Risk and Protective Factors Across Socioecological Levels of Risk for Suicide: An Evidence Map

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PREFACE

The VA Evidence Synthesis Program (ESP) was established in 2007 to provide timely and accurate syntheses of targeted healthcare topics of importance to clinicians, managers, and policymakers as they work to improve the health and healthcare of Veterans. These reports help:

- Develop clinical policies informed by evidence;
- Implement effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures; and
- Set the direction for future research to address gaps in clinical knowledge.

The program comprises three ESP Centers across the US and a Coordinating Center located in Portland, Oregon. Center Directors are VA clinicians and recognized leaders in the field of evidence synthesis with close ties to the AHRQ Evidence-based Practice Center Program. The Coordinating Center was created to manage program operations, ensure methodological consistency and quality of products, and interface with stakeholders. To ensure responsiveness to the needs of decision-makers, the program is governed by a Steering Committee composed of health system leadership and researchers. The program solicits nominations for review topics several times a year via the program website.

Comments on this evidence report are welcome and can be sent to Nicole Floyd, Deputy Director, ESP Coordinating Center at Nicole.Floyd@va.gov.

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This topic was developed in response to a nomination by VA Health Services Research & Development (HSR&D) Office for an evidence review on the risk and protective factors for suicide across socioecological (SE) levels of risk. The scope was further developed with input from the topic nominators (*ie*, Operational Partners), the ESP Coordinating Center, the review team, and the technical expert panel (TEP).

In designing the study questions and methodology at the outset of this report, the ESP consulted several technical and content experts. Broad expertise and perspectives were sought. Divergent and conflicting opinions are common and perceived as healthy scientific discourse that results in a thoughtful, relevant systematic review. Therefore, in the end, study questions, design, methodologic approaches, and/or conclusions do not necessarily represent the views of individual technical and content experts.

The authors gratefully acknowledge the following individuals for their contributions to this project:

Operational Partners

Operational partners are system-level stakeholders who have requested the report to inform decision-making. They recommend TEP participants; assure VA relevance; help develop and approve final project scope and timeframe for completion; provide feedback on draft report; and provide consultation on strategies for dissemination of the report to field and relevant groups.

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Technical Expert Panel (TEP)

To ensure robust, scientifically relevant work, the TEP guides topic refinement; provides input on key questions and eligibility criteria, advising on substantive issues or possibly overlooked areas of research; assures VA relevance; and provides feedback on work in progress. TEP members are listed below:

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Peer Reviewers

The Coordinating Center sought input from external peer reviewers to review the draft report and provide feedback on the objectives, scope, methods used, perception of bias, and omitted evidence. Peer reviewers must disclose any relevant financial or non-financial conflicts of interest. Because of their unique clinical or content expertise, individuals with potential conflicts may be retained. The Coordinating Center and the ESP Center work to balance, manage, or mitigate any potential nonfinancial conflicts of interest identified.

EXECUTIVE SUMMARY

INTRODUCTION

Suicide remains a critical public health concern, with suicide rates increasing by 33% in the United States (US) between 1999 and 2019. Suicide rates vary by sex, race, age, and occupation, including military service, which is associated with increased risk for suicide. The suicide rate among US Veterans is 1.5 times that of the general population, when adjusted for age and sex.[1] Similar to the general population, male sex, non-Hispanic white race, mental health diagnoses, and age (55-74), are suicide risk factors in Veterans. Suicide prevention is the highest priority for the US Department of Veterans Affairs (VA).[2]

The Centers for Disease Control and Prevention (CDC) suggests that prevention efforts for any health or disease issue require an understanding of the underlying influencing factors. The CDC's Social-Ecological Model (SEM) is a 4-tiered framework for organizing risk and protective factors, which can then inform prevention strategies.[3] The framework considers the complex interaction between factors included in the 4 strata: societal, community, relationship, and individual. Evaluating risk factors through the lens of the Social-Ecological Model can provide additional context for the development of suicide prevention policies and practices.

Prior work has examined risk and protective factors among individuals known to be at high suicide risk based on age, sex, and mental health diagnoses. However, little information is available on suicide risk factors in the general population and understanding such factors may be helpful in developing public health and primary care prevention strategies. We conducted a systematic review of research published since 2011 and prepared an evidence map to identify risk and protective factors associated with suicide or suicide attempts in the general Veteran or active military personnel populations. The topic was nominated by VA Health Services Research and Development to develop research priorities and identify areas for future funding on suicide prevention in VA. In collaboration with VA leadership and members of a Technical Expert Panel (TEP) the following Key Question was developed: *What are the risk and protective factors for suicidal behaviors (attempts or death by suicide) across socioecological levels of risk?*

METHODS

Data Sources and Searches

We searched MEDLINE, Embase, PsycINFO, and Sociological Abstracts from January 2011 to January 2021. We used Medical Subject Headings (MeSH) and title/abstract terms indicative of suicide outcomes and risk or protective factors. We supplemented these results with additional searches of bibliographies from recent systematic reviews, and references from our TEP.

Study Selection

Eligible citations were screened independently by 2 reviewers using Distiller SR (Distiller SR, Evidence Partners, Ottawa, Canada) with prespecified criteria. Citations moved to full-text review if either reviewer considered the citation eligible. At full-text review, agreement of 2 reviewers was needed for study inclusion or exclusion; disputes were resolved by discussion with input from a third reviewer, if needed.

We included observational studies in the English-language that evaluated "modifiable" risk or protective factors for suicides or suicide attempts (*ie,* not sex, race, or age) in samples drawn from general populations of US Veterans and active military personnel. Studies must have reported suicide deaths or suicide attempts as outcomes; studies which included only composite outcomes (*eg*, suicide deaths plus attempts as 1 outcome) were excluded. Studies that did not capture the risk or protective factor(s) prior to the outcome of suicide or suicide attempts were excluded. We also excluded studies of special populations (*eg*, those known to be high risk due to mental health diagnoses or past suicide attempts) unless results were reported separately for individuals not considered at increased risk. However, we included studies of a general population of Veterans or active Service members that described their study sample's mental health diagnoses or past suicide attempts as risk factors.

Data Abstraction and Quality Assessment

Risk of bias (ROB) was assessed using the Quality In Prognosis Studies (QUIPS) tool.[4] Studies judged to have high risk of bias in 2 or more of the 6 domains were considered high overall ROB. Studies with low ROB in all 6 domains were considered low overall ROB. Studies not meeting either of these conditions were considered moderate ROB overall.

We abstracted data from eligible studies on study and population characteristics and reported prognostic factors and outcomes. For studies rated low or moderate ROB, we extracted the association between the risk or protective factor and the outcome, described the direction of the association and determined whether a factor was prognostic based statistical significance. ROB assessments and data abstraction were conducted by 1 trained reviewer and verified or modified by a second reviewer.

Data Synthesis and Analysis

Using the SEM,[3] we categorized reported risk and protective factors into 1 of 4 nested domains: Individual, Relational, Community, or Societal. We prepared an evidence map summarizing studies within this framework for those assessed as low or moderate ROB. We then included separate sections to summarize findings from studies with the strongest design or methodological quality – first, prospective cohort studies and second, any study design with low ROB. We did not conduct a quantitative evidence synthesis or detailed study level analyses due to study heterogeneity and the number and variation in risk and protective factor reporting. We did not rate certainty of evidence for the same reason. We describe the included individual studies in supplemental tables.

RESULTS

Results of Literature Search

After removing duplicates, we identified 1,351 citations for title and abstract triage. We reviewed the full text of 295 articles and identified 63 which met our inclusion criteria.

Summary of Results

Individual Level

The Individual domain of the Social-Ecological Model consists of factors pertaining to personal characteristics, such as demographics and health conditions.[5] We identified 57 studies, with 50 meeting low or moderate ROB criteria (6 prospective cohort studies[6-11]). Of the 50 studies identified, 25 had a study sample size ≥ 100,000, thirty evaluated samples drawn from the Veteran population, 25 made use of VHA data sources, and 29 made use of Department of Defense (DoD) data sources. Among these 50 studies, 19 also reported relational risk or protective factors, and 4 evaluated community-level risk or protective factors.

Of the 6 prospective cohort studies that identified individual risk factors, 4 reported on suicides and 3 reported on attempts. Two of the 6 were rated low ROB and evaluated ≥ 100,000 individuals and reported on suicides; neither of these 2 reported attempts. One study focused on Veterans and used VHA medical records while the other involved active duty military from Operation Enduring Freedom and Operation Iraqi Freedom (OEF/OIF) and used a variety of DoD data sources. All 4 moderate ROB studies evaluated active duty military personnel.

Posttraumatic Stress Disorder (PTSD), other mental health disorders, alcohol, tobacco, and/or drug use, and homelessness/housing instability, as well as prior suicide attempts or ideation, were commonly reported as risk factors. The evidence identifying these variables as risk factors for both suicides and attempts was primarily from retrospective and case-control studies, but the direction and statistical significance was generally consistent and found in both low and moderate risk of bias studies.

The evidence regarding other risk/protective factors, such as pain, healthcare service use, criminal or legal history, or financial or life stressors was more sparse and less consistent in direction and statistical significance across studies. Among the risk or protective factors related to military history, deployment status was most frequently reported, in 14 studies in total. However, the diverse categorization of deployment status (*ie,* currently vs previously deployed; ever vs never; or total number of deployments) made comparison between studies difficult. Military service variables, such as less time in service and separation from service, were also associated with both suicide deaths and attempts. Increased body mass index (BMI) was found to be a protective factor in 2 moderate ROB studies.

Relational Level

The Relational domain of the Social-Ecological Model contains direct person-to-person interactions, such as interpersonal relationships, social support, and family.[5] We identified 22 studies that reported on such factors; 18 were rated moderate ROB[6,8,9,12-26] and 4 were rated low ROB.[11,27,28] Studies reported a variety of risk and protective factors, including marital status, relationship problems, sexual violence, history of family violence, adverse childhood experiences, bullying within military unit, social isolation, perceived burdensomeness (*eg,* "feeling others would be better off if I were dead"), thwarted belongingness (*ie,* social isolation), and death of a loved one or pet.

Twelve studies reported on marital status. Most reported no significant effect for suicidal behaviors (k=8[9,11,13,15,17,18,23,24]), but some (k=4[19,25,27,29]) reported that being unmarried (single,

widowed, divorced, separated, or never married) were at increased risk for both suicides and attempts. Seven studies reported on relationship problems, including recently failed intimate relationships, and recent divorce or counseling. Five of these studies (including 2 low ROB) reported these factors increase risk for suicides and attempts,[11,16,17,22,28] while 2 reported no significant differences.[6,13]

Four studies reported on sexual violence; 1 of these studies was rated low ROB. Two reported that military sexual trauma increased risk of suicides for both men and women,[20,30] the third reported that any sexual assault increased risk for suicide attempts,[21] and the fourth study found no significant effects between sexual or physical abuse history and suicide attempts.[14]

Two moderate ROB studies reported no significant increase in suicide risk for those reporting perceived burdensomeness,[8] thwarted belongingness,[8] or social isolation.[13] However, 1 low ROB study reported decreased social support increased risk of suicide.[11]

Two moderate ROB studies reported a history of family violence increased risk for suicide attempts.[23,26] One low ROB study reported that an Adverse Childhood Experiences (ACE) score of ≥ 4 increased risk for suicide as an adult.[11] One moderate ROB study reported that being bullied within your military unit increased risk of suicide attempts.[6] One moderate ROB study reported no significant increase in risk of suicide behavior for those suffering from grief or loss of a loved one or pet.[13]

Community Level

The Community domain of the Social-Ecological Model contains factors which are bounded to a certain region, setting, or area, such as neighborhoods, schools, or workplaces.[5] We identified 3 studies which reported on factors in this domain; all were rated moderate ROB.[31-33] All 3 articles focused on military-related factors: monthly frequency of improvised explosive device (IED) incidents, unit suicides, and exposure to nerve gas.

One study that used data from the Study to Assess Risk and Resilience in Servicemembers (STARRS) reported that the monthly frequency of IED incidents (as measured by the Joint IED Defeat Organization) was associated with increased risk for suicide attempts (moderate ROB).[32] Another study found that, as the number of suicide attempts in a military unit increased, so too did individual risks for suicide attempt (moderate ROB).[33] One moderate ROB study found no significant effects of nerve gas exposure on risk of suicide deaths.[31]

Societal Level

We did not identify any studies that reported societal level factors.

Summary of Findings from Prospective Cohort Studies

The 6 prospective cohort studies may provide more reliable information on whether assessed factors were predictive of suicide rather than merely associated with suicide.

Four studies reported on suicide and 3 reported on suicide attempts. One of these studies reported on both suicides and attempts.[10] Two were considered low ROB and both reported on suicides (1 in Veterans and 1 in active military).[7,11] Of the 4 reports evaluating suicide death, only 2 assessed

more than a single predictive factor.[9,11] Three reports were from the STARRS database and were considered moderate ROB,[6,8,10] though only 1 study assessed suicide,[10] while the other 2 reported suicide attempts.

Two low ROB studies assessed the role of tobacco use on suicides and found an increased risk when controlling for other factors.[7,11] Bohnert et al[7] used Veteran's Health Administration (VHA) electronic medical record information and found that a diagnosis of tobacco use disorder was associated with suicides among Veterans when controlling for age group, sex, Charlson comorbidity scores, VHA service connection, substance use disorder, bipolar disorder, depression, other anxiety disorder, posttraumatic stress disorder, and schizophrenia. Philipps[11] and colleagues evaluated tobacco and other drug use in OEF/OIF active military individuals as part of the Recruit Assessment Program study. However, only alcohol use was reported in models adjusting for other factors (depression, PTSD, adjustment disorder, and deployment). One moderate ROB study, using data from the Millennium Cohort Study,[34] reported that alcohol use, defined as heavy/binge drinking or alcohol related problems identified on a screening question, was positively associated with suicides.[9]

One low ROB study conducted in active duty military[11] noted a number of risk factors predictive of suicide death, including: mental illness, history of traumatic brain injury (TBI), lack of high school education, the percentage of time deployed while in the military, and military occupation. OEF/OIF deployment was a protective factor against suicide, while a history of PTSD was not significantly associated with suicide (similarly reported in 1 other moderate ROB prospective cohort study[9]). In contrast, the number of deployments was positively associated with suicide attempts in a single moderate ROB study among active duty military.[6]

Summary of Findings from Low Risk of Bias Studies

We identified 12 retrospective studies rated low ROB in addition to the 2 prospective studies mentioned above (14 total). Twelve studies involved more than 100,000 individuals, 11 studies enrolled Veterans and 5 included active duty military. Individual factors were reported in 14 studies, and relational factors were reported in 4 studies. No studies reported on community or societal factors. All studies reported on suicides and 2 reported on attempts.

While 14 studies reported on *individual risk factors,* each unique risk factor was typically assessed in only 1 or 2 studies. The following risk factors were assessed in 3 or more low ROB studies: previous suicide ideation or attempts; mental illness (not including PTSD); PTSD; and alcohol, drug, or tobacco use. Suicide ideation or previous attempts were positively associated with suicide in 3 retrospective studies, 2 in Veterans and 1 in active military.[27,28,35] A history of mental illness was consistently associated with suicide in 4 studies (3 in Veterans and 1 in active military).[27,28,35,36] In 4 of 5 retrospective studies, substance use disorder was associated with increased suicides and in the 2 prospective studies tobacco use was also associated with increased suicide risk in both Veterans and active military. The effect of PTSD on suicides was inconsistent. Two retrospective studies found a positive association while 1 found a protective effect, and the single prospective study[11] found no significant relationship with PTSD and subsequent suicide among active duty military.

Of the 4 low ROB studies reporting on *relational factors*, 2 were retrospective cohort studies, 1 was cross-sectional, and 1 was a prospective cohort. One study in Veterans noted that Veterans

who were divorced, widowed, or never married had an increased suicide risk compared to married individuals.[27] Similarly, the report by Shen and colleagues[28] showed that being divorced was associated with an increased risk of suicide. Cusack et al reported that a history of military sexual trauma increased risk for suicide deaths.[30] Phillips,[11] a prospective cohort study in active duty military, found that adverse childhood experiences, relationship problems, and social isolation were each associated with increased suicide while marital status had no significant association.

DISCUSSION

Key Findings

Our systematic review and evidence maps evaluated risk and protective factors for suicide and suicide attempts among general populations of Veterans and active duty military across the 4 levels included in the CDC's social-ecological model. We identified 55 studies rated as either low or moderate ROB published since 2011. Six were prospective studies (2 low ROB) examining risk factors for suicide deaths. The greatest amount of information was related to individual risk factors and came from retrospective cohort studies, many of which were moderate ROB. Additionally, variation in risk factor definitions and categorization limited consistency in reporting and results interpretation. Nonetheless, we found that:

1) A history of prior suicide ideation or attempts, mental illness (not including PTSD), and substance, alcohol, or tobacco use were consistently predictive of, or associated with, suicide and attempts.

2) PTSD, unlike depression, anxiety, and the other common mental disorders studied, was not consistently associated with suicide.

3) From the relational domain, marital status was not consistently associated with suicide or attempts, while relationship difficulties were generally consistently found to be risk factors.

4) Community-level, relational-level, and other individual-level factors were reported in only 1 or 2 studies. These factors were sometimes associated with suicide and attempts, but the few studies limited confidence. Thus, further exploration of factors such as firearm status, marital status, and various forms of interpersonal violence is warranted.

5) No studies reported on societal-level risk or protective factors.

Our report updates, and expands on, previous reviews evaluating suicide predictors in Veterans and active duty military.[37,38] These reviews included literature published prior to 2011 and 2015 respectively, evaluated demographic and clinical factors, mainly targeted high risk individuals, focused primarily on "risk prediction tools" and their accuracy, and did not use the CDC Social-Ecological Model to evaluate or summarize findings.

We urge caution in interpretation of our findings. This report was intended as an evidence map in general populations of Veterans and active duty military individuals. Thus, it provides a broad overview of risk and protective factors identified since 2011 using the CDC's social-ecological model and identifies gaps in existing evidence. We excluded studies focused on individuals

known to be at high risk of suicide and limited studies to those evaluating Veterans or active duty military. Studies in populations not known to be at high risk and outside of Veterans and active duty military members could be informative and provide a richer understanding of risk and protective factors for suicide and suicide attempts. Studies included in this review differed widely in terms of the factors they assessed, the categories they used to define risk domains, and the definitions they used to evaluate putatively similar constructs. This limited our ability to synthesize the available evidence. Most studies did not report the era of service for its sample, but when reported, the most common era of service was OEF/OIF for both active duty and Veterans. The factors assessed, and categories used to assess risk domains, varied considerably in their definition. The models used to assess the independence of reported factors also varied, and there remains a high potential that unmeasured confounders were explanatory. Additionally, results could be dependent on thresholds or methods used to define the factor or the variables controlled. Reported results may either be due to chance or lack of power. Prospective studies have the advantage of eliminating temporal ambiguity between the putative risk factor and the associated outcome. However, even in prospective studies, most of the effect sizes we saw were small to modest. Given the risk for potential unmeasured confounding and for Type 1 or Type 2 error, results should be accepted only cautiously. Furthermore, because suicide is a rare event in the general population (including Veterans and active duty military) implementing these findings is likely to unnecessarily label many at increased risk or result in program development to mitigate risk in identified individuals that could be resource intensive, burdensome, and costly and result in harms from overdiagnosis and labeling of individuals who would never attempt or die by suicide.

Applicability

This report is applicable to general Veteran and active military duty populations, as all studies evaluated Veterans or active duty military. We excluded studies that evaluated known high-risk populations (*eg*, individuals with a history of mental health illness or prior suicide attempts). Additionally, most studies did not report the era of service for its sample, but when reported, the most common era of service was OEF/OIF for both active duty and Veterans. Therefore, results may not apply to Veterans from World War II, or the Korean or Vietnam Wars.

Research Gaps/Future Research

The currently available evidence is perhaps most notable for its limitations and gaps, emphasizing the need for future research on risk and protective factors for suicide across social-ecological domains. Because suicide is a rare event, assessing prognostic factors in those not known to be at elevated risk requires very large sample sizes and long follow-up. However, given the large individual and societal impact of suicides and attempts, research to determine risk and protective factors and develop strategies to mitigate these events is valuable. Additional creation of large cohorts to prospectively collect data specifically targeted to potential social-ecologic factors, both known and unknown, in general populations associated with increased risk would be useful. Utilization of large administrative/clinical data sets is helpful for efficiently collecting data on clinical diagnoses, healthcare service use, and other centrally collected health information. However, additional, more granular information related to community, relational, societal, and individual levels will likely require supplemental data, such as self-report information and natural language processing of medical charts. The current social-ecological model is useful for conceptualizing broad domains. Categorizing identified factors into

standardized domains and then subdomains is 1 possible strategy for exploring factors. Additional research is needed to better classify the factors related to suicide and suicide attempts and to standardize their definitions and classifications. There is also little research on the potential combination of factors in predicting suicide or suicide attempts. More refined analytic methods are needed to adjust for known and potential confounders, and to better understand whether results are due to exploratory analyses, chance, or limited statistical power.

Conclusions

This systematic review and accompanying evidence map highlights main areas of information as well as gaps in the evidence according to study design and potential prognostic factor across the Social-Ecological Model among general populations of Veterans and active duty military. Individual-level social-ecological domain factors, especially mental illnesses, alcohol, drug, or tobacco use, as well as prior suicide attempts or ideation, may be the best currently supported risk factors for suicide and attempts. Information on the risk of interpersonal relationship issues was mixed. Information on military traumas and sexual or family violence generally showed positive associations with suicide. There were no data on societal level factors. There was little information regarding factors protective against suicide. Risk factor definitions and analyses varied considerably across reports and many were derived from multiple publications involving similar population databases. Standardization of risk factor definitions and comprehensive adjustments for potential confounding variables would aid our understanding of the association between these factors and suicidality, both individually and in concert with other factors.