Published in final edited form as:
J Hunger Environ Nutr. 2022 September 04; 17: . doi:10.1080/19320248.2022.2118564.

Food Insecurity and Food Worries During the COVID-19 Pandemic: A Point-In-Time Study of Injured United States Veterans

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Abstract

US Military Veterans experience higher rates of food insecurity compared to civilians, but the impact of the COVID-19 pandemic on Veterans is unclear. We conducted a nationwide survey of injured post-9/11 Veterans' food security, Coronavirus exposure, and nutrition habits. Of 193 Veterans, 63 (32.6%) were food insecure. Food insecurity was associated with Hispanic ethnicity ($p = 0.02$), prior homelessness ($p = 0.003$), combat service ($p < 0.0001$), and food-related worries ($p = 0.003$). Food insecure Veterans were more likely to report anxiety about stigma related to COVID-19 infection ($p = 0.007$). Nutrition assistance initiatives should attend to emergent psychosocial factors, beyond well-established economic factors, that increase risk for food insecurity.

Keywords

Food insecurity; COVID-19; veterans; food worry; eating habits; disability

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Disclosure statement
No potential conflict of interest was reported by the author(s).

Introduction

The coronavirus-19 (COVID-19) global pandemic significantly disrupted many aspects of economic life in the United States, with widespread job losses,[1] increased use of unemployment benefits,[2] and greater reliance on charitable donations to meet basic needs.[3] In particular, the financial downturn had a substantial, adverse effect on food security. Food *in*security, the condition in which there is limited or uncertain access to adequate nutrition,[4] consistently declined since the Great Recession of 2008, with a national prevalence near 15% in 2010, and decreasing to 11% in 2019.[5] Since the pandemic lockdown began in March of 2020, however, estimates of food insecurity prevalence substantially increased. While methodologies differ, and new data continue to become available, the prevalence estimates range from over 20%[6] to nearly 40%.[7]

Previous economic disruptions caused increases in food insecurity,[8] but the impact of the pandemic is arguably unparalleled. While federal and state nutrition assistance programs responded to the increased need by expanding benefits,[9] their implementation and disbursement has often been uneven, hampered by logistical and administrative obstacles.[10] Food insecurity is a complex, multifactorial problem, and is associated with a variety of adverse effects on physical and mental health, many of which can persist over the lifespan.[11,12] Figure 1 presents a recently published theoretical model by Leddy et al.,[13] which contextualizes the impact of the COVID-19 pandemic on food insecurity, as well as the various economic, psychological, and sociocultural factors that may shape people's experiences with securing sufficient food during a global health crisis. As a result, public health experts are calling for research efforts and policy changes aimed at addressing the long term impacts of "pandemic food insecurity," even if/when COVID-19 infection rates decrease and the economy stabilizes.[13,14] Recent research in food insecurity has expanded its focus beyond financial factors to include psychological concepts, such as worries relating to having enough food or money to purchase food.[15,16] Assessing these food worries, in addition to economic aspects, can provide a more comprehensive characterization of food insecurity in a population.

People with chronic health conditions are at significantly increased risk of experiencing food insecurity.[17] United States (US) Military Veterans, particularly those who served after September 11th, 2001, contend with a high prevalence of service-related conditions and injuries,[18] while also experiencing significantly higher rates of food insecurity compared to non-Veteran populations.[19–21] Physical disabilities, psychiatric conditions, social isolation, and lingering cognitive difficulties (primarily from mild traumatic brain injuries [mTBI], which are the "signature" injuries of the post-9/11 era)[22] may render these Veterans uniquely vulnerable to experiencing pandemic food insecurity. While the full economic impact of COVID-19 on this population is still unclear, understanding and characterizing pandemic-related food insecurity in post-9/11 Veterans can provide insights into service shortfalls and treatment gaps, as well as identify opportunities for long-term intervention. To that end, we conducted a point-in-time study of food insecurity, nutrition habits, and the socioeconomic impact of COVID-19 among a sample of injured military Veterans.

Methods

Data Source

We used the Department of Veterans Affairs Corporate Data Warehouse (CDW) to identify potential participants. Veterans were considered eligible if they: 1) served after September 11, 2001; 2) ever received care at a VA Medical Center, and 3) met criteria for a diagnosis of service-related polytrauma. Polytrauma was established if diagnostic codes (ICD-9/10) indicated the following: 1) at least one mTBI; and 2) at least one TBI-related comorbidity (i.e., posttraumatic stress disorder [PTSD], depression, anxiety, spinal cord injury, chronic pain, amputation, burns, bone fractures, visual damage, and/or auditory damage). Over 10,000 eligible Veterans were identified, from which a random sample of 5,000 was selected. The sample was comprised of 50.2% White, non-Hispanic males and 49.8% had at least one minority characteristic (female, nonwhite, Hispanic).

Data Collection

Recruitment and data collection took place concurrently, from March to July of 2021. All 5,000 Veterans were mailed a packet inviting them to participate, which included a description of the study, a consent sheet, a refusal postcard, contact information, and directions for completing the web-based surveys. This study was conducted according to the guidelines in the Declaration of Helsinki and all procedures involving human participants were approved by the Colorado Multiple Institutional Review Board (COMIRB).

Survey Items

Participants completed 4 questionnaires, administered using a Research Electronic Data Capture (REDCap) system, a HIPAA-compliant web-based application for collecting and storing survey-based data.[23] To expedite data collection and analysis during the pandemic, no hard copies of questionnaires were used. A demographic questionnaire assessed age, gender, race/ethnicity, education, and combat exposure. To establish food insecurity status, participants completed the U.S. Department of Agriculture (USDA) Household Food Security Module: Six-Item Short Form.[24] Third, participants completed the 22-item Coronavirus Exposure and Concerns questionnaire,[25] which assesses pandemic-related factors across psychological, social, and financial domains, among others. Several items assess infection history (e.g., “Have you got or had Coronavirus?”), and Likert-type scales gauge virus-related worries, (e.g., “How worried are you about being infected with Coronavirus?”). The questionnaire also evaluates financial worries (e.g., “How worried are you about your job security because of Coronavirus?”), and perceptions of community and government responses to the pandemic, (“How worried are you about a shortage of food or day-to-day products as a result of Coronavirus?”).

Lastly, participants completed 10 questions developed for this study to assess how the pandemic affected their nutrition habits, which includes eating habits, grocery purchasing habits, and food budgets (Appendix 1). Survey items used Likert-type responses to assess factors such as food budgets, (“Since March 13, 2020, the amount of money that I am able to spend on food … Significantly decreased/Somewhat decreased/etc.”), and food worries, (“I worry about food … Almost all the time/A lot more/etc.”). The survey also

evaluated if respondents are receiving, have applied for, or have applied for and been denied nutrition assistance in the form of government (e.g., SNAP [Supplemental Nutrition Assistance Program] benefits), or community (e.g., food pantries, Meals-on-Wheels) aid. All participants who completed the 4 questionnaires were compensated for their time, either with a check mailed to their home address, or via direct deposit through the VA system.

Statistical Analysis

The prevalence of food insecurity was calculated for the sample. Demographic and military characteristics, nutrition habits during the COVID-19 pandemic, and Coronavirus exposure were described. Poisson regression with robust error variance was used to calculate unadjusted relative risk estimates and 95% confidence intervals (CI) for associations between food insecurity and demographic characteristics, nutrition habits, and Coronavirus exposure. We examined univariate associations between variables and food security status using two-sample *t*-tests or Wilcoxon rank sum tests for continuous variables and chi-square or Fisher's exact tests for categorical variables. Demographic variables that displayed significance in the univariate models were identified as potential confounders. Associations between food insecurity and nutrition habits and Coronavirus exposure, adjusting for age, ethnicity, employment status, total household income, history of homelessness, children residing in the home, and history of combat were assessed using Poisson regression with robust error variance. An alpha level of 0.05 was used to assess statistical significance. All analyses were performed in SAS 9.4 (SAS Institute, Inc., Cary, North Carolina).

Results

Demographic characteristics are presented in Table 1. Out of 5,000 potential participants, 201 injured Veterans initiated data collection (4% response rate). Eight participants did not complete all the surveys or were lost to follow up. Out of the remaining 193 participants who completed data collection, 63 (32.6%) reported being food insecure. Among the food insecure, 32 participants met the USDA's definition of "Low" food security, and 31 met the definition of "Very Low" food security. The overall sample was predominantly male (78.1%) and White (74.6%), and one-fifth of participants identified as Hispanic. Approximately half of participants were employed at the time of data collection, and a third were retired. On average, participants had been deployed on two combat tours during their military service. Nearly one-third (32.1%) of participants reported having a prior experience of homelessness.

Relative risk estimates for food insecurity are presented in Table 2. In univariate modeling, Hispanic ethnicity was associated with a 64% increase in relative risk of being food insecure, compared to non-Hispanic injured Veterans, RR = 1.64, 95% CI (1.09, 2.47), $p = 0.02$. Being unemployed was associated with 2.35 times the risk for being food insecure and being retired was associated with 1.47 times the risk, 95% CI (1.47, 3.78) and (0.91, 2.35), respectively, overall $p = 0.002$. Relative to never having been deployed on a combat tour, injured Veterans who served in combat experienced 1.09 times the risk of being food insecure, 95% CI (1.05, 1.13), $p < 0.0001$. Compared to those who had never experienced homelessness, injured Veterans who had at least one lifetime experience of homelessness had 1.8 times the risk of being food insecure, 95% CI (1.22, 2.67), $p = 0.003$. Having

children was also associated with increased risk of food insecurity, RR = 1.18, 95% CI (1.05, 1.33), $p = 0.005$. Lastly, increasing strata of annual income were significantly associated with reduced risk of experiencing food insecurity; for example, earning over $75,000 but less than $100,000 per year conferred a 70% decrease in risk, RR = 0.30, 95% CI (0.10, 0.88), overall income $p = 0.0007$.

For multivariate estimates of nutritional habits and food insecurity risk (Table 2 – Nutrition Habits), the model was adjusted for the aforementioned characteristics, age, ethnicity, employment status, total household income, history of homelessness, children residing in the home, and history of combat. Categories of responses were collapsed into "positive" or "desirable" reference groups (e.g., having as much or more money for food as before the pandemic, never having applied for nutrition assistance benefits), and "negative" or "undesirable" comparison groups (e.g., applying for but being ineligible for assistance, experiencing increased worry about food). Across all variables, experiencing a negative/undesired factor was associated with a significantly increased adjusted risk for being food insecure. Of note, worries about having enough money for food ($p = 0.003$), being able to afford preferred foods ($p = 0.0004$), and running out of nutrition assistance benefits in the future ($p = 0.003$), were particularly impactful, conferring between two and three times the risk of being food insecure compared to participants without these worries.

Lastly, results for the Coronavirus Exposure and Concerns questionnaire, by food security status, are presented in Table 3. Compared to food secure participants, injured Veterans experiencing food insecurity were more likely to report self-isolating at home ($p = 0.0009$), but less likely to report having COVID-like symptoms within the previous week ($p = 0.03$). In terms of following news and consuming media content related to the pandemic, food insecure participants were significantly more likely to check media sources multiple times per day, compared to food secure participants, particularly on traditional media such as television and radio ($p = 0.02$), and on official COVID-related websites ($p = 0.01$). For pandemic-related worries, participants with food insecurity were significantly more likely to report feeling worried about job security ($p = 0.02$), financial implications of the pandemic ($p < 0.0001$), and experiencing shortages of food and day-to-day products ($p < 0.0001$), compared to food secure counterparts. Food insecure participants were also significantly more likely to report that they were worried about experiencing stigma or rejection if they were to be infected with COVID-19 ($p = 0.007$). Lastly, food insecure participants were significantly more likely than food secure counterparts to report being "Quite a bit" or "Extremely" worried about the government and health care systems being able to manage the pandemic, $p < 0.0001$ and $p = 0.001$, respectively.

Discussion

Demographic Factors

To our knowledge, this is the first study to examine food insecurity, food-related worries, and the COVID-19 pandemic in injured Veterans. Nearly one-third of participants reported being food insecure since the beginning of the pandemic lockdown, which falls in the middle of the 20–40% range of prevalence estimates for the US.[6,7] Women were slightly overrepresented in the sample, comprising over 20% of the cohort, compared

to approximately 18% of post-9/11 Veterans nationwide,[26] but food security did not differ by gender. Food security also did not differ by racial identity, even though racial minorities, particularly African and Native Americans, are consistently at significantly increased risk of experiencing food insecurity compared to White counterparts in the general population.[27] The proportions of participants who identified as White/Caucasian closely approximated racial distributions for the entire post-9/11 Veteran population, nevertheless, African Americans were somewhat underrepresented, comprising just over 9% or this cohort, compared to 14% of post-9/11 Veterans nationwide.[26] Of note, the numbers of Pacific Islanders, Asian Americans, and Native American/Alaskan Natives in the cohort, while representative of their respective national populations, yielded insufficient numbers to identify potential differences. Hispanic injured Veterans were overrepresented (21% of the cohort compared to 14% of post-9/11 Veterans nationally)[26] and experienced a 64% increase in risk of being food insecure relative to their non-Hispanic counterparts. This finding suggests that the COVID-19 pandemic may have uniquely placed Hispanic people at increased risk for being food insecure. Specifically, Hispanic people are more likely to work in the hospitality and leisure industries than any other racial or ethnic group, and experienced drastic increases in unemployment rates as these industries bore the brunt of the pandemic lockdown and subsequent economic downturn.[28,29] It is unknown if injured Hispanic Veterans are also more likely to work in the hospitality and leisure industries, but this may explain some of the ethnic disparity in food insecurity.

Economic Factors

As expected, experiencing food insecurity was significantly associated with several well-established risk factors, namely lower income, having children in the household, and unemployment/retired status.[30–33] More specifically, participants who reported that the amount of money they are able to spend on food somewhat or significantly decreased since March of 2020 experienced a 67% increase in relative risk of being food insecure. Of note, both the use of, and ineligibility for government nutrition assistance benefits were significantly associated with increased risk of experiencing food insecurity. For the latter, our findings highlight a common concern among food insecure Americans, namely that “near poverty,” or earning just above 130% of the federal poverty line, usually precludes eligibility for nutrition assistance like SNAP.[34] The USDA counts unemployment benefits and Social Security benefits toward total income, as well as service-connected disability payments for injured Veterans who are not deemed 100% disabled,[35] leaving many people unable to afford sufficient food, and reliant on community assistance programs to meet their needs.[3] Given that the pandemic significantly overburdened many food banks’ and mutual-aid programs’ resources, even with increases in federal funding,[36] the food insecure Veterans who reported being ineligible for government nutrition assistance arguably found it even more difficult to procure sufficient food to meet their needs.

For the participants who reported receiving nutrition assistance, our findings support previous studies’ observations that receiving nutrition assistance benefits does not necessarily mitigate food insecurity.[37,38] This may be the result of the cyclical nature of food insecurity, in which benefit payments issued at the beginning of the month are frequently not sufficient to last until the end of the month.[39] Another explanation may be the increase in

food prices since the start of the pandemic. Independently of disruptions in manufacturing and supply chains, food prices have risen since March of 2020. USDA estimates of the Consumer Price Index (CPI) for all at-home food purchases have increased by 2.5% since 2020, and are projected to continue rising into 2022.[40] For households already experiencing other pandemic-related challenges, such a seemingly modest price increase may compound their hardships; we found that participants who reported obtaining insufficient amounts of food compared to before the pandemic were 3.8 times more likely to be food insecure than households where food quantities had stayed the same. In October of 2021, SNAP benefits were expanded beyond the temporary increase,[41] though it remains to be seen how overall food insecurity will be affected.

Lastly, a history of homelessness was also a significant economic factor, conferring an 80% increase in relative risk compared to injured Veterans who had never been homeless. Much of the literature on homelessness has focused on *current* homelessness, though longitudinal data suggest that, even once housed, previously homeless people experience increased morbidity and mortality compared to people who had never experienced homelessness.[42,43] Like food insecurity, homelessness is a complex, multifactorial issue, often intertwined with other factors associated with economic hardship, such as criminal justice involvement and mental illness.[44] While we did not evaluate the context in which participants experienced homelessness, our finding suggests that assessing homelessness history may be useful in evaluating food insecurity risk.

Psychosocial Factors

Injured Veterans who expressed food worries were significantly more likely to be food insecure than those Veterans who denied feeling an increase in food-related worries since the start of the pandemic. Food insecure participants expressed worries about food in general, being able to afford sufficient food in the future, having their nutrition assistance benefits run out, and being able to obtain the types of foods their households prefer. These findings closely align with a recent study of COVID-related food worries among Americans by Dumas et al.,[15] as well as with a nationally representative survey of Canadians, in which food insecurity during the pandemic was associated with increased anxiety and poorer self-reported mental health.[45] Food insecurity and mental health conditions, (especially anxiety and mood disorders), are highly correlated,[12,46] often independently of income.[47,48] Much of the research in this area, however, has focused on clinically diagnosed psychiatric disorders. Our findings, along with a small but growing body of research on the impact of COVID-19 on food worries, call attention to sub-clinical mental distress, and its potential impact on overall health.

Beyond financial resources, a variety of sociocultural factors shape not only people's perceptions of their own food insecurity, but also how they contextualize it in their wider life experiences.[49] Engelman et al's[16] study of COVID-related food worry in the deaf and hard-of-hearing observed that participants who expressed an increased degree of food worry were significantly more likely to worry about contracting COVID-19 and needing to self-isolate than those who did not express food worries. In our study, injured Veterans with food insecurity were significantly more likely than food secure counterparts to worry

not only about the financial implications of the pandemic, but also to report self-isolating, checking COVID-related news on media outlets multiple times per day, and worrying about experiencing stigma and/or rejection from others if they were to become infected. The latter may be of particular interest for public health efforts. Being food insecure and using nutrition assistance benefits has long been associated with stigma and a perceived lack of self-sufficiency.[50–52] Among Veterans, stigma is a common and well-characterized barrier to seeking treatment for mental health conditions,[53,54] along with a generalized culture of mistrust toward government institutions, clinicians and non-Veterans.[55,56] Food insecure injured Veterans, therefore, may be more likely to express different pandemic-related worries as part of a larger sense of stigma or social alienation than injured Veterans who are not experiencing any difficulty meeting their nutritional needs. This may also explain why having served in combat, worry about the government's ability to respond to COVID-19, and worry about the health care system's ability to contain the pandemic were all significantly associated with increased relative risk of food insecurity, though worry and mistrust should not be conflated. To our knowledge, this is the first study of food insecurity to evaluate combat history among Veterans, injured or otherwise, though as a cross-sectional study, we cannot be certain how combat experience impacts financial or psychosocial aspects of food insecurity, nor whether it is simply a proxy for service-related injuries. The worries regarding institutional responses to COVID, however, highlight the challenges facing public health programs, not only in overcoming mistrust of COVID-related efforts,[57,58] but also in engaging with Americans struggling with food insecurity.

Wider Considerations

While this study examined food insecurity in a specific subset of injured Veterans with TBI, our findings may nevertheless be applicable to the general population. Nationwide, the burden of disability is considerable; nearly 14% of adult Americans have a disability that affects their physical mobility, and nearly 11% content with at least one cognitive deficiency that interferes with daily functioning.[26,59] During a global pandemic, these disabilities were especially challenging. At the start of the pandemic lockdown in 2020, clinicians and public health stakeholders called attention to the increased difficulty faced by people with disabilities in maintaining employment remotely, accessing healthcare services, and obtaining daily necessities,[60] while also theorizing that this would result in disparities in long-term COVID-19 infection outcomes between the fully able and the disabled.[61] In addition, while the associations between food insecurity and clinically diagnosed mental health disorders are well-established,[12] this study found supporting evidence for an association between *sub*-clinical distress and increased food insecurity risk. The World Health Organization (WHO) identified mental health as a crucial issue of concern at the start of the pandemic,[62] and a recent review by Aknin, et al.[63] concluded that the accumulation of individual, interpersonal, and societal stresses relating to COVID −19 contributed to a significant increase in psychological distress. It remains to be seen how the psychological effects of the pandemic impact people over time, but it is likely that these ramifications will shape experiences of food insecurity and overall quality of life for the long term.[64] Overall, our study confirms previous findings that food insecurity is shaped by various psychosocial factors beyond economic concerns. With these factors in mind, future assessment may be needed to characterize the different manifestations of food insecurity, including assessment

of disability status. A better understanding of how the interrelated risk factors cluster or manifest could be used to expand beyond the more traditional, binary view of food insecurity. As a result, both screening and intervention efforts could be customized to target the main drivers of food insecurity more efficiently.

Limitations

As a point-in-time evaluation of food insecurity during the COVID-19 pandemic, this study has limitations. While many of the survey items asked participants to compare economic and psychosocial factors prior to, and during the pandemic, others (e.g., employment status), were cross-sectional, and did not establish temporality. At the time of data collection, to our knowledge there was no validated metric available to assess nutrition habits in the context of the pandemic, and the COVID-19 Nutrition Habits Questionnaire was a developed solely for this study. It is possible that the questionnaire has flaws in its accuracy and/or validity. Similarly, the 22-item Coronavirus Exposure and Concerns questionnaire was recently developed and tested in the United Kingdom, and has not been formally validated in a US population. In addition, in order to minimize participant burden and maximize enrollment, we did not have detailed information on participants' health conditions and injuries. All participants had a history of at least one TBI, and though the impact of TBI on cognitive and psychosocial functioning is highly variable,[65] this may limit the generalizability of our findings to populations without a history of TBI. Additionally, while all participants had a polytrauma diagnosis, it is possible that food insecure Veterans were more physically or cognitively impaired, or more likely to have psychiatric conditions than their food secure counterparts. In order to assess food insecurity during COVID-19, and with rapid changes in economic forces and government policies, we limited recruitment efforts to 5,000 injured Veterans. A response rate higher than 4% would have been preferable, and by necessity, we were not able to recruit injured Veterans who were unhoused, did not have the ability or resources to access the internet, or had medical conditions that precluded the ability to complete web-based questionnaires, potentially limiting the applicability of our findings. Lastly, the demographic breakdown of our cohort somewhat differed from the national post-9/11 Veteran population, potentially skewing estimates of food insecurity prevalence by gender, race, and/or ethnicity.

Conclusion

Overall, our findings suggest that pandemic food insecurity was associated with many well-established economic factors, but also with less understood factors that may be especially pertinent for post-9/11 injured Veterans with TBI in the context of COVID-19, namely Hispanic ethnicity, homelessness history, and food worries. At the same time, given the wide prevalence of physical and cognitive disabilities of the general American population, our findings may also be applicable to civilian populations. Future public health efforts aimed at addressing the long-term effects of the pandemic should target not only previously established risk factors for food insecurity, but also examine the various possible manifestations of food insecurity that include these more emergent factors.

Acknowledgments

We acknowledge the Veterans who participated in this study. We also acknowledge Raymond Oliva. This material is based upon work supported (or supported in part) by the Department of Veterans Affairs, Veterans Health Administration. The views, opinions, and/or findings contained in this article are those of the author(s) and should not be construed as an official Department of Defense or Veterans Affairs position, policy, or decision unless so designated by other documentation.

Funding

This presentation is based on work supported by the VA Office of Research and Development, Rehabilitation Research and Development Service (RR&D) Award #RX003128, but does not necessarily represent the views of the Department of Veterans Affairs or the United States Government.

Appendix 1.: COVID-19 Nutrition Habits Questionnaire

Instructions

- Please answer the following questions as they apply to you and other members of your household.
- Please answer the questions as they apply to you since the national emergency for COVID-19 was declared on March 13th, 2020.

1. I worry about food:

Almost all the time	A lot more	Somewhat more	About the same	Somewhat less	A lot less	Almost never	Not Applicable/Not Sure

2. Since March 13, 2020, the amount of moneythat I/my household are ableto spend on food:

a. Significantly increased

b. Somewhat increased

c. Stayed about the same

d. Somewhat decreased

e. Significantly decreased

f. Not applicable/Not sure

3. As of today, the amount of foodI/my household are getting (from all sources) is:

Plenty/ Much more than enough	Somewhat more than enough	Comfortably enough	Just barely enough	Somewhat less than enough	A lot less than enough	Severely insufficient	Not Applicable/Not Sure

4. Compared to before the pandemic, I/my household are able to eat the kinds of foods we prefer:

A lot more often	Somewhat more often	About as often as before	Somewhat less often	A lot less often	Not Applicable/Not Sure

5. Since March 13, 2020, my/my household's eating habits have changed:

a. Not at all

b. Somewhat

c. Quite a bit

d. Significantly

e. Not applicable/Not sure

6. Regarding governmentnutrition assistance* (select all that apply):

a. I was receiving assistance on a regular basis before the pandemic.

b. I am receiving assistance now.

c. I am in the process of enrolling/waiting for my benefits to start.

d. I applied for assistance before the pandemic, but was told I'm ineligible.

e. I applied for assistance during the pandemic, but was told I'm ineligible.

f. I have never applied for government nutrition assistance.

g. Not applicable/Not sure

*Government nutrition assistance provided by any local, state, or federal government program, such as:

- The Supplemental Nutrition Assistance Program (SNAP), formerly the Food Stamp Program;
- The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC);
- The Commodity Supplemental Food Program (CSFP);
- The Emergency Food Assistance Program (TEFAP);
- The Food Distribution Program on Indian Reservations (FDPIR)

7. Regarding communitynutrition assistance* (select all that apply):

a. I was receiving assistance on a regular basis before the pandemic.

b. I am receiving assistance now.

c. I am in the process of enrolling/waiting to receive assistance.

d. I applied for assistance before the pandemic, but was told I'm ineligible.

e. I applied for assistance during the pandemic, but was told I'm ineligible.

f. I have never received for community nutrition assistance.

g. Not applicable/Not sure

*Community nutrition assistance provided by any non-for-profit organization, for example:

- Community food banks
- Food pantries
- Meal delivery programs (e.g., Meals-on-Wheels)
- Veteran Service Organizations (VSOs)
- Church meal programs
- Mutual-aid societies

8. I worry about having enough money to buy food in the future.

Strongly Agree	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree	Not Applicable/Not Sure

9. I worry about being able to get the kinds of foods I/my household prefer in the future.

Strongly Agree	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree	Not Applicable/Not Sure

10. I worry about my food assistance benefits running out, or not being able to get benefits in the future.

Strongly Agree	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree	Not Applicable/Not Sure

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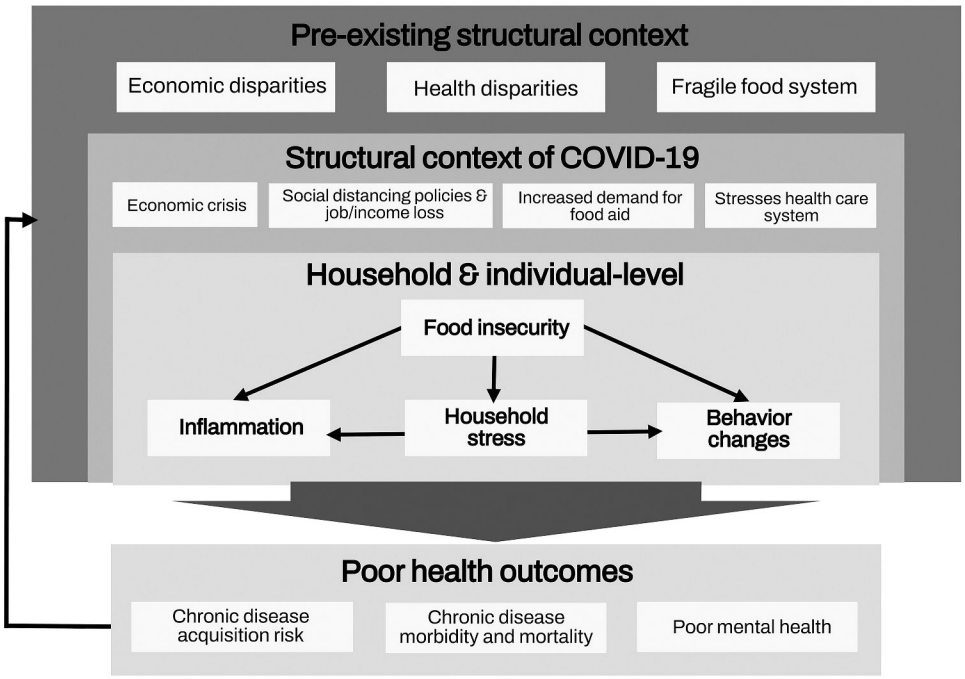

Figure 1.

Leddy et al's[13] theoretical model: Social and structural impacts of COVID-19 on food insecurity and health outcomes*. * Leddy, 2020. Copyright 2020 by Oxford University Press. Reprinted with permission.

Table 1.

Demographic characteristics, by food security status.

	Total Cohort N=193		Food Secure N=130		Food Insecure[1] N=63	
Age						
Mean ± SD	45.87	±8.48	46.58	±8.96	44.42	±7.26
Gender[2]						
Male	150	(78.1)	101	(78.3)	49	(77.8)
Female	41	(21.4)	27	(20.9)	14	(22.2)
Other	1	(0.5)	1	(0.8)	0	(0.0)
Racial Background (n = 189)[4]						
Caucasian/White	141	(74.6)	100	(78.1)	41	(65.1)
Black or African American	18	(9.4)	10	(7.8)	8	(12.7)
Other	32	(16.8)	18	(14.1)	14	(22.2)
Hispanic[3]	40	(20.7)	21	(16.2)	19	(30.2)
Highest level of education						
No high school diploma/High school diploma/equivalent	8	(4.2)	4	(3.1)	4	(6.4)
Some college	43	(22.3)	28	(21.5)	15	(23.8)
Associate's or Bachelor's degree	102	(52.9)	72	(55.4)	30	(47.6)
Post-graduate degree	40	(20.7)	26	(20.0)	14	(22.2)
Employment Status (n = 192)[3]						
Part-time or Full-time	102	(53.1)	77	(59.7)	25	(39.7)
Unemployed	26	(13.5)	11	(8.5)	15	(23.8)
Retired	64	(33.3)	41	(31.8)	23	(36.5)
Military Service History						
Current/Former Branch of Service (n = 192)[3]						
Army	147	(76.6)	98	(76.0)	49	(77.8)
Air Force	2	(1.0)	0	(0.0)	2	(3.2)
Navy	11	(5.7)	9	(7.0)	2	(3.2)
Marine Corps	20	(10.4)	14	(10.9)	6	(9.5)
Coast Guard	1	(0.5)	0	(0.0)	1	(1.6)
Multiple	11	(5.7)	8	(6.2)	3	(4.8)
Number of times deployed						
Mean ± SD	2.67	±2.05	2.59	±1.95	2.83	±2.23
Number of combat tours						
Mean ± SD	2.11	±1.87	2.59	±1.95	2.83	±2.23
Household Characteristics						
Previous experience of homelessness	62	(32.12)	33	(25.38)	29	(46.03)
Marital status						
Married or cohabitating	134	(69.43)	96	(73.85)	38	(60.32)
Single	26	(13.47)	16	(12.31)	10	(15.87)
Divorced/Separated	33	(17.10)	18	(13.85)	15	(23.81)
Total annual household income (n = 188)[5]						

	Total Cohort N=193		Food Secure N=130		Food Insecure[1] N=63	
<$10,000	3	(1.6)	1	(0.8)	2	(3.3)
$10,000–$24,999	12	(6.4)	4	(3.2)	8	(13.1)
$25,000–$49,999	40	(21.2)	21	(16.5)	19	(31.2)
$50,000–$74,999	45	(23.9)	29	(22.8)	16	(26.2)
$75,000–$99,999	30	(16.0)	24	(18.9)	6	(9.8)
$100,000+	58	(30.9)	48	(37.8)	10	(16.4)
Number of children in household						
Mean ± SD	1.05	±1.28	0.89	±1.13	1.37	±1.52

[a] Among 63 Food Insecure participants, 32 met the USDA definition of “Low” food security, 31 met the definition of “Very Low” food security.

[b] n = 1 missing.

[c] n = 2 missing.

[d] n = 32 Participants identified as“Other;” n = 9 “Asian,” n = 4 Native American/Alaskan Native, n = 2 Pacific Islander, n = 18 selected “Other” indicating they did not identify with any listed racial groups, or identified as multi-racial.

[e] n = 5 missing.

Table 2.

Relative risk estimates for food insecurity.

	Univariate RR (95% CI)	*p*-value	Adjusted RR[1] (95% CI)	*p*-value
Demographics				
Age	0.98 (0.95, 1.00)	0.09		
Race				
Caucasian/White	REF	0.13		
Black/AA	1.53 (0.86, 2.72)			
Other	1.50 (0.94, 2.41)			
Hispanic ethnicity	1.64 (1.09, 2.47)	0.02[2]		
Education				
No high school diploma/High school diploma or equivalent	REF	0.56		
Some college	0.70 (0.31, 1.56)			
Associate's or Bachelor's degree	0.59 (0.28, 1.25)			
Post-graduate degree	0.70 (0.31, 1.58)			
Employment Status				
Part-time or Full-time	REF	0.002[3]		
Unemployed	2.35 (1.47, 3.78)			
Retired	1.47 (0.91, 2.35)			
Number of times deployed	1.03 (0.95, 1.13)	0.43		
Number of combat tours	1.09 (1.05, 1.13)	<0.0001[3]		
Household Characteristics				
Previous experience of homelessness	1.80 (1.22, 2.67)	0.003[3]		
Marital status				
Divorced/Separated	REF			
Married or cohabitating	0.62 (0.39, 0.99)	0.12		
Single	0.84 (0.46, 1.56)			
Annual household income				
< $10,000	REF	0.0007[3]		
$10,000-$24,999	1.00 (0.41, 2.45)			
$25,000-$49,999	0.71 (0.30, 1.69)			
$50,000-$74,999	0.53 (0.22, 1.30)			
$75,000-$99,999	0.30 (0.10, 0.88)			
$100,000+	0.26 (0.10, 0.69)			
Number of children in household	1.18 (1.05, 1.33)	0.005[3]		
Nutrition Habits [4]				
I worry about food				
About the same/	REF	0.0001[3]	REF	0.001[3]
Somewhat less/				
A lot less/				
Almost never				

	Univariate RR (95% CI)	*p*-value	Adjusted RR[1] (95% CI)	*p*-value
Almost all the time/	2.36 (1.53, 3.63)		2.00 (1.31, 3.05)	
A lot more/				
Somewhat more				
Since 03/13/20, the amount of money that I/my household are able to spend on food:				
Significantly increased/	REF	0.002[3]	REF	0.03[2]
Somewhat increased/				
Stayed about the same				
Somewhat decreased/	1.89 (1.28, 2.79)		1.67 (1.06, 2.61)	
Significantly decreased				
As of today, the amount of food I/my household are getting (from all sources) is:				
Plenty/	REF	<0.0001[3]	REF	<0.0001[3]
Much more than enough/				
Somewhat more than enough/				
Comfortably enough				
Just barely enough/	4.49 (3.18, 6.33)		3.80 (2.50, 5.76)	
Somewhat less than enough/				
A lot less than enough/				
Severely insufficient				
Compared to before the pandemic, I/my household are able to eat the kinds of foods we prefer:				
A lot more often/	REF	<0.0001[3]	REF	0.002[3]
Somewhat more often/				
About as often as before				
Somewhat less often/	2.84 (1.83, 4.40)		2.09 (1.30, 3.36)	
A lot less often				
Since March 13, 2020, my/my household's eating habits have changed:				
Not at all	REF	0.003[3]	REF	0.002[3]
Somewhat/	5.47 (1.81,		4.10 (1.66,	
Quite a bit/	15.54)		10.12)	
Significantly				
Regarding government nutrition assistance:				
Not Applicable/Not Sure	REF	<0.0001[3]	REF	0.002[3]
Previous/Current/Pending Assistance	2.65 (1.56, 4.51)		1.31 (0.74, 2.32)	
Not Applicable/Not Sure	REF		REF	
Ineligible	3.51 (2.56, 4.80)		2.30 (1.44, 3.67)	
Previous/Current/Pending Assistance	REF		REF	
Ineligible	1.32 (0.81, 2.17)		1.75 (1.03, 2.99)	
Regarding community nutrition assistance:				
Never Applied/Not Applicable/Not Sure	REF	<0.0001[3]	REF	0.001[3]
Previous/Current/Pending Assistance	2.50 (1.62, 3.85)		1.56 (0.88, 2.76)	
Never Applied/Not Applicable/Not Sure	REF		REF	
Ineligible	3.09 (2.10, 4.55)		2.28 (1.45, 3.57)	
Previous/Current/Pending Assistance	REF		REF	

	Univariate RR (95% CI)	*p*-value	Adjusted RR[1] (95% CI)	*p*-value
Ineligible	1.24 (0.77, 1.98)		1.46 (0.78, 2.72)	
I worry about having enough money to buy food in the future.				
Neutral/	REF	<0.0001[3]	REF	0.003[3]
Somewhat disagree/				
Disagree/				
Strongly disagree				
Strongly agree/	3.15 (1.97, 5.03)		2.13 (1.30, 3.48)	
Agree/				
Somewhat agree				
I worry about being able to get the kinds of foods I/my household prefer in the future.				
Neutral/	REF	<0.0001[3]	REF	0.0004[3]
Somewhat disagree/				
Disagree/				
Strongly disagree				
Strongly agree/	4.25 (2.30, 7.87)		2.97 (1.62, 5.44)	
Agree/				
Somewhat agree				
I worry about my food assistance benefits running out, or not being able to get benefits in the future.				
Neutral/	REF	<0.0001[3]	REF	0.003[3]
Somewhat disagree/				
Disagree/				
Strongly disagree				
Strongly agree/	3.85 (1.98, 7.48)		3.10 (1.48, 6.48)	
Agree/				
Somewhat agree				

[a] Estimates controlled for employment status, combat tour history, history of homelessness, having children in the household (y/n), and annual income.

[b] Significant at *p*-value <0.05.

[c] Significant at *p*-value <0.01.

[d] Nutrition habit responses categorized into Reference (REF) groups deemed desirable/positive, compared to categories deemed negative/ undesirable.

Table 3.

Coronavirus exposure and concerns by food security status.

	Total Cohort N=193		Food Secure N=130		Food Insecure N=63		*p*-value
Coronavirus Exposure							
Have you had Coronavirus?							
No	132	(68.4)	84	(64.6)	48	(76.2)	0.24
Yes	28	(14.5)	22	(16.9)	6	(9.5)	
I don't know	33	(17.1)	24	(18.5)	9	(14.3)	
Do you know someone who has caught Coronavirus?	157	(81.3)	106	(81.5)	51	(81.0)	0.92
Are any of these people close family members or similar? (n = 157)	94	(59.9)	61	(57.6)	33	(64.7)	0.39
Are you self-isolating at the moment?	42	(22.3)	20	(15.4)	23	(36.5)	0.0009[3]
Have you decided to self-isolate to avoid being infected by other people?	66	(34.2)	40	(30.8)	26	(41.3)	0.15
Have you decided to self-isolate because you have symptoms?	21	(10.9)	14	(10.8)	7	(11.1)	0.94
Have you been tested for Coronavirus?	130	(67.4)	91	(70.0)	39	(61.9)	0.26
Are you currently caring for someone who has been diagnosed with Coronavirus?	8	(4.2)	4	(3.1)	4	(6.4)	0.44
In the past week have you had any of these symptoms?[1]	65	(33.9)	37	(28.7)	28	(44.4)	0.03[2]
How often are you reading, watching, or hearing reports or updates on the Coronavirus outbreak:							
On social media (e.g., Facebook, Twitter, WhatsApp, Instagram)?							
Less than once a day	95	(49.2)	67	(51.5)	28	(44.4)	0.03[2]
1–5 times a day	58	(30.1)	43	(33.1)	15	(23.8)	
More than 5 times a day	40	(20.7)	20	(15.4)	20	(31.8)	
On traditional media (e.g., newspapers, TV news, radio news)?							
Less than once a day	71	(36.8)	53	(40.8)	18	(28.6)	0.02[2]
1–5 times a day	75	(38.9)	53	(40.8)	22	(34.9)	
More than 5 times a day	47	(24.4)	24	(18.5)	23	(36.5)	
On dedicated apps or official websites that have been set up to update on Coronavirus?							
Less than once a day	143	(74.1)	104	(80.0)	39	(61.9)	0.01[2]
1–5 times a day	31	(16.1)	18	(13.9)	13	(20.6)	
More than 5 times a day	19	(9.8)	8	(6.2)	11	(17.5)	
Coronavirus Concerns							
How worried are you about being quarantined?							
Not at all	112	(58.0)	79	(60.8)	33	(52.4)	0.11
A little bit	30	(15.5)	24	(18.5)	6	(9.5)	
Moderately	26	(13.5)	14	(10.8)	12	(19.1)	
Quite a bit	14	(7.3)	7	(5.4)	1	(11.1)	
Extremely	11	(5.7)	6	(4.6)	5	(7.9)	
How worried are you about being infected with Coronavirus?							
Not at all	69	(35.8)	52	(40.0)	17	(27.0)	0.13

	Total Cohort N=193		Food Secure N=130		Food Insecure N=63		*p*-value
A little bit	45	(23.3)	32	(24.6)	13	(20.6)	
Moderately	28	(14.5)	19	(14.6)	9	(14.3)	
Quite a bit	27	(14.0)	14	(10.8)	13	(20.6)	
Extremely	24	(12.4)	13	(10.0)	11	(17.5)	
How worried are you about infecting others?							
Not at all	71	(36.8)	49	(37.7)	22	(34.9)	0.83
A little bit	25	(13.0)	18	(13.9)	7	(11.1)	
Moderately	34	(17.6)	23	(17.7)	11	(17.5)	
Quite a bit	29	(15.0)	20	(15.4)	9	(14.3)	
Extremely	34	(17.6)	20	(15.4)	14	(22.2)	
How worried are you about being stigmatized or rejected because of Coronavirus?							
Not at all	120	(62.2)	90	(69.2)	30	(47.6)	0.007[3]
A little bit	22	(11.4)	16	(12.3)	6	(9.5)	
Moderately	20	(10.4)	10	(7.7)	10	(15.9)	
Quite a bit	14	(7.3)	5	(3.9)	9	(14.3)	
Extremely	17	(8.8)	9	(6.9)	8	(12.7)	
How worried are you about your job security because of Coronavirus?							
Not at all	131	(68.2)	97	(75.2)	34	(54.0)	0.02[2]
A little bit	18	(9.4)	12	(9.3)	6	(9.5)	
Moderately	14	(7.3)	6	(4.7)	8	(12.7)	
Quite a bit	14	(7.3)	7	(5.4)	7	(11.1)	
Extremely	15	(7.8)	7	(5.4)	8	(12.7)	
How worried are you about the financial implications of the Coronavirus outbreak?							
Not at all	48	(24.9)	45	(34.6)	3	(4.8)	<0.0001[3]
A little bit	36	(18.7)	30	(23.1)	6	(9.5)	
Moderately	31	(16.1)	19	(14.6)	12	(19.1)	
Quite a bit	36	(18.7)	19	(14.6)	17	(27.0)	
Extremely	42	(21.8)	17	(13.1)	25	(39.7)	
How worried are you about a shortage of food or day-to-day products as a result of Coronavirus? [1]							
Not at all	65	(33.9)	59	(45.4)	6	(9.7)	<0.0001[3]
A little bit	42	(21.9)	30	(23.1)	12	(19.3)	
Moderately	31	(16.2)	21	(16.2)	10	(16.1)	
Quite a bit	25	(13.0)	9	(6.9)	16	(25.8)	
Extremely	29	(15.1)	11	(8.5)	18	(29.0)	
How worried are you about the government's ability to manage the Coronavirus situation?							
Not at all	21	(10.9)	17	(13.1)	4	(6.4)	<0.0001[3]
A little bit	33	(17.1)	32	(24.6)	1	(1.6)	
Moderately	39	(20.2)	30	(23.1)	9	(14.3)	
Quite a bit	39	(20.2)	23	(17.7)	16	(25.4)	
Extremely	61	(31.6)	28	(24.5)	33	(52.4)	
How worried are you about the ability of the health system to care for Coronavirus patients?							
Not at all	38	(19.7)	33	(25.4)	5	(7.9)	0.0001[3]

	Total Cohort N=193		Food Secure N=130		Food Insecure N=63		*p*-value
A little bit	36	(18.7)	29	(22.3)	7	(11.1)	
Moderately	53	(27.5)	36	(27.7)	17	(27.0)	
Quite a bit	19	(9.8)	12	(9.2)	7	(11.1)	
Extremely	47	(24.4)	20	(15.4)	27	(42.9)	

[a] n = 1 missing.

[b] Significant at *p*-value <0.05.

[c] Significant at *p*-value <0.01.