



Differences in functional and structural social support among female and male veterans and civilians

Sarah B. Campbell^{1,2,3} · Kristen E. Gray^{1,4} · Katherine D. Hoerster^{1,2,3} · John C. Fortney^{1,3} · Tracy L. Simpson^{2,3,5}

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Abstract

Purpose Social support is an important correlate of health behaviors and outcomes. Studies suggest that veterans have lower social support than civilians, but interpretation is hindered by methodological limitations. Furthermore, little is known about how sex influences veteran–civilian differences. Therefore, we examined veteran–civilian differences in several dimensions of social support and whether differences varied by sex.

Methods We performed a cross-sectional analysis of the 2012–2013 National Epidemiologic Survey of Alcohol and Related Conditions-III, a nationally representative sample of 34,331 respondents (male veterans = 2569; female veterans = 356). We examined veteran–civilian differences in functional and structural social support using linear regression and variation by sex with interactions. We adjusted for socio-demographics, childhood experiences, and physical and mental health.

Results Compared to civilians, veterans had lower social network diversity scores (difference [diff] = − 0.13, 95% confidence interval [CI] − 0.23, − 0.03). Among women but not men, veterans had smaller social network size (diff = − 2.27, 95% CI − 3.81, − 0.73) than civilians, attributable to differences in religious groups, volunteers, and coworkers. Among men, veterans had lower social network diversity scores than civilians (diff = − 0.13, 95% CI − 0.23, − 0.03); while among women, the difference was similar but did not reach statistical significance (diff = − 0.13, 95% CI − 0.23, 0.09). There was limited evidence of functional social support differences.

Conclusion After accounting for factors that influence military entry and social support, veterans reported significantly lower structural social support, which may be attributable to reintegration challenges and geographic mobility. Findings suggest that veterans could benefit from programs to enhance structural social support and improve health outcomes, with female veterans potentially in greatest need.

Keywords Social support · Veterans · Gender differences

Sarah B. Campbell, Kristen E. Gray are co-primary authors

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✉ Sarah B. Campbell
Sarah.Campbell6@va.gov

¹ US Department of Veterans Affairs (VA) Puget Sound Health Care System, Research and Development Service, 1660 S Columbia Way, S-152, Seattle, WA 98108, USA

² US Department of Veterans Affairs (VA) Puget Sound Health Care System, Mental Health Service, 1660 South Columbian Way, S-116, Seattle, WA 98108, USA

³ Department of Psychiatry and Behavioral Sciences, University of Washington, 1959 NE Pacific Street, Box 356560, Seattle, WA 98195, USA

⁴ Department of Health Services, University of Washington, 1959 NE Pacific Street, Box 357660, Seattle, WA 98195, USA

⁵ US Department of Veterans Affairs (VA) Puget Sound Health Care System, Center of Excellence in Substance Addiction Treatment and Education, 1660 S. Columbian Way, Seattle, WA 98108, USA

Introduction

Social support has been identified as a significant predictor of mortality, with one meta-analysis finding 50% greater odds of premature mortality for those with weak versus strong social ties [1]. Associations of weak social support with premature mortality are of similar or larger effect sizes as poor health behaviors, such as smoking, physical activity, and obesity [1]. Additionally, low social support has been linked to physical inactivity and poor chronic disease self-management [2, 3], and negative physical (e.g., viral illness and cardiovascular disease [4, 5]) and mental health outcomes (e.g., psychiatric disorders [6] and suicide [7]). Social support, which encompasses functional support (e.g., the perception of receiving emotional or practical help when needed) and structural support (e.g., the number of people with whom one has supportive contact) [8, 9], is, thus, an important contributor to overall health and wellbeing. Enhancing and capitalizing on social support may be one mechanism by which health behaviors and physical and mental health outcomes can be improved.

Approximately, 20 million military veterans live in the United States [10] and they have worse health behaviors and health outcomes than civilians across a host of indicators [11, 12], making them an important subpopulation for epidemiological study and clinical intervention. Moreover, veterans experience unique life events related to reintegration in society following military service, which may both relate to experiences of social support and distinguish veterans from civilians in this domain [13]. Given growing interest in social support-based interventions for improving physical and mental health outcomes [14–16], evaluating social support differences between veterans and civilians could aid in tailoring interventions for these two subpopulations to enhance treatment success.

To date, few studies have examined social support differences between veterans and civilians using the same sampling and measurement methodologies. Those that have directly explored differences typically demonstrate that veterans report lower social support than civilians, but these studies have important methodological limitations. For example, veteran and civilian employees of a veteran-related community organization were compared on “genuine relationships,” defined as trusted relationships that provide functional support, and veterans reported lower social support than civilians [17]. While informative, the sampling frame limits generalizability, analyses were unadjusted, and the novelty of the measure inhibits comparison to other literature. Another study using a subsample of states from the 2010 Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance Survey also found lower levels of social support among

veterans than civilians in analyses adjusting for demographic and physical health-related factors [18]. However, this study used a single-item social support measure that is not robustly linked to health outcomes [1] and may have important psychometric deficits [19]. Moreover, this study did not adjust for likely confounders, such as mental health conditions or childhood environment, which are associated with both social support and military service [11, 20–24]. Thus, although a small number of studies suggest that veterans have lower social support than civilians, more research is needed using established complex measures of social support and accounting for a more complete set of confounders with a generalizable sample.

Another gap in existing research is the role of sex in veteran–civilian differences in social support. In the general population, women tend to have larger social networks and rely on romantic and other relationships for support; whereas, married men tend to rely exclusively on romantic relationships [25]. However, among veterans, women are less likely to be married and more likely to live alone than men, particularly as they age [26], which could influence both structural and functional social support. Therefore, it is unclear how differences in structural and functional support may differ among male and female veterans versus civilians.

To address these gaps in the literature, we analyzed data from the 2012–2013 National Epidemiologic Survey of Alcohol and Related Conditions-III (NESARC-III) to examine (1) differences between veterans and civilians in functional and structural social support and (2) whether veteran–civilian differences in functional and structural social support varied by sex, accounting for important confounders, including physical and mental health and childhood environment. We hypothesized that veterans would report less social support than civilians and that this difference would be more pronounced among women than men, such that female veterans would report the lowest structural and functional social support.

Methods

We conducted a secondary data analysis of the cross-sectional 2012–2013 NESARC-III survey, sponsored by the National Institute on Alcohol Abuse and Alcoholism. The Department of Veterans Affairs (VA) Puget Sound Institutional Review Board determined the research was exempt.

Sample

NESARC-III used multistage probability sampling to collect responses from a nationally representative sample of non-institutionalized US residents at least 18 years old and not serving on active military duty. Data were collected via

the Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM-5 Version (AUDADIS-5), an in-person structured diagnostic interview designed for use by non-clinicians. Trained interviewers asked respondents about background (e.g., age, education); lifestyle and drinking practices; and related mood, anxiety, behavior, personality, and medical conditions. The response rate was 60.1% with a total sample size of 36,309. Additional survey details, including sampling strategies, have been previously described [27]. The study sample included 12,375 male civilians, 19,031 female civilians, 2569 male veterans, and 356 female veterans who had at least one non-missing social support outcome and complete data for all a priori confounders. Less than 7% of respondents in each group defined by sex and veteran status were excluded due to missing data.

Measures

Independent variable: veteran status

NESARC-III assessed veteran status with a single question about having ever served on active duty in the U.S. Armed Forces, Military Reserves, or National Guard. We classified respondents who served on active duty in the past as veterans and those reporting never having served in the military as civilians. Respondents having training in the National Guard/Reserves ($n=200$) or with unknown veteran status ($n=8$) were excluded due to demonstrated differences in health status among National Guard/Reservists as compared to active duty service members [11].

Dependent variable: social support.

Structural social support NESARC-III evaluated structural social support with the Social Network Index (SNI) [4]. Respondents reported the number of people they saw or talked to on the phone or Internet at least every 2 weeks from 11 different social groups (adult children, parents, spouse/partner's parents, other relatives, friends, teachers/students, coworkers, neighbors, religious groups, volunteer groups, and "other groups"). Respondents also provided their marital status, a 12th social group, which presumed spouses/partners had regular contact. Social network size was defined as the number of regular contacts in the social network, summed across all 12 social groups (range 0–237). We also examined size of individual social groups (family, friends, teachers/students, coworkers, neighbors, religious groups, volunteer groups, and "other groups"), where family was the sum of spouse/partner, adult children, parents, spouse/partner's parents, and other relatives. Social network diversity was defined as the number of distinct social groups with which a respondent had regular contact (range 0–12). The SNI has shown fair reliability [28]. The NESARC-III

SNI varied slightly from the original measure in that the parents and spouse/partner's parents social group questions only had yes/no responses. We assigned a value of one for each question participants endorsed (versus possible values of one or two in the original measure), which did not affect social diversity.

Functional social support

NESARC-III captured functional social support with the 12-item Interpersonal Support Evaluation List (ISEL-12), which measures the following aspects of social support: the perceived availability of appraisal (e.g., "advice or guidance" [29]), belonging (e.g., "empathy, acceptance, concern" [29]), and tangible (e.g., "help or assistance, such as material or financial aid" [29]) social support. The measure includes positive (e.g., "There is someone I can turn to for advice about handling problems with my family") and negative (e.g., "I don't often get invited to do things with others") statements about social support with response options on a four-point scale (0–3) of definitely false, probably false, probably true, and definitely true. Responses were summed for a total score with reverse scoring of negative items, such that higher scores indicated greater total functional social support (range 0–36). We also examined the appraisal, belonging, and tangible social support domains (range 0–12). The ISEL-12 has good internal consistency reliability ($\alpha=0.75\text{--}0.90$) [29].

Moderator: sex A dichotomous variable reflecting male or female sex was evaluated as a moderator of the relationship between veteran status and social support. NESARC-III interviewers were instructed to ask respondents about their sex if it was "not apparent" and to select based on observation if a respondent refused or did not know.

Potential covariates We identified numerous potential covariates of interest, including socio-demographic characteristics, physical and mental health, and childhood environment, and we used directed acyclic graphs (DAGs) to ultimately select those included in analyses (described further below). Socio-demographic characteristics included age, race (white vs. non-white), nativity (born in the U.S. vs. not born in the U.S.), education (no college vs. at least some college), employment status (employed/in school vs. not employed), sexual orientation (gay, lesbian, or bisexual vs. heterosexual), and rurality (urban vs. rural).

Past-year mental health conditions were assessed with the AUDADIS-5, which operationalizes DSM-5 criteria for psychiatric disorders [30]. Mental health conditions queried through the in-person structured diagnostic interview included (1) substance-related and addictive disorders, (2) depressive disorders, (3) bipolar and related disorders, (4)

anxiety disorders, (5) post-traumatic stress disorder (PTSD), (6) feeding and eating disorders, and (7) personality disorders. We created a yes/no variable for each of these categories of mental health conditions, indicating whether the respondent had ≥ 1 disorder within the category, resulting in seven separate dichotomous mental health variables.

Participants were queried about whether a doctor or other professional had confirmed they had any of 32 potential medical conditions (e.g., diabetes, myocardial infarction, arthritis, serious traumatic brain injury) in the last 12 months, and we created a continuous variable reflecting the total number of physical health conditions endorsed (range 0–32).

Childhood environment included receipt of government assistance (e.g., welfare, food stamps) in childhood (yes/no) and childhood adversities. Childhood adversities before age 18 were captured in NESARC-III through five types of childhood maltreatment (sexual abuse, physical abuse, physical neglect, emotional abuse, and emotional neglect) and four types of household dysfunction (exposure to interpersonal violence, substance use at home, mental health issues, and incarceration of a parent/adult living in their home), similar to the Adverse Childhood Experiences Study [31]. Variables were dichotomized as yes/no using previously described procedures [32]. We created composite count scores for childhood maltreatment and household dysfunction that reflected the number of endorsed types of maltreatment (range 0–5) and dysfunction (range 0–4).

Statistical analyses

All analyses were conducted using Stata (version 15) and accounted for the complex survey design. Survey sample weights accounted for variable probabilities of selection, differential nonresponse rates, and possible deficiencies in the sampling frame and were used to produce counts scaled up to “known” population totals for major subgroups defined by region, sex, age, and race/ethnicity [27].

We first examined sociodemographic characteristics, physical and mental health, and childhood environment, stratified by veteran status and sex, using means and standard errors (SE) or frequencies and proportions for continuous and categorical variables, respectively. To compare social support between veterans and non-veterans, we fit separate linear regression models for each of the social support scores with veteran status as the independent variable. We added an interaction term between veteran status and sex to examine whether the association of veteran status with social support varied between men and women. We fit minimally and fully adjusted models (defined below) and obtained point estimates and corresponding 95% confidence intervals (CIs).

Covariates listed above were identified as potential confounders based on their availability in NESARC-III and existing literature demonstrating associations with social support and military service or veteran status (e.g., [23, 33–35]). Due to small cell sizes, sexual orientation and nativity were excluded as potential confounders. Minimally adjusted models included the non-modifiable demographic characteristics age, sex, and race. From the list of all potential covariates, we then constructed a DAG to determine the full set of confounders for which models required adjustment to produce unbiased estimates of associations [36]. DAGs are simple graphs developed and interpreted through a set of rules to help identify confounders and potential sources of bias. We used DAGitty [37], a browser-based environment for creating DAGs, to determine our final set of confounders for fully adjusted models (see Online Resource 1 for DAG). The final set included age, sex, race, education, employment, rurality, mental health, physical health, and childhood environment (receipt of government assistance, childhood maltreatment, and household dysfunction).

Results

There were demographic and participant characteristic differences by veteran status and sex among respondents (Table 1). Compared to civilians, veterans were older (especially men); more likely to be White (especially men), to be U.S.-born, to have at least some college education (especially women), and to have military health insurance (especially women). Veterans also had more physical health conditions and experienced greater childhood maltreatment. Male veterans were more likely than other groups to be married and to be living in rural locations; less likely to identify as gay or bisexual; and less likely to be employed or in school. Female veterans were more likely than other groups to identify as lesbian or bisexual; more likely to have received government assistance in childhood; and experienced greater childhood household dysfunction. Male civilians had the highest prevalence of substance-related or addictive disorders and bipolar or related disorders. Female civilians and veterans had higher prevalence than men of depressive disorders (especially civilians), anxiety disorders (especially veterans), and feeding or eating disorders. Female veterans had the highest prevalence of PTSD and personality disorders.

Differences in social support between veterans and civilians

Average unadjusted social support scores across civilians and veterans, and males and females are reported in Online Resource 2. In general, veterans had slightly lower average

Table 1 Socio-demographic, physical and mental health, and childhood environment characteristics of NESARC-III respondents by veteran status and sex

	Civilians		Veterans	
	Men (<i>n</i> = 12,420)	Women (<i>n</i> = 19,161)	Men (<i>n</i> = 2,581)	Women (<i>n</i> = 358)
Age (mean, SE)	42.3 (0.20)	47.0 (0.22)	61.0 (0.42)	51.4 (1.23)
White race (<i>n</i> , %)	6296 (63.7)	9966 (65.9)	1789 (80.4)	220 (74.6)
Married (<i>n</i> , %)	6011 (58.8)	8461 (55.8)	1385 (68.7)	169 (58.7)
At least some college education (<i>n</i> , %)	6793 (58.7)	11,281 (62.7)	1697 (67.0)	290 (80.7)
Employed or in school (<i>n</i> , %)	9063 (75.0)	11,265 (58.9)	1159 (44.5)	216 (56.5)
Lesbian, gay, or bisexual (<i>n</i> , %)	403 (2.9)	632 (3.0)	50 (1.4)	21 (5.4)
U.S.-born (<i>n</i> , %)	9703 (80.6)	15747 (84.1)	2474 (96.3)	339 (96.8)
Rural residence (<i>n</i> , %)	1,948 (19.9)	3,227 (21.5)	566 (25.7)	52 (20.8)
Military health insurance (<i>n</i> , %)	79 (0.6)	521 (2.8)	821 (30.0)	155 (39.7)
Number of physical health conditions (mean, SE)	1.1 (0.02)	1.6 (0.03)	2.3 (0.05)	2.0 (0.13)
DSM-5 mental health conditions (<i>n</i> , %)				
Substance-related or addictive disorders	2769 (21.4)	2321 (11.9)	369 (12.4)	55 (14.3)
Depressive disorders	1052 (7.9)	2772 (14.5)	222 (7.9)	49 (12.2)
Bipolar or related disorders	291 (2.4)	376 (1.9)	49 (1.7)	10 (2.0)
Anxiety disorders	1131 (9.2)	3053 (16.7)	235 (8.9)	68 (22.0)
Post-traumatic stress disorder	350 (2.7)	1,157 (5.9)	143 (5.2)	37 (11.6)
Feeding or eating disorders	69 (0.5)	285 (1.6)	13 (0.5)	3 (1.9)
Personality disorders	1649 (13.1)	2369 (11.8)	348 (12.6)	48 (15.0)
Childhood environment				
Government assistance (<i>n</i> , %)	2286 (16.2)	3910 (16.5)	388 (12.9)	88 (22.7)
Childhood maltreatment score (mean, SE)	0.7 (0.01)	0.8 (0.01)	0.9 (0.03)	1.2 (0.11)
Household dysfunction score (mean, SE)	0.5 (0.01)	0.6 (0.01)	0.5 (0.02)	0.8 (0.06)

SE standard error

Numbers may not add to totals or percents to 100% due to missing data; means, SEs, and percents account for survey sampling

unadjusted structural and functional social support scores than civilians overall and within sex.

In models minimally adjusted for age, gender, and race, compared to civilians, veterans had significantly lower structural support scores, including social network diversity (diff = -0.21, 95% CI -0.30, -0.11; Table 2) and social network size (diff = -0.88, 95% CI -1.71, -0.06). Veterans also had lower functional social support scores than civilians for the appraisal domain (difference [diff] = -0.13, 95% CI -0.25, -0.01). In fully adjusted models, only the veteran-civilian difference in social network diversity persisted (diff = -0.13, 95% CI -0.23, -0.03); there were no significant differences with regard to functional support.

Differences in social support between veterans and civilians, by sex

In minimally adjusted models, there was no evidence that veteran-civilian differences varied by sex (Table 3). However, among men, veterans had lower social network diversity (diff = -0.22, 95% CI -0.32, -0.11) and appraisal social support (diff = -0.16, 95% CI -0.29, -0.03) than

civilians. Among women, veterans had smaller network size (diff = -2.18, 95% CI -3.74, -0.63) and lower belonging social support (diff = -0.31, 95% CI -0.62, -0.01) than civilians.

With full adjustment, interactions between sex and veteran status emerged for social network size ($p=0.02$) and belonging social support ($p=0.04$). For both outcomes, there were no veteran-civilian differences among men, but among women, veterans had lower scores than civilians for social network size (diff = -2.27, 95% CI -3.81, -0.73) and belonging social support (diff = -0.24, 95% CI -0.53, 0.04; of note this latter finding did not reach statistical significance). Lastly, among men, veterans had lower social network diversity scores than civilians (diff = -0.13, 95% CI -0.23, -0.03). The magnitude of difference was the same among women but was nonsignificant (diff = -0.13, 95% CI -0.35, 0.09) such that there was no interaction between sex and veteran status for this outcome.

Table 2 Adjusted differences in social support scores between veteran and civilian respondents in NESARC-III

Social support measure	Veterans compared to civilians		
	Diff	95% CI	<i>p</i> value
Structural social support			
Social network diversity			
Minimal adjustment ^a	-0.21	-0.30, -0.11	<0.001
Full adjustment ^b	-0.13	-0.23, -0.03	0.01
Social network size			
Minimal adjustment ^a	-0.88	-1.71, -0.06	0.04
Full adjustment ^b	-0.55	-1.38, 0.28	0.19
Functional social support			
Total			
Minimal adjustment ^a	-0.26	-0.55, 0.03	0.08
Full adjustment ^b	-0.002	-0.27, 0.27	0.99
Appraisal			
Minimal adjustment ^a	-0.13	-0.25, -0.01	0.03
Full adjustment ^b	-0.07	-0.18, 0.04	0.24
Belonging			
Minimal adjustment ^a	-0.07	-0.19, 0.05	0.26
Full adjustment ^b	0.03	-0.09, 0.15	0.62
Tangible			
Minimal adjustment ^a	-0.06	-0.16, 0.04	0.26
Full adjustment ^b	0.03	-0.06, 0.13	0.48

diff difference, *CI* confidence interval

^aAdjusted for age (continuous), sex (male vs. female), and race (white vs. non-white)

^bAdjusted for ^a and education (at least some college vs. no college), employment (employed or in school vs. not employed), and rurality (urban vs. rural), DSM-5 substance-related or addictive disorders (yes vs. no), depressive disorders (yes vs. no), bipolar or related disorders (yes vs. no), anxiety disorders (yes vs. no), post-traumatic stress disorder (yes vs. no), feeding or eating disorders (yes vs. no), and personality disorders (yes vs. no), number of physical health conditions (continuous), childhood maltreatment score (continuous), childhood household dysfunction score (continuous), and childhood use of government assistance (yes vs. no)

Differences in size of specific social groups between veterans and civilians, by sex

When we examined minimally adjusted veteran–civilian differences by sex in the size of individual social groups with whom the respondent had contact, there was evidence of moderation for volunteers ($p < 0.001$; Table 4) and religious groups ($p = 0.04$). There were no differences among men, but among women, veterans had smaller-sized social groups than civilians (volunteers: $\text{diff} = -0.47$, 95% CI $-0.71, -0.24$; religious groups: $\text{diff} = -0.82$, 95% CI $-1.22, -0.43$). In minimally adjusted models, both male and female veterans had a smaller-sized group of coworkers with whom they had contact than civilians (males: $\text{diff} = -0.46$, 95% CI $-0.70, -0.21$; females: $\text{diff} = -0.29$, 95% CI $-0.58, -0.01$).

Among men, veterans also had a smaller-sized group of family with whom they had contact than civilians ($\text{diff} = -0.27$, 95% CI $-0.49, -0.05$).

In fully adjusted models, interactions remained for the size of volunteer ($p < 0.001$) and religious groups ($p = 0.049$), with no differences among men but smaller-sized social groups reported among female veterans compared to female civilians (volunteers: $\text{diff} = -0.58$, 95% CI $-0.81, -0.34$; religious groups: $\text{diff} = -0.78$, 95% CI $-1.16, -0.40$). Veteran–civilian differences in the size of coworker social groups were strengthened for women in fully adjusted analyses ($\text{diff} = -0.38$, 95% CI $-0.64, -0.11$) but were mitigated among men ($\text{diff} = -0.17$, 95% CI $-0.39, 0.06$). An additional interaction emerged in fully adjusted models for students/teachers ($p = 0.047$), with male veterans having a larger-sized social group of students/teachers with whom they had contact than male civilians ($\text{diff} = 0.11$, 95% CI $0.01, 0.21$), but no differences among women.

Discussion

Using a nationally representative sample, we examined whether there were differences in structural and functional social support between veterans and civilians, and whether differences varied by sex. In minimally adjusted analyses accounting only for the *non-modifiable* characteristics of age, sex, and race, veterans had modestly lower structural social support, including social network diversity and size, as well as appraisal social support. Among men, veterans reported lower social network diversity and appraisal social support than civilians and, among women, veterans reported smaller social network size and lower belonging social support than civilians.

When we estimated fully adjusted models further accounting for *modifiable* socio-demographic characteristics like physical and mental health and childhood environment, which have not been sufficiently accounted for in previous investigations, veteran–civilian differences in structural social support persisted. Overall, veterans had lower social network diversity than civilians. Findings also suggested that female veterans reported smaller social network size than civilians, with 2.3 fewer network members; while, male veterans reported lower social network diversity than male civilians. Although the magnitude of the difference in social network diversity was similar among women, the confidence interval included zero. In contrast to structural social support findings, however, differences in functional social support were generally mitigated in fully adjusted analyses with one exception. There was a suggestion of lower belonging social support—the availability of others who show acceptance, empathy, and concern—among female veterans compared to civilians, but no differences among men. This finding makes

Table 3 Adjusted differences in social support scores between veteran and civilian NESARC-III respondents, by sex

Social support measure	Veterans compared to civilians						<i>p</i> value for interaction
	Men			Women			
	Diff	95% CI	<i>p</i> value	Diff	95% CI	<i>p</i> value	
Structural social support							
Social network diversity							
Minimal adjustment ^a	-0.22	-0.32, -0.11	<0.001	-0.11	-0.36, 0.15	0.40	0.41
Full adjustment ^b	-0.13	-0.23, -0.03	0.01	-0.13	-0.35, 0.09	0.24	0.98
Social network size							
Minimal adjustment ^a	-0.70	-1.58, 0.18	0.12	-2.18	-3.74, -0.63	0.006	0.08
Full adjustment ^b	-0.31	-1.20, 0.59	0.50	-2.27	-3.81, -0.73	0.004	0.02
Functional social support							
Total							
Minimal adjustment ^a	-0.25	-0.57, 0.07	0.12	-0.34	-0.99, 0.31	0.30	0.81
Full adjustment ^b	0.02	-0.28, 0.32	0.89	-0.17	-0.81, 0.48	0.61	0.62
Appraisal							
Minimal adjustment ^a	-0.16	-0.29, -0.03	0.02	0.05	-0.21, 0.31	0.70	0.16
Full adjustment ^b	-0.09	-0.21, 0.04	0.18	0.08	-0.18, 0.34	0.56	0.30
Belonging							
Minimal adjustment ^a	-0.04	-0.17, 0.09	0.57	-0.31	-0.62, -0.01	0.04	0.09
Full adjustment ^b	0.07	-0.06, 0.20	0.30	-0.24	-0.53, 0.04	0.10	0.04
Tangible							
Minimal adjustment ^a	-0.05	-0.17, 0.06	0.34	-0.08	-0.31, 0.15	0.50	0.86
Full adjustment ^b	0.04	-0.07, 0.14	0.47	-0.004	-0.25, 0.24	0.98	0.76

diff difference, *CI* confidence interval

^aAdjusted for age (continuous) and race (white vs. non-white)

^bAdjusted for ^a and education (at least some college vs. no college), employment (employed or in school vs. not employed), and rurality (urban vs. rural), DSM-5 substance-related or addictive disorder (yes vs. no), depressive disorders (yes vs. no), bipolar or related disorders (yes vs. no), anxiety disorders (yes vs. no), post-traumatic stress disorder (yes vs. no), feeding or eating disorders (yes vs. no), and personality disorders (yes vs. no), number of physical health conditions (continuous), childhood maltreatment score (continuous), childhood household dysfunction score (continuous), and childhood use of government assistance (yes vs. no)

sense in light of the smaller social network size among female veterans.

Our results regarding functional social support contrast with the limited literature examining veteran–civilian differences in functional social support. In one study examining unadjusted associations, veterans had lower functional social support than civilians [17], similar to our minimally adjusted findings for appraisal social support; however, differences in our sample were largely mitigated after full adjustment, with the exception of a suggestion of lower belonging social support among female veterans. Another study found lower functional social support scores among veterans compared to civilians with adjustment for demographic and physical health [18]. However, lack of adjustment for mental health and other relevant confounders in that study, along with use of a single-item social support measure, could account for differences with current study findings. We are not aware of any other existing studies comparing structural social support between veterans and civilians.

Although it is often assumed that veterans have worse social support because of a higher burden of mental [6] and physical health conditions [4, 5], veterans in our sample had lower structural social support than civilians even after accounting for their higher prevalence of these conditions. Why, then, might these differences exist? One possibility is that findings reflect the impact of reintegration challenges on social support not accounted for by physical and mental health measures, such as feelings of disconnection from civilian society; social alienation unrelated to PTSD; and renegotiation of family roles, routines, and responsibilities [13]. Our findings may reflect the experience of military service, including frequent geographic relocation, prompting veterans to identify more as citizens of a country (i.e., the U.S.) than residents of a particular geographic location or community (with its implied structural and functional support), as has been shown among veterans from Australia [38]. Each of these effects may persist long after military separation. It may be that, due to the relative minority status

Table 4 Unadjusted and adjusted differences in size of individual social groups between veteran and civilian NESARC-III respondents, by sex

Social network group	Veterans compared to civilians						<i>p</i> value for interaction
	Men			Women			
	Diff	95% CI	<i>p</i> value	Diff	95% CI	<i>p</i> value	
Family							
Minimal adjustment ^a	-0.27	-0.49, -0.05	0.02	-0.45	-1.07, 0.17	0.15	0.58
Full adjustment ^b	-0.17	-0.40, 0.05	0.13	-0.33	-0.92, 0.26	0.27	0.61
Friends							
Minimal adjustment ^a	0.17	-0.47, 0.13	0.26	-0.40	-0.91, 0.12	0.13	0.42
Full adjustment ^b	-0.11	-0.41, 0.19	0.21	-0.39	-0.94, 0.16	0.16	0.33
Students							
Minimal adjustment ^a	0.08	-0.01, 0.18	0.09	-0.13	-0.32, 0.07	0.021	0.07
Full adjustment ^b	0.11	0.01, 0.21	0.04	-0.14	-0.35, 0.07	0.19	0.047
Coworkers							
Minimal adjustment ^a	-0.46	-0.70, -0.21	<0.001	-0.29	-0.58, -0.01	0.04	0.036
Full adjustment ^b	-0.17	-0.39, 0.06	0.14	-0.38	-0.64, -0.11	0.01	0.23
Neighbors							
Minimal adjustment ^a	0.14	-0.04, 0.32	0.13	0.09	-0.24, 0.41	0.59	0.80
Full adjustment ^b	0.15	-0.03, 0.33	0.09	0.11	-0.21, 0.43	0.50	0.83
Volunteers							
Minimal adjustment ^a	0.18	-0.08, 0.44	0.18	-0.47	-0.71, -0.24	<0.001	<0.001
Full adjustment ^b	0.11	-0.16, 0.38	0.40	-0.58	-0.81, -0.34	<0.001	<0.001
Other groups							
Minimal adjustment ^a	0.19	-0.04, 0.43	0.11	0.29	-0.31, 0.89	0.34	0.75
Full adjustment ^b	0.15	-0.09, 0.39	0.21	0.17	-0.44, 0.78	0.58	0.96
Religious groups							
Minimal adjustment ^a	0.27	-0.63, 0.10	0.15	-0.82	-1.22, -0.43	<0.001	0.04
Full adjustment ^b	-0.26	-0.62, 0.09	0.15	-0.78	-1.16, -0.40	<0.001	0.049

diff difference, *CI* confidence interval

^aAdjusted for age (continuous) and race (white vs. non-white)

^bAdjusted for ^a and education (at least some college vs. no college), employment (employed or in school vs. not employed), and rurality (urban vs. rural), DSM-5 substance-related or addictive disorder (yes vs. no), depressive disorders (yes vs. no), bipolar or related disorders (yes vs. no), anxiety disorders (yes vs. no), post-traumatic stress disorder (yes vs. no), feeding or eating disorders (yes vs. no), and personality disorders (yes vs. no), number of physical health conditions (continuous), childhood maltreatment score (continuous), childhood household dysfunction score (continuous), and childhood use of government assistance (yes vs. no)

and distinct identity of female veterans, these effects are particularly pronounced in limiting structural social support for female veterans as compared to other groups. Structural social support (i.e., social network size) may be more limited among veterans due to strong preference for self-reliance, potentially limiting the breadth and diversity of individuals with whom they may choose to engage regularly [39]. Military service produces unique forms of social support through fellow service members and unit cohesion, which can buffer against the negative effects of stressful events and traumas [40]. However, if these relationships do not persist after service, they may reinforce veteran–civilian differences in structural support.

Despite having similar levels of perceived functional social support, female veterans had smaller social network size, and male veterans had lower social network diversity, than civilians. Among women, deficits in social network size were specifically observed among relationships that are likely to be considered “weak ties,” or casual social relationships, including coworkers, fellow volunteers, or religious group members. Given that research has shown the importance of these weak ties for overall happiness and sense of belonging [41], increasing social network size and/or diversity among veterans—particularly female veterans—could be beneficial. Some psychosocial interventions within VA have modified social support-related content specifically for female veterans to encourage greater use of existing social

supports [56], and results of the present study suggest that encouragement to engage in a broader array of supportive relationships may be especially beneficial. One potential strategy to address female veterans' lower social network size could include social mapping exercises to encourage connection to organizations consistent with their values with whom they could forge social connection [43], which could also be useful in addressing male veterans' lower social network diversity. Given that reintegration challenges may erode social support, a focus on bolstering social connection among veterans who have recently separated from the military is warranted.

Acknowledging the value of social support in promoting physical and mental health, numerous clinical programs have been implemented and tested in the VA using peer supports and family members to improve outcomes [44–46]. While these efforts, and similar ones developed in civilian contexts [46–48], are promising, results of these programs have been mixed, suggesting a need for continued attention to optimally promote and capitalize on social support. It may be that more explicit attention to structural support enhancement in conjunction with focus on functional support is needed to bolster results [47]. Given the fine-grained differences in social support manifestations among groups and the important links between social support and long-term health, structured assessment and routine monitoring of social support appears warranted in health care settings [48]. Assessment of social support in routine VA clinical practice could help to identify veterans at greatest need of intervention.

Strengths and limitations

The present study is, to our knowledge, the first quantitative assessment of differences in social support between U.S. veterans and civilians using a nationally representative sample [27], complex measures of social support [47], and comprehensive models accounting for relevant covariates. However, findings should be considered in the context of certain limitations. For instance, our findings could be attributable to residual confounders, such as subthreshold levels of mental health conditions, which are highly prevalent among veterans [49] and known to be associated with reduced social support [50] but are unaccounted for in our statistical models. The cross-sectional nature of the data prevents analysis of change in social support in the years following military service as compared to matched civilian samples. Moreover, veteran effects may be driven by service era characteristics, which may differ in future studies with more female veterans or veterans of recent service eras. Indeed, in the current sample, women veterans represented approximately 12% of

the total sample of veterans, while data from 2015 place the percentage at 9.4 [51].

Because no clinical benchmarks exist to identify the point at which low social support becomes problematic, it is difficult to determine whether the observed differences are meaningful for health behaviors and outcomes. Future research must provide clinical heuristics for interpreting measures of social support to contextualize such findings. The National Association of Community Health Centers is encouraging routine monitoring of social support via its own brief instrument [48], potentially affording researchers large national datasets to correlate levels of social support with negative health outcomes and longitudinally assess the degree to which declines or improvements in social support are associated with concurrent health behavior or status change. Other health systems (e.g., VA) have not yet implemented such routine measurement of social support, though these findings suggest it may be warranted. Lack of objective measures of social support also limits conclusions that can be drawn, although a recent meta-analysis found no differences between measures of objective and subjective social isolation with regard to health outcomes [1]. Additionally, measuring socially focused constructs such as loneliness and social connection may add context to the present results.

An additional limitation is that survey administrators were instructed to ask respondents about their sex if it was not apparent rather than to ask all participants, which may have resulted in misclassification, conflated sex and gender, and eliminated self-identification as transgender or non-binary gender. Moreover, psychotic disorders, which are known to influence social support [6], were excluded from the diagnostic interview. We also tested many hypotheses, such that some findings may be due to chance and not necessarily reflect underlying veteran–civilian differences or variation by sex. Given the paucity of research in this area, we viewed our study as exploratory and elected not to adjust for multiple comparisons. Rather, we followed guidance from Althouse and presented effect sizes, confidence intervals, and p-values to allow readers to use their own judgement in interpreting findings and weighing conclusions [52]. Finally, although use of nationally representative sample is advantageous for drawing conclusions about veterans broadly, it precludes examination of differences by use of VA healthcare. Veterans who use VA healthcare have worse physical and mental health and poorer social functioning compared to veterans who do not use VA [53], which may limit the generalizability of our findings for VA patients. Moreover, although the small number of National Guard/Reserves members was excluded from the present analyses due to differences in health status as compared to active duty service members [11], future research should assess differences in functional and structural support in

reservists as compared to the general population and active duty service members. Some studies suggest reservists have comparatively more difficulty reintegrating than do active duty service members, potentially exacerbating differences in structural social support [54].

Conclusion

The current study expanded prior literature by a national sample to explore differences in structural and functional social support between veterans and civilians, finding that veterans displayed lower structural social support than civilians, even after accounting for common contributors to low social support, such as mental and physical health conditions. It is likely important to engage veterans in programming to enhance their structural social support to affect downstream outcomes such as premature mortality [1], with female veterans appearing to be in greatest need of such programming. Indeed, prior research has found comparatively stronger effects on mortality for poor structural compared to functional social support [1, 55], suggesting that in spite of relatively similar levels of functional support in fully adjusted models, the deficits in structural social support among veterans are worthy of clinical attention and may have stronger effects on long-term health. Additionally, given that differences in structural and functional social support between veterans and civilians were larger before adjusting for mental and physical health conditions, benefits may be maximized among veterans by building social support enhancement into interventions for mental and physical health conditions. Recent empirical research has drawn attention to increasing social isolation in society [56] and the health costs associated with such changes in social support [47]. Further, recent reductions in overall happiness and subjective wellbeing among the U.S. general population have been attributed to declines in social support networks over time [57]. Collectively, these results highlight the urgency of devoting greater attention and resources to building quality social support among veterans, with particular attention to the unique needs of subgroups of veterans such as women.

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Compliance with ethical standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical approval This was a secondary data analysis and does not contain clinical studies or patient data.

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