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## Suicide risk and firearm ownership and storage behavior in a large military sample

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### ABSTRACT

Firearms account for the majority of suicide deaths in the United States military and access to firearms is a risk factor for suicide. Prior research has shown service members tend to store firearms unsafely, with some research indicating this is particularly true among those with elevated suicide risk. Existing research has focused on individuals at known risk for suicide; however, those who die by suicide using a firearm are prone to avoiding mental healthcare and underreporting suicidal ideation, thereby necessitating an understanding of this phenomenon among firearm owners outside of the mental healthcare system. The present study examined firearm storage and suicide risk in a large nonclinical sample of service members (total sample  $n = 953$ ; firearm owning sample = 473). Lifetime suicidal ideation, current depressive symptoms, and perceived likelihood of making a future suicide attempt were associated with unsafe firearm storage. In contrast, lifetime suicidal ideation was not associated with a greater likelihood to own firearms. These findings suggest those at risk of suicide are more likely to store firearms unsafely, which increases ease of access to firearms. These findings reiterate the importance of means safety as a suicide prevention strategy.

### 1. Introduction

Suicide risk and firearm ownership and storage behavior in a large military sample. Firearms account for approximately half of all suicide deaths in the United States (Centers for Disease Control and Prevention [CDC], 2019) and approximately two-thirds of all suicide deaths in the military (Pruitt et al., 2017). Ready access to firearms is a robust risk factor for death by suicide, with data demonstrating that suicide is up to five times as likely in homes with a firearm present (Simon, 2007) and that firearm ownership is associated with statewide suicide rates even when accounting for a host of psychopathological, demographic, and geographic variables (Anestis & Houtsma, 2018; Miller et al., 2013; Miller et al., 2007).

In addition to general access, firearm storage practices have been shown to be associated with suicide risk (Shenassa et al., 2003). Troublingly, Simonetti and colleagues (2019) assessed a large nationally representative sample of veterans drawn from all branches ( $n = 3,949$ ) and reported that 32.7% of veteran firearm owners stored at least one firearm both loaded and unlocked and an additional 45.2% stored at least one firearm loaded or unlocked. Those with mental health diagnoses or chronic pain (operationalized as risk factors for suicide) did not differ from those without such characteristics on the propensity to own firearms or to store them unsafely. Bryan and

colleagues (2019) reported somewhat contrasting results in a large sample of service members and military veterans in primary care ( $n = 1,652$ ). In this sample, which included individuals from all branches, the authors found that service members and veterans with recent suicidal ideation were less likely to have a firearm at home but that among those with firearms, 66% of those with versus 59% of those without a lifetime history of suicidal ideation, and 86% of those with versus 58% of those without recent suicidal ideation, stored their firearms unsafely (loaded and unlocked). The Simonetti et al. (2019) study focused exclusively on veterans and the Bryan et al. paper (2019) focused only on primary care settings, thereby raising questions regarding generalizability to those service members who avoid mental health care or who underreport thoughts of suicide (Anestis & Green, 2015). Similarly, Morgan, Gomez, and Rowhani-Rahbar (2018) found no relationship between depression symptoms and firearm storage practices in a community sample drawn from Washington state, raising questions regarding the extent to which a distal risk factor for suicide like depression may influence or be influenced by firearm storage practices. Their findings, however, were not restricted to service members and were geographically bound. As such, it remains unclear to what extent service members drawn from the community would exhibit a similar pattern of results.

To address this gap, we examined firearm access (ownership and

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storage behavior) and suicide risk factors in a large non-clinical sample of service members. We anticipated that, among firearm owning service members, risk factors for suicide (depressive symptoms, perceived likelihood of a future suicide attempt, current suicidal ideation) would be associated with greater odds of storing personal firearms unsafely (loaded in a non-secure location). Additionally, we anticipated that service members with lifetime suicidal ideation would not differ from those without lifetime suicidal ideation on rates of firearm ownership but would be more likely to store personal firearms unsafely. Results consistent with our hypotheses would highlight a troubling tendency for those at elevated risk for suicide to store personal firearms unsafely.

## 2. Method

### 2.1. Participants

Demographic and firearm access characteristics for the full sample and various subsamples are available in [Table 1](#). Participants were 953 service members assessed at a large Joint Forces Training Center in the southern United States (82.3% male,  $m_{age} = 27.05$ , 62.1% White). A large majority of the participants were drawn from the National Guard (83.3%), with 3.9% affiliated with the Army, 3.1% affiliated with “other,” and 9.6% not endorsing an affiliation (affiliation was confirmed upon entry to the room but individuals were given the option not to answer the question in the survey). The study took place in a classroom setting with groups of up to 25 participants at a time. Participants were recruited by leadership and, in order to reduce concerns of potential coercion, individuals were told they could remain at their computer without participating in order not to disclose their lack of participation to others. Slightly more than half ( $n = 473$ ; 55.2%) of the sample endorsed owning a firearm, with 18.7% ( $n = 85$ ) of firearm owning service members reporting that they store their firearms unsafely (loaded and in a non-secure location). A fairly small minority ( $n = 105$ ; 15.2%) of the service members endorsed lifetime suicidal ideation, with 9.1% ( $n = 72$ ) reporting current suicidal ideation. All participants provided informed consent prior to participating and all relevant regulatory boards approved the protocol prior to implementation. Participants with active duty status at the time of the assessment were ineligible for compensation for their participation due to Department of Defense guidelines; however, other participants were paid \$20. [Table 2](#), [Table 3](#)

### 2.2. Measures

#### 2.2.1. Current suicidal ideation

Current suicidal ideation was assessed using the Beck Scale for Suicidal Ideation (BSS; Beck and Steer., 1991). The BSS is a 21-item self-report measure; however, for the purposes of this study items 20 and 21 were excluded from the BSS total score as they assess prior suicidal behavior as opposed to current ideation. Individuals were classified as experiencing current suicidal ideation if their total score on items 1–19 was greater than 0. The BSS demonstrated good internal consistency within the sample ( $\alpha = 0.85$ ).

#### 2.2.2. Lifetime suicidal ideation and perceived likelihood of a future suicide attempt

Lifetime suicidal ideation and perceived likelihood of a future suicide attempt were assessed using the Suicide Behaviors Questionnaire-Revised (SBQ-R; Osman et al., 2001). The SBQ-R is a four-item measure assessing several aspects of suicidal behaviors. For the purposes of this study item one was used as an assessment of lifetime suicidal ideation. Individuals were determined to have lifetime suicidal ideation if their score on item one was greater than 0. Perceived likelihood of making a suicide attempt in the future was assessed using item four of the SBQ-R.

#### 2.2.3. Depression

Depression was assessed using the Patient Health Questionnaire – 9 (PHQ-9; Spitzer et al., 1999). The PHQ-9 is a 9-item self-report questionnaire assessing current depressive symptoms. Within this sample, the PHQ-9 demonstrated good internal consistency ( $\alpha = 0.89$ ).

#### 2.2.4. Firearm ownership and storage

Firearm ownership was assessed using a single item asking, “Do you currently own any personal firearms (e.g., not issued by military)?” Firearm storage practices were assessed using a single item asking, “How do you store your personal firearms?” Participants could choose from four responses including, “Gun is kept unloaded in a secure location,” “Gun is kept loaded in a secure location,” “Gun is kept unloaded in a non-secure location,” and “Gun is kept loaded in a non-secure location.” Storage was considered to be unsafe if participants endorsed storing their firearms loaded and in a nonsecure location.

### 2.3. Data analytic plan

Multiple logistic regressions were used to examine the associations between current distress and firearm storage procedures. Additionally, logistic regressions were used to examine the associations between lifetime suicidal ideation and firearm ownership and firearm storage practices.

## 3. Results

Demographic and firearm access characteristics for the full sample and various subsamples are available in [Table 1](#). Among firearm owning service members, current depressive symptoms ( $OR = 1.45$ ) and perceived likelihood of a future suicide attempt ( $OR = 1.72$ ) were both significantly associated with greater odds of storing personal firearms unsafely. Those with current suicidal ideation did not differ from those without current suicidal ideation with respect to unsafe firearm storage behavior (28.9% vs 18.3%); however, low statistical power due to a limited number of currently suicidal service members may have contributed to that result ( $p = .086$ ,  $OR = 2.01$ ). Indeed, only 39 (9.1%) firearm owners reported current suicidal ideation.

Within the full sample of service members, those with lifetime suicidal ideation were not significantly more likely than those without lifetime suicidal ideation to own a personal firearm (61.0% vs 55.6%;  $OR = 1.32$ ). In contrast, among firearm owning service members, those with lifetime suicidal ideation were significantly more likely than those without lifetime suicidal ideation to store their firearms unsafely (31.7% vs 16.7%;  $OR = 2.62$ ).<sup>1</sup>

## 4. Discussion

The primary aim of this study was to examine the extent to which suicide risk factors are associated with firearm storage practices within a large non-clinical sample of service members. Overall, results supported study hypotheses. In the full sample of service members, those with lifetime suicidal ideation were not significantly more likely to own a personal firearm than those without lifetime ideation. However, consistent with previous findings (Bryan et al., 2019), service members with lifetime suicidal ideation were more likely to store their firearms

<sup>1</sup> Due to concerns that the heterogeneity in military affiliation within our sample may have reduced the clarity of our results, we re-ran all analyses while only including service members affiliated with the National Guard. Results were the same with respect to direction and effect size. The only difference that emerged was that the analysis considering depressive symptoms became non-significant ( $p = .067$  for the National Guard vs  $.044$  for the full sample). The odds ratio in that analysis, however, was nearly identical ( $OR = 1.40$  for National Guard vs  $1.44$  for full sample).

**Table 1**  
Sample Demographics.

	Full Sample	Firearm Owners	Unsafely Stored Firearms	Lifetime Ideation	Current Ideation
Sample Size	953	473	86	105	72
	<i>N(%) / Mean (SD)</i>	<i>N(%) / Mean (SD)</i>	<i>N(%) / Mean (SD)</i>	<i>N(%) / Mean (SD)</i>	<i>N(%) / Mean (SD)</i>
Sex					
% Male	706 (82.3%)	432 (92.3%)	80 (94.1%)	76 (72.4%)	55 (77.5%)
% Female	152 (17.7%)	36 (7.7%)	5 (5.9%)	29 (27.6%)	16 (22.5%)
Age	27.05 (8.11)	27.60 (8.38)	27.15 (7.89)	28.00 (9.40)	26.19 (8.07)
Race					
% White	538 (62.1%)	351 (74.5%)	70 (82.4%)	74 (70.5%)	41 (56.9%)
% Black	230 (24.1%)	83 (17.5%)	9 (10.6%)	20 (19.0%)	21 (29.2%)
Depression Symptoms	2.00 (3.65)	1.77 (3.23)	2.29 (3.54)	4.35 (4.75)	4.48 (5.00)
% Lifetime Ideation	105 (15.2%)	64 (16.6%)	20 (27.0%)	–	29 (49.2%)
% Current Ideation	72 (9.1%)	39 (9.1%)	11 (13.3%)	29 (29.0%)	–
% Firearm Owners	473 (55.2%)	–	–	64 (61.0%)	39 (54.2%)
% Store Firearms Unsafely	–	85 (18.7%)	–	20 (31.7%)	11 (28.9%)

Note: Unsafely stored firearms refers to individuals who store their personal firearms loaded and in a non-secure location; Percentages reported reflect percentage with valid data on the variable of interest; Percentage storing firearms unsafely indicates percentage of firearm owners within that subsample that endorsed unsafe storage (The value for the full sample is thus redundant with the firearm owner subsample value). Only 49.2% of those endorsing current ideation endorsed lifetime ideation. The answer options included never, “it was just a passing thought,” and then options indicating a plan had formed. As such, those with more extensive ideation histories but no plan may have answered inaccurately.

**Table 2**  
Logistic regressions examining the association between current distress (depression, perceived likelihood of a future suicide attempt, current suicidal ideation) and the likelihood of storing firearms unsafely (loaded in a non-secure location) among firearm owning military personnel.

	Wald	p	Odds Ratio
Sex	0.82	.364	1.82
Age	0.45	.502	0.99
Race	3.05	.081	0.50
Depression	4.05	.044	1.45
Sex	0.81	.369	1.69
Age	0.01	.915	1.00
Race	4.40	.036	0.46
Perceived Likelihood of a Future Suicide Attempt	6.22	.013	1.72
Sex	0.63	.428	0.64
Age	0.00	.979	1.00
Race	5.80	.016	2.35
Current Suicidal Ideation (Yes/No)	2.94	.086	2.01

Note: Race is coded such that (0) refers to Non-White and (1) refers to White.

**Table 3**  
Logistic regressions examining (1) the likelihood of private firearm ownership among service members with and without lifetime suicidal ideation and (2) the likelihood of unsafely storing firearms among firearm owning service members with and without lifetime suicidal ideation.

Predicting Firearm Ownership	Wald	p	Odds Ratio
Sex	46.03	.000	0.20
Age	6.95	.008	1.03
Race	39.30	.000	3.06
Lifetime Suicidal Ideation (Yes/No)	1.24	.266	1.32
Predicting Unsafe Firearm Storage	Wald	p	Odds Ratio
Sex	0.44	.505	0.70
Age	0.19	.664	0.99
Race	2.89	.089	1.84
Lifetime Suicidal Ideation (Yes/No)	8.98	.003	2.62

Note: Race is coded such that (0) refers to Non-White and (1) refers to White.

unsafely than were those without lifetime ideation. Within the subsample of firearm owning service members, current depressive symptoms were associated with unsafe firearm storage. Prior research had not found a relationship between depression and firearm storage (Morgan et al., 2018). The difference between current and previous findings may be partially explained by the samples examined in each study. Morgan and colleagues (2018) sample was comprised entirely of

individuals who lived in Washington State and was not restricted to military members, while the present study utilized a national, military sample. The regions in which individuals reside and being a service member may affect the relationship between depression and firearm storage. Indeed, firearm owners represent a heterogeneous group and, as such, behavioral tendencies with respect to firearm storage within the context of distress may vary based on a host of other variables (e.g. perception of depression as a sign of weakness, perception of best practices with respect to safe firearm storage).

Perceived likelihood of a future suicide attempt was also associated with storing a firearm unsafely. Although few studies have examined the association between perceived likelihood of a future suicide attempt and current unsafe firearm storage, findings from this study map onto previous results that unsafe storage moderates the relationship between current ideation and likelihood of a future attempt (Khazem et al., 2016). If firearm owning service members who are currently experiencing severe distress or who have previously had such experiences are more prone to unsafe storage practices, this represents a particularly dangerous situation, as service members are often hesitant to seek help for their distress or to disclose or change their firearm storage practices. Furthermore, if service members in distress avoid mental healthcare, limited opportunities exist to assess and address access to lethal means and, as such, suicidal desire remains untreated as practical capability for suicide is elevated. Taken together, these findings suggest a tendency for those at elevated risk for suicide to store firearms—the most lethal means for suicide—unsafely. In this sense, the importance of promoting shifts in cultural norms around firearm storage practices is obvious. If service members generally understand the risk associated with unsafe storage and embrace the basic tenets of safe storage as a suicide prevention tool, the base rate of safe storage would likely increase more broadly, thereby diminishing the need to rely upon healthcare workers to promote such behavior shifts and allowing for risk to decrease among those who do not engage with the healthcare system.

Extant research demonstrates that firearm ownership does not prompt suicidal ideation (Betz et al., 2011; Heinz et al., 2016; Miller et al., 2009; Smith et al., 2015). Rather, firearm owners and those who live in their homes are at elevated risk for suicide given that if suicidal ideation develops, high risk individuals then have ready access to a highly lethal means. This study, like Bryan et al. (2019), expands on these findings by demonstrating that history of suicidal ideation is also not associated with increased firearm ownership. Thus, previous research, as well as findings from the current study, indicate that firearm owners are no more likely than non-firearm owners to

develop suicidal ideation, nor are individuals who have experienced suicidal ideation more likely to choose to own firearms than those who have not. Importantly, simple firearm ownership is not the sole factor in increasing risk for suicide. As prior research has demonstrated, the manner in which firearms are stored contributes meaningfully to the pathway through which suicide risk is elevated.

Unsafe firearm storage can be conceptualized as increasing suicide risk through the Three Step Theory of Suicide (3ST; Klonsky and May, 2015), a theory rooted in an “ideation to action framework” focused on factors which serve to transition individuals from suicidal ideation to attempt. The 3ST posits that individuals will not die by suicide without the combination of suicidal desire and the capability for suicide, comprised of acquired, dispositional, and practical elements. In the 3ST, acquired capability develops through repeated exposure to events and stimuli that increase pain tolerance and decrease fear of death; dispositional capability via genetic predispositions to fearlessness about death and pain tolerance; and practical capability through logistical factors that facilitate suicide attempts, including familiarity with and unfettered access to lethal means for suicide. Firearms stored unsafely (loaded, without a cable/trigger lock, and/or in a non-secure location such as a bedside table rather than a gun safe) are more easily and quickly accessible, and thus increase practical capability for suicide.

Prior studies have demonstrated the relationship between firearm shooting experience, unsafe firearm storage, and capability for suicide (Anestis and Capron, 2018; Butterworth et al., 2018; Houtsma and Anestis, 2017), suggesting that comfort and familiarity with—and easy access to—a lethal means for suicide increases an individual's capability to die by suicide. Findings from the current study demonstrate that service members already at elevated risk for suicide given heightened depressive symptoms, perceived likelihood of a future suicide attempt, or lifetime suicidal ideation are more likely to store firearms unsafely. Thus, initial risk factors may prompt unsafe firearm storage, which in turn further increases suicide risk. In military populations, where firearm ownership is common, familiarity with firearms is nearly ubiquitous, and help-seeking for mental health is infrequent, interventions broadly focused on decreasing suicide risk through safer storage of personal firearms are thus essential.

This study does have its limitations. First, the study was cross-sectional and relied on self-report. Thus, causal inferences cannot be made. Second, the items utilized to assess firearm storage options have not been validated and are susceptible to personal interpretation. Specifically, the use of the term “secure location” could be interpreted in many ways. Future research should use more specific storage terminology (e.g., gun safe, lock box, cable lock, trigger lock, unloaded, etc.) to minimize interpretation issues. Third, the majority of the sample was from the National Guard, limiting generalizability to Active Duty personnel and other components of the military. Future research should examine if the findings can be replicated among Active Duty personnel and reservists. Lastly, as noted in Table 1, a portion of individuals endorsing current suicidal ideation did not also endorse lifetime suicidal ideation. The nature of our assessment tools required that we assess these constructs using separate instruments that utilized quite different wording. Our assessment of lifetime suicidal ideation structures its answer choices in such a way that moderate lifetime ideation did not fit any answer choices well (one answer referred to passing thoughts whereas the next answer referred to the presence of a plan). As such, it may be that several individuals with previous low severity suicidal ideation opted to endorse no prior ideation rather than characterize their past experiences in a manner that they felt was too severe or simply inaccurate. Future research should leverage assessment tools that assess lifetime and current ideation in a similar fashion, thereby allowing for an easier comparison.

Despite these limitations, this study advances knowledge regarding suicide risk factors and unsafe firearm storage practices in a large sample of service members. Results increase generalizability of similar

findings from studies conducted in samples of Veterans and service members in primary care settings. Further, findings from the current study provide additional support for the notion that suicidal ideation does not necessarily influence firearm ownership, but that suicidal ideation is associated with unsafe firearm storage for individuals who already own firearms. Overall, results indicate a troubling tendency for service members at elevated risk for suicide to store firearms unsafely, a factor that increases practical capability for suicide and has been previously shown to moderate the relationship between suicidal ideation and perceived likelihood of a future suicide attempt (Khazem et al., 2016). Interventions including lethal means counseling, messaging regarding safe firearm storage, provision of cable/trigger locks, and other strategies focused on increasing safe storage of personal firearms may represent the most effective available tools in preventing firearm suicides in military populations.

#### 4.1. Public health implications

Numerous strategies to render lethal means for suicide less accessible (broadly termed “means safety”) have demonstrated utility in preventing suicides, particularly in the domain of firearms (Alban et al., 2018; Anestis et al., 2019; Jehan et al., 2018; Kivisto and Phalen, 2018; Lubin et al., 2010; Mann et al., 2005; McManus et al., 1997; Sarchiapone et al., 2011). Providing firearm owners with messaging and psychoeducation regarding firearm suicide risk and safe storage strategies is essential. Brief lethal means counseling sessions conducted in a motivational interviewing framework show promise, particularly when individuals are resistant to or ambivalent about changing their firearm storage practices (Britton et al., 2016). Temporary removal of firearms from the home during times of suicidal crises can also be effective in reducing risk. Use of cable/trigger locks, storage of ammunition separate from firearms, removal of firing pins, temporarily allowing another individual to keep the key or change the code for a gun safe or locking device, and other strategies focused on limiting the ability of a suicidal individual to readily access personal firearms are also likely effective in preventing firearm suicides. Further, interventions should seek to increase safe storage at the population level rather than selectively focusing on individuals perceived to be at imminent risk of suicide given that suicide risk is not always apparent and many service members do not present to mental healthcare settings (Anestis and Green, 2015). Indeed, interventions that can be applied that the population level may represent the most powerful tool available for prompting broad shifts in cultural norms surrounding firearm storage practices among service members. Although we certainly would not argue against the broad dissemination and implementation of interventions such as lethal means counseling within the healthcare system, delivery of prevention efforts outside of that system will be vital in order to reach the population of interest. Our sample consisted of a non-clinical group of service members and, although some individuals openly endorsed difficulties with mental health, prior findings from this same sample demonstrated the reticence among these service members with respect to speaking openly about their mental health difficulties (Anestis and Green, 2015). If the most high risk individuals will not engage with the established treatment system, that system cannot be the primary tool for delivering the help that they need.

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### Declaration of Competing Interest

Author M.A. receives royalties from a book on firearms and suicide. He also receives consulting and speaking fees on this topic.

Author C.B. receives income for clinical training workshops related to firearms and suicide.

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### Supplementary materials

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