

# Association between Food Insecurity, Mental Health, and Intentions to Leave the US Army in a Cross-Sectional Sample of US Soldiers

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## ABSTRACT

**Background:** Previous research has demonstrated that certain groups in the United States are at a greater risk for food insecurity. However, food insecurity has not been sufficiently characterized in active duty military populations.

**Objectives:** The primary objective of this study was to determine the prevalence of marginal food insecurity at a large US Army installation. The secondary objective was to determine how marginal food insecurity may be associated with intentions to leave the US Army after the current service period (“intentions to leave”).

**Methods:** A cross-sectional, online survey was administered by the US Army Public Health Center at an Army installation in 2019 ( $n = 5677$ ). The main predictor was the 2-item food insecurity screener (Hunger Vital Signs), and the main outcome was a 5-point Likert question, “How likely are you to leave the army after your current enlistment/service period?” that was dichotomized for this analysis. Multiple logistic regression was used to assess the association between marginal food insecurity and intentions to leave. Mental health covariates were analyzed as a potential mediator.

**Results:** The sample was primarily male (83%), age >25 y (49%), and White (56%). One-third of respondents were classified as marginally food insecure using the Hunger Vital Signs, and 52% had intentions to leave. There was no significant association between marginal food insecurity and intentions to leave in the composite multivariable model, but mediation analyses revealed that food insecurity was significantly and independently associated with anxiety, depression, and suicidal ideation, which was in turn associated with intentions to leave.

**Conclusions:** The association between marginal food insecurity and mental health showed that addressing food insecurity could improve mental health and subsequently reduce intentions to leave. Solutions to reduce military food hardship include expanding Supplemental Nutrition Assistance Program eligibility requirements, improving food resources communication, and expanding healthy food choices on-post. *J Nutr* 2021;00:1–8.

**Keywords:** food insecurity, military, retention, attrition, Hunger Vital Signs, food security

## Introduction

Food insecurity is defined by the USDA as a “lack [of] access to enough food for an active, healthy life for all household members” (1). Households with low food security “reported multiple indications of food acquisition problems and reduced diet quality, but typically have reported few, if any, indications of reduced food intake (2).” Very low food security is classified as having “reported multiple indications of reduced food intake and disrupted eating patterns due to inadequate resources for food” (2). The USDA estimated that 10.5% of American households were food insecure, and 4.1% experienced very low food security, at any point in the 2019 calendar year (1).

Certain subgroups have higher rates of food insecurity than the national average. These groups include low-income households, households with children, single-parent households,

women and men living alone, Black and Hispanic households, and households in large cities (2). Food insecurity is associated with numerous adverse health outcomes in adults, including increased risk for diabetes (3), incomplete virologic suppression among people living with HIV (4–6), and adverse mental health outcomes (7, 8). Food insecure households are also associated with higher healthcare expenditures (9); increased risk of depression, anxiety, and sleep disorders (10); and higher mortality when compared to food secure households (11).

Numerous studies have investigated food insecurity among veteran populations in the United States. In a cross-sectional study among veterans of the US wars in Iraq and Afghanistan, 27% of veterans reported food insecurity (15% low food security and 12% very low food security) (12). In the Veterans Aging Cohort Study, similar rates of food insecurity were found, with 24% of respondents classified as food insecure

(13). In contrast, another study reported much lower rates of food insecurity in veteran households (8.4%) than nonveteran households (14.4%) (14). An analysis by the Health and Retirement Study reported similar findings, with 6.4% of male veterans classified as food insecure compared with 11.9% of male nonveterans (15).

However, active duty populations have received less attention in food insecurity research, primarily due to limited data on their food security. At the rank of private in the US Army, personnel are paid an annual salary of \$20,797.20 (16), which exceeds the federal poverty line for a single individual of \$13,300 within the 48 contiguous states (17). However, as soon as soldiers marry or have children, it is possible that their incomes do not increase at a rate that will guarantee they will remain above the poverty line, thus increasing their risk for food insecurity. In 2019 for example, 33% of households with incomes below 130% of the federal poverty line were food insecure (1).

Food-insecure soldiers are often forced to turn to food pantries and nutrition assistance programs. In 2012, Feeding America estimated that 25% of active duty, Guard, and Reserve service members used food banks to supplement meals for themselves and their families (18, 19). A 2016 Government Accountability Office report found that the US Department of Defense does not currently know the extent to which service members use food pantries due to lack of comprehensive data collection and coordination with the USDA (20). Over \$21 million in Supplemental Nutrition Assistance Program (SNAP) benefits were used by active duty service members between September 2014 and August 2015 (20). However, commissaries represent only 1 source of food, and the actual extent of food insecurity is unknown in active duty populations.

A study by Wax and Stankorb reported that nearly 1 in 7 active duty families located at Joint Base San Antonio experienced food insecurity (21). However, this study was only conducted among parents of children who were enrolled in on-base childcare and therefore the sample size was small ( $n = 248$ ) and not representative of the entire installation. In addition, a report by the Blue Star Families organization found that 7% of military family respondents had experienced food insecurity in the past year (22). The Blue Star survey asked respondents directly about food insecurity, a term that may not have been understood by all respondents, and therefore the proportion may be an underestimate of true food insecurity.

It is also unknown if food insecurity has an impact on intent to leave the military. A previous study of attrition reported that sex, age, race, depression, and BMI ( $\text{kg}/\text{m}^2$ ) are all associated with attrition (23). However, it is unclear how food insecurity may be associated with intent to leave the military. One possible explanation is that food insecurity is capturing the material wellbeing of military households. Food-insecure military households, like their civilian counterparts,

generally have experienced income shocks—through lower spousal earnings (24) or the loss of spousal employment (25) associated with military service—that make smoothing their consumption difficult. A military household may therefore be more likely to leave the military if their needs are not being met and they feel the civilian labor market offers better opportunities (26, 27). Given the substantial cost of recruiting and training US Army personnel (28), further studies on predictors for intentions to leave the military are needed.

The goal of the current analysis was to 1) characterize marginal food insecurity among a sample of active duty soldiers in the US Army and 2) determine how marginal food insecurity, controlling for demographic, financial, and mental health covariates, is associated with intentions to leave the US Army.

## Methods

In 2019, Behavioral and Social Health Outcomes Program personnel of the US Army Public Health Center (APHC) were contacted by the commanding officer of a US Army installation to investigate a perceived increase in suicidal behavior and preventable deaths. A mixed-methods approach was used with qualitative data from focus groups informing the development of a quantitative survey. The investigative team provided the commander with a URL for the survey. The commander then distributed the survey through the chain of command to soldiers for completion within a period of 40 d via their smartphone, computer, or other web-enabled device. Installation leadership encouraged soldiers to complete the survey in a timely manner either during or after duty hours. No incentive was provided for survey participation.

Informed consent was obtained at the beginning of the survey, and respondents were informed that they could exit the survey at any time. Following acknowledgement of informed consent, a screening question was asked to ensure appropriate participation. Respondents were allowed to complete the survey if they indicated that they were military personnel, and all soldiers at the US Army installation surveyed were eligible to participate. Respondents who answered that they were either contractors or civilian employees were directed to the end of the survey. The US Army installation where the survey took place is located in the United States, and the installation has a population size of <10,000 soldiers. All other details of the installation are omitted in this manuscript to protect the anonymity of respondents.

Respondents were asked questions on demographic and military characteristics, nutrition and food insecurity, sleep behavior, mental health, substance use, leadership, social support, and access to installation resources. Demographic and military characteristics included sex, race/ethnicity, military rank, financial insecurity, marital status, and number of children.

The primary purpose of the survey was to assess factors associated with preventable death and suicidal behavior at the installation, not food insecurity. Food insecurity was mentioned as a concern in focus groups and therefore was added to the quantitative survey after the main survey was drafted. Because this was the first APHC survey to ask about food insecurity, the survey design team selected a short, validated food-insecurity screening tool to minimize overall survey fatigue. Marginal food insecurity was measured with a 2-item food insecurity screener (29) derived from the USDA's 18-item Household Food Security Survey Module (HFSSM), commonly referred to as the Hunger Vital Sign (30). Marginal food insecurity is a broader measure of food insecurity that captures individuals who report any indications of compromised economic access to food among themselves and their families, which are classified as having marginal, low, or very low food security according to the USDA's food security status classification system. Among a sample of 30,098 families across 7 urban medical centers, Hager et al. reported that 2 items from the HFSSM were most frequently endorsed among families experiencing food insecurity. The question "Within the past 12 months, we worried whether our food would run out before we got money to buy more," was endorsed by 92.5% of families experiencing

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Supplemental Tables 1-4 are available from the "Supplementary data" link in the online posting of the article and from the same link in the online table of contents at <https://academic.oup.com/jn>.

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Abbreviations used: APHC, US Army Public Health Center; BAH, basic allowance for housing; BAS, basic allowance for subsistence; CPS-FSS, Current Population Survey Food Security Supplement; HFSSM, Household Food Security Survey Module; OHP, Office of Human Protections; REF, reference; SNAP, Supplemental Nutrition Assistance Program; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children

food insecurity. The question “Within the past 12 months, the food we bought just didn’t last and we didn’t have money to get more,” was endorsed by 81.9% of families experiencing food insecurity. The authors reported in their study that an affirmative answer to either of these questions had a sensitivity of 97% and a specificity of 83% for food insecurity compared with the original HFSSM. For the purposes of the current analysis, respondents who answered either “Often true” or “Sometimes true” to either of these 2 questions were classified as marginally food insecure.

The main outcome of interest was intentions to leave the military after the current service period. Specifically, respondents were asked “How likely are you to leave the army after your current enlistment/service period?” The potential responses were on a 5-point Likert scale with a decline to answer option. Respondents who answered “very likely” or “somewhat likely” were coded as “likely to leave the military.” Respondents who answered, “neither likely nor unlikely,” “somewhat unlikely,” or “very unlikely,” were coded as “neutral” or “unlikely to leave the military.” Respondents who declined to answer were coded as “missing.”

### Statistical analysis

Bivariate associations were evaluated with chi-square tests to determine if there were significant differences between observed and expected proportions of demographic, food security, financial, and mental health predictors with the outcome of interest (intentions to leave the US Army after the current service period). Multivariable logistic regression analysis was used to examine associations between soldier-classified marginal food insecurity and soldier-reported intentions to leave the US Army after the current service period, controlling for demographic, financial, and mental health covariates.

In addition to the first model with all predictors, we ran a mediation analysis to determine associations between food insecurity, mental health (mediator), and intentions to leave. Specifically, we analyzed the association between demographic, food insecurity, and financial security predictors with mental health outcomes: anxiety (model 2), depression (model 3), and suicidal ideation (model 4). Last, the fifth model looked at the association between mental health predictors (anxiety, depression, and suicidal ideation) with intentions to leave after the current service period.

An  $\alpha$  level  $<0.05$  was used as a threshold to determine statistical significance of all tests. All statistical analyses were performed using Statistical Analysis Software (SAS®) version 9.4.

### Ethical review

The APHC Human Protections Administrator determined this activity to be public health practice under OHP number 19-734. The APHC Public Health Review Board concurred with the public health practice determination.

### Results

There were 5677 unique respondents, resulting in a response rate of approximately 85%. Respondents were primarily male (83%),  $<25$  y of age (49%), junior enlisted in rank (private through corporal) (44%), White (56%), either married or in a relationship (48%), and reported no children (62%) (Table 1). Approximately 33% of respondents were classified as marginally food insecure. A little over half of the respondents (52%) reported they were likely to leave the Army after their current service period, 42% reported they were either neutral or unlikely to leave the Army after their current service period, and 6% had missing data.

In bivariate analyses, soldiers who reported that they were likely to leave the Army after the current service period were more likely to report marginal food insecurity (46%) when compared with soldiers who were neutral or unlikely to leave

**TABLE 1** Demographic variables at a US Army installation, 2019 ( $n = 5677$ )

Demographic variable	Values
Sex, <i>n</i>	
Male	4717 (83.1)
Female	613 (10.8)
Missing	347 (6.1)
Age group, <i>y</i>	
$<25$	2801 (49.3)
25–29	1288 (22.7)
30–34	566 (10.0)
35–39	349 (6.1)
$\geq 40$	213 (3.8)
Missing	460 (8.1)
Rank group	
Private to corporal (E1–E4)	2480 (43.7)
Sergeant to staff sergeant (E5–E6)	979 (17.2)
Sergeant first class to sergeant major (E7–E9)	194 (3.4)
Second lieutenant to captain (O1–O3)	355 (6.3)
Major or above (O4 or above)	62 (1.1)
Warrant officer 1 to chief warrant officer 5 (W1–W5)	79 (1.4)
Missing	1528 (26.9)
Race/ethnicity	
White only	3195 (56.3)
Black only	689 (12.1)
Hispanic only	753 (13.3)
Other	976 (17.2)
Missing	64 (1.1)
Financial security	
Very comfortable and secure	1704 (30.0)
Able to make ends meet without much difficulty	1633 (28.8)
Occasionally have some difficulty making ends meet	984 (17.3)
Tough to make ends meet but keeping your head above water	376 (6.6)
In over your head	180 (3.2)
Missing	800 (14.1)
Marital status	
Married/relationship	2740 (48.3)
Separated/divorced/widowed	280 (4.9)
Single	1885 (33.2)
Missing	772 (13.6)
Children, <i>n</i>	
0	3543 (62.4)
1	708 (12.5)
2	584 (10.3)
$\geq 3$	561 (9.9)
Missing	281 (4.9)
Likelihood to leave the Army after current service period	
Likely	2933 (51.7)
Neutral or unlikely	2380 (41.9)
Missing	364 (6.4)
Food insecurity <sup>2</sup>	
Food insecure	1862 (32.8)
Food secure	2637 (46.5)
Missing	1178 (20.8)
Total	5677 (100.0)

<sup>1</sup>Values are presented as number (percentage) of study participants unless otherwise indicated. E, enlisted; O, officer; W, warrant officer.

<sup>2</sup>Individuals who answered “sometimes true” or “often true” for either “Within the past 12 months, we worried whether our food would run out before we got money to buy more,” or “Within the past 12 months, the food we bought just didn’t last and we didn’t have money to get more” were coded as food insecure.

**TABLE 2** Chi-square tests of intentions to leave the US Army after the current service period by food security, demographic, and mental health variables at a US Army installation, 2019<sup>1</sup>

	Likely to leave the Army after current service period ( <i>n</i> = 2933)	Neutral or unlikely to leave the Army after current service period ( <i>n</i> = 2380)	<i>P</i> value
Food security concerns, <i>n</i>			<0.0001
0	1332 (54.3)	1277 (63.9)	
1	211 (8.6)	171 (8.6)	
2	908 (37.0)	551 (27.6)	
Sex			0.36
Male	2494 (88.1)	2053 (89.0)	
Female	336 (11.9)	255 (11.0)	
Age group, y			<0.0001
<25	1,639 (59.1)	1,068 (47.1)	
25–29	655 (23.6)	591 (26.0)	
30–34	227 (8.2)	319 (14.1)	
35–39	159 (5.7)	179 (7.9)	
≥40	91 (3.3)	112 (4.9)	
Rank group			<0.0001
Private to corporal (E1–E4)	1509 (66.3)	944 (51.8)	
Sergeant to staff sergeant (E5–E6)	458 (20.1)	503 (27.6)	
Sergeant first class to sergeant major (E7–E9)	87 (3.8)	105 (5.8)	
Second lieutenant to captain (O1–O3)	160 (7.0)	194 (10.6)	
Major or above (O4 or above)	19 (0.8)	42 (2.3)	
Warrant officer 1 to chief warrant officer 5 (W1–W5)	43 (1.9)	36 (2.0)	
Race/ethnicity			0.04
White only	1739 (59.8)	1349 (57.2)	
Black only	331 (11.4)	328 (13.9)	
Hispanic only	400 (13.8)	319 (13.5)	
Other	439 (15.1)	362 (15.4)	
Financial security			<0.0001
Very comfortable and secure	850 (32.0)	834 (38.5)	
Able to make ends meet without much difficulty	867 (32.6)	755 (34.8)	
Occasionally have some difficulty making ends meet	570 (21.4)	402 (18.5)	
Tough to make ends meet but keeping your head above water	250 (9.4)	122 (5.6)	
In over your head	121 (4.6)	55 (2.5)	
Marital status			0.001
Married/relationship	1434 (53.6)	1275 (58.5)	
Separated/divorced/widowed	150 (5.6)	127 (5.8)	
Single	1091 (40.8)	777 (35.7)	
Children, <i>n</i>			<0.0001
0	1977 (69.0)	1438 (61.2)	
1	359 (12.5)	331 (14.1)	
2	286 (10.0)	282 (12.0)	
≥3	244 (8.5)	297 (12.6)	
Suicidal ideation			<0.0001
No	2221 (84.2)	2004 (93.3)	
Yes	416 (15.8)	143 (6.7)	
Probable anxiety			<0.0001
No	2257 (79.8)	2074 (91.0)	
Yes	570 (20.2)	205 (9.0)	
Probable depression			<0.0001
No	582 (20.6)	2076 (91.5)	
Yes	2239 (79.4)	192 (8.5)	

<sup>1</sup> Values are presented as number (percentage) of study participants unless otherwise indicated. E, enlisted; O, officer; W, warrant officer.

the Army after the current service period (36%) (Table 2). In addition, soldiers who reported that they were likely to leave the Army after the current service period significantly differed at the bivariate level from soldiers who were neutral or unlikely to leave by age group, rank group, race/ethnicity, financial security,

marital status, children, suicidal ideation, probable anxiety, and probable depression.

In the multivariable model, there was not a significant association between food insecurity and intentions to leave the US Army after the current service period (adjusted odds ratio:

**TABLE 3** Multivariable model of demographic, food security, financial, and mental health predictors on likelihood to leave the Army after the current service period at a US Army installation, 2019<sup>1</sup>

Predictor	Estimate	SE	P value	OR (95% CI)	P value
Food insecure (REF = food secure)	0.14	0.09	0.1318	1.15 (0.96–1.37)	
Sex (REF = male)	0.17	0.13	0.1795	1.18 (0.93–1.51)	
Rank group (REF = O4 or above)					<0.0001
Private to corporal (E1–E4)	1.14	0.33	0.0006	3.14 (1.64–6.03)	
Sergeant to staff sergeant (E5–E6)	0.71	0.33	0.0313	2.04 (1.07–3.89)	
Sergeant first class to sergeant major (E7–E9)	0.83	0.36	0.0222	2.30 (1.13–4.69)	
Second lieutenant to captain (O1–O3)	0.55	0.34	0.1064	1.74 (0.89–3.42)	
Warrant officer 1 to chief warrant officer 5 (W1–W5)	1.24	0.41	0.0024	3.47 (1.55–7.73)	
Race/ethnicity (REF = white only)					0.003
Black only	−0.39	0.12	0.0015	0.68 (0.54–0.86)	
Hispanic only	0.08	0.12	0.4797	1.09 (0.86–1.37)	
Other	−0.20	0.11	0.0739	0.82 (0.66–1.02)	
Financial security (REF = very comfortable and secure)					0.017
Able to make ends meet without much difficulty	0.14	0.09	0.1454	1.15 (0.95–1.37)	
Occasionally have some difficulty making ends meet	0.01	0.12	0.9025	1.01 (0.81–1.28)	
Tough to make ends meet but keeping your head above water	0.31	0.17	0.0673	1.37 (0.98–1.91)	
In over your head	0.36	0.25	0.1468	1.43 (0.88–2.32)	
Marital status (REF = married/relationship)					0.9
Separated/divorced/widowed	−0.04	0.17	0.8013	0.96 (0.69–1.34)	
Single	0.03	0.09	0.7248	1.03 (0.86–1.25)	
Children, <i>n</i> (REF = 0)					0.0002
1	−0.21	0.12	0.0852	0.81 (0.63–1.03)	
2	0.02	0.14	0.9114	1.02 (0.77–1.34)	
≥3	−0.63	0.16	<.0001	0.53 (0.39–0.72)	
Probable anxiety (REF = no probable anxiety)	0.60	0.14	<.0001	1.82 (1.39–2.39)	
Probable depression (REF = no probable depression)	0.58	0.15	<.0001	1.78 (1.34–2.37)	
Suicidal ideation (REF = no suicidal ideation)	0.58	0.14	<.0001	1.78 (1.35–2.35)	

<sup>1</sup>E, enlisted; O, officer; REF, reference value; W, warrant officer.

1.15; 95% confidence interval: 0.96–1.37) (Table 3). However, soldiers who screened positive for anxiety ( $P < 0.0001$ ), depression ( $P < 0.0001$ ), and suicidal ideation outcomes (model 4;  $P < 0.0001$ ) were all more likely to report intentions to leave the US Army. There was no observed relation between birth sex ( $P = 0.18$ ), marital status ( $P = 0.90$ ), or financial condition ( $P = 0.17$ ) and intentions to leave the Army after the current service period.

The mediation analyses showed that food insecurity was related independently to anxiety (model 2;  $P < 0.0001$ ), depression (model 3;  $P < 0.0001$ ), and suicidal ideation outcomes (model 4;  $P = 0.02$ ), controlling for demographic and financial security variables (Supplementary Tables 1–3). In addition, anxiety ( $P < 0.0001$ ), depression ( $P < 0.0001$ ), and suicidal ideation ( $P < 0.0001$ ) were all significantly related to intentions to leave after the current service period (model 5) (Supplementary Table 4).

## Discussion

The primary objective of this study was to analyze the relation between marginal food insecurity and intentions to leave after the current service period, controlling for demographic, financial security, and mental health variables. Although there was not a significant relationship in the composite model, the mediation analyses showed that marginal food insecurity was significantly related to mental health outcomes (anxiety, depression, and suicidal ideation) which were related to intentions to leave after the current service period (full mediation). These

results indicate that by addressing food insecurity, there will be subsequent positive effects for mental health and for reductions in intentions to leave the Army after the current service period.

The USDA estimated that 10.5% of all US households experienced food insecurity in 2019 (31), which is in stark contrast to 33% marginal food insecurity within this sample of soldiers. However, a more comparable estimate of food insecurity would be marginal food insecurity among all US households. In the USDA 2019 Current Population Survey Food Security Supplement (CPS-FSS), 17.9% of all US households were marginally food insecure in 2019. While this does reduce the discrepancy between these 2 estimates, differences remain that must be considered since it appears that soldiers are more likely than the general population to be marginally food insecure.

The increased likelihood of marginal food insecurity among soldiers relative to the general population can be explained by considering several relevant factors. First, the population of soldiers is likely younger on average than the general working-age population. According to the Bureau of Labor Statistics, 9% of full-time workers in the United States are 16 to 24 y old (32). In comparison, 49% of the subjects in this analysis were <25 y old. Since food insecurity generally declines with age, we might expect that the age of the population in the present study may be a significant reason for the differences in food insecurity. Moreover, we find that the marginal food insecurity rate increases to 25.2% for US households with adults aged ≤25 y based on the USDA 2019 CPS-FSS, demonstrating food insecurity is higher among households with younger members.

**TABLE 4** Comparison in demographics between the study sample and the entire active duty population in the Army<sup>1</sup>

	Sample ( <i>n</i> = 5677)	Entire Army <sup>2</sup> ( <i>n</i> = 472,047)
Sex		
Male	83.1	85.1
Female	10.8	14.9
Missing	6.1	0
Rank group		
Private to corporal (E1–E4)	43.7	45
Sergeant to staff sergeant (E5–E6)	17.2	25.3
Sergeant first class to sergeant major (E7–E9)	3.4	10.2
Second lieutenant to captain (O1–O3)	6.3	10.4
Major or above (O4 or above)	1.1	6
Warrant officer 1 to chief warrant officer 5 (W1–W5)	1.4	3
Missing	26.9	0
Marital status		
Married/relationship	48.3	55.5
Separated/divorced/widowed	4.9	5
Single	33.2	39.4
Missing	13.6	0.1

<sup>1</sup>Values are percentages of *n* for each group. E, enlisted; O, officer; W, warrant officer.

<sup>2</sup>The most recent data for the entire Army are from the 2017 calendar year.

Second, disparities in financial management skills could also explain why food insecurity is higher among the soldiers in our sample than the general population. According to the Board of Governors of the Federal Reserve System, 77% of adults in the general population were at least doing okay financially (i.e., these adults reported they were very comfortable and secure or able to make ends meet without much difficulty) in July 2019, while only 58.8% of the soldiers in our sample reported this level of financial wellbeing (33).

Third, soldiers move on average every 3–4 y for a permanent change of station, which carries a significant financial cost. Although certain aspects of the move are subsidized by the military, military.com estimates that service members spend on average \$1725 in nonreimbursable costs for each move (34). In addition, a RAND report published in 2016 found that spouses experience an average decrement in pay of \$2100, or 14% of annual income, during the year of a move (35). The out of pocket cost for moves and decrement in spousal pay may introduce financial stress, which increases the probability for food insecurity. Fourth, whereas civilians may be able to take on a second job if they desire, soldiers are required to get an off-duty agreement with the soldier's commander for a second job. Fifth, soldiers have access to lower-cost food from commissaries, but 70% of soldiers live off-post (36), which can be a challenge if soldiers and their families live far away from the installation.

Although we believe that the reasons outlined above justify higher rates of marginal food insecurity among soldiers, we also allow for the possibility that our estimate of the prevalence of marginal food insecurity among active duty soldiers may be overestimated due to the composition of our sample. The demographic composition of our sample demonstrates that our sample reasonably approximates the population of active duty soldiers (Table 4); however, we do observe senior enlisted and commissioned officers at a lower rate in our sample than that found in the overall Army population. Since the educational attainment and earnings of senior enlisted soldiers and commissioned officers are greater than those of junior

enlisted soldiers, we believe this finding implies that we are overestimating the prevalence of food insecurity among active-duty soldiers.

Therefore, our findings should be treated as an estimate for the upper bound of the probability of marginal food insecurity among soldiers. Yet given the lack of information on food insecurity among this population, this study provides important insights on food insecurity among active duty soldiers.

There are both civilian and military policy solutions for reducing food insecurity. The civilian SNAP, (formerly the Food Stamp Program) was designed to assist families in poverty with food insecurity. SNAP eligibility is determined by household income, assets, family size, and citizenship status. An analysis of the 2008–2012 data from the American Community Survey reported that 2.2% of active duty service members participated in SNAP, a proportion that is lower than participation for both veterans as well as national guard/reserve members (37). However, there may be a wide disparity between need and participation within the active duty soldier population. This gap is partially explained by the fact that Basic Allowance for Housing (BAH) is considered income in assessing SNAP eligibility for active duty personnel. If the BAH were excluded from this assessment, many more military families would be eligible for SNAP assistance (38). As recently as December 2020, there was legislation under consideration called the Military Family Basic Needs Allowance which proposed removing basic housing allowance when considering SNAP benefits, but this provision has not been approved as of this writing. In addition, SNAP eligibility criteria are determined by each state. Soldiers who qualify at one duty station may no longer qualify after moving to their new duty station in a different state. Lastly, military families may also be eligible for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provided they have a dependent child <5 y old.

Military policy solutions for food insecurity include educating leaders and commanders about food insecurity, increasing the awareness of those who might be at risk for

food insecurity, and offering education and resources. Many service members are not familiar with SNAP or WIC. Local installations should partner with Army Community Services, Family and Morale and Welfare and Recreation Programs, and Commanders Ready and Resiliency Councils to promote local services and educational programs. Local dietitians can also partner with commissaries to promote nutrition education programs, including Commissary Tours and educational programs.

The current investigation's findings must be interpreted in light of numerous limitations. First, the primary purpose of the evaluation was not to assess food insecurity. To reduce survey fatigue, an abbreviated 2-item food insecurity screener was used. A previous study reported a sensitivity of 97% and a specificity of 83% for the abbreviated food insecurity screener when compared with the original Household Food Security Survey instrument (30). Second, there was a high degree of missing responses for different survey questions (e.g., 27% for military rank). The missing responses for these questions could have been due to social desirability bias, survey fatigue, confidentiality concerns, or other unknown factors. The study team reiterated throughout the survey that all responses were anonymous to reduce social desirability bias, used abbreviated screeners to reduce survey fatigue, and collapsed key demographic response categories to reduce confidentiality concerns (e.g., private through corporal as opposed to separate options for each rank). Third, the survey did not collect data on either the location of housing (e.g., barracks or off-post) or Basic Allowance for Subsistence (BAS). For example, soldiers who live in the barracks, thus not receiving BAS, are entitled to eat all of their meals in the on-post dining facilities free of charge. Soldiers who do not live in the barracks often receive BAS (about \$370/mo) which they can use to purchase food either on or off post. Since food security may differ by either type of housing or BAS, future analyses of Army populations should incorporate these variables. Fourth, the survey was available to all soldiers at the installation and participation was high, with 85% of soldiers taking the survey among those invited. However, the demographics of the 15% of nonrespondents were not available, and we were unable to determine if those who participated systematically differed from the respondents. Last, the US Army installation where the survey took place is not necessarily representative of the Army as a whole and therefore may not be generalizable. The large proportion of missing responses to key demographic predictors precludes an accurate comparison of the study sample to the entire US Army population (Table 4).

To gain a better understanding of the current military climate, more research is needed to understand food insecurity in the military. Research is needed to assess use of available resources and potential use of community and government programs to improve access to adequate food and nutrition programs including SNAP, WIC, the National School Lunch Program and National School Breakfast Program, food bank/food shelf programs, or any other programs intended to offset the cost of food. Other questions of interest could include community programs, such as budgeting classes, cooking classes, community gardens, and local food pantries.

As opined by Mark Milley, chairman of the Joint Chiefs of Staff, and Secretary of Defense Mark Esper, "The army's greatest strength is our people—the intelligent, adaptable, and professional soldiers, civilians, and families who sacrifice for our nation" (39). By creating and implementing policies that reduce food insecurity among soldiers, army commanders can optimize

the mental health of the force while taking care of the force's greatest strength.

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