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

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**A B S T R A C T**

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) = [2.92–3.53]; 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.

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**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; Commission 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, Gregory, & 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...
of stress (American Psychological Association, 2015). Twenty percent of US adults reported having or considering 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 to and 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 BRFSS datasets were appended after accounting for each state’s independent sampling methodology. Response rates for the four BRFSS datasets were appended after accounting for each state’s independent sampling methodology.

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 (Rosart, 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

| Characteristic Prior military service status | Without | With |
|-------------------------------------------|---------|------|
| N  | % (95% CI)  | N  | % (95% CI) |
|----|-----------|----|-----------|
| 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 | | | | |
| 18–24 | 20,301  | 47.2 (46.5–48.0) | 1296  | 21.8 (20.1–23.6) |
| 25–44 | 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 | 40,082  | 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) |
| Food insecurity | 14,137  | 23.1 (22.4–23.7) | 1091  | 13.7 (12.3–15.1) |
| Housing insecurity | 21,928  | 36.0 (35.2–36.7) | 1839  | 22.8 (20.8–24.1) |
| Poor mental health | 10,675  | 16.9 (16.3–17.5) | 1081  | 12.6 (11.3–13.9) |
| Poor physical health | 12,180  | 16.1 (15.5–16.7) | 1962  | 19.5 (18.5–21.3) |

* Sample is drawn from respondents in nine states that responded to the social context optional module in either 2011 or 2012.
* Unweighted sample size.
* Weighted percentage and 95% Confidence Interval (CI).
* 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.
* 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.
* Poor mental health was defined using the cutoff of ≥ 6 days in the past 30 days.
* Poor physical health was defined using the cutoff of ≥ 14 days in the past 30 days.
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 \((P < .001)\), older aged \((P < .001)\), had less years of education \((P < .001)\), 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

| Characteristic                  | Poor mental health | P-value | Poor physical health | P-value |
|--------------------------------|--------------------|---------|----------------------|---------|
|                                | % (95% CI)         |         | % (95% CI)           |         |
| Sex                            |                    |         |                      |         |
| Male                           | 13.8 (13.0–14.6)   | <.001   | 14.7 (13.9–15.4)     | <.001   |
| Female                         | 18.9 (18.1–19.6)   |         | 18.1 (17.4–18.8)     |         |
| Age, yr                        |                    |         |                      |         |
| 18–44                          | 18.7 (17.7–19.7)   | <.001   | 12.4 (11.5–13.2)     | <.001   |
| 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)   | <.001   | 14.6 (14.0–15.1)     | <.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)   | <.001   | 12.9 (12.4–13.4)     | <.001   |
| Prior military service         |                    |         |                      |         |
| No                             | 16.9 (16.3–17.5)   | <.001   | 16.1 (15.5–16.6)     | <.001   |
| Yes                            | 12.6 (11.3–13.6)   |         | 19.9 (18.3–20.9)     |         |
| Food insecurity                |                    | <.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             |                    | <.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                             | –                  | <.001   | 11.9 (11.4–12.4)     | <.001   |
| Yes                            | –                  |         | 39.8 (38.7–40.5)     |         |
| Poor physical health           |                    |         |                      |         |
| No                             | 11.8 (11.3–12.4)   | –       | –                    | –       |
| Yes                            | 39.7 (38.4–42.1)   | –       | –                    | –       |

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

* Sample is drawn from respondents in nine states that responded to the social context optional module in either 2011 or 2012.

† Poor mental health was defined using the cutoff of ≥6 days in the past 30 days.

‡ Poor physical health was defined using the cutoff of ≥14 days in the past 30 days.

§ Weighted percentage and 95% Confidence Interval (CI).

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.

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 pay rent or mortgage.
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 = [1.32–1.71]). 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.

References

Aldwin, C., & Stokols, D. (1988). The effects of environmental change on individuals and groups: Some neglected issues in stress research. Journal of Environmental Psychology, 8(1), 57–75. http://dx.doi.org/10.1016/0190-4769(88)90023-9.
Aldwin, C. M., Levenson, M. R., & Spiro, A. (1994). Vulnerability and resilience to combat exposure: Can stress have lifelong effects? Psychology and Aging, 9(1), 34–44.
American Psychological Association (2015). Stress in America: Paying with our health; Retrieved 19.02.15 from (http://www.apa.org/news/press/releases/stress/2014/stress-report.pdf).
Blosnich, J. R., Dichter, M. E., Gerlull, C., Batten, S. V., & Bossarte, R. M. (2014). Disparities in adverse childhood experiences among individuals with a history of military service. JAMA Psychiatry, 71(9), 1041–1048. http://dx.doi.org/10.1001/jamapsychiatry.2014.724.
Bossarte, R. M., He, H., Claassen, C. A., Knox, K., & Tu, X. (2011). Validation and development of a daily standard for the identification of frequent mental distress. Social Psychiatry and Psychiatric Epidemiology, 46(5), 403–411 10.1007/s00127-010-0204-4.
Braveman, P., Egerter, S., & Williams, D. R. (2011). The social determinants of health: Coming of age. Annual Review of Public Health, 32, 381–398. http://dx.doi.org/10.1146/annurev-publhealth-031210-101218.
Casey, P. H., Simpson, P. M., Gossert, J. M., Bogle, M. L., Champagne, C. M., Connell, C., & Stuff, J. E. (2006). The association of child and household food insecurity with childhood overweight status. Pediatrics, 118(5), e1406–e1413. http://dx.doi.org/10.1542/peds.2006-0097.
Centers for Disease Control and Prevention (2013a). Behavioral Risk Factor Surveillance System 2011 summary data quality report (version 8).
Centers for Disease Control and Prevention (2013b). Behavioral Risk Factor Surveillance System 2012 summary data quality report.
Centers for Disease Control and Prevention (2013c). Behavioral Risk Factor Surveillance System: Data and documentation.
Centers for Disease Control and Prevention (2000). Measuring healthy days: Population assessment of health-related quality of life.
