Mental Disorders, Gun Ownership, and Gun Carrying Among Soldiers After Leaving the Army, 2016–2019

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See also Katz, p. 1718.

Objectives. To examine associations of current mental and substance use disorders with self-reported gun ownership and carrying among recently separated US Army soldiers. Veterans have high rates of both gun ownership and mental disorders, the conjunction of which might contribute to the high suicide rate in this group.

Methods. Cross-sectional survey data were collected in 2018–2019 from 5682 recently separated personnel who took part in the Army Study to Assess Risk and Resilience in Servicemembers. Validated measures assessed recent mood, anxiety, substance use, and externalizing disorders. Logistic regression models examined associations of sociodemographic characteristics, service characteristics, and mental disorders with gun ownership and carrying.

Results. Of the participants, 50% reported gun ownership. About half of owners reported carrying some or most of the time. Mental disorders were not associated significantly with gun ownership. However, among gun owners, major depressive disorder, panic disorder, posttraumatic stress disorder, and intermittent explosive disorder were associated with significantly elevated odds of carrying at least some of the time.

Conclusions. Mental disorders are not associated with gun ownership among recently separated Army personnel, but some mental disorders are associated with carrying among gun owners. (*Am J Public Health*. 2021;111(10):1855–1864. https://doi.org/10.2105/AJPH.2021.306420)

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An estimated 250 000 people died in 2016 worldwide as a result of firearm injuries.[1] Globally, homicide accounted for nearly two thirds of all firearm-related deaths. By contrast, suicide accounts for nearly 60% of firearm-related deaths in the United States.[2] Access to lethal means[3,4] and mental illness[5] are leading risk factors in suicides. Limiting access to firearms has been associated with significant reductions in gun-related mortality, resulting in several policies proposed to limit firearms access among members of high-risk populations,[6] although the effects of such policies have not been widely studied.[7]

To date, large epidemiological studies have not revealed associations of most mental disorders with gun ownership or carrying,[8–12] although some studies have shown relationships between heavy alcohol use and gun-related outcomes.[13–15] An important exception is that several studies have shown associations of gun ownership with intermittent explosive disorder (IED), a mental disorder characterized by impulsive aggression and anger.[12,16] This association is concerning because impulsivity, aggression, and anger are also associated with both suicide and interpersonal violence.[17,18]

A better understanding of gun ownership, gun carrying, and their relationships with mental disorders among recently separated service members is needed to enhance understanding of risks for gun-related suicide and interpersonal violence. Veterans are more likely to die by suicide than civilians.[19] Suicide rates are especially high after

separation from active duty service.[20] Veterans have high levels of access to firearms,[21] and suicides in this group are much more likely than those in the general population to result from firearm injuries.[22]

Veterans also have comparatively high rates of posttraumatic stress disorder (PTSD), depression, and anxiety.[23–25] Exposure to traumatic stress and associated PTSD may result in a heightened sense of vulnerability[26] that predisposes veterans to gun ownership and gun carrying, resulting in high levels of ownership and carrying among veterans with mental disorders. There is evidence that feelings of vulnerability secondary to PTSD decrease over time after separation from active duty service, highlighting the importance of risk management during the period of transition out of service and back into the civilian world.[27] In addition, transition from active duty military service to civilian life is a period of complex psychosocial change with the potential for heightened feelings of vulnerability and distress independent of PTSD and associated traumatic exposures.[28]

Our overarching objective in this study was to examine associations of current mental disorders with self-reported gun ownership and carrying among recently separated US Army veterans.

METHODS

Data were derived from the wave 2 interview of the Study to Assess Risk and Resilience in Servicemembers—Longitudinal Study (STARRS-LS), the only STARRS-LS survey asking about gun ownership and carrying. The initial STARRS-LS sampling frame consisted of 72 387 soldiers who participated in one of the baseline Army STARRS surveys and consented to having their survey data linked to administrative data.[29] The Army STARRS design has been detailed elsewhere[30]; briefly, the design consisted of 8 coordinated component studies, including 3 large surveys: the All-Army Study (AAS), the Pre-Post Deployment Study (PPDS), and the New Soldiers Study (NSS).

The initial STARRS-LS sampling frame included all participants in the 3 Army STARRS surveys, with the sample divided into 3 strata: Army STARRS participants with a history of suicidality or any clinically significant mental disorder (stratum 1; n = 22 176); participants in a population segment of high importance to Army leadership, such as Special Forces members, National Guard or Reserve soldiers, and female soldiers (stratum 2; n = 26 833); and the remaining participants (stratum 3; n = 23 378). The final STARRS-LS wave 1 (LS1) target sample included all of the baseline participants from stratum 1, all of the Special Forces soldiers, a probability sample of 67% from the remainder of stratum 2, and a probability sample of 50% from stratum 3 (a total of 51 963 soldiers). LS1 included both soldiers still in the Army and those who had separated at the time of LS1, which was carried out between September 2016 and April 2018. LS1 participants were given the option to complete the interview by telephone or self-administration online.

As in the earlier Army STARRS surveys,[31] the final LS1 survey data were weighted for nonresponse on the basis of a range of demographic and administrative variables; they were also weighted for Army STARRS survey responses and to adjust for the differential sampling by stratum just described. Weights were computed separately for soldiers who were part of the NSS and those who were part of the AAS or PPDS. We distinguished the NSS from the other surveys because it was administered exclusively to new soldiers during their first few days of service and before the start of basic training. The AAS and PPDS, in comparison, were administered to probability samples of soldiers no longer in training: the AAS in a sample of soldiers across the world, including those in combat deployments in Afghanistan, and the PPDS in a series of combat arms units just before their deployment to Afghanistan and then again shortly after their return.

Initial LS1 nonrespondents were subsampled in subsequent increased recruitment efforts to complete the LS1 survey and were upweighted to adjust for the underrepresentation of difficult-to-recruit participants in the final sample. A total of 14 508 soldiers completed the LS1 interview, resulting in a weighted response rate of 35.6% (Figure A, available as a supplement to the online version of this article at http://www.ajph.org). All LS1 respondents were eligible to complete LS2, which was administered from April 2018 through July 2019 according to the same field procedures used in LS1. The 12 156 LS2 participants (5172 from the NSS and 6984 from the AAS and PPDS) represented a conditional response rate of 83.7% (Figure B, available as a supplement to the online version of this article at http://www.ajph.org). We included in our study the 5682 LS2 participants (3558 originally from the AAS or PPDS, 2124 originally from the NSS) who had separated from the Army at the time LS2 was administered.

Measures

Firearm ownership and carrying. Respondents were asked about the number of firearms they kept in or

around their home (response options were 0, 1, 2, 3–5, and ≥6) and, if they had a firearm, how often they carried it with them (or in their vehicle) when going out in the neighborhood (response options were none of the time, a little of the time, some of the time, most of the time, and all or almost all of the time). No attempt was made to quantify these response categories more objectively. Nor was a recall period defined. We dichotomized reports of carrying into ever versus never and dichotomized carrying into often (most of the time or more) and not often (less frequent). Other indicators of accessibility were not assessed.

Mental disorders. The LS2 survey screened for *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)* mental disorders[32] with a short form of the Composite International Diagnostic Interview[33–35] that assessed major depressive disorder, panic disorder, generalized anxiety disorder, IED, and substance use disorders (alcohol and drug abuse and dependence, including misused prescription drugs and illicit drugs) in the preceding 30 days; attention-deficit/hyperactivity disorder in the preceding 6 months; and lifetime bipolar disorder. Bipolar disorder was assessed over respondents' lifetime because of concerns that veterans with recent episodes of mania or hypomania might be underrepresented in the survey. The PTSD Checklist was used to assess PTSD over the preceding 30 days.[36] All disorders were assessed in the absence of *DSM-5* diagnostic hierarchy or organic exclusion rules. Diagnoses derived from the Composite International Diagnostic Interview and the PTSD Checklist have demonstrated good concordance with independent clinical diagnoses.[34,35,37]

Anger attacks. As part of the IED assessment, participants reported the number of days in the preceding 30 days they had experienced attacks of anger in which they lost control and yelled at someone, had heated arguments or threatened someone (verbal anger attacks), or had attacks of anger in which they lost control and hurt someone, hurt an animal, or broke something of value (physical anger attacks).

Sociodemographic and Army career characteristics. Data on sociodemographic and Army career characteristics were derived from the LS2 interview and administrative records. They included age, sex, race/ethnicity, sexuality, region of residence, education, marital history, and current employment. Army career characteristics included a history of being in the regular Army versus only in the National Guard or Reserve, lifetime combat deployment, rank, years in regular Army service, and total years in service (whether on active duty or in the nonactivated National Guard or Reserve).

Statistical Analysis

Analyses were conducted separately for the NSS and the AAS and PPDS given that NSS participants had been in service no more than 2 terms before separation. In each subsample, we initially estimated the prevalence of gun ownership and carrying and then examined univariate associations of sociodemographic and Army career characteristics with ownership and carrying in a series of 6 models. Model 1 predicted any gun ownership (yes or no). Model 2 predicted number of guns owned. Model 3 predicted history of carrying a gun among gun owners. Model 4 predicted often carrying a gun often among those who had ever carried. Models 5 and 6 predicted history of carrying in the total sample (model 5) and carrying often in the total sample (model 6) to examine combined predictors of (1) ownership and (2) carrying conditional on ownership. Simple logistic regression was used in each model other than model 2, which involved a discrete-event survival analysis with a logistic link function and 3 transitions for ownership of more than 1, 2, and 5 guns; slopes were constrained to be constant across transitions.[38]

We next added information about mental disorders as predictors in each model separately for each mental disorder to avoid the problem of high correlations among disorders. We then instead used data on number of disorders as predictors. Logits and their confidence intervals (CIs) were exponentiated and are reported here as odds ratios (ORs) with their 95% confidence intervals. Statistical significance was evaluated with .05-level 2-sided tests. Given the large number of predictors and models considered, we adjusted for the false discovery rate[39,40] to control the expected proportion of falsely positive coefficients (which we set at .05) rather than, as in the Bonferroni method, controlling the familywise error rate; thus, we were able to increase statistical power while still guarding against false positives. Finally, on the basis of evidence in prior research, we decomposed the associations of IED with the outcomes by distinguishing between verbal and physical anger attacks. SAS version 9.4 (SAS Institute Inc, Cary, NC) was used for all of the analyses.

RESULTS

As noted, LS2 was the third survey administered to individuals who

participated initially in the baseline Army STARRS NSS (or AAS/PPDS) and then in LS1. The baseline survey samples were poststratified to match the population of all eligible soldiers on a wide range of sociodemographic and Army career variables recorded in Army administrative systems.[31] The LS1 sample was then reweighted to the weighted baseline sample distributions, and the LS2 sample was reweighted again to the weighted LS1 sample distributions. All weighting was carried out via 1/p weights based on propensity score analyses with logistic regression. Weight trimming of the upper and lower 5% of each sample distribution was used to avoid extreme weights, a procedure known to improve inferences in propensity score modeling based on logistic regression when the model is well specified.[41]

Comparisons of the weighted LS2 sample with the original population used in NSS and AAS or PPDS weighting showed generally good consistency with sociodemographic distributions but somewhat of an overrepresentation of non-Hispanic Whites and soldiers with higher levels of education in both samples (Table A, available as a supplement to the online version of this article at http://www.ajph.org). In addition, the weighted LS2 subsamples from the AAS and PPDS exhibited good consistency with population distributions of Army career characteristics as of the time of recruitment.

Variable Distributions

The distribution of firearms owned was similar across the subsamples (Table 1). Approximately half of all participants (50.8% in the AAS/PPDS, 48.5% in the NSS) reported owning at least 1 gun, with 12.9% to 13.5% owning exactly 1 and 10.3% to 12.3% owning 6 or more. Similar proportions of gun owners in the 2 subsamples reported they had ever carried a gun (49.6% in the AAS/PPDS, 54.3% in the NSS), but the proportion of gun owners reporting carrying often was significantly lower in the AAS and PPDS than in the NSS (29.9% vs 36.9%; $t = 3.0$; $P = .003$).

Sociodemographic and Army Career Predictors

The odds of history of carrying and often carrying were similar in the AAS and PPDS subsample, with significantly elevated odds for participants who were young (22–29 years of age), male, sexually active, residents of the South or Midwest (significant only for history of carrying), and enlisted (as opposed to being officers) and for those with comparatively few years in service before separation (Table 2). Other sociodemographic characteristics were not related to the outcomes (Table B, available as a supplement to the online version of this article at http://www.ajph.org). The significant aggregate associations were due for the most part to elevated odds of gun ownership among all participants and of history of carrying among owners rather than elevated odds of often carrying among those who had ever carried. The exceptions were being sexually active, being enlisted, and having few years of service, all of which were associated only with elevated odds of history of carrying among owners.

Two of these predictors, young age and male sex, were also significant in the NSS (Table 3). In the case of male sex, disaggregation showed the significant components observed in the ASS and PPDS (i.e., elevated odds of gun ownership among all participants and history of carrying among owners) but did not show elevated odds of often carrying among those who had ever carried. The same components were important for 2 other significant predictors not found in the AAS and PPDS: being a student or employed and history of combat deployment. In the case of young age, however, the significant components were elevated odds of carrying among owners and of often carrying among those who had ever carried as opposed to elevated odds of gun ownership among all participants. These components were also important for the 2 remaining significant predictors not found in the AAS and PPDS: less than a college education and history of being married. Other sociodemographic characteristics were not related to the outcomes (Table C, available as a supplement to the online version of this article at http://www.ajph.org).

Mental Disorder Predictors

We considered mental disorders one at a time and combined as predictors of gun ownership and carrying after adjustment for sociodemographic and Army career characteristics. The combined measure of having any mental disorder was not associated significantly with any of the outcomes (Table D, available as a supplement to the online version of this article at http://www.ajph.org). A summary measure of number of disorders was associated with only one of the 12 outcomes (often carrying among gun owners who had ever carried in the AAS and PPDS), and this association was nonmonotonic owing to a high odds ratio among veterans with exactly 1 mental disorder (OR = 2.2; 95% CI = 1.3, 4.0) but

TABLE 1— Firearm Ownership and Carrying Among Recently Separated US Army Soldiers in the AAS/PPDS and NSS: 2018–2019

	AAS/PPDS (n = 3558)		NSS (n = 2124)	
	% (SE)	No.	% (SE)	No.
No. of firearms owned				
None	49.2 (1.4)	1651	51.5 (1.4)	1063
1	12.9 (1.1)	454	13.5 (0.9)	291
2	9.0 (0.9)	316	9.3 (0.7)	221
3–5	16.6 (1.2)	610	15.3 (1.1)	325
≥ 6	12.3 (0.9)	527	10.3 (1.0)	224
Firearm carrying frequency among gun owners				
Never	50.4 (1.9)	927	45.7 (1.7)	505
Some of the time	19.8 (1.6)	373	17.4 (1.2)	196
Most or all of the time	29.9 (1.7)	607	36.9 (1.6)	360

Note. AAS = All Army Study; NSS = New Soldiers Study; PPDS = Pre–Post Deployment Study. Data are weighted but reported sample sizes are unweighted.

nonsignificantly elevated odds ratios among veterans with 2 or more disorders.

In addition, none of the individual disorders considered one at a time predicted gun ownership in the AAS and PPDS and only one did so (and inversely) in the NSS: generalized anxiety disorder (OR = 0.6; 95% CI = 0.5, 0.8). Only one mental disorder was associated significantly with ever carrying in either subsample, and another was associated with often carrying; however, neither remained significant after adjustment for the false discovery rate. In the AAS and PPDS, panic disorder was the predictor of history of carrying a firearm (OR = 1.4; 95% CI = 1.0, 2.0). This was a result of a significant association with history of carrying among owners (OR = 2.0; 95% CI = 1.2, 3.1) as opposed to elevated odds either of owning or of history of carrying among owners.

One mental disorder was also associated significantly with often carrying: IED in the NSS (OR = 2.3; 95% CI = 1.0, 4.9). Inspection of models 1, 3, and 4 showed that this significant association was a result of consistently positive but nonsignificant associations of IED with ownership (OR = 1.4; 95% CI = 0.7, 2.9), history of carrying among owners (OR = 1.4; 95% CI = 0.6, 3.5), and carrying often among those who had ever carried (OR = 2.7; 95% CI = 0.6, 11.2). It is noteworthy that PTSD was associated with history of carrying among gun owners in both subsamples (AAS/PPDS: OR = 1.5; 95% CI = 1.0, 2.2; NSS: OR = 1.8; 95% CI = 1.0, 3.0), even though PTSD was not associated significantly in either sample with history of carrying among all participants or with frequent carrying among all participants.

Given evidence in prior research that IED predicts gun carrying,[11,12] we looked more closely at the components of IED involving number of verbal and physical attacks as predictors of gun ownership and carrying (Tables E and F, available as supplements to the online version of this article at http://www.ajph.org) but found no compelling evidence for significant associations. None of these disaggregated predictors were significant in predicting history of carrying or frequently carrying either in the AAS and PPDS or in the NSS (the only coefficient significant in predicting the latter outcome in the NSS was no longer significant after adjustment for the false discovery rate).

DISCUSSION

Our finding that participants with mental disorders were not more likely to own guns than those without mental disorders is consistent with the results of general population epidemiological studies assessing similar associations.[8–11] Importantly, a higher proportion of veterans than civilians are known to own firearms.[42] However, we found that veterans with mental disorders did not differ from other veterans in terms of owning or carrying firearms. The combination of these factors means that veterans with mental disorders, particularly panic disorder,

TABLE 2— Associations of Sociodemographic and Army Career Characteristics With Firearm Ownership and Carrying Among Recently Separated US Army Soldiers in the AAS/PPDS: 2018– 2019

	Distribution, Estimate[a] (SE)	Model 1[b]: Any Firearm Ownership in the Total Sample, OR (95% CI)	Model 2[c]: No. of Firearms Owned in the Total Sample, OR (95% CI)	Model 3[b]: History of Carrying a Firearm Among Gun Owners, OR (95% CI)	Model 4[b]: Often Carry a Firearm Among Gun Owners Who Have Ever Carried, OR (95% CI)	Model 5[b]: History of Carrying a Firearm in the Total Sample, OR (95% CI)	Model 6[b]: Often Carry a Firearm in the Total Sample, OR (95% CI)
Sociodemographic characteristics							
Age, y							
22–24	5.6 (0.6)	1.8 (1.0, 3.1)	1.1 (0.7, 1.5)	4.0 (1.5, 10.5)	0.9 (0.4, 2.0)	3.3 (1.8, 6.3)	2.5 (1.3, 4.6)
25–29	20.8 (1.4)	1.1 (0.7, 1.8)	0.9 (0.7, 1.2)	1.8 (1.1, 2.7)	1.7 (0.9, 3.0)	1.6 (1.1, 2.3)	1.9 (1.2, 3.0)
30–34	27.9 (1.5)	0.8 (0.6, 1.0)	0.8 (0.6, 1.0)	1.2 (0.9, 1.7)	1.7 (0.8, 3.9)	1.0 (0.7, 1.3)	1.2 (0.8, 2.0)
35–39	13.8 (1.0)	0.9 (0.6, 1.4)	0.9 (0.7, 1.1)	1.3 (0.8, 1.9)	1.3 (0.6, 2.8)	1.2 (0.8, 1.8)	1.3 (0.7, 2.4)
≥40	32.0 (1.6)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
F_4[d]		2.9*	1.3	3.4*	1.1	3.7*	3.1*
Male	85.1 (1.1)	1.5 (1.1, 2.1)	1.5 (1.2, 1.9)	2.4 (1.5, 3.9)	1.6 (0.6, 4.0)	2.5 (1.7, 3.8)	2.9 (1.6, 5.0)
Sexuality							
Heterosexual	86.5 (1.2)	1.0 (0.7, 1.5)	1.0 (0.8, 1.3)	0.9 (0.5, 1.5)	1.8 (0.9, 3.7)	0.9 (0.6, 1.5)	1.3 (0.8, 2.1)
Sexually inactive	3.1 (0.6)	0.6 (0.2, 1.4)	0.6 (0.3, 1.1)	0.2 (0.1, 0.6)	1.0 (0.1, 8.0)	0.2 (0.1, 0.6)	0.2 (0.1, 0.8)
Gay, lesbian, or bisexual (ref)	10.4 (0.9)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
F_2[d]		0.9	1.9	4.0*	1.6	4.5*	4.6*
Region of residence							
South	50.1 (1.7)	1.7 (1.0, 2.9)	1.3 (1.1, 2.0)	1.9 (1.0, 3.8)	1.3 (0.5, 3.7)	2.3 (1.2, 4.3)	2.4 (1.1, 5.2)
Midwest	15.2 (1.0)	2.1 (1.3, 3.4)	1.7 (1.1, 2.4)	2.0 (0.9, 4.1)	0.7 (0.2, 2.3)	2.6 (1.3, 5.1)	2.0 (0.9, 4.6)
West	23.9 (1.7)	1.2 (0.8, 1.9)	1.2 (0.9, 2.1)	1.4 (0.6, 3.0)	0.8 (0.3, 2.6)	1.4 (0.8, 2.6)	1.3 (0.5, 3.0)
Northeast	7.2 (0.8)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
F_3[d]		4.2*	3.9*	2.4	1.4	4.2*	5.5*
Army career characteristics							
Highest rank obtained							
Junior enlisted	42.2 (1.6)	0.9 (0.6, 1.3)	0.8 (0.6, 1.0)	2.4 (1.5, 3.6)	1.5 (0.7, 3.0)	1.7 (1.1, 2.6)	2.1 (1.3, 3.3)
Senior enlisted	44.3 (1.4)	1.1 (0.6, 1.3)	0.9 (0.7, 1.2)	2.1 (1.4, 3.1)	1.2 (0.6, 2.7)	1.7 (1.1, 2.7)	1.9 (1.1, 3.2)
Warranted officer	3.2 (0.6)	1.0 (0.5, 2.1)	1.0 (0.5, 2.1)	1.4 (0.4, 4.8)	0.3 (0.0, 1.4)	2.4 (1.1, 5.0)	0.5 (0.1, 2.0)
Commissioned officer	10.3 (0.8)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)

Continued

TABLE 2— Continued

	Distribution, Estimate[a] (SE)	Model 1[b]: Any Firearm Ownership in the Total Sample, OR (95% CI)	Model 2[c]: No. of Firearms Owned in the Total Sample, OR (95% CI)	Model 3[b]: History of Carrying a Firearm Among Gun Owners, OR (95% CI)	Model 4[b]: Often Carry a Firearm Among Gun Owners Who Have Ever Carried, OR (95% CI)	Model 5[b]: History of Carrying a Firearm in the Total Sample, OR (95% CI)	Model 6[b]: Often Carry a Firearm in the Total Sample, OR (95% CI)
F_3[d]		0.4	2.2	5.9*	2.0	2.4	4.3*
F_2[d]		0.6	2.0	1.0	2.6	0.5	2.2
Total years of Army enlistment (mean)	11.6 (0.3)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (0.9, 1.0)	1.0 (0.9, 1.0)	1.0* (1.0, 1.0)	1.0* (1.0, 1.0)

Note. AAS = All Army Study; CI = confidence interval; OR = odds ratio; PPDS = Pre-Post Deployment Study. Distributions and model estimates reflect weighted data.

[a]Percentages for categorical variables and means for continuous variables.
[b]Based on logistic regression models that were calculated separately for each variable and did not include any controls.
[c]Based on a discrete-event survival analysis with a logistic link function and 3 transitions for ownership of more than 1 gun, more than 2 guns, and more than 5 guns, with slopes constrained to be constant across transitions.[38]
[d]Numerator degrees of freedom.
*$P < .05$ (2-sided test).

IED, and PTSD, are more likely to own and carry a firearm than their civilian peers but are not more likely to do so than other veterans.

Furthermore, most of the mental disorders we assessed were not associated with gun carrying among gun owners. However, there were some minor exceptions, the most notable of which were PTSD associated with history of carrying a gun among gun owners in both samples, IED associated with often carrying among those who had ever carried in the AAS and PPDS sample, and IED associated with often carrying in the total NSS sample. Because IED is associated with both suicide and interpersonal violence[12,17] and has been linked to increased gun ownership or carrying in previous studies,[12,16,43] our findings regarding IED might warrant further consideration in future research. Neither alcohol nor substance use disorder was significantly associated with firearm ownership or use, although it is possible that broader measures of alcohol and substance use not available in the STARRS-LS may have yielded different findings.

Our study has several important strengths. First, we used a large, contemporary epidemiological sample of separated Army personnel. Second, we used *DSM-5* diagnoses. Third, because of the rich data in the Army STARRS-LS, we were able to adjust for numerous sociodemographic and Army career characteristics that might otherwise confound associations.

The study also involved some noteworthy limitations, however. Information on gun ownership and carrying was self-reported, which may have resulted in misclassification if participants did not accurately report these variables. The response rate for LS1 was comparatively low and may have

TABLE 3— Associations of Sociodemographic and Army Career Characteristics With Firearm Ownership and Carrying Among Recently Separated US Army Soldiers in the NSS, 2018–2019

	Distribution, Estimate[a] (SE)	Model 1[b]: Any Firearm Ownership in the Total Sample, OR (95% CI)	Model 2[c]: No. of Firearms Owned in the Total Sample, OR (95% CI)	Model 3[b]: History of Carrying a Firearm Among Gun Owners, OR (95% CI)	Model 4[b]: Often Carry a Firearm Among Gun Owners Who Have Ever Carried, OR (95% CI)	Model 5[b]: History of Carrying a Firearm in the Total Sample, OR (95% CI)	Model 6[b]: Often Carry a Firearm in the Total Sample, OR (95% CI)
Sociodemographic characteristics							
Age, y							
22–24	46.8 (1.3)	1.2 (0.9, 1.5)	1.2 (1.0, 1.5)	1.8 (1.2, 2.9)	2.1 (1.2, 3.7)	1.6 (1.1, 2.4)	2.2 (1.4, 3.3)
25–29	35.5 (1.1)	1.3 (1.0, 1.8)	1.4 (1.1, 1.6)	1.7 (1.0, 2.7)	1.8 (1.0, 3.1)	1.7 (1.1, 2.5)	2.1 (1.3, 3.2)
≥ 30	17.6 (0.9)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
F_4[d]		2.0	5.3*	3.7*	3.4*	4.0*	7.2*
Male	78.7 (1.1)	2.0 (1.6, 2.6)	1.7 (1.4, 2.2)	2.5 (1.7, 3.9)	1.0 (0.6, 1.7)	3.1 (2.1, 4.5)	2.9 (1.8, 4.5)
Lifetime marital history							
Currently married	37.2 (1.2)	1.7 (1.4, 2.1)	1.4 (1.1, 1.6)	1.1 (0.8, 1.5)	1.6 (1.0, 2.5)	1.5 (1.2, 2.0)	1.8 (1.3, 2.4)
Previously married	15.0 (1.0)	1.0 (0.7, 1.3)	1.0 (0.8, 1.2)	1.7 (1.1, 2.9)	2.1 (1.1, 4.2)	1.3 (0.9, 1.9)	1.7 (1.2, 2.5)
Never married	47.9 (1.2)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
F_2[d]		12.5*	6.8*	2.5	3.3*	4.9*	7.6*
Current employment							
Full-time student	21.7 (1.1)	1.6 (1.1, 2.4)	1.3 (1.0, 1.8)	1.8 (1.0, 3.4)	1.4 (0.6, 3.4)	2.1 (1.3, 3.3)	2.3 (1.2, 4.3)
Employed	67.7 (1.1)	1.7 (1.2, 2.4)	1.3 (1.0, 1.7)	1.7 (1.0, 2.8)	1.7 (0.8, 3.8)	2.1 (1.4, 3.1)	2.4 (1.4, 4.4)
Other	10.6 (0.8)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
F_2[d]		4.8*	2.1	2.2	1.0	6.0*	4.7*
Army career characteristics							
Lifetime combat deployment	21.2 (1.1)	1.8 (1.3, 2.4)	1.3 (1.1, 1.5)	1.5 (1.1, 2.2)	0.9 (0.6, 1.4)	1.9 (1.4, 2.5)	1.7 (1.2, 2.3)

Note. CI = confidence interval; NSS = New Soldiers Study; OR = odds ratio. Distributions and model estimates reflect weighted data.

[a]Percentages for categorical variables and means for continuous variables.
[b]Based on logistic regression models that were calculated separately for each variable and did not include any controls.
[c]Based on a discrete-event survival analysis with a logistic link function and 3 transitions for ownership of more than 1 gun, more than 2 guns, and more than 5 guns, with slopes constrained to be constant across transitions.[38]
[d]Numerator degrees of freedom.
*$P < .05$ (2-sided test).

led to biased estimates of mental health disorders or their associations with firearm ownership and carrying behaviors. Mental disorder diagnoses also were derived from self-report symptom scales rather than clinical diagnoses, although diagnoses derived from the screening measures used here have demonstrated good concordance with diagnoses from independent clinical interviews.[34,35,37]

In addition, as a result of the cross-sectional and observational nature of our study, we cannot determine the temporal order of variables or infer causality. Previous research has suggested that veterans are more likely to own guns than their civilian peers.[21] It is also possible that gun owners or those with characteristics such as impulsivity may be more likely to volunteer for military service. Future research should consider how baseline patterns of gun ownership and use and characteristics associated with high-risk behaviors might predict or be modified by active duty military service. The

measures of firearm ownership we used did not assess whether the firearms were acquired by the veteran or by others in the household, whether they were acquired before or after the onset of psychiatric disorders, or recency of acquisition. Finally, although mental disorders and access to firearms are potent risk factors for suicide, we did not examine suicidality in our study. Future research should examine joint associations between mental disorders, firearm access, and suicidal thoughts and behaviors.

PUBLIC HEALTH IMPLICATIONS

Our results align with previous studies that have not revealed associations between mental disorders and gun ownership. Our findings indicate that separated Army personnel with panic disorder, IED, or PTSD may be more likely to carry guns, potentially increasing the risk for firearm injury. Screening for gun carrying behaviors and reducing access to lethal means during periods of distress among those with access to firearms may be indicated for veterans diagnosed with some, but not all, psychiatric disorders. Future research should investigate the potential costs and public health effects of routine screening for access to firearms among individuals diagnosed with panic disorder, PTSD, or IED. AJPH

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CONTRIBUTORS

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CONFLICTS OF INTEREST

In the past 3 years, M. B. Stein has been a paid consultant for Actelion, Aptinyx, Bionomics, Genentech, GW Pharma, Janssen, Neurocrine Biosciences, Nobilis Therapeutics, and Oxeia Biopharmaceuticals. In the past 3 years, R. C. Kessler has been a consultant for Datastat Inc, Sage Pharmaceuticals, and Takeda. C. L. Dempsey and D. M. Benedek received a grant from the Centers for Disease Control and Prevention for work unrelated to this article.

HUMAN PARTICIPANT PROTECTION

This study was approved by the institutional review boards of the Army STARRS collaborating institutions. Participants provided written informed consent to participate in the surveys and were asked separately for consent to link their survey responses to their Army/Department of Defense administrative records.

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