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## Suicide Risk in U.S. Military Veterans: Insights from the National Health and Resilience in Veterans Study

### Introduction

Suicide is a public health crisis and the top research and clinical priority of the U.S. Department of Veterans Affairs. Veterans endorse high rates of suicidal thoughts and behaviors (STBs) and are more likely to die by suicide than their non-Veteran counterparts. In 2021, Veterans accounted for 13% of all suicide deaths despite making up less than 6% of the population, and their age- and sex-adjusted suicide rate was 71.8% higher than that of non-Veteran adults (U.S. Department of Veterans Affairs, 2023).

The National Health and Resilience in Veterans Study (NHRVS) is one of the most comprehensive sources of data on suicide and STB risk and resilience in the U.S. Veteran population. The NHRVS is a contemporary, nationally representative, population-based study that has, to date, recruited three cohorts of more than 8,000 Veterans. NHRVS cohorts were recruited from Ipsos' KnowledgePanel, the oldest and largest probability-based online panel in the U.S., with over 50,000 members. To ensure representativeness, post-stratification weights based on U.S. Census demographic data were applied. Each cohort completed assessments on demographics, military history, medical and psychiatric problems, and psychosocial factors. Veterans were also invited to submit a saliva sample for genomic analyses.

- Cohort 1: Baseline survey in 2011 ( $n=3,157$ ), follow-ups at 2, 4, 7, and 10 years.
- Cohort 2: Baseline survey in 2013 ( $n=1,484$ ), follow-up in 3 years.
- Cohort 3: Baseline survey in 2019 ( $n=4,069$ ), follow-ups at 1- and 3- years.

Results from the NHRVS provide unique insights into psychosocial and biological factors that contribute to, and mitigate, STBs in Veterans. In this review, we synthesize key findings related to STB risk, highlight lessons learned, and discuss directions for clinical research.

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### Multiple Traumatic Exposures Amplify Suicide Risk in Veterans

Evidence from the NHRVS has demonstrated that childhood and military-related trauma significantly contribute to STB risk in Veterans. To date, nine studies have examined the relationship between childhood trauma, combat experiences, military sexual trauma, and moral injury with STBs (Holliday et al., 2023; Klingensmith et al., 2014; Nichter et al., 2020a, 2020b; Nichter et al., 2024b; Nichter et al., 2022b; Nichter et al., 2021b; Slavin et al., 2024; Wisco et al., 2017). A study of cohort 1 data (Nichter et al., 2020a) found that childhood sexual abuse was independently associated with increased risk of past-year suicidal ideation and lifetime suicide attempt. Furthermore, a significant child sexual abuse by combat exposure interaction was observed in predicting suicidal ideation, indicating that combat-exposed Veterans with a history of child sexual abuse had nearly three-fold greater odds of suicidal ideation than those without child sexual abuse.

Building on this study, cohort 3 data were analyzed to assess the impact of child sexual abuse and military sexual trauma on STB risk (Holliday et al., 2023). Results indicated that both child sexual abuse and military sexual trauma were independently associated with past-year suicidal ideation, lifetime suicide attempt, and future suicidal intent. Moreover, the interaction between child sexual abuse and military sexual trauma significantly amplified STB risk, with Veterans exposed to both types of sexual trauma having higher risk for all three indicators (i.e., suicidal ideation, suicide attempt, and suicidal intent) compared to those with only one or neither.

Exposure to specific types of combat experiences and STBs were examined using cohort 1 data of combat Veterans (Nichter et al., 2020b). Results indicated that, while overall severity of combat exposure was only weakly associated with suicidal ideation and suicide attempt, certain combat experiences were more robustly linked to higher STB risk. Specifically, witnessing unit members being killed or wounded, seeing someone hit by incoming or outgoing rounds, and being in imminent danger of death or injury were associated with elevated risk for suicidal ideation and suicide attempt.

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Cohort 1 data were also used to examine the association between exposure to potentially morally injurious experiences and STBs in combat Veterans. Results revealed that 36.3% of Veterans reported at least one potentially morally injurious experience, with transgressions by others (23.1%) and betrayal (24.5%) being the most common forms of potentially morally injurious experiences. Exposure to potentially morally injurious experiences were significantly associated with suicidal ideation, suicide planning, and suicide attempt, even after adjusting for cumulative combat exposure, PTSD, and major depressive disorder (MDD).

## The Transition from Suicidal Ideation to Attempts in Veterans

NHRVS data have been used to identify factors that distinguish Veterans with a history of suicidal ideation only from those with a history of suicide attempt (Nichter et al., 2021a). Several key factors differentiated Veterans with a history of suicidal ideation from those with suicide attempt, with the strongest being younger age, history of non-suicidal self-injury, greater number of adverse childhood experiences, and lifetime history of alcohol use disorder (AUD). Although promising, a notable limitation of this study is its reliance on cross-sectional data, which precludes the ability to differentiate risk factors from correlates of suicidal behavior. Accordingly, a study using the 7-year longitudinal data from cohort 1 examined risk factors for incident suicide attempt (Nichter et al., 2022c). Over the study period, 3.1% of Veterans reported suicide attempt. The strongest prospective predictors were higher baseline loneliness, lower dispositional gratitude, thoughts of self-harm, and post-baseline trauma exposure, collectively explaining 12.3%–41.3% of the variance in suicide attempt. This study also found that Veterans with multiple co-occurring risk factors were at substantially higher risk for suicide attempt; and that predicted probabilities of suicide attempt were 2.0% among Veterans with no risk factors, increasing to 55.0% for those with all four identified risk factors. Loneliness emerged as the single strongest risk factor, accounting for 41.3% of explained variance.

## Modifiable Protective Factors Linked to Suicide Risk in Veterans

Research from the NHRVS has underscored the role of modifiable protective factors in STB risk among Veterans. Several studies have highlighted the importance of psychological and social factors, such as dispositional gratitude, social connection, and purpose in life, in relation to STBs. For example, using cohort 1 data, dispositional gratitude—the tendency to be thankful for positive life experiences and outcomes—was associated with lower rates of incident suicidal ideation and suicide attempt over a 7-year period (McGuire et al., 2022). Specifically, Veterans with high baseline levels of gratitude exhibited markedly lower rates of suicidal ideation (6.8%) and suicide attempt (1.5%) compared to those with low gratitude (33.6% and 20.3%, respectively).

A follow-up study expanded on these findings by examining incident suicidal ideation and suicide attempt over a 10-year period among Veterans with no prior history of STBs (Fischer et al., 2023b). Results showed that 10.1% developed new-onset suicidal ideation, while 3.0% reported suicide attempt. Several key factors differentiated those who did and did not develop STBs. Veterans with lower household income, PTSD, AUD, functional disabilities, reduced social support, and lower purpose in life were more likely to develop suicidal ideation. For suicide attempt, the strongest predictors included current AUD, greater cumulative trauma, and lower purpose in life. Notably, purpose in life was the strongest predictor of both incident suicidal ideation and suicide attempt, explaining 27% and 29% of the variance in these outcomes, respectively.

More recent findings from cohort 3 further illustrate the role of psychological and social factors in relation to STB risk during stressful life events (Fischer et al., 2023a). The COVID-19 pandemic provided a unique opportunity to examine fluctuation in STBs over time. Prior to the pandemic in November 2019, 9.3% of Veterans endorsed past-year suicidal ideation. This declined to 6.8% during the pandemic's first year (November 2020) but rose slightly to 7.7% by August 2022. Among 2,110 Veterans who had no history of STBs before the pandemic, 3.8% reported new-onset suicidal ideation, and 1.2% reported making a suicide plan. Notably, lower pre-pandemic purpose in life and higher loneliness were the strongest predictors of new-onset suicidal ideation, and higher distress and lower purpose in life were the strongest predictors new-onset suicide planning.

## Genetic and Environmental Factors Related to Suicide Risk in Veterans

Individual differences in genetic predisposition to STBs play a significant role in STB risk and environmental factors—both risk and protective—shape how this vulnerability manifests. However, genetic studies have rarely examined gene-environment interactions, and environmental studies have often neglected genetic influences. Findings from the NHRVS have begun to bridge this gap, with two studies to date investigating how environmental factors moderate genetic liability for STBs in U.S. Veterans.

Using cross-sectional data from cohort 1, which included 1,664 European-American Veterans, one study (Nichter et al., 2023) found that a STB polygenic risk score derived from a large genome-wide association study was associated with lifetime suicide attempt. Cumulative trauma burden moderated this association, such that Veterans with both high STB polygenic risk scores and high trauma burden (> 4 traumatic events) had a 10-fold higher predicted probability of suicide attempt compared to those with high polygenic risk scores but low trauma burden (<1 event; 16.6% vs. 1.4%).

In a subsequent analysis of this same cohort, 7-year longitudinal data were analyzed to examine the association between STB polygenic risk scores and chronic, new-onset, and remitted suicidal ideation (Na et al., 2022). Results indicated a positive association between STB polygenic risk scores and chronic suicidal ideation and new-onset suicidal ideation, and negatively with remitted suicidal ideation. Notably, higher optimism emerged as a significant moderator, reducing the strength of the association between the polygenic risk scores and chronic suicidal ideation and remitted suicidal ideation. Higher social support also attenuated the association between STB polygenic risk scores and new-onset suicidal ideation.

## Firearm Storage Practices and Suicide Risk in Veterans

Firearms are involved in a staggering 73% of suicide deaths among Veterans, which is significantly higher than non-Veterans (U.S. Department of Veterans Affairs, 2023). NHRVS research has shed light on the relationship between firearm access, storage behavior, and STB risk. A study of cohort 3 found that 50.9% of Veterans reported owning a personal firearm, with 52.9% of these Veterans reporting storing at least one firearm unsafely (i.e., loaded and/or in a non-secure location; Nichter et al., 2024a). Veterans with a history of lifetime MDD, AUD, or greater trauma exposure were significantly more likely to store firearms unsafely. Furthermore, Veterans who endorsed future suicidal intent had 7-fold greater odds of storing firearms loaded and/or non-securely relative to those who denied future intent. Although caution is warranted in interpreting these results given a small number of Veterans endorsed suicidal intent overall, these findings nonetheless warrant further research.

## Barriers to Mental Healthcare Among Suicidal Veterans

NHRVS data have also been used to characterize mental health treatment utilization among Veterans at risk for suicide. Barriers and facilitators of mental health treatment utilization were examined in cohort 1 (Nichter et al., 2020c). A total of 7.3% of Veterans endorsed current suicidal ideation, yet only 36.1% were currently engaged in any form of mental health treatment. The strongest correlates of treatment engagement included younger age, female sex, current MDD, lifetime suicide attempt, and number of lifetime traumas. However, Veterans who mistrusted mental health providers or feared treatment would harm their reputation were significantly less likely to be engaged in care.

Similar results were observed in cohort 3. Approximately one in ten Veterans reported past two-week suicidal ideation, but only 35.5% of Veterans with recent suicidal ideation were engaged in any form of mental health treatment e.g., psychotherapy or psychiatric medication). Mental health utilization was significantly higher among VA users than non-VA users, highlighting disparities in access to care. Even among Veterans with a history of suicide attempt, less than half reported being engaged in health care.

## Lessons Learned and Future Directions

Based on insights from the NHRVS, we identify three key areas for future epidemiologic research that may help refine our understanding of STB risk and resilience in Veterans: (1) longitudinal studies with more frequent assessments to better characterize the fluctuating nature of STBs; (2)

integration of biological data with empirically-derived psychosocial factors; and (3) greater emphasis on positive psychosocial factors that may help mitigate STB risk.

Findings from longitudinal NHRVS studies have provided valuable insights into longer-term predictors of STBs, identifying key risk and protective factors. Nevertheless, STBs fluctuate over shorter time scales than years and are shaped by a broad range of psychological, social, and environmental factors. More frequent assessments, such as monthly surveys or even more frequent ecological momentary assessments, would likely provide deeper insight into shorter-term and fluctuating patterns of risk and resilience. Repeated measures could also clarify the interplay between chronic and acute risk factors, offering a more nuanced understanding of when and how Veterans transition from suicidal thoughts to behaviors. It would also be useful to examine the longitudinal relationship between lethal means counseling and STBs, assess the impact of firearm storage practices and safety devices, and identify credible messengers for effective firearm safety communication.

Findings from the NHRVS highlight the role of positive psychosocial factors in mitigating STB risk. Because accurately identifying individuals at imminent risk remains challenging, promoting well-being across the Veteran population may offer a broader, more effective approach to suicide prevention. Interventions that foster interpersonal connection and a sense of purpose—such as those implemented within the VA's Whole Health initiative—may help to enhance quality of life and ensure veterans build lives they find meaningful and fulfilling.

NHRVS research has advanced knowledge of genetic influences on STBs, particularly how genetic risk interacts with environmental factors such as trauma and social support. Continued work in this area may benefit from continued efforts to combine biological, psychological, and social data, while also expanding the scope of biological markers to include epigenetics, transcriptomics, and proteomics. For example, incorporation of epigenetic measures may help to reveal how life experiences—trauma exposure, chronic stress, social support—alter gene expression in ways that influence STB risk. For example, methylation patterns in stress-related genes could help elucidate biological pathways linking adverse experiences to increased vulnerability for STBs. Longitudinal studies incorporating repeated biological assessments in combination with psychosocial data could provide insight into how these molecular changes evolve over time and whether they are reversible through intervention.

## REFERENCES

U. S. Department of Veterans Affairs (2023). *2023 National Veteran Suicide Prevention Annual Report*. Retrieved from: [https://www.mentalhealth.va.gov/suicide\\_prevention/data.asp](https://www.mentalhealth.va.gov/suicide_prevention/data.asp)

## FEATURED ARTICLES

Fischer, I. C., Nichter, B., Na, P. J., Norman, S. B., Krystal, J. H., & Pietrzak, R. H. (2023a). **Longitudinal trends in suicidal thoughts and behaviors among US military veterans during the COVID-19 pandemic.** *JAMA Psychiatry*, 80(6), 577–584. doi:10.1001/jamapsychiatry.2023.0393 *Importance:* Concerns have been raised since the onset of the COVID-19 pandemic that vulnerable populations, such as military veterans, may be at increased risk of suicidal thoughts and behaviors (STBs). *Objective:* To examine longitudinal trends in STBs in US military veterans during the first 3 years of the COVID-19 pandemic. *Design, setting, and participants:* This cohort study is a population-based longitudinal study including US military veterans that used 3 surveys from the National Health and Resilience in Veterans Study. Median dates of data collection were November 21, 2019 (prepandemic); November 14, 2020; and August 18, 2022. *Main outcomes and measures:* Lifetime and past-year suicidal ideation, suicide planning, and suicide attempt. *Results:* In this longitudinal study including 2441 veterans (mean [SD] age, 63.2 years [14.0]; 2182 [92.1%] male), past-year suicidal ideation decreased from 9.3% prepandemic (95% CI, 8.2%-10.6%) to 6.8% a year later (95% CI, 5.8-7.9%) and then slightly increased to 7.7% (95% CI, 6.7%-8.9%) 2 years later. In total, 9 veterans (0.4%) reported attempting suicide at least once during the follow-up period, while 100 (3.8%) developed new-onset suicidal ideation and 28 (1.2%) developed new-onset suicide planning. After adjusting for sociodemographic and military characteristics,

factors strongly associated with new-onset suicidal ideation included higher education (odds ratio [OR], 3.27; 95% CI, 1.95-5.46), lifetime substance use disorder (OR, 2.07; 95% CI, 1.23-3.46), prepandemic loneliness (OR, 1.28; 95% CI, 1.09-1.49), and lower prepandemic purpose in life (OR, 0.92; 95% CI, 0.86-0.97). Factors associated with new-onset suicide planning included lifetime substance use disorder (OR, 3.03; 95% CI, 1.22-7.55), higher prepandemic psychiatric distress (OR, 1.52; 95% CI, 1.06-2.18), and lower prepandemic purpose in life (OR, 0.88; 95% CI, 0.81-0.95). *Conclusions and relevance:* Contrary to expectations, the prevalence of STBs did not increase for most US veterans during the COVID-19 pandemic. However, veterans with preexisting loneliness, psychiatric distress, and lower purpose in life were at heightened risk of developing new-onset suicidal ideation and suicide planning during the pandemic. Evidence-based prevention and intervention efforts that target these factors may help mitigate suicide risk in this population.

Fischer, I. C., Nichter, B., Feldman, D. B., Na, P. J., Tsai, J., Harpaz-Rotem, I., Schulenberg, S. E., & Pietrzak, R. H. (2023b). **Purpose in life protects against the development of suicidal thoughts and behaviors in U.S. veterans without a history of suicidality: A 10-year, nationally representative, longitudinal study.** *Journal of Affective Disorders*, 340, 551–554. doi:10.1016/j.jad.2023.08.040 *Objectives:* To determine the incidence of suicidal ideation and suicide attempts (STBs) in veterans without an endorsed history of STBs and identify baseline predictors of these outcomes over a 10-year period. *Methods:* Population-based prospective cohort study of 2307 US military veterans using five waves of the 2011–2021 National Health and Resilience in Veterans Study. Baseline data were collected in 2011, with follow-up assessments conducted 2–(2013), 4–(2015), 7–(2018), and 10–years (2021) later. *Results:* In total, 10.1 % (N = 203) of veterans endorsed incident suicidal ideation (SI) over the 10-year period and 3.0 % (N = 55) endorsed an incident suicide attempt (SA). Multivariable regression analyses revealed the following baseline predictors of incident SI: lower annual household income, current posttraumatic stress disorder, current alcohol use disorder (AUD), disability with activities of daily living (i.e., ADLs) or instrumental activities of daily living (i.e., IADLs), lower perceived social support, lower community integration, and lower purpose in life. Current AUD, greater cumulative trauma burden, and lower purpose in life at baseline were predictive of incident SA. Relative importance analyses revealed that lower purpose in life was the strongest predictor of both incident SI and SA. *Conclusions:* Psychosocial determinants of health, such as purpose in life, may be more reliable predictors of incident suicidal thoughts and behaviors than traditional risk factors (e.g., psychiatric distress; history of SA) in those without a history of STBs. Evidence-based interventions that facilitate purpose in life and feelings of connectedness and belonging should be examined as possible treatments for STBs.

Holliday, R., Nichter, B., Holder, N., Hill, M. L., Monteith, L. L., Norman, S. B., & Pietrzak, R. H. (2023). **Childhood sexual abuse and military sexual trauma interact to increase suicide risk: Results from a nationally representative veteran sample.** *Journal of Interpersonal Violence*, 38(5-6), 5354–5369. doi:10.1177/08862605221120909 Childhood sexual abuse (CSA) and military sexual trauma (MST) are prevalent among veterans. Such exposures are associated with adverse mental-health sequelae, including elevated risk for suicidal thoughts and behaviors. Nonetheless, prior studies have largely focused upon discrete experiences of CSA or MST in circumscribed samples. In the current study, we analyzed data from a large, nationally representative sample of 4,069 US military veterans to examine main and interactive effects of CSA and MST in relation to suicidal thoughts and behaviors. After accounting for sociodemographics, psychiatric comorbidity, and trauma-related characteristics, we detected a significant interaction between MST and CSA as it related to report of past-year suicidal ideation, lifetime suicide attempt, and risk for future suicide attempt. These findings underscore the impact of sexual trauma throughout the lifespan, highlighting the continued importance of screening for trauma exposure and connecting veterans to appropriate, evidence-based treatment to decrease their risk for suicidal thoughts and behaviors.

Klingensmith, K., Tsai, J., Mota, N., Southwick, S. M., & Pietrzak, R. H. (2014). **Military sexual trauma in US veterans: Results from the National Health and Resilience in Veterans Study.** *The Journal of Clinical Psychiatry*, 75(10), e1133–e1139. doi:10.4088/JCP.14m09244 *Objective:* To evaluate the prevalence of military sexual trauma (MST) among US veterans, identify sociodemographic and military characteristics of MST, and examine the relationships between MST and psychiatric comorbidities, functioning/quality of life, and mental health treatment utilization. *Method:* Data were analyzed from the National Health and Resilience in Veterans



Study, a contemporary, nationally representative survey of 1,484 US veterans conducted September-October 2013. Poststratification weights were applied to analyses to permit generalizability of results to the US veteran population. Outcomes measured include history of MST, trauma histories, lifetime and current DSM-IV mental disorders, functioning and quality of life, and utilization of mental health treatment. **Results:** The overall prevalence of MST was 7.6% and was higher among female than male veterans (32.4% vs 4.8%) and younger than older veterans (22.8% among veterans aged 18-29 years vs 4.5% among veterans aged 60+ years). After adjustment for sociodemographic and military characteristics, MST was associated with elevated rates of current major depressive disorder, posttraumatic stress disorder, and generalized anxiety disorder (adjusted odds ratio [aOR] range, 2.19-3.12); past history of suicide attempt (aOR = 2.78) and current suicidal ideation (aOR = 2.19); and decreased mental and cognitive functioning and quality of life (Cohen d, 0.23-0.38). MST was also associated with increased current utilization of psychotropic medication (aOR = 3.70) and psychotherapy or counseling (aOR = 2.41), independent of psychiatric morbidities. **Conclusions:** 7.6% of US veterans screen positive for MST, with substantially higher rates among female and younger veterans. MST is associated with elevated rates of several psychiatric morbidities and suicidality, reduced functioning and quality of life, and increased mental health treatment utilization, independent of other sociodemographic, military, and mental health factors. These results suggest that MST is prevalent among US veterans and associated with elevated health burden. Findings can help inform efforts to identify at-risk veterans and characterize the concomitant health burden and needs associated with MST in this population.

McGuire, A. P., Fagan, J. G., Tsai, J., Merians, A. N., Nichter, B., Norman, S. B., Southwick, S. M., & Pietrzak, R. H. (2022). **Dispositional gratitude predicts the development of psychopathology and suicidal behaviors: Results from a 7-year population-based study of U.S. military veterans.** *Journal of Psychiatric Research*, 149, 168–176. doi:10.1016/j.jpsychires.2022.02.028 **Background:** Dispositional gratitude has been implicated as a psychological characteristic that may modulate risk for mental health outcomes. Using a population-based sample of U.S. military veterans, this study evaluated the association between dispositional gratitude and the development of psychopathology and suicidal behaviors over a 7-year period. **Methods:** A nationally representative sample of U.S. veterans was surveyed at four timepoints across seven years. Analyses were restricted to veterans without incident outcomes at baseline. Multivariable analyses were conducted to examine the relation between baseline levels of dispositional gratitude and risk of developing (a) major depressive disorder (MDD), generalized anxiety disorder (GAD), or posttraumatic stress disorder (PTSD); (b) suicidal ideation; and (c) suicide attempts. **Results:** A total 9.6% of veterans developed MDD, GAD, and/or PTSD, 9.5% developed suicidal ideation, and 2.8% reported having attempted suicide over the 7-year follow-up period. Among veterans with high levels of dispositional gratitude, incidence was lower for MDD/GAD/PTSD (8.0%), suicidal ideation (6.8%), and suicide attempts (1.5%). Conversely, veterans with low dispositional gratitude were at substantially higher risk of developing MDD/GAD/PTSD (27.7%), suicidal ideation (33.6%), and suicide attempts (20.3%). **Conclusions:** High dispositional gratitude may help protect against the development of psychopathology and suicidal behaviors in U.S. military veterans, whereas low gratitude may increase risk of developing these outcomes. Collectively, these results support the potential utility of enhancing gratitude as part of primary prevention efforts for veterans, service members, and other populations at heightened risk for adverse mental health outcomes.

Na, P. J., De Angelis, F., Nichter, B., Wendt, F. R., Krystal, J. H., Southwick, S. M., Levey, D. F., Gelernter, J., Polimanti, R., & Pietrzak, R. H. (2022). **Psychosocial moderators of polygenic risk for suicidal ideation: Results from a 7-year population-based, prospective cohort study of US veterans.** *Molecular Psychiatry*, 27(2), 1068–1074. doi:10.1038/s41380-021-01352-2 Polygenic risk scores (PRS) may help inform the etiology of suicidal thoughts and behaviors. In this study, we evaluated whether a suicidality PRS derived from a large genome-wide association study (GWAS) of suicidality from the UK Biobank ( $N = 122,935$ ) predicted suicidal ideation (SI) in a 7-year population-based, prospective cohort of European-American US veterans ( $N = 1326$ ). Results revealed that 8.8% ( $n = 115$ ) of veterans developed new-onset SI, 4.0% ( $n = 52$ ) had chronic SI, 3.4% ( $n = 31$ ) had remitted SI, and 83.8% ( $n = 1128$ ) denied SI over the study period. Suicidality PRS standardized was positively associated

with chronic SI (relative risk ratio [RRR] = 4.54, 95% confidence interval [CI] = 1.01-20.48) and new-onset SI (RRR = 2.97, 95%CI = 1.22-7.23), and negatively associated with remitted SI (RRR = 0.12, 95% CI = 0.02-0.60). Among veterans with higher suicidality PRS, those with higher baseline dispositional optimism had a lower likelihood of chronic SI (RRR = 0.67, 95% CI = 0.49-0.91) and higher likelihood of remitted SI (RRR = 1.98, 95% CI = 1.18-3.31). Among veterans with higher suicidality PRS, those with higher baseline levels of social support were less likely to develop new-onset SI (RRR = 0.95, 95% CI = 0.92-0.99). These interaction effects were enriched for genes implicated in neuron recognition and development, while the PRS main effect was enriched for genes involved in mannosylation. Collectively, results of this study suggest that suicidality PRS is linked prospectively to symptomatic courses of SI, and that dispositional optimism and social support moderate these associations. Interventions targeting these modifiable psychosocial factors may help mitigate risk of SI in veterans with high polygenic risk for suicidality.

Nichter, B., Hill, M., Norman, S., Haller, M., & Pietrzak, R. H. (2020a). **Associations of childhood abuse and combat exposure with suicidal ideation and suicide attempt in U.S. military veterans: A nationally representative study.** *Journal of Affective Disorders*, 276, 1102–1108. doi:10.1016/j.jad.2020.07.120 **Background:** Military veterans with a history of childhood abuse are at increased risk for suicidality. To date, however, little research has examined whether exposure to childhood abuse may heighten veterans' susceptibility to the effects of combat exposure and increase risk for suicidal behavior. This study examined whether childhood abuse has an additive or interactive effect on the association between combat exposure and suicide-related outcomes in a national sample of veterans. **Methods:** Data were from the National Health and Resilience in Veterans Study, a nationally representative survey of U.S. veterans ( $n = 3,157$ ). Analyses compared veterans with/without current suicidal ideation and lifetime suicide attempts (SI/SA) on sociodemographic, military, and clinical characteristics; and examined the unique contribution of childhood physical and sexual abuse and combat exposure, and their interaction, with SI/SA. **Results:** After adjusting for sociodemographic characteristics and lifetime trauma burden, a significant interaction emerged between childhood sexual abuse and combat exposure predicting SI, such that combat-exposed veterans with histories of abuse were nearly three times more likely to currently be contemplating suicide relative to those without such histories. Childhood sexual abuse predicted lifetime suicide attempt, above and beyond sociodemographic characteristics, lifetime trauma burden, and combat exposure. **Limitations:** Cross-sectional design precludes causal inference. **Conclusions:** Results indicate that childhood sexual abuse exposure may operate both independently and synergistically with combat exposure to increase risk for suicidality among veterans. Findings suggest that veterans who experience childhood sexual abuse represent a subgroup that may be especially vulnerable to experiencing suicidal ideation following combat exposure.

Nichter, B., Hill, M., Norman, S., Haller, M., & Pietrzak, R. H. (2020b). **Impact of specific combat experiences on suicidal ideation and suicide attempt in U.S. military veterans: Results from the National Health and Resilience in Veterans Study.** *Journal of Psychiatric Research*, 130, 231–239. doi:10.1016/j.jpsychires.2020.07.041 **Background:** A burgeoning body of research suggests that specific types of combat experiences may be a stronger predictor of suicidality among veterans than a history of combat exposure itself. To date, however, little population-based data exist about these associations in representative samples of veterans. This study examined the association between overall severity of combat exposure and specific combat experiences with suicidal ideation and suicide attempt(s) (SI/SA) in a nationally representative sample of combat veterans. **Methods:** Data were from the National Health and Resilience in Veterans Study, a nationally representative survey of U.S. combat veterans ( $n = 1100$ ). Analyses (a) compared veterans with/without current SI and lifetime SA on sociodemographic, military, and clinical characteristics; and (b) examined associations between overall combat exposure and specific combat experiences, and SI/SA. **Results:** Hierarchical regression analyses revealed that overall combat exposure was positively, albeit weakly, associated with SI/SA, after adjusting for sociodemographic characteristics and lifetime trauma burden [odds ratios (ORs) = 1.02-1.03]. Combat experiences involving direct exposure to death, killing, or grave injury were independently associated with SI/SA (ORs = 1.46-1.70), whereas several general combat experiences (e.g., combat patrols) were negatively associated with SI/SA (ORs = 0.44-0.65). **Discussion:** Results indicate that U.S. combat veterans who have witnessed others be killed or wounded in combat are at

substantially higher risk for SI/SA relative to those without such histories. Collectively, findings suggest that combat exposure, when examined as an aggregate severity measure, may yield a poor prognostication of suicide risk, as it may be insufficiently sensitive to detect the effects of specific combat-related experiences.

Nichter, B., Hill, M., Norman, S., Haller, M., & Pietrzak, R. H. (2020c). **Mental health treatment utilization among U.S. military veterans with suicidal ideation: Results from the National Health and Resilience in Veterans Study.** *Journal of Psychiatric Research*, 130, 61–67. doi:10.1016/j.jpsychires.2020.07.004

**Background:** Despite advances in the treatment of suicidality over the last decade, a significant proportion of veterans with suicidal ideation do not utilize mental health treatment. To date, however, few population-based studies have examined factors that may facilitate or impede mental healthcare engagement among veterans currently contemplating suicide. This study examined barriers and facilitators of current mental healthcare utilization in a nationally representative sample of U.S. military veterans who endorsed current suicidal ideation. **Methods:** Using data from the National Health and Resilience in Veterans Study ( $n = 3157$ ), collected in 2011, multivariable analyses were conducted to identify predisposing (e.g., age), enabling (e.g., social support), and need (e.g., psychiatric history) characteristics, as well as perceptions of stigma and barriers to care, associated with current mental healthcare utilization. **Results:** A total of 7.3% ( $n = 231$ ) of veterans endorsed current suicidal ideation, of which 36.1% ( $n = 84$ ) were engaged in current mental health treatment. Younger age, female sex, current depression, lifetime suicide attempt(s), and number of lifetime traumas and medical problems were associated with treatment utilization. Mistrust of mental health providers and fear of treatment harming one's reputation were associated with lower likelihood of treatment engagement, over and above the effects of these predisposing, enabling, and need characteristics. **Discussion:** More than 3 of 5 U.S. veterans endorsing current suicidal ideation are not engaged in mental health treatment. Results underscore the importance of multi-modal suicide prevention and treatment engagement efforts that target need-based factors, and perceptions of stigma and negative beliefs about mental healthcare in this population.

Nichter, B., Hill, M. L., Fischer, I., Panza, K. E., Kline, A. C., Na, P. J., Norman, S. B., Rowcliffe, M., & Pietrzak, R. H. (2024a). **Firearm storage practices among military veterans in the United States: Findings from a nationally representative survey.** *Journal of Affective Disorders*, 351, 82–89. doi:10.1016/j.jad.2024.01.179 **Background:** Unsafe storage of firearms is associated with increased risk of suicide. However, contemporary population-based data on the prevalence and correlates of firearm storage practices among veterans are limited. **Methods:** Data were from the 2022 National Health and Resilience in Veterans Study, a nationally representative sample of 2441 veterans. Analyses examined: (1) the prevalence of firearm storage practices; (2) sociodemographic, psychiatric, and clinical characteristics associated with storing firearms loaded and/or in non-secure location; and (3) associations between types of potentially traumatic events and storage practices. **Results:** More than half of veterans reported owning one or more personal firearms (50.9%). Among firearm owners, 52.9% reported some form of unsafe firearm storage practice (i.e., loaded and/or non-secure location), with 39.9% reporting that they stored one or more firearms loaded. After adjusting for sociodemographic characteristics, major depressive, alcohol and drug use disorders, direct trauma exposures, future suicidal intent, and traumatic brain injury were associated with storing firearms loaded and/or in a non-secure location (ORs = 1.09–7.16). Veterans with a history of specific forms of direct trauma exposure (e.g., physical assault) were more likely to store firearms unsafely. **Limitations:** Cross-sectional design precludes causal inference. **Conclusions:** Half of U.S. veterans who own firearms store at least one personal firearm loaded and/or in a non-secure location, with approximately four-in-ten keeping a loaded firearm in the home. These high rates underscore the importance of nationwide training initiatives to promote safe firearm storage for all service members and veterans, regardless of risk status, as well as for healthcare professionals working with veterans.

Nichter, B., Hill, M. L., Maguen, S., Norman, S. B., Fischer, I. C., & Pietrzak, R. H. (2024b). **Health and psychiatric impairment associated with moral injury, military sexual trauma, and their co-occurrence in U.S. combat veterans.** *Journal of Psychosomatic Research*, 179, 111617. doi:10.1016/j.jpsychores.2024.111617 **Background:** Military sexual trauma (MST) and moral injury (MI) are associated with adverse psychiatric and

health outcomes among military veterans. However, no known population-based studies have examined the incremental burden associated with the co-occurrence of these experiences relative to either alone. **Method:** Cross-sectional data were analyzed from the National Health and Resilience in Veterans Study, a nationally representative sample of 1330 U.S. combat veterans. Veterans reported on history of exposure to MST and potentially morally injurious events (PMIEs). Analyses estimated the lifetime prevalence of MST only, PMIEs only, and co-occurring MST and PMIEs; and examined associations between MST/PMIEs status and psychiatric and physical health comorbidities, functioning, and suicidality. **Results:** The lifetime weighted prevalence of exposure to MST only, PMIEs only, and co-occurring MST and PMIEs were 2.7%, 32.3%, and 4.5%, respectively. Compared with all other groups, the co-occurring MST + PMIEs group reported greater severity of posttraumatic stress, depression, generalized anxiety, and insomnia symptoms. They also scored lower on measures of physical, mental, and psychosocial functioning, and reported a greater number of chronic medical conditions and somatic complaints. Veterans with co-occurring MST + PMIEs were more than twice as likely as those with MST only to report past-year suicidal ideation. **Conclusions:** The co-occurrence of MST and MI is associated with a greater psychiatric and health burden among combat veterans than either experience alone. Results underscore the importance of assessing and treating MST and MI in this population. Findings underscore the importance for future work to parse overlap between morally salient aspects of MST and the concept of moral injury.

Nichter, B., Holliday, R., Monteith, L. L., Na, P. J., Hill, M. L., Kline, A. C., Norman, S. B., & Pietrzak, R. H. (2022b). **Military sexual trauma in the United States: Results from a population-based study.** *Journal of Affective Disorders*, 306, 19–27. doi:10.1016/j.jad.2022.03.016 **Background:** The reported prevalence of military sexual trauma (MST) has increased over the past decades in the United States, yet scarce population-based studies have examined the prevalence, correlates, and health burden of MST in the general veteran population. **Methods:** Data were from the 2019–2020 National Health and Resilience in Veterans Study, a population-based survey of veterans ( $n = 4069$ ). Analyses: (1) estimated the prevalence of MST; (2) identified sex-stratified sociodemographic, military, and trauma characteristics associated with MST; and (3) examined sex-stratified associations between MST and psychiatric comorbidities, functioning, disability, and treatment utilization. **Results:** Female veterans reported substantially higher rates of MST (44.2%) than male veterans (3.5%). Relative to male veterans without MST histories, male veterans with MST histories had nearly 3-fold increased odds of reporting future suicidal intent, 2-to-3-fold greater odds of screening positive for current posttraumatic stress disorder (PTSD), depression, and generalized anxiety disorder; and nearly 2-fold increased odds of being disabled. Male veterans with MST histories also scored lower on mental, physical, cognitive, and psychosocial functioning ( $d$ 's = 0.16–0.29). Relative to female veterans without MST histories, female veterans with MST histories had 5-fold greater odds of current PTSD, 2-fold greater odds of engaging in mental health treatment, and scored lower on psychosocial functioning and higher on somatic symptoms (both  $d$ 's = 0.25). **Limitations:** Cross-sectional design precludes causal inference. **Conclusions:** A substantial proportion of veterans in the U.S. experience sexual trauma during their military service, and these experiences are associated with an elevated health burden.

Nichter, B., Koller, D., De Angelis, F., Wang, J., Girgenti, M. J., Na, P. J., Hill, M. L., Norman, S. B., Krystal, J. H., Gelernter, J., Polimanti, R., & Pietrzak, R. H. (2023). **Genetic liability to suicidal thoughts and behaviors and risk of suicide attempt in US military veterans: Moderating effects of cumulative trauma burden.** *Psychological Medicine*, 53(13), 6325–6333. doi:10.1017/S0033291722003646 **Background:** Little is known about environmental factors that may influence associations between genetic liability to suicidality and suicidal behavior. **Methods:** This study examined whether a suicidality polygenic risk score (PRS) derived from a large genome-wide association study ( $N = 122,935$ ) was associated with suicide attempts in a population-based sample of European-American US military veterans ( $N = 1664$ ; 92.5% male), and whether cumulative lifetime trauma exposure moderated this association. **Results:** Eighty-five veterans (weighted 6.3%) reported a history of suicide attempt. After adjusting for sociodemographic and psychiatric characteristics, suicidality PRS was associated with lifetime suicide attempt (odds ratio 2.65; 95% CI 1.37–5.11). A significant suicidality PRS-by-trauma exposure interaction emerged, such that veterans with higher levels of suicidality PRS and greater trauma burden had the highest probability of lifetime suicide attempt (16.6%),

whereas the probability of attempts was substantially lower among those with high suicidality PRS and low trauma exposure (1.4%). The PRS-by-trauma interaction effect was enriched for genes implicated in cellular and developmental processes, and nervous system development, with variants annotated to the DAB2 and SPNS2 genes, which are implicated in inflammatory processes. Drug repurposing analyses revealed upregulation of suicide gene-sets in the context of medrysone, a drug targeting chronic inflammation, and clofibrate, a triacylglyceride level lowering agent. **Conclusion:** Results suggest that genetic liability to suicidality is associated with increased risk of suicide attempt among veterans, particularly in the presence of high levels of cumulative trauma exposure. Additional research is warranted to investigate whether incorporation of genomic information may improve suicide prediction models.

Nichter, B., Monteith, L. L., Norman, S. B., Maguen, S., Hill, M. L., Herzog, S., & Pietrzak, R. H. (2021a). **Differentiating U.S. military veterans who think about suicide from those who attempt suicide: A population-based study.** *General Hospital Psychiatry*, 72, 117–123. doi:10.1016/j.genhosppsych.2021.08.007 **Objective:** Several vulnerability factors for suicidal behavior in U.S. veterans have been identified. However, little is known about factors that differentiate veterans who contemplate suicide from those who attempt suicide. This study examined sociodemographic and clinical characteristics that distinguish veterans who think about suicide from those who attempt suicide. **Method:** Data were analyzed from the 2019-2020 National Health and Resilience in Veterans Study, which surveyed a population-based sample of 4069 veterans. Analyses estimated the lifetime prevalence of suicide ideation (SI) and suicide attempts (SA); and examined differences between veterans with a history of attempt(s), and SI without a history of attempt(s). **Results:** A total 25.9% of U.S. veterans reported lifetime SI and 3.9% reported a SA. Several factors distinguished veterans with a history of SA from those with SI only: the strongest were younger age (odds ratio [OR] = 0.97, 95% CI = 0.95-0.98), nonsuicidal self-injury (OR = 1.81, 95% CI = 1.11-3.03), adverse childhood experiences (OR = 1.14; 95% CI = 1.06-1.23), alcohol use disorder (OR = 1.99; 95% CI = 1.28-3.12), lower household income (OR = 0.62; 95% CI = 0.40-0.95), and physical disability (OR = 1.69; 95% CI = 1.07-2.70). **Conclusions:** Although a quarter of U.S. veterans contemplate suicide in their lifetimes, the majority do not attempt suicide. Specific sociodemographic and clinical features may differentiate veterans who contemplate versus attempt suicide.

Nichter, B., Norman, S. B., Maguen, S., & Pietrzak, R. H. (2021b). **Moral injury and suicidal behavior among US combat veterans: Results from the 2019–2020 National Health and Resilience in Veterans Study.** *Depression and Anxiety*, 38(6), 606–614. doi:10.1002/da.23145 **Background:** Recent research suggests that exposure to potentially morally injurious experiences (PMIEs) may be associated with increased risk for suicidal behavior among US combat veterans, but population-based data on these associations are scarce. This study examined the association between PMIEs with current suicidal ideation (SI), lifetime suicide plans (SP), and suicide attempts (SA) in a contemporary, nationally representative sample of combat veterans. **Methods:** Data were analyzed from the 2019-2020 National Health and Resilience in Veterans Study, which surveyed a nationally representative sample of US combat veterans (n = 1321). PMIEs were assessed using the Moral Injury Events Scale (MIES). Multivariable logistic regression analyses were conducted to examine associations between MIES total scores and specific types of PMIEs with suicidal behavior. **Results:** Thirty-six point three percent of veterans reported at least one PMIE. Perceived transgressions by self, others, and betrayal were associated with SI, SP, and SA (odds ratios [ORs] = 1.21-1.27, all p < .05), after adjusting for sociodemographic, trauma, and psychiatric characteristics. MIES total scores were significantly, albeit weakly, associated with SP (OR = 1.03, p < .01), but not SI/SA. Depression, posttraumatic stress disorder (PTSD), and age emerged as the strongest correlates of SI/SP/SA (14.9%-38.1% of explained variance), while PMIEs accounted for a comparatively modest amount of variance (3.3%-8.9%). **Conclusions:** Reports of potentially morally injurious experiences are prevalent among US combat veterans, and associated with increased risk for suicidal behavior, above and beyond severity of combat exposure, PTSD, and depression. Implications for clinical practice and future research are discussed, including the need for methodological advancements in the measurement of moral injury.

Nichter, B., Stein, M. B., Monteith, L. L., Herzog, S., Holliday, R., Hill, M. L., Norman, S. B., Krystal, J. H., & Pietrzak, R. H. (2022c). **Risk factors for suicide attempts among U.S. military veterans: A 7-year population-based, longitudinal cohort study.** *Suicide and Life-Threatening Behavior*, 52(2), 303–316. doi:10.1111/sltb.12822 **Background:** Population-based data on risk factors for suicide attempts among veterans remains limited. **Methods:** A national probability sample of 2307 veterans was followed over the course of four timepoints spanning seven years to examine how a range of baseline risk factors predict incident suicide attempt. Suicide attempt data were aggregated into a single follow-up timepoint. **Results:** Sixty-two veterans (3.1%) reported attempting suicide during the 7-year period. The strongest risk factors for suicide attempts were higher baseline levels of loneliness, lower baseline levels of adaptive psychosocial traits (e.g., dispositional gratitude), baseline thoughts of self-harm, and greater post-baseline trauma exposures (12.3%-41.3% of explained variance). Veterans with multiple co-occurring risk factors were at greatest risk for attempts; of veterans with 0, 1, 2, 3, and all 4 of these factors, the predicted probability of suicide attempt was 2.0%, 5.3%, 13.5%, 30.4%, and 55.0%, respectively. **Conclusions:** Baseline loneliness, dispositional gratitude, thoughts of self-harm, and new-onset traumas emerged as the strongest risk factors for suicide attempts among veterans, underscoring the potential importance of targeting these factors in prevention efforts. Veterans with multiple co-occurring risk factors have substantially greater risk for suicide attempts, suggesting that examination of multiple coinciding vulnerability factors may help improve suicide risk prediction models.

Slavin, A. Z., Fischer, I. C., & Pietrzak, R. H. (2024). **Differential associations of adverse childhood experiences and mental health outcomes in U.S. military veterans.** *Journal of Psychiatric Research*, 172, 261–265. doi:10.1016/j.jpsychires.2024.02.040 Adverse childhood experiences (ACEs) are robustly associated with adverse mental health outcomes across the lifespan. Military veterans may be particularly vulnerable to adverse mental health effects of ACEs given their potentially higher prevalence of childhood traumas and compounding effects of military service-related traumas. To date, however, scarce research has examined the differential impact of individual ACEs on mental health outcomes in population-based samples of veterans. To address this gap, we analyzed data from the National Health and Resilience in Veterans Study (NHRVS), which surveyed a nationally representative sample of 4069 U.S. veterans, to examine the association between specific ACEs and major depressive, generalized anxiety, and posttraumatic stress disorders, and suicidal thoughts and behaviors. Results of multivariable logistic regression analyses revealed that emotional neglect and sexual abuse were most consistently associated with these outcomes, even after adjustment for the number of ACEs endorsed. Collectively, results of this study underscore the importance of assessing for specific ACEs—most notably childhood emotional neglect and sexual abuse—and treating these potentially unresolved childhood traumas in veterans.

Wisco, B. E., Marx, B. P., May, C. L., Martini, B., Krystal, J. H., Southwick, S. M., & Pietrzak, R. H. (2017). **Moral injury in U.S. combat veterans: Results from the National Health and Resilience in Veterans Study.** *Depression and Anxiety*, 34(4), 340–347. doi:10.1002/da.22614 **Background:** Combat exposure is associated with increased risk of mental disorders and suicidality. Moral injury, or persistent effects of perpetrating or witnessing acts that violate one's moral code, may contribute to mental health problems following military service. The pervasiveness of potentially morally injurious events (PMIEs) among U.S. combat veterans, and what factors are associated with PMIEs in this population remains unknown. **Methods:** Data were analyzed from the National Health and Resilience in Veterans Study (NHRVS), a contemporary and nationally representative survey of a population-based sample of U.S. veterans, including 564 combat veterans, collected September–October 2013. Types of PMIEs (transgressions by self, transgressions by others, and betrayal) were assessed using the Moral Injury Events Scale. Psychiatric and functional outcomes were assessed using established measures. **Results:** A total of 10.8% of combat veterans acknowledged transgressions by self, 25.5% endorsed transgressions by others, and 25.5% endorsed betrayal. PMIEs were moderately positively associated with combat severity ( $\beta = .23$ ,  $P < .001$ ) and negatively associated with white race, college education, and higher income ( $\beta$ s = .11-.16,  $P$ s < .05). Transgressions by self were associated with current mental disorders (OR = 1.65,  $P < .001$ ) and suicidal ideation (OR = 1.67,  $P < .001$ ); betrayal was associated with postdeployment suicide attempts (OR = 1.99,  $P < .05$ ), even after conservative adjustment for covariates, including combat severity. **Conclusions:** A significant minority of U.S. combat veterans report PMIEs related to their military service. PMIEs are associated with risk for mental disorders and suicidality, even after adjustment for sociodemographic variables, trauma and combat exposure histories, and past psychiatric disorders.



## SUPPLEMENTAL ARTICLES

Corona, C. D., Van Orden, K. A., Wisco, B. E., & Pietrzak, R. H. (2019). **Meaning in life moderates the association between morally injurious experiences and suicide ideation among U.S. combat veterans: Results from the National Health and Resilience in Veterans Study.** *Psychological Trauma: Theory, Research, Practice, and Policy*, 11(6), 614–620. doi:10.1037/tra0000475

Fischer, I. C., Nichter, B., Trachik, B., Bryan, C. J., & Pietrzak, R. H. (2024). **Suicide-specific cognitions and suicidal behavior in U.S. military veterans.** *Psychiatry: Interpersonal and Biological Processes*, 87(3), 241–250. doi:10.1080/00332747.2024.2352883

Fischer, I. C., Nichter, B., Aunon, F. M., Feldman, D. B., Levy, B. R., Esterlis, I., & Pietrzak, R. H. (2023c). **Suicidal thoughts and behaviors in older U.S. military veterans: Results from the National Health and Resilience in Veterans Study.** *The American Journal of Geriatric Psychiatry*, 31(10), 844–852. doi:10.1016/j.jagp.2023.04.013

Herzog, S., Nichter, B., Hill, M. L., Norman, S. B., & Pietrzak, R. H. (2022). **Factors associated with remission of suicidal thoughts and behaviors in U.S. military veterans with a history of suicide attempt.** *Journal of Psychiatric Research*, 149, 62–67. doi:10.1016/j.jpsychires.2022.02.021

McCarthy, E., DeViva, J. C., Southwick, S. M., & Pietrzak, R. H. (2022). **Self-rated sleep quality predicts incident suicide ideation in US military veterans: Results from a 7-year, nationally representative, prospective cohort study.** *Journal of Sleep Research*, 31, e13447. doi:10.1111/jsr.13447

Nichter, B., Na, P. J., Stanley, I. H., Marx, B. P., Herzog, S., Moynahan, V., Hill, M. L., Norman, S. B. & Pietrzak, R. H. (2022a). **Identifying factors associated with elevated suicidal intent among U.S. military veterans.** *Journal of Psychiatric Research*, 155, 68–74. doi:10.1016/j.jpsychires.2022.08.001

Stanley, I. H., Marx, B. P., Nichter, B., & Pietrzak, R. H. (2022). **Non-response to questions about suicide ideation and attempts among veterans: Results from the National Health and Resilience in Veterans Study.** *Suicide and Life-threatening Behavior*, 52, 763–772. doi:10.1111/sltb.12860