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Article

Food and housing insecurity and health status among U.S. adults with and without prior military service

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ABSTRACT

Food and housing insecurity may contribute to poorer mental and physical health. It is unclear as to whether those with prior military service, compared to those without, are more vulnerable to these current stressors. The objective of this study was to use U.S. population-based data to determine whether prior military service moderates the association of food and housing insecurity with poor mental and physical health.

We analyzed data from nine states administering the Social Context module from the 2011 and 2012 Behavioral Risk Factor Surveillance System. Multivariable logistic regression was used to examine the associations of housing and food insecurity with poor mental and physical health and potential modification by military service. Compared with those with a history of military service, those without had higher prevalence of food insecurity (23.1% versus 13.7%) and housing insecurity (36.0% versus 22.5%). Food insecurity was associated with poor mental and physical health (mental health: odds ratio (OR)=3.47, 95% confidence interval (CI)=[3.18–3.77]; physical health: OR=3.21, 95% CI=[2.92–3.53]). Similar associations were observed between housing insecurity and poor mental and physical health. Prior military service was significantly associated with poor physical health. Interaction terms of prior military service with food and housing were not statistically significant. Food and housing insecurity does not appear to differentially impact mental and physical health among those with and without military service.

Introduction

Individuals with prior military experience are a unique population and may provide insights regarding the effects of social stressors on vulnerability and resilience (King, King, Foy, Keane, & Fairbank, 1999). Competing hypotheses exist as to whether this population is psychologically and physically more vulnerable or resilient to current stressors (Aldwin & Stokols, 1988; Elder & Clipp, 1989). Many individuals may join the military to escape dysfunctional and chaotic situations, suggesting that despite exposure to early adversity, this population may have an increased capacity for resilience (Blosnich, Dichter, Cerulli, Batten, & Bossarte, 2014; Katon et al., 2015). Nevertheless, compared with those without military service, those with such a history consistently report poorer physical and mental health (Hoerster et al., 2012; Lehavot, Hoerster, Nelson, Jakupcak, & Simpson, 2012). Thus, it is possible that early adverse experiences, coupled with military-related trauma may increase vulnerability to long-term social stressors (Aldwin, Levenson, & Spiro, 1994). Yet, it remains unclear whether social stressors may differentially contribute to observed health disparities among those with a history of military service.

Food and housing insecurity are two types of social stressors that can have a profound impact on health (Braveman, Egerter, & Williams, 2011; Commision on Social Determinants of Health (CSDH), 2008; Office of Disease Prevention and Health Promotion, 2015). In 2013, approximately 14% of U.S. households were food insecure, defined as having restricted access to safe and healthy foods (Coleman-Jensen, Gergory, & Singh, 2014). Adverse living conditions, such as crowded living and high housing cost to income ratio, represent housing insecurity (Johnson & Meckstroth, 1998); In 2014, 40% of adults reported that mortgage or rent were significant sources of stress (American Psychological Association, 2015).

A growing body of evidence demonstrates the link between food and housing insecurity and poor health behaviors and healthcare access. For example, 43% of US adults reported that they have eaten too much or have eaten unhealthy foods because

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of stress (American Psychological Association, 2015). Twenty percent of US adults reported having or considered skipping an annual doctor visit due to financial concerns (American Psychological Association, 2015). Food and housing insecurity may also contribute to unhealthy weight status among youth and adults (Casey et al., 2006; Cutts et al., 2011; Pan, Sherry, Njai, & Blanck, 2012; Rose & Bodor, 2006), and are associated with increased emergency room use, hospitalization, and poor mental health (Heflin, Siefert, & Williams, 2005; Kushel, Gupta, Gee, & Haas, 2006; Whitaker, Phillips, & Orzol, 2006).

Identifying population segments more vulnerable to poor health is crucial to direct funding for appropriate evidence-based programs and services and to address existing health disparities. Little knowledge exists as to whether social stressors differentially impact the health of those with and without prior military service. Therefore, the objective of this study was to use U.S. population-based data to determine whether prior military service moderates the association of food and housing insecurity with poor mental and physical health.

Methods

Data were derived from respondents in nine states (Hawaii, Illinois, Massachusetts, Michigan, Nebraska, New Jersey, North Carolina, Oklahoma, and Wyoming) administering the Social Context module as part of the 2011 or 2012 Behavioral Risk Factor Surveillance System (BRFSS). BRFSS is an annual cross-sectional telephone survey coordinated between state health departments and the Centers for Disease Control and Prevention (Centers for Disease Control and Prevention, 2013c). BRFSS is administered via random-digit dialing of landline and cell phones of non-institutionalized adults aged ≥ 18 years using a cluster stratified random sampling design. Details on methodology used in the collection of BRFSS data have been previously documented (Centers for Disease Control and Prevention, 2013c). State-level BRFSS datasets were appended after accounting for each state's independent sampling methodology. Response rates for the four states in 2011 ranged from 43.1% to 60.9% and for the seven states in 2012 ranged from 38.0% to 47.8% (Centers for Disease Control and Prevention, 2013a, 2013b). The analytic sample included 81,405 (71.4%) of 113,983 respondents to the Social Context module, after excluding those with missing (i.e., 'not applicable,' 'refused,' and 'don't know/not sure' responses) responses to questions about military service status ($n=184$), food insecurity ($n=22{,}009$), housing insecurity ($n=29{,}929$), mental health ($n=1937$), and physical health ($n=2445$). To assess the potential non-respondent bias to the independent variables, we compared those with and without missing values on the independent variables.

Measures

Prior military service status (yes/no) was obtained from self-reported responses to the question "Have you ever served on active duty in the United States Armed Forces, either in the regular military or in a National Guard or military reserve unit?"

Dependent variables were measures of poor mental and physical health. The mental health measure was derived from the question "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" The physical health measure was derived from the survey question "Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?" Based on prior literature, we used the cutoff value of ≥ 6 days to indicate poor mental health (Bossarte, He, Claassen, Knox, & Tu, 2011) and ≥ 14 days to indicate poor physical health (Centers for Disease Control and Prevention, 2000).

The two independent variables of interest were dichotomous measures of housing and food insecurity. Housing insecurity was based on responses to the question "How often in the past 12 months would you say you were worried or stressed about having enough money to pay your rent/mortgage?" Food insecurity was derived from the question "How often in the past 12 months would you say you were worried or stressed about having enough money to buy nutritious meals?" Response options included "never," "rarely," "sometimes," "usually," and "always." Consistent with other studies (Liu, Njai, Greenlund, Chapman, & Croft, 2014; Pan et al., 2012), we classified those as having food and housing insecurity if their responses included "sometimes," "usually," or "always."

Demographics included sex, age (18–44, 45–65, and ≥ 65 years), race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, and other/mixed race), education (< 12, 12, and > 12 years), and current marital/partnership status.

Statistical analysis

First, we calculated observed distributions and weighted percentages of selected demographic characteristics by prior military

Table 1
Population characteristics of U.S. adults by prior military service, 2011–2012 Behavioral Risk Factor Surveillance System[a] (n = 81,405).

Characteristic	Prior military service status			
	Without		With	
	N[b]	% (95% CI)[c]	N[b]	% (95% CI)[c]
Total	71,290	100.0	10,115	100.0
Sex				
Male	23,065	42.8 (42.0–43.5)	9310	92.7 (91.8–93.6)
Female	48,225	57.2 (56.5–58.0)	805	7.3 (6.4–8.2)
Age, yr				
18-44	20,901	47.2 (46.5–48.0)	1296	21.8 (20.1–23.6)
45-64	30,003	37.3 (36.6–38.0)	3350	35.7 (34.0–37.5)
≥ 65	19,924	15.5 (15.1–15.9)	5416	42.5 (40.8–44.2)
Race/ethnicity				
Non-Hispanic White	54,534	69.2 (68.4–69.9)	8185	77.8 (76.1–79.4)
Non-Hispanic Black	6063	13.0 (12.5–13.5)	725	12.8 (11.4–14.3)
Hispanic	1949	6.1 (5.6–6.6)	172	2.2 (1.7–2.9)
Other/mixed race	8343	11.7 11.2–12.3)	952	7.2 (6.3–8.2)
Married/living together	40,682	54.1 (53.5–54.8)	6518	66.5 (65.0–67.9)
Education, yr				
< 12	5595	13.4 (12.7–14.0)	545	8.4 (6.9–9.2)
12	20,896	28.1 (27.4–28.8)	3007	31.1 (28.6–32.0)
> 12	44,690	58.5 (57.8–59.3)	6554	60.5 (60.0–63.5)
Food Insecurity[d]	14,137	23.1 (22.4–23.7)	1091	13.7 (12.3–15.1)
Housing Insecurity[e]	21,928	36.0 (35.2–36.7)	1839	22.5 (20.8–24.1)
Poor mental health[f]	10,675	16.9 (16.3–17.5)	1081	12.6 (11.3–13.9)
Poor physical health[g]	12,180	16.1 (15.5–16.7)	1962	19.9 (18.5–21.3)

[a] Sample is drawn from respondents in nine states that responded to the social context optional module in either 2011 or 2012.
[b] Unweighted sample size.
[c] Weighted percentage and 95% Confidence Interval (CI).
[d] Food insecurity was defined as response of "sometimes," "usually,", or "always" to the question of feeling worried or stressed about having enough money to buy nutritious meals.
[e] Housing insecurity was defined as response of "sometimes," "usually,", or "always" to the question of feeling worried or stressed about having enough money to pay rent or mortgage.
[f] Poor mental health was defined using the cutoff of ≥ 6 days in the past 30 days.
[g] Poor physical health was defined using the cutoff of ≥ 14 days in the past 30 days.

Table 2
Population prevalence of poor mental and physical health among U.S. adults by population characteristics, 2011–2012 Behavioral Risk Factor Surveillance System[a]

Characteristic	Poor mental health[b]		Poor physical health[c]	
	% (95% CI)[d]	*P* -value	% (95% CI)[d]	*P*-value
Sex		< .001		< .001
Male	13.8 (13.0–14.6)		14.7 (13.9–15.4)	
Female	18.9 (18.1–19.6)		18.1 (17.4–18.8)	
Age, yr		< .001		< .001
18–44	18.7 (17.7–19.7)		12.4 (11.5–13.2)	
45–64	16.9 (16.2–17.7)		18.7 (17.9–19.5)	
≥ 65	10.0 (9.3–10.7)		22.1 (21.3–23.1)	
Race/ethnicity		.005		.160
Non-Hispanic White	13.6 (13.4–13.9)		15.9 (14.8–16.3)	
Non-Hispanic Black	17.7 (16.8–18.6)		18.9 (18.2–19.6)	
Hispanic	16.7 (15.2–18.3)		17.2 (16.6–17.9)	
Other/mixed race	16.9 (16.2–17.7)		16.4 (15.6–16.8)	
Married/living together				
Yes	13.0 (12.5–13.5)	< 0.001	14.6 (14.0–15.1)	< 0.001
No	21.6 (20.8–22.5)		19.3 (18.6–20.1)	
Education, yr		< .001		< .001
< 12	22.4 (22.0–23.2)		27.7 (26.8–28.5)	
12	17.8 (16.8–18.8)		18.8 (17.8–19.8)	
> 12	14.5 (13.8–15.1)		12.9 (12.4–13.4)	
Prior military service		< .001		< .001
No	16.9 (16.3–17.5)		16.1 (15.5-16.6)	
Yes	12.6 (11.3–13.6)		19.9 (18.8-20.9)	
Food insecurity[e]		< .001		< .001
No	11.2 (10.7–11.7)		12.1 (11.5-12.6)	
Yes	34.9 (33.3–36.4)		29.7 (28.2-31.2)	
Housing insecurity[f]		< .001		< .001
No	9.7 (9.1–10.2)		12.2 (11.7-12.8)	
Yes	29.2 (28.0–30.4)		24.5 (23.4-25.6)	
Poor mental health				
No	–	–	11.9 (11.4-12.4)	< .001
Yes	–	–	39.8 (38.7-40.5)	
Poor physical health		< .001		
No	11.8 (11.3–12.4)		–	–
Yes	39.7 (38.4–42.1)		–	–

Note: *P*-values derived from omnibus Wald significance tests.

[a] Sample is drawn from respondents in nine states that responded to the social context optional module in either 2011 or 2012.
[b] Poor mental health was defined using the cutoff of ≥ 6 days in the past 30 days.
[c] Poor physical health was defined using the cutoff of ≥ 14 days in the past 30 days.
[d] Weighted percentage and 95% Confidence Interval (CI).
[e] Food insecurity was defined as a response of "sometimes," "usually,", or "always" to the question of feeling worried or stressed about having enough money to buy nutritious meals.
[f] Housing insecurity defined as a response of "sometimes," "usually,", or "always" to the question of feeling worried or stressed about having enough money to pay rent or mortgage.

service. Second, we generated the weighted prevalence of poor physical and mental health by the selected demographic characteristics and reported food or housing insecurity. The Wald significance test was used to determine significant differences by each characteristic. Last, we used multivariable logistic regression with military service status as a moderator (military status × food insecurity; military status × housing insecurity) using the Wald significance test to determine statistically significant interaction. All significance levels are denoted at $P < .05$. Multiple imputation was used to impute missing data on the covariates, all of which had less than 1% missing in the final analytic sample (Little & Rubin, 2014). All reported results, other than observed Ns, are from the multiple imputation. We used StataCorp Statistical Software version 13 for all of the analyses (StataCorp, 2013).

Results

Among the analytic sample, 71,290 reported no prior military service and 10,115 reported some prior military service. The distribution of demographic characteristics by prior military service is presented in Table 1. Compared to those *with* prior military service, a greater percentage of those *without* prior military experience had food insecurity (23.1% versus 13.7%) and housing insecurity (36.0% versus 22.5%). A greater percentage of those *without* prior military service reported poor mental health (16.9% versus 12.6%) whereas a greater percentage of those *with* prior military service reported poor physical health (19.9% versus 16.1%).

Table 2 indicates the sample prevalence of poor mental health and poor physical health by demographic characteristics. Poor mental health was most common among those who were female ($P < .001$), younger and middle-aged ($P < .001$), of racial/ethnic minority status ($P = .005$), had less years of education ($P < .001$), had no prior military service ($P < .001$), reported food and housing insecurity ($P < .001$), and had poor physical health ($P < .001$). Poor physical health was most common among those who were female ($P < .001$), older aged ($P < .001$), had less years of education ($P < .001$), had prior military service ($P < .001$), reported food and housing insecurity ($P < .001$), and had poor mental health ($P < .001$).

Table 3 shows the adjusted associations of food and housing insecurity with poor physical and mental health with prior military service as a moderator of these associations. In regards to mental health, both food and housing insecurity were significantly

Table 3
Adjusted[a] logistic regression of food and housing insecurity with poor mental and physical health with prior military status as moderator.

Main predictors	Poor mental health		Poor physical health	
	OR	95% CI	OR	95% CI
Food Insecurity model				
Food Insecurity	3.47	[3.18–3.77]	3.21	[2.92–3.53]
Prior Military Service (PMS)	1.06	[0.92–1.22]	1.52	[1.34–1.73]
PMS × food insecurity	1.19	[0.92–1.23]	0.95	[0.74–1.22]
Housing Insecurity model				
Housing Insecurity	3.23	[2.97–3.52]	2.60	[2.37–2.84]
Prior Military Service (PMS)	1.10	[0.94–1.29]	1.50	[1.31–1.72]
PMS x Housing Insecurity	1.11	[0.88–1.40]	1.08	[0.86–1.36]

OR = odds ratio; CI = confidence interval.

[a] Adjusted for sex, age, race/ethnicity, education, and marital/partnered status.

associated with poor mental health (OR = 3.47, 95% CI = [3.18–3.77] and OR = 3.23, 95% CI = [2.97–3.52], respectively). Neither prior military service or its' interaction with the insecurity measures were significantly associated with poor mental health. In regards to physical health, both food and housing insecurity were significantly associated with poor physical health (OR = 3.21, 95% CI = [2.92–3.53] and OR = 2.60, 95% CI = [2.37–2.84], respectively). Prior military service was significantly associated with poor physical health (Food Insecurity: OR = 1.52, 95% CI = [1.34–1.73]; Housing Insecurity: OR = 1.50, 95% CI = [1.32–1.72]). However, the interaction of prior military service with the insecurity measures was not significantly associated with poor physical health. Findings were consistent when stratifying by age and minority status.

Discussion

Our study shows that both food and housing insecurity are associated with poor mental and physical health regardless of prior service in the U.S. military. These findings support other similar finding demonstrating associations of food and housing insecurity with frequent mental distress (Liu et al., 2014). Our analyses indicated that prior military service was only associated with poor physical health. However, food and housing insecurity did not appear to differentially impact mental or physical health of those with military service.

Prior research has suggested that those with military service may have increased vulnerability or resilience to social stressors relative to civilians (Aldwin & Stokols, 1988; Elder & Clipp, 1989). These theories are not supported by our failure to detect an interaction between military service and food and housing insecurity. However, it is possible that any differential impact of food and housing insecurity on physical and mental health may be attenuated as a result of current programs and policies. Many of those with military service may have increased access to resources that may mitigate the health impacts of food and housing insecurity. For example, 42% of all veterans in the U.S. were enrolled in the Veterans Health Administration (VHA) (2014), which provides access to subsidized health care whereas civilians have experienced an estimated 80% rise in health insurance premiums since 2003 (Kaiser/HRET, 2013; U.S. Department of Veterans Affairs, 2014).

The advantage of the BRFSS data is the large population-based sample, which can allow for more precise population-level comparisons. That said, we acknowledge some inherent limitations in this analysis. We cannot generalize our findings to the entire country as our data are derived from states that selected to administer the social context module. Further data for this analysis are cross-sectional. Thus, the ability to establish causality is not possible. All data are self-reported and thereby prone to misclassification bias, which may lead to greater error in estimated odds ratios and respective confidence intervals. Finally, limitations in variables available in BRFSS did not allow for more detailed analyses disentangling environmental and social factors underlying veteran status.

To conclude, our study adds to current literature by identifying a robust relationship between measures of food and housing insecurity and poor mental and physical health. We further examined whether these relationships differed by prior military service status and did not identify significant differences. Future research aimed at clarifying stress-health mechanisms and potential vulnerability and protective factors are warranted. Results from this study can help inform social service policy makers about the added value of and need for a robust safety net for economically at-risk populations. Minimizing current economic insecurities may help save the public from present and future costs associated with poor mental and physical health.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.ssmph.2016.04.003.

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