



Systematic Review of Suicide Prevention in Veterans

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PREFACE

The VA Evidence-based Synthesis Program (ESP) was established in 2007 to provide timely and accurate syntheses of targeted healthcare topics of particular importance to clinicians, managers, and policymakers as they work to improve the health and healthcare of Veterans. QUERI provides funding for four ESP Centers, and each Center has an active University affiliation. Center Directors are recognized leaders in the field of evidence synthesis with close ties to the AHRQ Evidence-based Practice Centers. The ESP is governed by a Steering Committee comprised of participants from VHA Policy, Program, and Operations Offices, VISN leadership, field-based investigators, and others as designated appropriate by QUERI/HSR&D.

The ESP Centers generate evidence syntheses on important clinical practice topics. 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 ESP disseminates these reports throughout VA and in the published literature; some evidence syntheses have informed the clinical guidelines of large professional organizations.

The ESP Coordinating Center (ESP CC), located in Portland, Oregon, was created in 2009 to expand the capacity of QUERI/HSR&D and is charged with oversight of national ESP program operations, program development and evaluation, and dissemination efforts. The ESP CC establishes standard operating procedures for the production of evidence synthesis reports; facilitates a national topic nomination, prioritization, and selection process; manages the research portfolio of each Center; facilitates editorial review processes; ensures methodological consistency and quality of products; produces “rapid response evidence briefs” at the request of VHA senior leadership; collaborates with HSR&D Center for Information Dissemination and Education Resources (CIDER) to develop a national dissemination strategy for all ESP products; and interfaces with stakeholders to effectively engage the program.

Comments on this evidence report are welcome and can be sent to Nicole Floyd, ESP CC Program Manager, at Nicole.Floyd@va.gov.

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EXECUTIVE SUMMARY

INTRODUCTION

This systematic review updates evidence on the accuracy of methods to identify individuals at increased risk for suicide, and the efficacy/effectiveness and adverse effects of healthcare service interventions in reducing suicide and other suicidal self-directed violence. Important areas of ongoing research and current evidence gaps on suicide prevention are also addressed. This report includes studies relevant to healthcare services provided to Veterans and military personnel in the United States (US), and updates 3 previous Department of Veterans Affairs (VA) Evidence-based Synthesis Program (ESP) reviews on these topics.

Veterans and military personnel represent 20% of all known suicides in the US. Rates of suicide increased during the wars in Afghanistan and Iraq, and between 2000 and 2010, the suicide rate among Veterans rose higher than the rate among civilians. Female Veterans are at especially high risk relative to other women. These trends have led to new initiatives within the VA and military to address suicide prevention.

During the year prior to suicide, an estimated 77% of individuals make contact with primary care and 32% with mental health care clinicians, providing opportunities for suicide risk assessment and intervention. However, screening for suicide risk in general medical practice is not part of standard care in the US. Efforts to prevent suicide in individuals at high risk, such as those with recent suicide attempts, generally include treatment of underlying conditions and psychotherapy. In addition to individual-level approaches to suicide prevention, initiatives have been implemented at organizational, health system, and community levels. However, despite the existence of many types of services, very few studies demonstrating their efficacy and effectiveness have been published. As a result, their influence on suicide prevention remains unclear.

This systematic review is an update of previous VA ESP reviews that addresses the following key questions:

Key Question 1

- A) What are the accuracy and adverse effects of methods to identify Veterans and military personnel at increased risk for suicide and other suicidal self-directed violence?
- B) Does accuracy and adverse effects vary by settings, delivery modes, targeted populations, or other factors?

Key Question 2

What are the efficacy/effectiveness and adverse effects of suicide prevention interventions in reducing rates of suicide and other suicidal self-directed violence in Veterans and military personnel? Interventions include healthcare services directed towards:

- A) Populations (*eg*, hotlines, outreach programs).
- B) Individuals (*eg*, case management, follow-up).

Key Question 3

What are important areas of ongoing research and current evidence gaps in research on suicide prevention in Veterans and military personnel, and how could they be addressed by future research?

METHODS

Data Sources and Searches

Electronic database searches were conducted for MEDLINE, PubMed, PsycINFO, SocINDEX, Cochrane Central Register of Controlled Trials, and the Cochrane Database of Systematic Reviews (January 1, 2008 to September 11, 2015). A search of the grey literature was conducted on July 16, 2015. In addition, citations from reference lists of relevant primary studies, reviews, and conference proceedings, and from clinical and research experts were reviewed for inclusion.

Study Selection

Eligible English-language studies included populations of Veterans, military personnel, and demographically comparable non-Veteran/military adults aged 18 and older from the US, United Kingdom (UK), Canada, New Zealand, and Australia, consistent with inclusion criteria of the previous VA ESP reviews.

For Key Question 1, included studies evaluated the diagnostic accuracy and adverse effects of methods to assess risk for suicide and other suicidal self-directed violence, including instruments, checklists, and other approaches appropriate for clinical settings. For Key Question 2, studies of the efficacy or effectiveness of interventions were included that were specifically designed to prevent suicide and other suicidal self-directed violence and evaluated in randomized controlled trials (RCTs), observational studies with comparison groups, and systematic reviews with these study designs. Interventions included healthcare services directed towards populations or individuals that are clinically relevant to medical practice in the US. Studies of interventions that primarily treat co-existing conditions and studies of pharmacotherapy were outside the scope of this update. Key Question 3 is based on evidence gaps identified from the synthesis of studies addressing Key Questions 1 and 2. Consequently, studies included for Key Question 3 were identified from the searches for Key Questions 1 and 2. In addition, ongoing studies were selected from websites and other sources identified by the search of grey literature based on their relevance to the key questions.

Data Abstraction and Quality Assessment

Data from included studies were abstracted into a database by one reviewer and over-read for accuracy by a second reviewer. Abstracted information included study design, setting, population, methodology, and results. Two reviewers independently assessed the risk of bias of included studies using pre-specified criteria, and each study was given an overall summary assessment of low, high, or unclear risk of bias. Disagreements were resolved through consensus using a third reviewer.

Data Synthesis and Analysis

Conclusions are based on qualitative synthesis of the findings of recently published studies as well as relevant studies from the previous VA ESP reviews. The overall strength of evidence was determined using a method developed for the Agency for Healthcare Research and Quality's (AHRQ) Evidence-based Practice Centers (EPC).

RESULTS

Results of Literature Search

A total of 7,788 potentially relevant citations were identified by searches; 673 articles were selected for full-text review; and 28 recently published studies were included, 15 for Key Question 1 and 13 for Key Question 2. In addition, 9 studies from the previous VA ESP reviews also met inclusion criteria for this review.

Summary of Results for Key Questions

Methods to Identify Suicide Risk (Key Question 1)

Fifteen recently published studies and 4 from the previous VA ESP systematic review evaluated the accuracy of methods to identify individuals at risk for suicide and other suicidal self-directed violence and met inclusion criteria for this review. These include 2 case-control studies and 17 case-series studies designed to determine measures of diagnostic accuracy. No studies evaluated the adverse effects of risk assessment methods, or compared how accuracy and adverse effects vary by settings, delivery modes, targeted populations, or other factors.

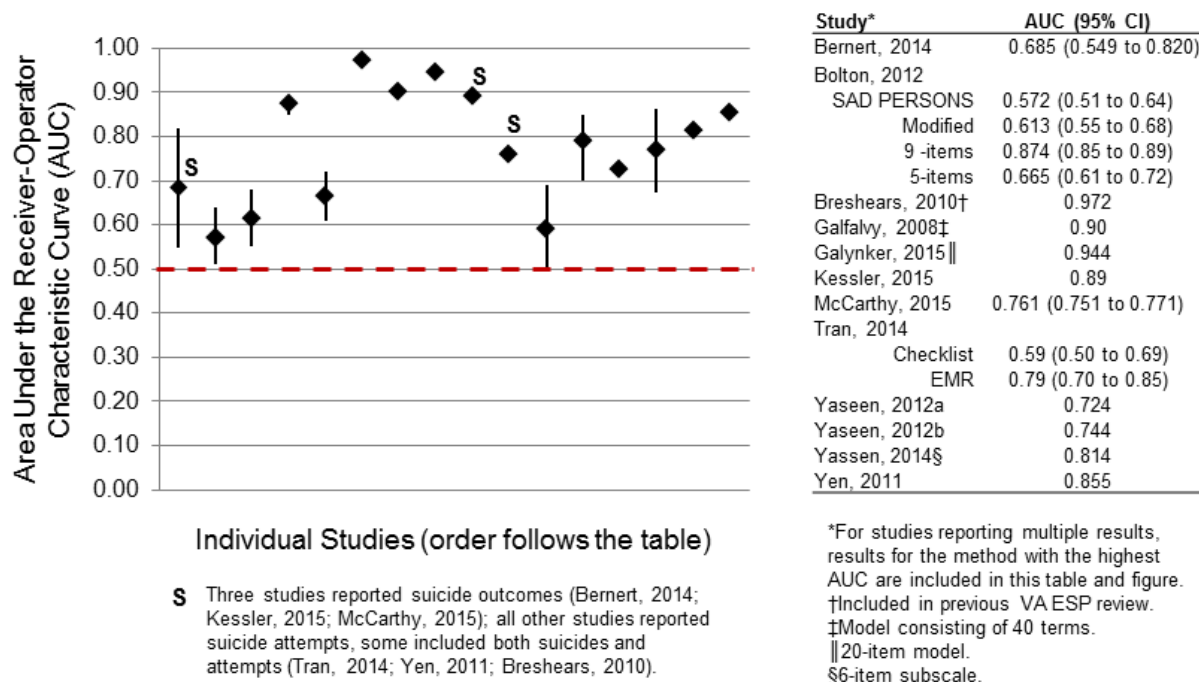
Results of studies indicated estimates of sensitivity ranging from 11% to 100% and area under the receiver-operator characteristic curve (AUC) from 0.57 to 0.97. Several risk assessment methods had estimates of sensitivity $\geq 80\%$ or AUC ≥ 0.70 , suggesting fair or better discrimination between patients with and without suicides or suicide attempts. Several studies used data from electronic medical records or administrative databases to identify individuals with known risk factors for suicide. The most relevant study used data from nearly 6 million patients of the Veterans Health Administration to create a prediction model to stratify patients according to their risk for suicide within the next year. This method had an AUC of 0.761 (95% CI, 0.751 to 0.771).

Four additional studies of Veterans were included in the previous VA ESP review. In one study, a decision tree for identifying high-risk patients was derived from the Addiction Severity Index and variables from VA databases. Sensitivity/specificity varied across the 3 prediction models that were evaluated (33%/87%, 72%/63%, 89%/42%). Three studies of Veterans evaluated the accuracy of established instruments to predict suicidal attempts and suicide. Results indicated high sensitivity/specificity for the Suicide Potential Index (91%/77%), and lower estimates for the Beck Depression Inventory (63%/80%) and Affective States Questionnaire (60%/74%).

The only study of military personnel was based on the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS) and included 40,820 active duty US Army soldiers hospitalized with psychiatric admission diagnoses. A risk algorithm to predict suicides within one year of hospitalization was developed from administrative data systems and demonstrated AUCs as high as 0.89.

Additional studies of non-Veterans evaluated the diagnostic accuracy of the risk instruments, including the Affective Intensity Rating Scale, Barwon Health Suicide Risk Assessment, Death/suicide Implicit Association Test, SAD PERSONS, Schedule for Nonadaptive and Adaptive Personality, Suicide Opinion Questionnaire, Sleep Quality Index, Suicidal Ideation Attributes Scale, and Suicide Trigger Scale. Results indicated a wide range of estimates depending on the instrument and selected cut-points.

Figure. Summary of Studies of Methods to Identify Suicide Risk Reporting Area Under the Receiver-Operator Characteristic Curve (AUC)



Healthcare Service Interventions for Suicide Prevention (Key Question 2)

Eight studies of the efficacy or effectiveness of population-level healthcare interventions met inclusion criteria, including a follow-up analysis of a study that was included in the previous VA ESP review. These studies evaluated multi-component initiatives implemented within existing organizational structures that included military populations, police officers, college students, and healthcare systems. No studies evaluated adverse effects of population-level interventions.

Suicide rates were lower after interventions in 6 observational studies, including studies of the Air Force Suicide Prevention Program, a program for an Army Infantry Division deployed to Iraq, and studies of police, college students, and health systems. Suicide rates were not lower in 2 studies of community programs. Studies were limited by the inherent biases of nonrandomized study designs, potential confounders were not considered, and comparison groups may not have been comparable.



Five recently published RCTs and 5 trials from a previous VA ESP review of the effectiveness of individual-level healthcare interventions met inclusion criteria. No studies specifically evaluated adverse effects of individual-level interventions. Trials compared usual care with psychotherapy and enrolled outpatient military personnel and non-military psychiatric inpatients or patients at acute risk for suicide.

Only 2 of 10 trials reported statistically significant differences between treatment and usual care. In a trial of outpatient active-duty soldiers with recent suicide attempts or ideation, those in a brief cognitive behavioral therapy program were less likely to make suicide attempts at 2-year follow-up than those in usual care (13.8% versus 40.2%, $P=.02$; hazard ratio 0.38, 95% CI, 0.16 to 0.87). In a trial of women with borderline personality disorder, those receiving dialectical behavior therapy had fewer suicide attempts than those receiving usual care at one-year follow-up (23% versus 46%; $P=.01$). Results of the other trials indicated no statistically significant differences between comparisons. However, trials were underpowered to detect differences for suicide and suicide attempt outcomes, and were compromised by other methodological limitations.

Research Gaps/Future Research (Key Question 3)

While a number of research gaps on risk assessment and interventions to prevent suicide and other suicidal self-directed violence remain, emerging work and ongoing studies in Veterans and military personnel are addressing some of these gaps.

Most risk assessment methods involve scales or checklists containing self-report items that are summed and scored, and specific instruments have rarely been examined in multiple studies. Even instruments based on large data sources and validated under study conditions require further testing in patient populations in order to determine their clinical uses. As a result, none of the published studies could be considered definitive for patient care at this point, and the best risk assessment method for clinical practice remains uncertain. To address these evidence gaps, future research should be directed towards more concerted replication and in-depth examination of the most promising instruments. In addition, research on other methods of risk assessment is needed, for example, newer approaches that use current information from patients' electronic medical records.

While many studies of risk assessment methods have relied on patient self-report data, a study of the computer-administered Implicit Association Test, which uses individuals' reaction times when classifying semantic stimuli in order to predict suicide attempts, is an important exception. In addition, individuals with histories of suicide attempts exhibit certain patterns of cognitive deficits that can be detected by tasks commonly included in neuropsychological testing batteries. Future research should test novel approaches to suicide risk assessment that build on this developmental work.

Many studies have examined biological markers for suicide or suicidal behaviors; however, this work is currently exploratory. Fewer studies have used neuroimaging to identify associations with suicide-related outcomes. While research on biological markers and neuroimaging for assessing risk for suicide is expanding, their role in clinical care has yet to be determined.

Studies of population-level healthcare service interventions for suicide prevention included in this review examined interventions comprising multiple complex components implemented within existing organizational structures. Future studies should be conducted in additional populations in order to further validate results of the initial studies, and to demonstrate the programs' applicability to general clinical practice. Additional details about how the program components were actually implemented and maintained in practice are also necessary in order to establish portable service packages and translate this work to other settings.

Studies of individual-level interventions generally targeted individuals identified as high-risk for suicide based on recent suicide attempts or self-harm or existence of psychiatric conditions. However, few studies have evaluated the efficacy or effectiveness of prevention interventions in individuals at earlier stages of the suicide pathway. These interventions address known risk factors for suicide, such as depression or traumatic brain injury, over the short term, with the goal of reducing suicide behaviors over the long term; research is needed to determine the validity of this assumption. Studies of interventions targeting protective factors for suicide are also needed, such as trials of programs improving social support.

Individual-level interventions included in this review evaluating the efficacy or effectiveness of psychotherapies or care management approaches were typically underpowered to detect differences and had high or unclear risk of bias. Improvement of this evidence base will require larger, more rigorous RCTs of existing interventions as well as innovative approaches, such as novel uses of technology to support or enhance care for individuals at risk for suicide.

Despite implementation of safety planning in VA care settings, evidence to support its use has not yet been established. Peer support specialists in VA settings are currently involved in providing general mental health support for Veterans receiving VA care. Continued work in this area should focus on establishing training requirements, functions, and eligibility of peer supporters, as well as evaluating effectiveness in reducing suicidal behavior.

DISCUSSION

Key Findings and Strength of Evidence

Current conventions do not provide strength of evidence grades for diagnostic accuracy studies. Studies of methods of risk assessment that were derived from large databases provided a rigorous approach with low risk of bias and high clinical applicability. Results indicated fair or better diagnostic accuracy for some of the models (sensitivity $\geq 80\%$ or AUC ≥ 0.70). These methods should be replicated in additional patient populations to refine the data variables and optimal cut-points, and further validate findings before they are adapted to clinical care uses.

Studies based on the diagnostic accuracy of individual instruments and scales are also useful, but are currently limited by small sample sizes, methodological limitations, and unclear applicability. Risk assessment instruments may provide diagnostic value to specific patient subgroups, such as those with previous suicide attempts or co-existing conditions. However, the current evidence base includes numerous inconclusive, small studies of a variety of instruments. Instruments demonstrating fair to good diagnostic accuracy in these studies should be further tested in larger clinical populations.

The strength of evidence grades for population-level healthcare interventions are insufficient for suicide attempt outcomes (no studies), low for suicide outcomes (8 observational studies), and insufficient for adverse effects (no studies). Although 6 of the 8 studies of interventions suggested reductions in suicide rates, the interventions varied across studies, risk of bias was unclear, and the comparability of comparison groups was not established. While the studies provided promising initial findings, these interventions should be replicated under more controlled conditions, such as RCTs, to strengthen the evidence of their effectiveness.

The strength of evidence grades for individual-level healthcare interventions are low for suicide attempt outcomes (7 trials), insufficient for suicide outcomes (4 trials), and insufficient for adverse effects (no studies). The most relevant trial, comparing brief outpatient cognitive behavioral therapy versus usual care in Army soldiers, indicated statistically significant reductions in suicide attempts with therapy, although risk of bias was unclear. The 4 trials reporting suicide outcomes had too few participants and suicide events to determine statistically significant differences between treatment and usual care. These interventions require replication in larger trials that are sufficiently powered to detect differences between comparisons.

Applicability

Of the 37 studies included in this review (including 9 from previous VA ESP reviews), 5 studies of risk assessment included Veterans and one included active military personnel; and 3 studies of interventions included active military personnel. In addition, inclusion criteria for studies enrolling participants outside Veterans and military populations were intended to include participants who were similar in age and other demographic characteristics. While these criteria may have excluded important studies, they also improved the systematic review's clinical relevance to the VA population.

Conclusions

Studies of risk assessment methods to identify individuals at increased risk for suicide and other suicidal self-directed violence evaluated numerous different approaches. Methods derived from data from electronic medical records, including studies of Veterans and military personnel, were robust predictors of subsequent suicide. Studies of various clinician-rated or patient self-report risk assessment instruments indicated accuracy that varied across methods and cut-points. Studies of multi-component population-level suicide prevention interventions and individual cognitive behavioral therapy in active military populations showed reduced suicide attempts and suicide. However, evidence is limited by the many single, inconclusive studies of various risk assessment instruments and prevention interventions, methodological deficiencies of studies, inherent challenges in conducting research in this area, and lack of studies addressing adverse effects.

ABBREVIATIONS TABLE

Abbreviation	Definition
AHRQ	Agency for Healthcare Research and Quality
Army STARRS	Army Study to Assess Risk and Resilience in Servicemembers
AUC	Area under the receiver-operator characteristic (ROC) curve
CAMS	Collaborative Assessment and Management of Suicidality
CI	Confidence interval
EPC	Evidence-based Practice Centers
ESP	Evidence-based Synthesis Program
ICD	International Classification of Disease Codes
KQ	Key Question
NPV	Negative predictive value
NS	Not statistically significant
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
PHQ-9	Patient Health Questionnaire
PPV	Positive predictive value
PTSD	Posttraumatic stress disorder
RCT	Randomized controlled trial
ROC	Receiver-operator characteristic curve
RR	Relative risk
SD	Standard deviation
UK	United Kingdom
US	United States
USPSTF	US Preventive Services Task
VA	Veterans Affairs