older adults (Gregory and Smith, 2019; Gundersen et al., 2017). In the present study, fewer than one in three food-insecure older adults reported receiving SNAP benefits during the past year. These efforts are particularly important given the current COVID-19 pandemic, which has already been shown to exacerbate existing food insecurity disparities among low-income adults (Wolfson and Leung, 2020). During these times, expanding longstanding programs like SNAP, including increasing benefit allotments and allowing for online grocery shopping, and enabling congregate meals to be delivered to participants' homes rather than needing to be consumed in communal settings, are needed to ensure these programs are consistently reaching older adults at risk of food insecurity, inadequate nutrition, and poor health status.

In addition to the cross-sectional design, another limitation of this study is that food insecurity was assessed using the shortened version of the USDA food security questionnaire. Although the USDA describes this measure as having high sensitivity and specificity with minimal bias, it does not capture the most severe experiences attributed to food

Table 2
Associations between food security status and self-reported health outcomes.[1]

| | Outcome 1: Multiple chronic conditions | | | | Outcome 2: Self-reported health status | | | |
| | 2–3 vs. 0–1 conditions | | 4–10 vs. 0–1 conditions | | Good vs. Excellent/very good | | Fair/poor vs. Excellent/very good | |
	RRR[2]	95% CI	RRR[2]	95% CI	RRR[2]	95% CI	RRR[2]	95% CI
Food insecurity								
Age and sex adjusted	1.69	1.20, 2.36	3.42	2.19, 5.34	2.29	1.53, 3.43	8.68	5.69, 13.24
Multivariate adjusted	1.60	1.08, 2.36	2.59	1.55, 4.33	1.84	1.16, 2.93	5.13	3.08, 8.52

RRR, Relative Risk Ratio.
[1] Effect estimates are weighted based on participant's age, race/ethnicity, education, Census region, household income, home ownership status, and metropolitan area to generate nationally representative estimates.
[2] Adjusted for age, sex, race/ethnicity, educational attainment, marital status, annual household income, employment status, and health insurance.

insecurity (US Department of Agriculture, 2012). Diagnosis of individual chronic conditions was also self-reported and may exclude individuals with underlying health conditions but lack a formal diagnosis. Lastly, food insecurity has also been associated with poorer mental health outcomes, which may bias one's ability to self-report the diagnosis of individual chronic conditions. Future studies may want to incorporate medical records or clinical biomarkers to extend the results of the present study.

5. Conclusion

Food insecurity is an important social determinant of health among older adults. In the present study, one in seven older adults experienced food insecurity in the past year, and food insecurity was subsequently associated with multiple chronic conditions and lower self-reported physical health status. Programs and policies aimed at improving food security are continually needed to ensure they are reaching older adults during times of national health and economic crises.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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